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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

Prepared by: Dave Jones Reviewed by: Moses Coss Final Date: March 23, 2024

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#### Abbreviations/Acronyms

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#### 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<sub>2.5</sub>) 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<sub>2.5</sub> nonattainment area. The designation of the area as "Serious" with regard to nonattainment of the 2006 24-hour PM<sub>2.5</sub> 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. <sup>1</sup>

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.<sup>2</sup> The EPA's Air Plan Partial Approval and Partial Disapproval; AK, Fairbanks North Star Borough; 2006 24-hour PM<sub>2.5</sub> Serious Area and 189(d) Plan<sup>3</sup> published in the Federal Register on December 5, 2023 (88 Fed. Reg. 84659) disapproved of Alaska's initial BACT determinations for PM2.5 and SO2 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 PM2.5, and the BACT analysis for sulfur dioxide (SO2) emissions, which is a precursor pollutant that can form PM2.5 in the atmosphere post combustion. Note that the section for oxides of nitrogen (NOx), which is also a precursor pollutant that can form PM<sub>2.5</sub> in the atmosphere post combustion, has been removed from this addendum because the EPA has approved<sup>3</sup> of the Department's comprehensive NOx precursor demonstration under 40 C.F.R. 51.1006(a)(1) and 51.1010(a)(2)(ii).

<sup>&</sup>lt;sup>1</sup> Federal Register, Vol. 82, No. 89, Wednesday May 10, 2017 (https://dec.alaska.gov/air/anpms/comm/docs/2017-09391-CFR.pdf)

<sup>&</sup>lt;sup>2</sup> Background and detailed information regarding Fairbanks PM<sub>2.5</sub> State Implementation Plan (SIP) can be found at http://dec.alaska.gov/air/anpms/communities/fbks-pm2-5-serious-sip/.

<sup>&</sup>lt;sup>3</sup> The EPA's Air Plan Partial Approval and Partial Disapproval; AK, Fairbanks North Star Borough; 2006 24-hour PM<sub>2.5</sub> Serious Area and 189(d) Plan can be found at <a href="https://www.regulations.gov/document/EPA-R10-OAR-2022-0115-0426">https://www.regulations.gov/document/EPA-R10-OAR-2022-0115-0426</a>.

<sup>&</sup>lt;sup>4</sup> 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<sub>2.5</sub> and SO<sub>2</sub>, 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.

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

Table A: Emission Units Subject to BACT Review

GVEA did not include BACT analyses for EUs 3 and 4. These emission units are fuel storage tanks and do not have NOx, PM<sub>2.5</sub>, or SO<sub>2</sub> emissions.

#### **Five-Step BACT Determinations**

The following sections explain the steps used to determine BACT for PM<sub>2.5</sub> and SO<sub>2</sub> 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<sub>2.5</sub> and SO<sub>2</sub> 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<sub>2.5</sub> and SO<sub>2</sub>.

#### **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<sub>2.5</sub> and SO<sub>2</sub> for the North Pole Power Plant. These BACT determinations are based on the information submitted by GVEA in their analysis, information from vendors, suppliers, subcontractors, RBLC, and an exhaustive internet search.

#### 3. BACT DETERMINATION FOR NO<sub>X</sub>

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,<sup>2</sup> 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. <sup>2</sup> The PM<sub>2.5</sub> 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.<sup>5</sup> 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<sub>2.5</sub> Serious Area and 189(d) Plan<sup>3</sup> published in the Federal Register on December 5, 2023 (88 Fed. Reg. 84659).

#### 4. BACT DETERMINATION FOR PM<sub>2.5</sub>

The Department based its PM<sub>2.5</sub> 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<sub>2.5</sub> BACT for the Fuel Oil-Fired Simple Cycle Gas Turbines (EUs 1 and 2)

Possible PM<sub>2.5</sub> 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<sub>2.5</sub> 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<sub>2.5</sub> emission rate listed in the RBLC is 0.0038 lb/MMBtu.

**Step 1 - Identification of PM<sub>2.5</sub> Control Technology for the Simple Cycle Gas Turbines** From research, the Department identified the following technologies as available for control of PM<sub>2.5</sub> emissions from fuel oil-fired simple cycle gas turbines:

<sup>&</sup>lt;sup>5</sup> 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<sub>2.5</sub> 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<sub>2.5</sub> 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. <u>High enough overall excess oxygen levels to complete combustion and maximize thermal efficiency.</u>

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 PM2.5 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<sub>2.5</sub> 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<sub>2.5</sub> emissions from the fuel oil-fired simple cycle gas turbines.

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

- (a) PM<sub>2.5</sub> 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<sub>2.5</sub> BACT for the Simple Cycle Gas Turbines

The Department's finding is that BACT for PM<sub>2.5</sub> emissions from the fuel oil-fired simple cycle gas turbine is as follows:

- (a) PM2.5 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<sub>2.5</sub> 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<sub>2.5</sub> 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<sub>2.5</sub> emissions from EUs 1 & 2 shall not exceed 0.012 lb/MMBtu<sup>6</sup> over a 3-hour averaging period; and
- (f) Initial compliance with the proposed PM<sub>2.5</sub> emission limit will be demonstrated by conducting a performance test to obtain an emission rate.

Table 4-2 lists the proposed PM<sub>2.5</sub> BACT determination for this facility along with those for other fuel oil-fired simple cycle gas turbines located in the Serious PM<sub>2.5</sub> nonattainment area.

Table 4-2. Comparison of PM2.5 BACT for Simple Cycle Gas Turbines at Nearby Power Plants

Facility	Process Description	Capacity	Limitation	Control Method	
GVEA –	Two Fuel Oil-Fired Simple	1,344 MMBtu/hr	0.012 lb/MMBtu <sup>6</sup>	Good Combustion Practices	
North Pole	Cycle Gas Turbines	1,344 MINIDIU/III	(3-hour averaging period)	Good Combustion Practices	
GVEA –	Two Fuel Oil-Fired Simple	536 MMBtu/hr	0.012 lb/MMBtu <sup>6</sup>	Good Combustion Practices	
Zehnder	Cycle Gas Turbines	330 MINIBIU/III	(3-hour averaging period)	Good Combustion Practices	

<sup>&</sup>lt;sup>6</sup> 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<sub>2.5</sub> BACT for the Combined Cycle Gas Turbines (EUs 5 and 6)

Possible PM<sub>2.5</sub> 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<sub>2.5</sub> 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<sub>2.5</sub> 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<sub>2.5</sub> Control Technology for the Combined Cycle Gas Turbines From research, the Department identified the following technologies as available for control of PM<sub>2.5</sub> 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<sub>2.5</sub> 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<sub>2.5</sub> 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<sub>2.5</sub> emissions from the fuel oil-fired combined cycle gas turbines.

#### Step 3 - Rank the Remaining PM2.5 Controls for the Combined Cycle Gas Turbines

The following control technologies have been identified and ranked by efficiency for the control of PM<sub>2.5</sub> 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<sub>2.5</sub> emissions from the fuel oil-fired combined cycle gas turbines:

- (a) PM<sub>2.5</sub> 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 PM2.5 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<sub>2.5</sub> BACT for the Combined Cycle Gas Turbines

The Department's finding is that BACT for PM<sub>2.5</sub> emissions from the combined cycle gas turbines is as follows:

- (a) PM<sub>2.5</sub> 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<sub>2.5</sub> emissions from EUs 5 and 6 shall not exceed 0.012 lb/MMBtu<sup>6</sup> over a 3-hour averaging period;
- (c) Initial compliance with the proposed PM<sub>2.5</sub> 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<sub>2.5</sub> BACT for the Large Diesel-Fired Engine (EU 7)

Possible PM<sub>2.5</sub> 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<sub>2.5</sub> 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<sub>2.5</sub> control technologies installed on large diesel-fired engines. The lowest PM<sub>2.5</sub> emission rate in the RBLC is 0.02 g/hp-hr.

**Step 1 - Identification of PM2.5 Control Technology for the Large Diesel-Fired Engine** From research, the Department identified the following technologies as available for controls of PM2.5 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<sub>2.5</sub> 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<sub>2.5</sub> 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<sub>2.5</sub> 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

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. 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

Limiting the operation of emissions units reduces the potential to emit of those units. 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>PM2.5 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<sub>2.5</sub> Control Technologies for the Large Engine PM<sub>2.5</sub> 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<sub>2.5</sub> emissions from the large diesel-fired engine.

Step 3 - Rank the Remaining PM<sub>2.5</sub> Control Technologies for the Large Diesel-Fired Engine The following control technologies have been identified and ranked by efficiency for the control of PM<sub>2.5</sub> 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<sub>2.5</sub> 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         \$143,00					
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<sub>2.5</sub> reduction does not justify the use of a diesel particulate filter based on the excessive cost per ton of PM<sub>2.5</sub> removed per year.

GVEA proposes the following as BACT for PM<sub>2.5</sub> emissions from the large diesel-fired engine:

- (a) PM<sub>2.5</sub> emissions from EU 7 shall be controlled by operating with positive crankcase ventilation;
- (b) Maintaining good combustion practices;
- (c) PM<sub>2.5</sub> emissions from EU 7 shall be controlled by limiting operation to no more than 52 hours per 12 month rolling period; and
- (d) PM<sub>2.5</sub> emissions from EU 7 shall not exceed 0.0022 lb/hp-hr<sup>7</sup> over a 4-hour averaging period.

#### Department Evaluation of BACT for PM2.5 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<sub>2.5</sub> from EU 7 will not be cost effective for installing a diesel particulate filter.

#### Step 5 - Selection of PM<sub>2.5</sub> BACT for the Large Diesel-fired Engine

<sup>&</sup>lt;sup>7</sup> Emissions Inventory Data: <a href="http://dec.alaska.gov/Applications/Air/airtoolsweb/PointSourceEmissionInventory/XmlInventory?reportingYear=2017&organizationKey=10&facilityKey=110&addEmissionUnits=0&addReleasePoints=0</a>

The Department's finding is that the BACT for PM<sub>2.5</sub> emissions from the large diesel-fired engine is as follows:

- (a) PM<sub>2.5</sub> emissions from EU 7 shall be controlled by operating with positive crankcase ventilation;
- (b) PM<sub>2.5</sub> 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<sub>2.5</sub> emissions from EU 7 shall not exceed 0.32 g/hp-hr<sup>8</sup> over a 3-hour averaging period; and
- (e) <u>Demonstrate compliance with the numerical BACT emission limit by complying with 40 C.F.R 63 Subpart ZZZZ</u>

Table 4-7 lists the proposed PM<sub>2.5</sub> BACT determination for the facility along with those for other diesel-fired engines rated at more than 500 hp located in the Serious PM<sub>2.5</sub> nonattainment area.

Table 4-7. Comparison of PM2.5 BACT for the Large Engines at Nearby Power Plants

Facility	<b>Process Description</b>	Capacity	Limitation	Control Method
	Large Diesel-Fired Engine	> 500 hp		Positive Crankcase Ventilation
UAF			$\frac{0.05 - 0.32 \text{ g/hp-}}{\text{hr}}$	Limited Operation
				<u> Ultra-Low Sulfur Diesel</u>
				Limited Operation
Fort Wainwright	8 Large Diesel-Fired Engines	> 500 hp	0.15 – 10.9 g/hp-hr	Ultra-Low Sulfur Diesel
Fort Wantwright				Federal Emission Standards
				Good Combustion Practices
	e Large Diesel-Fired Engine	600 hp		Positive Crankcase Ventilation
GVEA North Pole			0.32 g/hp-hr	Limited Operation
				Good Combustion Practices
CVEA Zahndan	21 D: 1E: 1E :	11,000 hp	0.22 / 1	Limited Operation
GVEA Zehnder	2 Large Diesel-Fired Engines	(each)	0.32 g/hp-hr	Good Combustion Practices

#### 4.5 PM<sub>2.5</sub> BACT for the Propane-Fired Boilers (EUs 11 and 12)

Possible PM<sub>2.5</sub> 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<sub>2.5</sub> Control for Gas-Fired Boilers

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

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

#### **RBLC Review**

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

## Step 1 - Identification of PM<sub>2.5</sub> Control Technology for the Propane-Fired Boilers From research, the Department identified the following technologies as available for control of PM<sub>2.5</sub> 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<sub>2</sub>S 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

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<sub>2.5</sub> 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<sub>2.5</sub> emissions. The Department considers GCPs a technically feasible control technology for the propane-fired boiler.

Step 2 - Eliminate Technically Infeasible PM<sub>2.5</sub> 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<sub>2.5</sub> 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<sub>2.5</sub> 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<sub>2.5</sub> 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<sub>2</sub> balance.

Department Evaluation of BACT for PM<sub>2.5</sub> 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<sub>2.5</sub> BACT for the Propane-Fired Boilers

The Department's finding is that BACT for PM<sub>2.5</sub> emissions from the propane-fired boilers is as follows:

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

- (b) PM<sub>2.5</sub> emissions from the operation of the propane-fired boilers shall be controlled with good combustion practices;
- (c) PM<sub>2.5</sub> emissions from EUs 11 and 12 shall not exceed 0.008 lb/MMBtu<sup>10</sup> 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<sub>2</sub> balance.

#### 5. BACT DETERMINATION FOR SO<sub>2</sub>

The Department based its SO<sub>2</sub> 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<sub>2</sub> BACT for the Fuel Oil-Fired Simple Cycle Gas Turbines (EUs 1 and 2)

Possible SO<sub>2</sub> 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<sub>2</sub> 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<sub>2</sub> control technologies determined as BACT for fuel oil-fired simple cycle gas turbines. The lowest SO<sub>2</sub> emission rate listed in the RBLC is combustion of ULSD at 0.0015 % S by wt.

Step 1 - Identification of SO<sub>2</sub> Control Technology for the Simple Cycle Gas Turbines
From research, the Department identified the following technologies as available for control of
SO<sub>2</sub> 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<sub>2</sub> 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<sub>2</sub> 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.

<sup>&</sup>lt;sup>10</sup> 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<sub>2</sub> 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<sub>2</sub> 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

<u>Limiting the operation of emissions units reduces the potential to emit of those units.</u> 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<sub>2.5</sub> 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<sub>2</sub>. The Department considers GCPs a technically feasible control technology for the fuel oil-fired simple cycle gas turbines.

Step 2 - Eliminate Technically Infeasible SO<sub>2</sub> 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<sub>2</sub> Control Technologies for the Simple Cycle Gas Turbines The following control technologies have been identified and ranked for control of SO<sub>2</sub> 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<sub>2</sub> 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<sub>2</sub> 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<sub>2</sub> 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<sub>2</sub> removed per year.

GVEA proposes the following as BACT for SO<sub>2</sub> emissions from the simple cycle gas turbines:

- (a) SO<sub>2</sub> 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<sub>2</sub> 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<sub>2</sub> 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 30year 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 1.5million-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<sub>2</sub> 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	<u>9,824,223 – 20,646,731</u>	<u>6,629 – 13,932</u>		
Capital Recove	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<sub>2</sub> 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 = <u>0.0931 (8.5%</u> interest rate for a 30-year equipment life)						

The Department's economic analysis indicates the level of SO<sub>2</sub> reduction justifies the use of ULSD as BACT for the fuel oil-fired simple cycle gas turbines located in the Serious PM<sub>2.5</sub> nonattainment area.

#### Step 5 - Selection of SO<sub>2</sub> BACT for the Simple Cycle Gas Turbines

The Department's finding is that BACT for SO<sub>2</sub> emissions from the fuel oil-fired simple cycle gas turbines is as follows:

- (a) SO<sub>2</sub> 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<sub>2</sub> BACT determination for this facility along with those for other fuel oil-fired simple cycle gas turbines located in the Serious PM<sub>2.5</sub> nonattainment area.

Table 5-6. Comparison of SO<sub>2</sub> BACT for Simple Cycle Gas Turbines at Nearby Power Plants

Facility	<b>Process Description</b>	Capacity	Limitation	<b>Control Method</b>
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<sub>2</sub> BACT for the Fuel Oil-Fired Combined Cycle Gas Turbines (EUs 5 and 6)

Possible SO<sub>2</sub> 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<sub>2</sub> 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<sub>2</sub> control technology installed on fuel oil-fired combined cycle gas turbines. The SO<sub>2</sub> emission rate listed in the RBLC is 6.7 lb/hr.

**Step 1 - Identification of SO<sub>2</sub> Control Technology for the Combined Cycle Gas Turbines** From research, the Department identified the following technologies as available for the control of SO<sub>2</sub> 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<sub>2</sub> 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<sub>2</sub> 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

<u>Limiting the operation of emissions units reduces the potential to emit of those units</u>. 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<sub>2.5</sub> 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<sub>2</sub> 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<sub>2</sub> 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<sub>2</sub> Control Technologies for the Combined Cycle Gas Turbines The following control technologies have been identified and ranked by efficiency for control of SO<sub>2</sub> 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
 (d) Limited Operation
 (e) Low Sulfur Fuel
 (f) Control
 (f) Control
 (f) Control
 (f) Control
 (f) 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<sub>2</sub> 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<sub>2</sub> reduction does not justify the use of ULSD or low sulfur fuel based on the excessive cost per ton of SO<sub>2</sub> removed per year.

GVEA proposes the following as BACT for SO<sub>2</sub> emissions from the combined cycle gas turbines:

(a) SO<sub>2</sub> emissions from EUs 5 and 6 shall combust Light Straight Run Turbine Fuel (30 ppm S in fuel)

Department Evaluation of BACT for SO<sub>2</sub> 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<sub>2</sub> 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<sub>2</sub> 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	<u>9.5</u>	<u>6.7</u>	=	<u>17,085,516 – 32,456,669</u>	<u>2,559,025 – 4,861,277</u>	
Capital Recovery Factor = <u>0.0931 (8.5% interest rate for a 30-year</u> equipment life)						

The Department's economic analysis indicates the level of SO<sub>2</sub> 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<sub>2.5</sub> 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<sub>2</sub> BACT for the Combined Cycle Gas Turbines

The Department's finding is that BACT for SO<sub>2</sub> emissions from the fuel oil-fired combined cycle gas turbines is as follows:

- (a) Except during startup, SO<sub>2</sub> 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) <u>During startup</u>, <u>SO<sub>2</sub> 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);</u>
- (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<sub>2</sub> BACT for the Large Diesel-Fired Engine (EU 7)

Possible SO<sub>2</sub> 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<sub>2</sub> 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<sub>2</sub> control technologies installed on large diesel-fired engines. The lowest SO<sub>2</sub> emission rate listed in the RBLC is 0.001 g/hp-hr.

**Step 1 - Identification of SO<sub>2</sub> Control Technology for the Large Diesel-Fired Engine** From research, the Department identified the following technologies as available for control of SO<sub>2</sub> 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<sub>2</sub> 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<sub>2.5</sub> 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<sub>2.5</sub> 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<sub>2</sub> 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<sub>2</sub> emissions from the large diesel-fired engine.

Step 3 - Rank the Remaining SO<sub>2</sub> Control Technologies for the Large Diesel-Fired Engine The following control technologies have been identified and ranked by efficiency for the control of SO<sub>2</sub> 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 dieselfired 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<sub>2</sub> 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<sub>2</sub> reduction does not justify the use of ULSD based on the excessive cost per ton of SO<sub>2</sub> removed per year.

GVEA proposed the following as BACT for SO<sub>2</sub> emissions from the diesel-fired engine:

- (a) SO<sub>2</sub> 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<sub>2</sub> Emissions from the Large Diesel-Fired Engine</u> <u>The Department reviewed GVEA's proposal for the large diesel-fired engine and revised</u> the cost analysis for the fuel switch to ULSD. The Department used the difference in the 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<sub>2</sub> Controls

Control Alternative	Potential to Emit (tpy)	Emission Reduction (tpy)	Total Capital Investment (\$)	Total Annualized Costs (\$/year)	Cost Effectiveness (\$/ton)		
<u>ULSD</u>	<u>0.0118</u>	<u>0.0116</u>	=	<u>444 – 1,083</u>	<u>38,150 – 93,086</u>		
Capital Recove	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<sub>2</sub> reduction does not justify the use of ULSD as BACT for the large diesel fired engine located in the Serious PM<sub>2.5</sub> nonattainment area.

#### Step 5 - Selection of SO<sub>2</sub> BACT for the Large Diesel-Fired Engine

The Department's finding is that the BACT for SO<sub>2</sub> emissions from the diesel-fired engine is as follows:

- (a) SO<sub>2</sub> 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<sub>2</sub> 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<sub>2</sub> 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<sub>2.5</sub> nonattainment area.

Table 5-13. Comparison of SO<sub>2</sub> BACT for Large Diesel-Fired Engines at Nearby Power Plants

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

Facility	<b>Process Description</b>	Capacity	Limitation	Control Method
				Limited Operation
UAF	Large Diesel-Fired Engine	13,266 hp	15 ppmw S in fuel	Good Combustion Practices
				Ultra-Low Sulfur Diesel
				Limited Operation
GVEA North Pole	Large Diesel-Fired Engine	600 hp	500 ppmw S in fuel	<u>Low Sulfur Diesel</u>
				Good Combustion Practices
GVEA Zehnder	2 Large Diesel-Fired Engines	11 000 bp	15 ppmw S in fuel	Good Combustion Practices
GVEA Zennder	2 Large Diesel-Fired Engines	11,000 np	15 ppinw 5 in luci	Ultra-Low Sulfur Diesel

#### 5.4 SO<sub>2</sub> BACT for the Propane-Fired Boilers (EUs 11 and 12)

Possible SO<sub>2</sub> 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<sub>2</sub> Control for Gas-Fired Boilers with a Rating < 100 MMBtu/hr

Control Technology	Number of Determinations	<b>Emission Limits</b>		
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<sub>2</sub> control technologies installed on propane-fired boilers. The lowest SO<sub>2</sub> emission rate listed in the RBLC is 0.0006 lb/MMBtu.

#### Step 1 - Identification of SO<sub>2</sub> Control Technology for the Propane-Fired Boilers

From research, the Department identified the following technologies as available for SO<sub>2</sub> control for the propane-fired boilers:

#### (a) Low Sulfur Fuel

The theory of low sulfur fuel was discussed in detail in the PM<sub>2.5</sub> 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<sub>2.5</sub> 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<sub>2</sub>. The Department considers GCPs a technically feasible control technology for the propane-fired boilers.

Step 2 - Eliminate Technically Infeasible SO<sub>2</sub> 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<sub>2</sub> 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<sub>2</sub> emissions from the propane-fired boilers:

- (a) SO<sub>2</sub> emissions from the operation of the propane-fired boilers shall be controlled by using low sulfur fuel at all times of operation.
- (b) SO<sub>2</sub> 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<sub>2</sub> 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<sub>2</sub> BACT for the Propane-Fired Boilers

The Department's finding is that BACT for SO<sub>2</sub> emissions from the propane-fired boilers is as follows:

- (a) SO<sub>2</sub> 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 appro	ved a comprehensive precursor demonstration for NOx  See details in the Section 1 Introduction

#### Table 6-2. PM<sub>2.5</sub> 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
2	Fuel Oil-Fired Simple Cycle Gas Turbine	672 MMBtu/hr	0.012 lb/MMBtu	Limited Operation  Good Combustion Practices
5	Fuel Oil-Fired Combined Cycle Gas Turbine	455 MMBtu/hr	0.012 lb/MMBtu	Limited Operation
6	Fuel Oil-Fired Combined Cycle Gas Turbine	455 MMBtu/hr	0.012 lb/MMBtu	Good Combustion Practices
				Limited Operation
7	Large Diesel-Fired Engine	619 hp	0.32 g/hp-hr	Positive Crankcase Ventilation
				Good Combustion Practices
11	Propane-Fired Boiler	5.0 MMBtu/hr	0.008 lb/MMBtu	Propane as Fuel
12	Propane-Fired Boiler	5.0 MMBtu/hr	0.008 lb/MMBtu	Good Combustion Practices

#### Table 6-3. SO<sub>2</sub> 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
2	Fuel Oil-Fired Simple Cycle Gas Turbine	672 MMBtu/hr	15 ppmw S in fuel	Good Combustion Practices
5	Fuel Oil-Fired Combined Cycle Gas Turbine	455 MMBtu/hr	50 ppmw S in fuel (Normal Ops)  15 ppmw S in fuel (Start Up)	Limited Operation  Light Straight Run Turbine Fuel (Normal Operations)
6	Fuel Oil-Fired Combined Cycle Gas Turbine	455 MMBtu/hr	Start-Up	ULSD (Start-Up)  Good Combustion Practices
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
12	Propane-Fired Boiler	5.0 MMBtu/hr	120 ppmv S in fuel	Good Combustion Practices

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 <sub>2.5</sub>			
BACT Measure Monitoring, Recordkeeping and Reporting Requirements <sup>1</sup>			
0.012 lb/MMBtu (3-hr avg);	<ul> <li>In each Annual Compliance Certification required by the Operating Permit, report the compliance status for this requirement.</li> <li>Conduct a one-time performance test using Method 201A and 202 at maximum achievable load to demonstrate compliance and submit results to the Department.</li> </ul>		
Combust Only Low Ash (Distillate) Fuel	<ul> <li>For each shipment of fuel combusted, keep receipts that specify fuel grade, and quantity of fuel received.</li> <li>Include a statement in each operating report required by the Operating Permit, affirming that the fuel delivered was a low ash (distillate) fuel.</li> </ul>		
Good Combustion Practices	<ul> <li>Keep records of maintenance conducted on emission units to comply with this BACT measure.</li> <li>Keep a copy of the manufacturer's and the operator's recommended maintenance procedures.</li> <li>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.</li> </ul>		
Limited Operation	<ul> <li>EU 1 shall comply with the combined annual NOx limit for EUs 1, 5, and 6, listed in Condition 16.1a, and the MR&amp;R listed in Conditions 16.1 through 16.4 of Construction Permit AQ0110CPT01 Rev. 1.</li> <li>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&amp;R listed in Conditions 19.1 through 19.4 of Operating Permit AQ0110TVP04.</li> </ul>		

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

Pollutant of Concern: PM2.5			
<b>BACT Measure</b>	BACT Measure Monitoring, Recordkeeping and Reporting Requirements <sup>1</sup>		
0.012 lb/MMBtu (3-hr avg)	<ul> <li>In each Annual Compliance Certification required by the Operating Permit, report the compliance status for this requirement.</li> <li>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.</li> </ul>		

<sup>&</sup>lt;sup>1</sup> 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	<ul> <li>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.</li> <li>Perform the MR&amp;R required by Conditions 16.1 through 16.4 of</li> </ul>
AQ0110CPT01 Rev. 1	Construction Permit AQ0110CPT01 Rev. 1.
Good Combustion Practices	<ul> <li>Keep records of maintenance conducted on emission units to comply with this BACT measure.</li> <li>Keep a copy of the manufacturer's and the operator's recommended maintenance procedures.</li> <li>If manufacturer specifications provide specific recommended combustion settings for CO and O<sub>2</sub> concentrations in the flue gas, at least once during each quarter that the emission unit operates, measure CO and O<sub>2</sub> in the exhaust stream using a portable handheld combustion analyzer and report these values in the following semiannual operating report required by the Operating Permit.</li> </ul>

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

Pollutant of Concern: PM <sub>2.5</sub>				
BACT Measure Monitoring, Recordkeeping and Reporting Requirements <sup>1</sup>				
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)	<ul> <li>Submit initial certification in a Facility Operating Report that a positive crankcase ventilation system has been installed or is an inherent design.</li> <li>Operate, maintain, and inspect according to the manufacturer's instructions and recommendations.</li> </ul>			
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: PM2.5		
<b>BACT Measure</b>	BACT Measure Monitoring, Recordkeeping and Reporting Requirements <sup>1</sup>	

0.008 lb/MMBtu (3-hr avg)	<ul> <li>In each Annual Compliance Certification required by the Operating Permit, report the compliance status for this requirement.</li> </ul>
Combust Only Propane as Fuel	<ul> <li>Demonstrate compliance by complying with Conditions 7 through 7.3 of Construction Permit AQ0110CPT01 Rev. 1.</li> </ul>
Good Combustion Practices and Periodic O <sub>2</sub> Monitoring	<ul> <li>Keep records of maintenance conducted on emission units to comply with this BACT measure.</li> <li>Keep a copy of the manufacturer's and the operator's recommended maintenance procedures.</li> <li>If manufacturer specifications provide specific recommended combustion settings for CO and O<sub>2</sub> concentrations in the flue gas, at least once during each quarter that the emission unit operates, measure CO and O<sub>2</sub> in the exhaust stream using a portable handheld combustion analyzer and report these values in the following semiannual operating report required by the Operating Permit.</li> </ul>

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 <sub>2</sub>		
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	<ul> <li>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.</li> <li>Include in each semi-annual operating report, a summary of fuel test</li> </ul>	
	results or shipping receipts from the reporting period.	
Good Combustion Practices	<ul> <li>Keep records of maintenance conducted on emission units to comply with this BACT measure.</li> </ul>	
	<ul> <li>Keep a copy of the manufacturer's and the operator's recommended maintenance procedures.</li> </ul>	

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.
	<ul> <li>Include in each semi-annual operating report, a summary of fuel test results or shipping receipts from the reporting period.</li> </ul>
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.
	<ul> <li>Include in each semi-annual operating report, a summary of fuel test results or shipping receipts from the reporting period.</li> </ul>
Good Combustion Practices	Keep records of maintenance conducted on emission units to comply with this BACT measure.  **The state of the state o
	<ul> <li>Keep a copy of the manufacturer's and the operator's recommended maintenance procedures.</li> </ul>

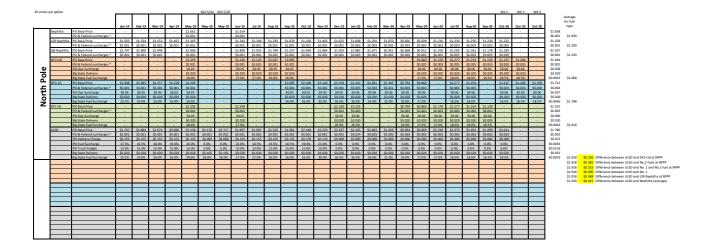
Emission Unit: EU ID 7 (400 kW Emergency Diesel Engine)

Pollutant of Concern: SO <sub>2</sub>		
BACT Measure	Monitoring, Recordkeeping and Reporting Requirements Error! Bookmark not defined.	

Limit the sulfur content of the fuel combusted to 0.05 weight percent	<ul> <li>For each shipment of fuel combusted in EU ID 7, keep receipts that specify fuel grade, and quantity of fuel received.</li> <li>Include in each semi-annual operating report a summary of the records listed above.</li> </ul>
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 <sub>2</sub>
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;	<ul> <li>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.</li> <li>Alternatively, conduct a stack test to directly measure SO<sub>2</sub> emissions and report results in lb/1,000 gal of fuel combusted.</li> <li>Include in each semi-annual operating report, a summary of fuel test results or shipping receipts from the reporting period.</li> </ul>
Good Combustion Practices	<ul> <li>Keep records of maintenance conducted on emission units to comply with this BACT measure.</li> <li>Keep a copy of the manufacturer's and the operator's recommended maintenance procedures.</li> </ul>



 HS#2+10
 HS#2-15
 No. 1 ULS <15 ppm</th>
 Difference between ULS and HS2
 NO 1 < 1,000 ppm</th>
 Difference between ULS and No. 1

 Weighted Average
 \$ 4.2754
 \$ 2.7819
 \$ 3.8870
 \$ 0.358
 \$3.2358
 \$ 0.652



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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 <a href="http://dec.alaska.gov/Applications/Air/airtoolsweb/PointSourceEmissionInventory">http://dec.alaska.gov/Applications/Air/airtoolsweb/PointSourceEmissionInventory</a>. 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).



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If you have any questions please contact me by phone at 907-458-4557 or by email at <a href="mailto:nmknight@gvea.com">nmknight@gvea.com</a>. 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

Public Review Draft April 28, 2023 ADEC – 2022 Point Source Emission Inventory Page 3

## 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** 

Chrispher M. Formes

	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,	Naomi Morton Knight, P.E.		
and Contact Number	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		

	Mary Way	Emis	sion Unit 01	e as a set as	
Specifications	Will -				
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 N	lodel BR	Serial Number	238057	
Regulations			And the second s		
Regulation/Description					
Not Applicable					A STATE OF THE STA
> Control Equipment					
Capture Efficiency (%)	0				
System Description	None				
Equipment Type(s)	None				
Pollutants Controlle	d				
Pollutant Description		7	Note that the second	Reduction Efficiency (9	(1
Not Applicable				Not Applicable	8)
Processes				INOT Applicable	
	I				
rocess	Primary Process				
CC 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			American and a second		
Total		Summer %	Fall %	Winter %	Spring %
	9 gallons	16.6	25.8	24.9	32.7
Operational Schedule		120.0	123.0	124.3	132.7
		lu I fo . I	Provide the second		
Days/Week	Hours/Day	Weeks/Period	Hours/Period		
0.1	0.5	1.0	167.9		
Fuel Characteristics					
leat Content	Elem. Sulfur Content (v	vt. H <sub>z</sub> S Sulfur Content	Ash Content	THE RESERVE AND ADDRESS OF THE PERSON NAMED IN COLUMN TWO IN COLUMN TO THE PERSON NAMED IN COLUM	
MMBtu/kgal)	pct. S)				
136.602	0.303	Not Available	Not Available		
Heating	·				
Heat Input (MMBtu/hr)		Heat Output		Heat Values Convention	
194		Not Available		Heat Values Conventio HHV	1
Emissions		INOL AVAIIABLE		Інни	
ollutant	Emission Factor	EF Numerator	EF Denominator	EF Source	Tons
arbon Monoxide (CO)	6.5E+00	POUNDS	HOUR	2022 CEMS Average	5.456E-01
Ammonia (NH₃)	Not Available	Not Available	Not Available	Not Available	Not Available
litrogen Oxides (NO <sub>x</sub> )	3.1E+02	POUNDS	HOUR	2022 CEMS Average	2.584E+01
M <sub>10</sub> Primary					
Filt + Cond)(PM10-PRI)	1.2E-02	POUNDS	MILLION BTUS	AP-42 Table 3.1-2a	3.969E-01
M <sub>2.5</sub> Primary					<del></del>
Filt + Cond)(PM <sub>2.5</sub> -PRI)	1.2E-02	POUNDS	MILLION BTUS	AP-42 Table 3.1-2a	3.969E-01
M <sub>2.5</sub> Filterable					
	4.3E-03	POUNDS	MILLION BTUS	AP-42 Table 3.1-2a	1.422E-01
PM <sub>25</sub> -FIL)				-	
M Condensible	7.2E-03	POUNDS	MILLION BTUS	AP-42 Table 3.1-2a	2.381E-01
PM-CON)				1001E J.1-20	E.301E-01
ulfur Dioxide (SO <sub>2</sub> )	4.4E-02	POUNDS	GALLON	Mass Balance	1.071E+01
olatile Organic	4.1E-04	DOLINDS	MILLION BYUS	AD 43 7-11-3 4 4	4 3565 00
ompounds (VOC)	4.1E-04	POUNDS	MILLION BTUS	AP-42 Table 3.1-2a	1.356E-02
ead and lead	4 45 05	DOLLADO		1	
ompounds	1.4E-05	POUNDS	MILLION BTUS	AP-42 Table 3.1-2a	4.630E-04
rocess	Secondary Process	·			
CC Code	20100109				
	> Internal Combustion I	Engines			
	> Electric Generation	ingules .			
	> Distillate Oil (Diesel)				
THE POWER OF THE PARTY OF	> Turbine: Exhaust				
laterial Processed	Distillate Oil (No. 1 ULS				
eriod Start	1/1/2022		Period End	12/31/2022	
Throughput					
otal		Summer %	Fall %	Winter %	Spring %
220	gallons	12.0	17.2	41.6	
	18-119-119	144.0	111.6	1-11.0	29.2
	les de				
Operational Schedule ays/Week .9E-04	Hours/Day 3.1E-03	Weeks/Period 6.6E-03	Hours/Period		

	Taking sen salah	Emiss	sion Unit 01	- WIE - W - W - W - W - W - W - W - W - W -	er au i i i
Fuel Characteristics					
Heat Content	Elem. Sulfur Content (wt.	H <sub>2</sub> S Sulfur Content	Ash Content		
(MMBtu/kgal)	pct. S)	E .			
133.699	0.101	Not Available	Not Available		
Heating					
Heat Input (MMBtu/hr)		Heat Output	- 1 2	Heat Values Conventio	n de la companya de l
386		Not Available		нну	
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 <sub>3</sub> )	Not Available	Not Available	Not Available	Not Available	Not Available
Nitrogen Oxides (NO <sub>x</sub> )	3.08E+02	POUNDS	HOUR	2022 CEMS Average	1.718E-01
PM <sub>10</sub> Primary			110011	LOZZ CZINS AVEIBGE	1.7101-01
(Filt + Cond)(PM <sub>10</sub> -PRI)	1.2E-02	POUNDS	MILLION BTUS	AP-42 Table 3.1-2a	2.583E-03
PM <sub>2.5</sub> Primary					
77	1.2E-02	POUNDS	MILLION BTUS	AP-42 Table 3.1-2a	2.583E-03
(Filt + Cond)(PM <sub>2.5</sub> -PRI)					
PM <sub>2,5</sub> Filterable	4.3E-03	POUNDS	MILLION BTUS	AP-42 Table 3.1-2a	9.256E-04
(PM <sub>2.5</sub> -FIL)			WILLION DIOS	WL-45 Janie 2'1-59	3.230E-U4
PM Condensible	7.2E-03	POUNDS	MILLION BTUS	AP-42 Table 3.1-2a	1 5505 03
(PM-CON)		, 501103	WILLION BIO3	AF-42 18018 3.1-28	1.550E-03
Sulfur Dioxide (SO <sub>2</sub> )	1.4E-02	POUNDS	GALLON	Mass Balance	2.211E-02
Volatile Organic	4.1E-04	POUNDS	MILLION BTUS	AP-42 Table 3.1-2a	0.0055.05
Compounds (VOC)	7.11-04	POUNDS	IVIILLION BIUS	AP-42 Table 3.1-2a	8.825E-05
Lead and lead	1.4E-05	POUNDS	MILLION BTUS	AD 42 Table 2.1.2-	2 0145 05
compounds	1.46-03	FOONDS	WILLION BIOS	AP-42 Table 3.1-2a	3.014E-06
Release Points					
ID	Description			Type	Apportion %
01N	GT #1 North Stack			Vertical	50
015	GT #1 South Stack			Vertical	50
	IN CALL TO BE A T	Releas	e Point 01N		A 11 11 11 11 11 11 11 11 11 11 11 11 11
Specifications					
D	01N				
Description	GT #1 North Stack		Туре	Vertical	
Stack Status	Active				
NOW THE PERSON NAMED IN COLUMN TO TH	Active				
Stack Parameters	[es   es   fes		TE 1012 101 W 10 100 0		
Stack Height (ft)	Stack Diameter (ft)	Exit Gas Temp (F)	Exit Gas Velocity (fps)	Exit Gas Flow Rate (acfr	n)
52 Caraman Market		729	182	620,700	
Geographic Coordina					
atitude	64.73549	Longitude	-147.35021	Datum	NAD 1983
Base Elevation	150	Accuracy	1		
ocation Description	North Pole, AK				
Data Source	Engineering Estimate				
		Releas	e Point 01S		
Specifications					
D	015		Туре	Vertical	
Description	GT #1 South Stack		Гійре	vertical	
tack Status	Active				
tack Parameters	L. C.				
	Sanah Diameter (fe)	F. da C T 4-1			
tack Helght (ft)		Exit Gas Temp (F)	Exit Gas Velocity (fps)	Exit Gas Flow Rate (acfr	n)
2		729	182	620,700	
Seographic Coordinat					
atitude		Longitude	-147.35021	Datum	NAD 1983
ase Elevation		Accuracy	1		
ocation Description	North Pole, AK				
ata Source	Engineering Estimate				

		Emis	sion Unit 02	Same of the State	
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, 19	77
Model Number	Frame 7, Series 7001, M	1odel BR	Serial Number	248861	
Regulations					
Regulation/Description					
Not Applicable					
> Control Equipment					
Capture Efficiency (%)	0				
System Description	None				
Equipment Type(s)	None				
Pollutants Controlle	<u>d</u>				
Pollutant Description				Reduction Efficiency (	%)
Not Applicable				Not Applicable	
Processes					
Process	Primary Process				
SCC Code	20100109				
	> Internal Combustion E	ingines			
	> Electric Generation				
	> Distillate Oil (Diesel)				
Material Processed	> Turbine: Exhaust				
Period Start	Distillate Oil (No. 2) 1/1/2022		D 1 1 1 1	lantas tasas	
	11/1/2022		Period End	12/31/2022	
Throughput			T		
Total 5,384,656	Indiana	Summer % 18.3	Fall %	Winter %	Spring %
Operational Schedule		18.5	8.2	25.8	47.7
Days/Week		1			
Days/week 1.4	Hours/Day 4.8	Weeks/Period	Hours/Period		
Fuel Characteristics	14.8	10.5	1,767		
Heat Content	[m. n. v. n	. In a second			
	Elem. Sulfur Content (w	t. H <sub>2</sub> S Sultur Content	Ash Content		
(MMBtu/kgal) 136.602	pct. S) 0.303	Not Available			
Heating	10.303	Not Available	Not Available		
Heat Input (MMBtu/hr)		lu .o.		10	
116		Heat Output		Heat Values Convention	
Emissions		Not Available		HHV	
Pollutant	Emission Factor	Tre Nomenton	ler p		
arbon Monoxide (CO)	3.3E-03	EF Numerator POUNDS	EF Denominator MILLION BTUS	EF Source	Tons
Ammonia (NH <sub>3</sub> )	Not Available	Not Available	Not Available	AP-42 Table 3.1-1	1.214E+00
litrogen Oxides (NO <sub>x</sub> )	8.8E-01	POUNDS		Not Available	Not Available
PM <sub>10</sub> Primary	D-0E-01	LOOIAD2	MILLION BTUS	AP-42 Table 3.1-1	3.236E+02
Filt + Cond)(PM <sub>10</sub> -PRI)	1.2E-02	POUNDS	MILLION BTUS	AP-42 Table 3.1-2a	4.413E+00
PM <sub>2,5</sub> Primary	1.2E-02	POUNDS	MILLION BTUS	AP-42 Table 3.1-2a	4.413E+00
Filt + Cond)(PM <sub>2.5</sub> -PRI)	1				
M <sub>2,5</sub> Filterable	4.3E-03	POUNDS	MILLION BTUS	AP-42 Table 3.1-2a	1 581F+00
PM <sub>2,5</sub> -FIL)			cion bios	72 TOUTE 3.1-2d	1.581E+00
M Condensible	7.2E-03	POUNDS	MILLION BTUS	AP-42 Table 3.1-2a	2.648E+00
PM-CON)					2.0405700
ulfur Dioxide (SO <sub>2</sub> )	4.4E-02	POUNDS	GALLON	Mass Balance	1.191E+02
olatile Organic  ompounds (VOC)  ead and lead	4.1E-04	POUNDS	MILLION BTUS	AP-42 Table 3.1-2a	1.508E-01

		Emis	sion Unit 02		
Process	Secondary Process				
SCC Code	20100109				
	> Internal Combustion	Engines			
	> Electric Generation				
	> Distillate Oil (Diesel				
Material Process 4	> Turbine: Exhaust	,			
Material Processed Period Start	Distillate Oil (No. 1 ULS	1		Laterter	
	1/1/2022		Period End	12/31/2022	
Throughput					
Total		Summer %	Fall %	Winter %	Spring %
	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	Elem. Sulfur Content (v	vt. H <sub>2</sub> S Sulfur Content	Ash Content		
MMBtu/kgal)	pct, S)	THE RESERVE			
133.699	0.101	Not Available	Not Available		
Heating					
Heat Input (MMBtu/hr)		Heat Output		Heat Values Convention	on
107		Not Available		нну	
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 <sub>3</sub> )	Not Available	Not Available	Not Available	Not Available	Not Available
litrogen Oxides (NO <sub>x</sub> )	8.8E-01	POUNDS	MILLION BTUS	AP-42 Table 3.1-1	2.613E+01
M <sub>10</sub> Primary		1	WILLION DIOS	1-45 Table 2:1-1	2.0130+01
Filt + Cond)(PM <sub>10</sub> -PRI)	1.2E-02	POUNDS	MILLION BTUS	AP-42 Table 3.1-2a	3.564E-01
PM <sub>2.5</sub> Primary Filt + Cond)(PM <sub>2.5</sub> -PRI)	1.2E-02	POUNDS	MILLION BTUS	AP-42 Table 3.1-2a	3.564E-01
PM <sub>2.5</sub> Filterable PM <sub>2.5</sub> -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
ulfur Dioxide (SO <sub>2</sub> )	1.5E-02	POUNDS	GALLON	Mass Balance	3 2755,00
olatile Organic	5.52.02	700105	GALLON	IAIG22 DGIGILE	3.275E+00
ompounds (VOC)	4.1E-04	POUNDS	MILLION BTUS	AP-42 Table 3.1-2a	1.218E-02
ompounds	1.4E-05	POUNDS	MILLION BTUS	AP-42 Table 3.1-2a	4.158E-04
Release Points					
	Description		1427	Туре	Apportion %
2N	GT #2 North Stack			Vertical	50
25	GT #2 South Stack			Vertical	50
		Releas	se Point 02N		
pecifications					
D	02N		Туре	Vertical	
	GT #2 North Stack		Пуре	vertical	
tack Parameters	C. TE HOLDI STACK				
	Canaly Diameter (fr)	Truta Care Trust (-1	E to Control of the	la tra	
tack Height (ft)	Stack Diameter (ft) 8.46	Exit Gas Temp (F)	Exit Gas Velocity (fps)	Exit Gas Flow Rate (acf	m)
		729	182	620,700	
eographic Coordinat					
atitude	64.735044	Longitude	-147.351072	Datum	NAD 1983
ase Elevation	150	Accuracy	1		
cation Description	North Pole, AK				
ata Source	Engineering Estimate				
		Releas	se Point 025		
pecifications	005		Туре	Vertical	
	025		LIVE	1 vertical	
	025 GT #2 South Stack				
escription	GT #2 South Stack				
escription tack Parameters	GT #2 South Stack	Full Co-T (e)	Indian Maria	Talka a s	
escription tack Parameters tack Height (ft)	GT #2 South Stack Stack Diameter (ft)	Exit Gas Temp (F)	Exit Gas Velocity (fps)	Exit Gas Flow Rate (acfi	m)
escription tack Parameters tack Height (ft)	GT #2 South Stack Stack Diameter (ft) 8.46	Exit Gas Temp (F)	Exit Gas Velocity (fps)	Exit Gas Flow Rate (acfi 620,700	m)
o escription tack Parameters tack Height (ft) 2 leographic Coordinat	GT #2 South Stack Stack Diameter (ft) 8.46 e	729	182	620,700	
eographic Coordinat	GT #2 South Stack Stack Diameter (ft) 8.46 e 64.73525	729 Longitude	-147.35127		MAD 1983
escription tack Parameters tack Height (ft) t eographic Coordinat	GT #2 South Stack Stack Diameter (ft) 8.46 e	729	182	620,700	

	Telephone Sections	Emis	sion Unit 05	BLOTT NEW YORK	1 *
Specifications					
ID	05		Design Capacity	455 MILLION BTU PER	HOUR
Description	GT#3 Gas Turbine		Emission Unit Status	Operating	HOUR
Manufacturer	General Electric		Manufactured Year	Purchased 2004	
Model Number	LM6000PC		Serial Number	191-548	
Regulations			Jenai (Gillbei	131-346	
Regulation/Description					
40 CFR 60 Subpart GG					
> Control Equipment					
Capture Efficiency (%)	100				
System Description	Weir Rotojet Water Injec	tion (NO)			
S and the second second	Emerachem LLC CO catalo				
Equipment Type(s)	Water Injection	V3L			
Pollutants Controlle					
Pollutant Description	at the second			D-1-1- 560 1 60	,
Carbon Monoxide				Reduction Efficiency (9	
Nitrogen Oxides				77	
Processes				1//	
Process	Primary Process				
SCC Code	20100901				
Sec code	> Internal Combustion En	dines			
	> Electric Generation	gines			
	> Kerosene/Naphtha (Je	+ Friell			
reduction to the	> Turbine: Exhaust	t ruei)			
Material Processed	Naphtha				
Period Start	1/1/2022		Period End	12/31/2022	
Throughput	11/1/2022		Period End	12/31/2022	
Total	TO STATE OF THE ST	Ic	Is not	The second	
26,058,464	Institute	Summer %	Fall %	Winter %	Spring %
Operational Schedule		J23.5	25.2	29.7	21.7
		Don't do a de			
Days/Week	Hours/Day	Weeks/Period	Hours/Period		
6.4	22.0	47.7	8,019		
Fuel Characteristics					
Heat Content	Elem. Sulfur Content (wt.	H <sub>2</sub> S Sulfur Content	Ash Content		
(MMBtu/kgal)	pct. S)				
109.068	0.0018	Not Available	Not Available		
Heating					
Heat Input (MMBtu/hr)		Heat Output	V.V.	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 <sub>3</sub> )	Not Available	Not Available	Not Available	Not Available	Not Available
Nitrogen Oxides (NO <sub>x</sub> )	1.18E+02	POUNDS	HOUR	2022 CEMS Average	4.731E+02
PM <sub>10</sub> Primary	1 35 03	nous no			
(Filt + Cond)(PM <sub>10</sub> -PRI)	1.2E-02	POUNDS	MILLION BTUS	AP-42 Table 3.1-2a	1.705E+01
PM <sub>2.5</sub> Primary					
(Filt + Cond)(PM <sub>2.5</sub> -PRI)	1.2E-02	POUNDS	MILLION BTUS	AP-42 Table 3.1-2a	1.705E+01
PM <sub>2.5</sub> Filterable				+	<del></del>
(PM <sub>2.5</sub> -FIL)	4.3E-03	POUNDS	MILLION BTUS	AP-42 Table 3.1-2a	6.111E+00
M Condensible					
PM-CON)	7.2E-03	POUNDS	MILLION BTUS	AP-42 Table 3.1-2a	1.023E+01
Sulfur Dioxide (SO <sub>2</sub> )	2 15 04	DOLLARDS			
/olatile Organic	2.1E-04	POUNDS	GALLON	Mass Balance	2.934E-01
Compounds (VOC)	4.1E-04	POUNDS	MILLION BTUS	AP-42 Table 3.1-2a	5.826E-01
ead and lead ompounds	1.4E-05	POUNDS	MILLION BTUS	AP-42 Table 3.1-2a	1.989E-02

20,00109   20,00109		La William L. Com	Emiss	ion Unit 05		
	Process	Secondary Process	110000	CONC. (1000) 4/2 (00.10)		
	SCC Code					
Distillate Oil (No. 1 U.S)		> Internal Combustion En	gines			
Turbine: Eshaust		> Electric Generation				
Distillate Oil (No. 1 ULS)						
Period End   1/2/022   Period End   12/31/2022   Period End   12/31/2022   Period End   12/31/2022   Period End   Period   Period End	-use a feather					
Total   262,514   gallons   21.2   0.8   0.3   77.6						
Summer   Summer   Fall   Summer   Sum		1/1/2022		Period End	12/31/2022	
262,514   gallons   21.2   D.8   D.8   D.3   77.6	Throughput					
Departational Schedule	Total	2,7 A, 118 E	Summer %	Fall %	Winter %	Spring %
Days/Neek		- 15/-	21.2	0.8	0.3	77.6
D.1	Operational Schedule	2				· · · · · · · · · · · · · · · · · · ·
Fuel Characteristics   Elem. Sulfur Content (wt.   H <sub>3</sub> S Sulfur Content   Mash	Days/Week	Hours/Day	Weeks/Period	Hours/Period		
Heat Content   Heat	0.1	0.2	0.5	80.8		
MMRILION BTUS   MILLION BTUS   MILLION BTUS   MILLION BTUS   MP-42 Table 3.1-2a   1.264E-01   MILLION BTUS   MP-42 Table 3.1-2a   2.457E-04   MILLION BTUS   MILLION BTUS   MP-42 Table 3.1-2a   2.457E-04   MILLION BTUS   MP-42 Table 3.1-2a   2.64E-01   MP	Fuel Characteristics					
MMMtufukrat	Heat Content	Elem. Sulfur Content (wt.	H₂S Sulfur Content	Ash Content		
Not Available   Not Availabl	(MMBtu/kgal)					
Heating   Heating   Heat Output   Millon   Heat Values Convention	133.699		Not Available	Not Available		
Not Available	Heating		-11			
Not Available	Heat Input (MMBtu/hr)		Heat Output		Heat Values Convention	n
Emissions   Emission Factor   EF Numerator   EF Denominator   EF Source   Tons   Carbon Monoxide (CO)   1.7E+00   POUNDS   HOUR   2022 CEMS Average   6.867E-02   Ammonia (NH₂)   Not Available   Not Avail	134					
Carbon Monoxide (CO)   1.7E+00	Emissions					
Carbon Monoxide (CO)   1.7E+00	Pollutant	Emission Factor	EF Numerator	EF Denominator	EF Source	Tons
Not Available   Not Availabl	Carbon Monoxide (CO)					
	Ammonia (NH <sub>3</sub> )	Not Available				
PM_10   Primary   POUNDS   MILLION BTUS   AP-42 Table 3.1-2a   2.106E-01						
1.2E-02		1		,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	FOLE CLIAID WASINGS	7.7002700
PM_2   Primary   Filt + Cond (PM_2 - PRI)   POUNDS   MILLION BTUS   AP-42 Table 3.1-2a   2.106E-01		1.2E-02	POUNDS	MILLION BTUS	AP-42 Table 3.1-2a	2.106E-01
1.2E-02						
Pound   Poun	75	1.2E-02	POUNDS	MILLION BTUS	AP-42 Table 3.1-2a	2.106E-01
Pounds   P						
PM_S-FIL	7.5	4.3E-03	POUNDS	MILLION BTUS	AP-42 Table 3 1-2a	7 546E-02
POUNDS   MILLION BTUS   AP-42 Table 3.1-2a   1.264E-01	PM <sub>2,5</sub> -FIL)			THE CONTROL	72 Table 3.1-28	7.3400-02
PM-CON   POUNDS   GALLON   Mass Balance   2.678E-02		7.2F-03	POLINDS	MILLION PTUS	AD-42 Table 2 1 2-	1 2645 01
Volatile Organic Compounds (VOC)  ead and lead ompounds (VOC)  ead and lead ompounds  I.4E-05  POUNDS  MILLION BTUS  AP-42 Table 3.1-2a  7.195E-03  AP-42 Table 3.1-2a  7.195E-03  AP-42 Table 3.1-2a  7.195E-04  AP-42 Table 3.1-2a  7.195E-03  AP-42 Table 3.1-2a  AP-42 Table 3.1-2a  7.195E-03  AP-42 Table 3.1-2a  Type  AP-42 Table 3.1-2a  Typ	PM-CON)			MILLION DIOS	AF-42 Table 5.1-28	1.264E-U1
AP-42 Table 3.1-2a   7.195E-03		2.0E-04	POUNDS	GALLON	Mass Balance	2.678E-02
Appoint   Appo	/olatile Organic	4 1F-04	DOLINDS	MULION PTUE	AD 43 T-bl- 3 4 3	7 4055 03
AF-05   POUNDS   MILLION BTUS   AP-42 Table 3.1-2a   2.457E-04	Compounds (VOC)	7.11-04	FUUNDS	IVIILLION BTOS	Ar-42 Table 3.1-2a	7.195E-03
Release Points  Description Specifications  Description Specifications Specifications  Description Specifications Specificat	ead and lead.	1 4F-05	POLINDS	MILLION PTUS	AD 42 Table 2 1 2s	2 4575 04
Description	ompounds	at03	001103	INITERIOR BIO2	mr-42 Table 3.1-2a	2.45/E-U4
Stack   Vertical   100	Release Points					
Second   Stack   Second   Se	D	Description			Туре	Apportion %
Release Point 05   Specifications   Type   Vertical   Specifications   Type   Vertical   Specifications   Type   Vertical   Specification	05	GT#3 Stack				
Description   O5	THE RELIES IN		Releas	se Point 05		
Type	inacifications		neico.	C. Milit V.		
Stack   Farameters   Stack   Diameter (ft)   Exit Gas Temp (F)   Exit Gas Velocity (fps)   Exit Gas Flow Rate (acfm)		lor				
tack Parameters  tack Height (ft)				Гуре	Vertical	
tack Height (ft)		UI#3 Stack				
10						
Geographic Coordinate  atitude 64.73526 Longitude -147.34985 Datum NAD 1983  ase Elevation 150 Accuracy 1						n)
atitude 64.73526 Longitude -147.34985 Datum NAD 1983 ase Elevation 150 Accuracy 1			270	73.8	347,949	
ase Elevation 150 Accuracy 1						
ase Elevation 150 Accuracy 1	atitude	64.73526	Longitude	-147.34985	Datum	NAD 1983
	lase Elevation	150				
	ocation Description					
ata Source Engineering Estimate						

		Emiss	sion Unit 06	10 principal force	
Specifications					
ID	06		Design Capacity	455 MILLION BTU PE	B HUIB
Description	GT#4 Gas Turbine		Emission Unit Status	Not Installed	KHOOK
Manufacturer	General Electric		Manufactured Year	This unit has not bee	n installed
Model Number	LM6000PC		Serial Number	TBD	THIS CONC.
Regulations			- Items with the second		
Regulation/Description					
40 CFR 60 Subpart KKKK					
> Control Equipment					
Capture Efficiency (%)	Not Applicable				
System Description	Not Applicable				
Equipment Type(s)	Not Applicable				
Pollutants Controlle					
Pollutant Description				Dadustin Efficiency	(0/)
Not Applicable				Reduction Efficiency	[%]
Processes				Not Applicable	
Process	Drimany Drases				
SCC Code	Primary Process Not Applicable				
JCC Code	Not Applicable				
	Not Applicable				
	Not Applicable				
	Not Applicable				
Material Processed	Not Applicable				
Period Start	1/1/2022		Period End	12/31/2022	
Throughput	Andread		J. G. IOG C. IO	112/31/2022	
Total		Summer %	Fall %	Winter %	Spring %
Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Operational Schedule		пострынавис	пострыкава	Inot Applicable	[ног Аррисавіе
Days/Week	Hours/Day	Weeks/Period	Hours/Period		
Not Applicable	Not Applicable	Not Applicable	Not Applicable		
Fuel Characteristics	The traphologic	Inter repricable	пос пррисавие		
Heat Content	Elem. Sulfur Content	H <sub>2</sub> S Sulfur Content	Ash Content		
Not Applicable	Not Applicable	Not Applicable	Not Applicable		
Heating	INOT Applicable	livot Applicable	INOT Applicable		
Heat Input		III		1	
Not Applicable		Heat Output Not Applicable		Heat Values Convention	
Emissions		[NOT Applicable		Not Applicable	
Pollutant	Emission Factor	EF Numerator	Terra .		
Carbon Monoxide (CO)	Not Applicable	Not Applicable	EF Denominator	EF Source	Tons
Ammonia (NH <sub>3</sub> )	Not Applicable		Not Applicable	Not Applicable	Not Applicable
Nitrogen Oxides (NO <sub>x</sub> )	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
M <sub>10</sub> Primary	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Filt + Cond)(PM <sub>10</sub> -PRI)	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
PM <sub>2.5</sub> Primary Filt + Cond)(PM <sub>2.5</sub> -PRI)	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
M2.5 Filterable PM <sub>2.5</sub> -FIL)	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
M Condensible PM-CON)	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
ulfur Dioxide (SO <sub>2</sub> )	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
olatile Organic	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
ead and lead ompounds	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable

	des in the st	Emiss	ion 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	e				1/
Days/Week	Hours/Day	Weeks/Period	Hours/Period	Year of the second	
Not Applicable	Not Applicable	Not Applicable	Not Applicable		
Fuel Characteristics			, , , , , , , , , , , , , , , , , , ,		
Heat Content	Elem. Sulfur Content	H <sub>2</sub> S Sulfur Content	Ash Content	V	
Not Applicable	Not Applicable	Not Applicable	Not Applicable		
Heating	Inocuppicable	INOT Applicable	INOT Applicable		
Heat Input		Heat Output		Heat Values Conventi	
Not Applicable		Not Applicable		Not Applicable	on
Emissions		INOT Applicable		INOL Applicable	
Pollutant	Emission Factor	EF Numerator	EF Denominator	Ire comme	
Carbon Monoxide (CO)	Not Applicable	Not Applicable	Not Applicable	EF Source Not Applicable	Tons Not Applicable
Ammonia (NH <sub>3</sub> )	Not Applicable	Not Applicable	Not Applicable	Not Applicable	
Nitrogen Oxides (NO <sub>x</sub> )					Not Applicable
	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
PM <sub>10</sub> Primary (Filt + Cond)(PM <sub>10</sub> -PRI)	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
PM <sub>2.5</sub> Primary	Not Applicable	Nat Analizable	AL . A I' L I		
(Filt + Cond)(PM <sub>2,5</sub> -PRI)	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
PM2.5 Filterable		1			
PM <sub>2.5</sub> -FIL)	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
PM Condensible	L				
PM-CON)	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
iulfur Dioxide (SO <sub>2</sub> )	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
/olatile Organic					
Compounds (VOC)	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
ead and lead					
ompounds	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Release Points			***	*	
D	Description		7 - 18	Туре	Apportion %
Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable

		Emiss	ion Unit 07		
Specifications					
D	07		Design Capacity	565 HORSEPOWER	
Description	Emergency Generator En	gine	Emission Unit Status	Operating	
Manufacturer	Mitsubishi		Manufactured Year	Installed 2005	
Model Number	0A8829		Serial Number	2083094	
Regulations					
Regulation/Description					
10 CFR 63 Subpart ZZZZ					
Control Equipment					
Capture Efficiency (%)	lo				
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 En	gines			
	> 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	151-11-11-11-11-11-11-11-11-11-11-11-11-		premod End	112/51/2022	
Total		Summer %	Fall %	had-ao/	In the state of
	gallons	61.1	16.7	Winter %	Spring %
Operational Schedule		101.1	116.7	0.0	22.2
Days/Week	Hours/Day	Weeks/Period	Hours/Period		
1.4E-03	4.9E-03	0.01	2		
Fuel Characteristics					
Heat Content					
	Elem. Sulfur Content (wt.	H <sub>2</sub> S Sulfur Content	Ash Content		
	pct. S)		Ash Content		ne e in
		H <sub>2</sub> S Sulfur Content Not Available	Ash Content  Not Available		7575 70
	pct. S)				Name of
133.699 Heating	pct. S)			Heat Values Conventic	nn .
133.699 Heating Heat Input (MMBtu/hr)	pct. S)	Not Available		Heat Values Conventic	on.
.33.699 Heating leat Input (MMBtu/hr)	pct. S)	Not Available  Heat Output		Heat Values Conventio	on
.33.699 Heating Heat Input (MMBtu/hr)  Emissions	pct. 5) 0.0015	Not Available  Heat Output  Not Available	Not Available	нну	111
.33.699  Heating Heat Input (MMBtu/hr)  Emissions Follutant	pct. S) 0.0015 Emission Factor	Not Available  Heat Output Not Available  EF Numerator	Not Available  EF Denominator	HHV EF Source	Tons
Heating Heat Input (MMBtu/hr)  Emissions Collutant Carbon Monoxide (CO)	ect. 5) 0.0015 Emission Factor 6.68E-03	Not Available  Heat Output Not Available  EF Numerator POUNDS	Not Available  EF Denominator HORSEPOWER-HOUR	EF Source AP-42 Table 3.3-1	Tons 3.397E-03
Heating Heating Heat Input (MMBtu/hr)  Emissions Pollutant Carbon Monoxide (CO)	ect. 5) 0.0015 Emission Factor 6.68E-03 Not Available	Not Available  Heat Output Not Available  EF Numerator POUNDS Not Available	Not Available  EF Denominator HORSEPOWER-HOUR Not Available	EF Source AP-42 Table 3.3-1 Not Available	Tons 3.397E-03 Not Available
Heating Heating Heat Input (MMBtu/hr)  Emissions Pollutant Carbon Monoxide (CO) Ammonia (NH <sub>3</sub> ) Vitrogen Oxides (NO <sub>x</sub> )	ect. 5) 0.0015 Emission Factor 6.68E-03	Not Available  Heat Output Not Available  EF Numerator POUNDS	Not Available  EF Denominator HORSEPOWER-HOUR	EF Source AP-42 Table 3.3-1	Tons 3.397E-03
Heating Heating Heat Input (MMBtu/hr) Emissions Collutant Carbon Monoxide (CO) Ammonia (NH <sub>3</sub> ) Litrogen Oxides (NO <sub>x</sub> ) M <sub>10</sub> Primary	Emission Factor 6.68E-03 Not Available 3.1E-02	Not Available  Heat Output Not Available  EF Numerator POUNDS Not Available POUNDS	Not Available  EF Denominator HORSEPOWER-HOUR Not Available HORSEPOWER-HOUR	EF Source AP-42 Table 3.3-1 Not Available AP-42 Table 3.3-1	Tons 3.397E-03 Not Available 1.576E-02
Heating Heating Heat Input (MMBtu/hr)  Emissions Pollutant Carbon Monoxide (CO) Ammonia (NH <sub>3</sub> ) Nitrogen Oxides (NO <sub>x</sub> ) PM <sub>10</sub> Primary Filt + Cond)(PM <sub>10</sub> -PRI)	ect. 5) 0.0015 Emission Factor 6.68E-03 Not Available	Not Available  Heat Output Not Available  EF Numerator POUNDS Not Available	Not Available  EF Denominator HORSEPOWER-HOUR Not Available	EF Source AP-42 Table 3.3-1 Not Available	Tons 3.397E-03 Not Available
Heating Heatin	Emission Factor 6.68E-03 Not Available 3.1E-02 2.2E-03	Not Available  Heat Output Not Available  EF Numerator POUNDS Not Available POUNDS POUNDS	EF Denominator HORSEPOWER-HOUR NOT Available HORSEPOWER-HOUR HORSEPOWER-HOUR	EF Source AP-42 Table 3.3-1 Not Available AP-42 Table 3.3-1 AP-42 Table 3.3-1	Tons 3.397E-03 Not Available 1.576E-02 1.119E-03
Heating Heatin	Emission Factor 6.68E-03 Not Available 3.1E-02	Not Available  Heat Output Not Available  EF Numerator POUNDS Not Available POUNDS	Not Available  EF Denominator HORSEPOWER-HOUR Not Available HORSEPOWER-HOUR	EF Source AP-42 Table 3.3-1 Not Available AP-42 Table 3.3-1	Tons 3.397E-03 Not Available 1.576E-02
Heating Heatin	Emission Factor 6.68E-03 Not Available 3.1E-02 2.2E-03	Not Available  Heat Output Not Available  EF Numerator POUNDS Not Available POUNDS POUNDS POUNDS	EF Denominator HORSEPOWER-HOUR Not Available HORSEPOWER-HOUR HORSEPOWER-HOUR HORSEPOWER-HOUR	EF Source AP-42 Table 3.3-1 Not Available AP-42 Table 3.3-1 AP-42 Table 3.3-1 AP-42 Table 3.3-1	Tons 3.397E-03 Not Available 1.576E-02 1.119E-03
Heating Heatin	Emission Factor 6.68E-03 Not Available 3.1E-02 2.2E-03	Not Available  Heat Output Not Available  EF Numerator POUNDS Not Available POUNDS POUNDS	EF Denominator HORSEPOWER-HOUR NOT Available HORSEPOWER-HOUR HORSEPOWER-HOUR	EF Source AP-42 Table 3.3-1 Not Available AP-42 Table 3.3-1 AP-42 Table 3.3-1	Tons 3.397E-03 Not Available 1.576E-02 1.119E-03
Heating Heatin	Emission Factor 6.68E-03 Not Available 3.1E-02 2.2E-03	Not Available  Heat Output Not Available  EF Numerator POUNDS Not Available POUNDS POUNDS POUNDS	EF Denominator HORSEPOWER-HOUR Not Available HORSEPOWER-HOUR HORSEPOWER-HOUR HORSEPOWER-HOUR	EF Source AP-42 Table 3.3-1 Not Available AP-42 Table 3.3-1 AP-42 Table 3.3-1 AP-42 Table 3.3-1	Tons 3.397E-03 Not Available 1.576E-02 1.119E-03 1.119E-03
Heating Heatin	Emission Factor 6.68E-03 Not Available 3.1E-02 2.2E-03	Not Available  Heat Output Not Available  EF Numerator POUNDS Not Available POUNDS POUNDS POUNDS	EF Denominator HORSEPOWER-HOUR Not Available HORSEPOWER-HOUR HORSEPOWER-HOUR HORSEPOWER-HOUR	EF Source AP-42 Table 3.3-1 Not Available AP-42 Table 3.3-1 AP-42 Table 3.3-1 AP-42 Table 3.3-1	Tons 3.397E-03 Not Available 1.576E-02 1.119E-03 1.119E-03
Heating Heatin	Emission Factor 6.68E-03 Not Available 3.1E-02 2.2E-03 2.2E-03 Not Available	Not Available  Heat Output Not Available  EF Numerator POUNDS Not Available  POUNDS POUNDS POUNDS POUNDS Not Available	EF Denominator HORSEPOWER-HOUR Not Available HORSEPOWER-HOUR HORSEPOWER-HOUR HORSEPOWER-HOUR HORSEPOWER-HOUR Not Available	HHV  EF Source AP-42 Table 3.3-1 Not Available AP-42 Table 3.3-1 AP-42 Table 3.3-1 AP-42 Table 3.3-1 AP-42 Table 3.3-1 Not Available	Tons 3.397E-03 Not Available 1.576E-02 1.119E-03 1.119E-03 Not Available
Heating Heatin	Dct. S) 0.0015  Emission Factor 6.68E-03 Not Available 3.1E-02 2.2E-03 2.2E-03	Not Available  Heat Output Not Available  EF Numerator POUNDS Not Available POUNDS POUNDS POUNDS POUNDS	EF Denominator HORSEPOWER-HOUR Not Available HORSEPOWER-HOUR HORSEPOWER-HOUR HORSEPOWER-HOUR HORSEPOWER-HOUR	HHV  EF Source AP-42 Table 3.3-1 Not Available AP-42 Table 3.3-1 AP-42 Table 3.3-1 AP-42 Table 3.3-1 AP-42 Table 3.3-1	Tons 3.397E-03 Not Available 1.576E-02 1.119E-03 1.119E-03 1.119E-03
Heating Heatin	Emission Factor 6.68E-03 Not Available 3.1E-02 2.2E-03 2.2E-03 Not Available	Not Available  Heat Output Not Available  EF Numerator POUNDS Not Available  POUNDS POUNDS POUNDS POUNDS Not Available	Not Available  EF Denominator HORSEPOWER-HOUR Not Available HORSEPOWER-HOUR HORSEPOWER-HOUR HORSEPOWER-HOUR Not Available GALLON	HHV  EF Source AP-42 Table 3.3-1 Not Available AP-42 Table 3.3-1 AP-42 Table 3.3-1 AP-42 Table 3.3-1  AP-42 Table 3.3-1  Not Available Mass Balance	Tons 3.397E-03 Not Available 1.576E-02 1.119E-03 1.119E-03 Not Available 5.875E-06
Heat Input (MMBtu/hr)	Dct. S) 0.0015  Emission Factor 6.68E-03 Not Available 3.1E-02 2.2E-03 2.2E-03 Not Available 2.2E-03	Not Available  Heat Output Not Available  EF Numerator POUNDS Not Available POUNDS POUNDS POUNDS Not Available POUNDS POUNDS	EF Denominator HORSEPOWER-HOUR Not Available HORSEPOWER-HOUR HORSEPOWER-HOUR HORSEPOWER-HOUR HORSEPOWER-HOUR Not Available	HHV  EF Source AP-42 Table 3.3-1 Not Available AP-42 Table 3.3-1 AP-42 Table 3.3-1 AP-42 Table 3.3-1 AP-42 Table 3.3-1 Not Available	Tons 3.397E-03 Not Available 1.576E-02 1.119E-03 1.119E-03 Not Available

and the second	Emiss	sion Unit 07		THE RESERVE
Secondary Process				
Not Applicable				
1/1/2022		Period End	12/31/2022	
	Summer %	Fall %	Winter %	Spring %
Not Applicable	Not Applicable	Not Applicable		Not Applicable
				1,000
Hours/Day	Weeks/Period	Hours/Period		
		- Trophicasic		
Elem. Sulfur Content Just	H.S Sulfur Content	Ach Contest		
	1125 Suntil Content	Asii Content		
	Not Applicable	Not Applicable		
Chancage	Inot ubburgate	Пиот Аррисаріе		
	Heat Outre		To the second	
				ion
	INOT Applicable		Not Applicable	
	r=			
			EF Source	Tons Per Year
		Not Applicable	Not Applicable	Not Applicable
	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
			постърновоге	ivot Applicable
Not Applicable	Not Applicable	Not Applicable	Not Applicable	Net Applies ble
	Applicable	Tot Applicable	lant whhiteaple	Not Applicable
Not Applicable	Not Applicable	Not Applicable	Net Auglierti	N-1 A 11 11
TOT Applicable	Mor Abblicable	NOT Applicable	Not Applicable	Not Applicable
Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Not Applicable	Not Applicable			
			Not Applicable	Not Applicable
Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
			Туре	Apportion %
Emergency Engine Stack			Vertical	100
TEAL OF REPORT	Releas	se Point 07	حيين وتعروا	التبريو كالمتبرك
			-11	
07		Туре	Vertical	
Emergency Engine Stack				
Stack Diameter (ft)	Exit Gas Temp (F)	Exit Gas Velocity (fps)	Evit Cas Flow Bats Is-	
	1,299	88.7	Exit Gas Flow Rate (ac	rm)
	I,LJJ	100./	2,878	
	-14			
)				
9 54.7341	Longitude	-147.35072	Datum	NAD 1983
9 54.7341	Longitude Accuracy	-147.35072 1	Datum	NAD 1983
	Not Applicable Not Applicable Not Applicable Not Applicable Not Applicable Not Applicable I/1/2022  Not Applicable Not Applicable I/1/2022  Not Applicable Hours/Day Not Applicable Elem. Sulfur Content (wt. pct. S) Not Applicable Emission Factor Not Applicable	Secondary Process Not Applicable Research Not Applicable	Not Applicable Not Ap	Secondary Process   Not Applicable   N

		Emis	sion Unit 11		
Specifications					
ID	11		Design Capacity	5 MILLION BTU PER H	IOUR
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 (%)	lo				
System Description	None				
Equipment Type(s)	None				
Pollutants Controlled					
Pollutant Description	The second second second			Reduction Efficiency (	9/1
Not Applicable				Not Applicable	76)
Processes				[NOT Applicable	
Process	Primary Process				
SCC Code	10301002				
ACC CODE	> External Combustion	n Boilers			
	> Space Heaters	DOUBLE			
	> Commercial/Institu	tional			
	> Liquified Petroleur				
Material Processed	Propane	ii daa (tr d)			
Period Start	1/1/2022		Period End	12/31/2022	
Throughput	12/2/22		p choo cho	12/31/2022	
Total		Summer %	Fall %	Winter %	0-2-06
	7 gallons	29.6	20.4	19.0	Spring % 31.0
Operational Schedule		123.0	120.4	[13.0	131.0
Days/Week	Hours/Day	Manka/Dariad	Iu		
0.1	0.2	Weeks/Period 0.4	Hours/Period 67.3		
Fuel Characteristics	10.2	10.4	167.3		
Heat Content	Flow Cultus Contact (	III c c(c c	Table 1		
		wt. H <sub>2</sub> S Sulfur Content	Ash Content		
MMBtu/kgal)	pct. S)	(vol. pct. H <sub>2</sub> S)			
91.6	3.12E-06	0.2	Not Available		
Heating					
Heat Input (MMBtu/hr)		Heat Output		Heat Values Convention	on
		Not Available		HHV	
Emissions		121			
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
\mmonia (NH₃)	Not Available	Not Available	Not Available	Not Available	Not Available
Nitrogen Oxides (NO <sub>x</sub> )	13	POUNDS	THOUSAND GALLONS	AP-42 Table 1.5-1	2.390E-02
M <sub>10</sub> Primary					
Filt + Cond)(PM <sub>10</sub> -PRI)	0.7	POUNDS	THOUSAND GALLONS	AP-42 Table 1.5-1	1.287E-03
M <sub>2.5</sub> Primary			1		
Filt + Cond)(PM <sub>2.5</sub> -PRI)	0.7	POUNDS	THOUSAND GALLONS	AP-42 Table 1.5-1	1.287E-03
M <sub>2.5</sub> Filterable					
-10	0.2	POUNDS	THOUSAND GALLONS	AP-42 Table 1.5-1	3.677E-04
PM <sub>2.5</sub> -FIL)					
M Condensible	0.5	POUNDS	THOUSAND GALLONS	AP-42 Table 1.5-1	9.192E-04
PM-CON) ulfur Dioxide (SO <sub>2</sub> )	2 05 07			77.	
	2.6E-07	POUNDS	GALLON	Mass Balance	4.823E-07
/olatile Organic	0.8	POUNDS	THOUSAND GALLONS	AP-42 Table 1.5-1	1.471E-03

		Emis	ssion Unit 11		27 (39),5133.1011
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		- Washington			
Total		Summer %	Fall %	Winter %	Spring %
Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Operational Schedule		-100			
Days/Week	Hours/Day	Weeks/Period	Hours/Period		
Not Applicable	Not Applicable	Not Applicable	Not Applicable		
Fuel Characteristics		- 570 - 2711			
Heat Content	Elem. Sulfur Content	H <sub>2</sub> S Sulfur Content	Ash Content		
Not Applicable	Not Applicable	Not Applicable	Not Applicable		
Heating	The state of the s	4.4			
Heat Input		Heat Output		Heat Values Convent	tion
Not Applicable		Not Applicable		Not Applicable	WHI .
Emissions				1	
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 <sub>3</sub> )	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Nitrogen Oxides (NO <sub>x</sub> )	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
PM <sub>10</sub> Primary	- TOTT I PRODUCT	Trot Applicable	нос аррисавіе	Тчот Аррисавіе	Not Applicable
Filt + Cond)(PM <sub>10</sub> -PRI)	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
PM <sub>2,5</sub> Primary Filt + Cond)(PM <sub>2,5</sub> -PRI)	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
M <sub>2.5</sub> Filterable					
PM <sub>2,5</sub> -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
ulfur Dioxide (SO <sub>2</sub> )	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
/olatile Organic Compounds (VOC)	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
ead and lead compounds	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Release Points					
D	Description			Туре	Apportion %
	Building Boiler			Vertical	100
	The state of the s	Relea	ase Point 11	Incincal	TIOO
Specifications					
	11		Туре	Vertical	
	Building Boiler		Living	ACITICAL	
Stack Parameters					
	Stack Diameter (ft)	Evit Gas Tama (5)	Evit Cos Volositu /51	Truit Con Claus D : 1	-f\
	0.98	Exit Gas Temp (F) 450	Exit Gas Velocity (fps) 121	Exit Gas Flow Rate (a	crmj
Seographic Coordinate		J45U	1121	5,477	
	64.73416	Longitude	-147.35072	Datum	NAD 1983
	150	Accuracy	1	Datum	IAWD 1292
	North Pole, AK	[. tecaract			
	Engineering Estimate				

		Emiss	sion Unit 12		
Specifications					
ID	12		Design Capacity	5 MILLION BTU PER H	OUR
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	8				
Capture Efficiency (%)	To				
System Description	None				
Equipment Type(s)	None				
Pollutants Controlled					
Pollutant Description			3 3 3 3 3 3	Reduction Efficiency (	χ1
Not Applicable				Not Applicable	70)
Processes				Inot Applicable	
Process	Primary Process				
SCC Code	10301002				
	> External Combustion E	Roilers			
	> Space Heaters	roncia			
	> Commercial/Instituti	onal			
	> Liquified Petroleum				
Material Processed	Propane				
Period Start	1/1/2022		Period End	12/31/2022	
Throughput				120,027,000	
Total		Summer %	Fall %	Winter %	Spring %
	7 gallons	29.6	20.4	19.0	31.0
Operational Schedule		1000	120.4	13.0	[31.0
Days/Week	Hours/Day	Weeks/Period	Hours/Period		
0.1	0.2	0.4	67.3		
Fuel Characteristics	0.2	10.4	107.3		
Heat Content	Elem. Sulfur Content (w	. H <sub>2</sub> S Sulfur Content	Ash Content		
(MMBtu/kgal)			Asn Content		
	pct. S)	(vol. pct. H <sub>2</sub> S)			
91.6	3.12E-06	0.2	Not Available		
Heating					
leat Input (MMBtu/hr)		Heat Output		Heat Values Convention	n
·		Not Available		HHV	
Emissions					
Pollutant	Emission Factor	EF Numerator	EF Denominator	EF Source	Tons
arbon Monoxide (CO)	7.5	POUNDS	THOUSAND GALLONS	AP-42 Table 1.5-1	1.379E-02
Ammonia (NH₃)	Not Available	Not Available	Not Available	Not Available	Not Available
Nitrogen Oxides (NO <sub>x</sub> )	13	POUNDS	THOUSAND GALLONS	AP-42 Table 1.5-1	2.390E-02
PM <sub>10</sub> Primary	0.7	POLINIES			
Filt + Cond)(PM <sub>10</sub> -PRI)	0.7	POUNDS	THOUSAND GALLONS	AP-42 Table 1.5-1	1.287E-03
PM <sub>2.5</sub> Primary					
Filt + Cond)(PM25-PRI)	0.7	POUNDS	THOUSAND GALLONS	AP-42 Table 1.5-1	1.287E-03
M <sub>2.5</sub> Filterable					+
	0.2	POUNDS	THOUSAND GALLONS	AP-42 Table 1.5-1	3.677E-04
PM <sub>2.5</sub> -FIL) M Condensible					
	0.5	POUNDS	THOUSAND GALLONS	AP-42 Table 1.5-1	9.192E-04
PM-CON)	2 05 07	1			
ulfur Dioxide (SO <sub>2</sub> )	2.6E-07	POUNDS	GALLON	Mass Balance	4.823E-07
/olatile Organic Compounds (VOC)	0.8	POUNDS	THOUSAND GALLONS	AP-42 Table 1.5-1	1.471E-03
ead and lead compounds	N/A	N/A	N/A	N/A	N/A

y Process cable cable cable cable cable cable	Common			
cable cable cable cable cable				
cable cable cable cable				
cable cable cable				
cable cable				
cable				
		Period End	12/31/2022	
	Summer %	Fall %	Winter %	Spring %
cable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
y	Weeks/Period	Hours/Period		
cable	Not Applicable	Not Applicable		
	i vo e v ip pinea a i c	тос присове		
Cantont	Lu C Sulfun Cantant	la-t-G		
ur Content	H <sub>2</sub> S Sulfur Content	Ash Content		
cable	Not Applicable	Not Applicable		
	Heat Output		Heat Values Convent	tion
	Not Applicable		Not Applicable	
Factor	EF Numerator	EF Denominator	EF Source	Tons
cable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
cable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
able	Not Applicable	Not Applicable	Not Applicable	Not Applicable
able	Not Applicable	Not Applicable	Not Applicable	Not Applicable
able	Not Applicable	Not Applicable	Not Applicable	Not Applicable
able	Not Applicable	Not Applicable	Not Applicable	Not Applicable
able	Not Applicable	Not Applicable	Not Applicable	Not Applicable
able	Not Applicable	Not Applicable	Net Applicable	No. A U Li.
BNIE	пос мррисавте	Not Applicable	Not Applicable	Not Applicable
able	Not Applicable	Not Applicable	Not Applicable	Not Applicable
able	Not Applicable	Not Applicable	Not Applicable	Not Applicable
n			Туре	Apportion %
oiler			Vertical	100
	Relea	ase Point 12		
	Aleres			
		Туре	Vertical	
oiler		11100	I + ET LICOT	
and an Idaa	Full Con T (m)	E 1. E 1. 1. 1. 1. 1.	T-1	
ieter (ft)				cfm)
	1450	[121	5,477	
	Longitude	-147.35011	Datum	NAD 1983
	Accuracy	1		
	, AK g Estimate	Longitude Accuracy	450 121  Longitude -147.35011  Accuracy 1	450 121 5,477  Longitude -147.35011 Datum Accuracy 1

No. 1016 & Belevici	200000	Coherenter	- Annual Contract of the Contr					1					
No. 1 Use & blencis   3504   71,00	Aguard	reprosty	March	April	May	June	July	August	September	October	November	December	Total
No. 2 Diesell & Beheds   \$5,207   \$7,204   \$7,704   \$7,		402	240		7007		200		*:	4.7	4	380	
No. 1 Use & Bends   1,245   2,369   3,551   5,65,241   3,66,584   1,271,4779   445,254   45		47.810	DET 75		130 614		000	20	41/	137		634	3,220
No. 10 test & blends   1,454   2,356   3,52,1   5,56,24   1,51,479   4,52,24   4,52,					120,024		80,483		41,304	83,627		20,435	484,209
No. 10 test & blends   669586   19933   629714   366,684   1,571,479   465,644   1,671,479   465,644   1,671,479   465,644   1,671,479   465,644   1,671,479   465,644   1,671,479   465,644   1,671,479   465,644   1,671,479   1,671,4		2,369	3,622	506	2.695	472 858	2 533	Coo	1 067				Œ.
Propare   Prop		109,913	628,714	366.684	1 571 479	454 541	455,054	77.713	196'T	976	685	3,724	444,249
No. 1 UiSpeele   No. 2 UiSpeele   UiSpeele   No. 2 UiSpeele		] 4	×			***************************************	L	11,145	103,663	65,004	194,555	608,578	5,384,656
Propare	*	387	344	328	203,094	54,077	367	1 304	509	283	000	000	***************************************
Propare   Prop	2,649,997	2,362,166	2,378,305	2,368,272	903.124	2.267.786	2 192 979	1 650 436	1 649 632	7 237 630	200 CCC	975	15,202
Propante   Propante   2,277			13	٠	æ	91	9	10	1,333,063	4,327,030	7/6'557'7	2,729,474	26,058,464
Free! Type	0.0	0'0		0.0	0'0	П	0.2	E'0	0.0	03	00		37.6
Fuel Type         Fuel Usage by Season (%)         String         Tank		181	(*)	96	7,77	Ĭ.	8	2 179			1 100	1 400	
Fuel Type   Summer   Fuel   Large by \$6a3con   \$6/1   Minter   Spring   Fuel   Type   Summer   Fall   Winter   Spring   Mo. 1 ULS   Mo. 1 ULS   Mo. 2 Diesel   Ruends   Let A   Mo. 2 Diesel									3		2001	DOT. 1	+cc',
Property   Part   Par													
No. 2 Diesel & blends   Soninger   Solid   No. 2 Diesel		.,	ason (%)			Tank		Fuel Usage	Fuel Usage by Season (%)			41111	Operating
No. 2 Diesel & blends   12.0   17.2   41.6   23.2   17.5   18.5   18.5   23.2   19.5	Summer	Fall	Winter	Spring			Summer	Fall	Winter	Spring		EUID	Hours <sup>2</sup>
No. 2 Diesel & blends   12.0   17.2   41.6   25.2   10.0				*		Jet A	0	0	0	0			169.0
No. 2 Diesel & blends   16.6   25.8   24.9   32.7   No. 2 Diesel   No. 2 Diesel & blends   1.66   0.8   1.7   1.5   1.		17.2	41.6	29.2		No. 1 Diesel	67.9	6.0	1.4	29.8		10	1 013 5
No. 2 Diesel & bends   September   Septe		25,8	24.9	32,7	_	No. 2 Diesel	18,2	9.7	25.7	46.4		1 0	0 1000
No. 10LS	33	•	ř			ULSD	61,1	16.7	0.0	22.2		7	0,100,0
No. 2 Diesel & blends   18.3   8.2   25.8   47.7	0.96	8.0	1.7	1.5	20								0 (
No. 10 leses & blends   Jan		8.2	25.8	47.7								11	6/3
No.1 ULS   21.2   0.8   0.3   77.6   77.6   77.6   72.2   22.5   22.7   22.1   22.2				٠							_	777	6/,3
Propane   23.5   25.7   21.7   22.2   22.4   22.2	21.2	8.0	0.3	77.6									
Propane   29 6   204   19   31   31   31   31   31   31   31	23.5	25.2	29.7	21.7									
Fuel Type         January         February         March         April         May         June           Jet A         Jet A         June         1,738         3,158         4,206         834         206,489         476,987           No. 2 Diesel & blends         1,738         3,158         4,206         834         206,489         476,987           No. 2 Diesel & blends         721,788         157,723         6,64,48         366,884         1,702,093         454,56           Propane         721,788         157,723         6,64,48         366,884         1,702,093         454,56           Propane         138         135,256         2,378,305         2,388,272         303,124         2,267,72           Propane         Jet A         133,556         134,135         134,045         133,866         133,824         139,58           No. 1 Diesel & blends         133,556         134,135         134,045         133,866         131,824         139,68           No. 1 Diesel & blends         133,556         134,135         134,045         133,86         131,824         139,68           No. 1 Diesel & blends         133,556         134,135         134,045         133,68         133,86         133,86	61.1	16.7		22.2									
Fuel Type         January         February         March         April         May         June           No. 2 Lots         1,738         3,158         4,206         834         206,489         476,93           No. 2 Lotsel & blends         1,738         3,158         4,206         834         206,489         476,93           No. 2 Lotsel & blends         721,788         157,723         656,448         366,841         1,702,093         454,50           No. 4 Lotsel & blends         Jan         Feb         Mar         Apr         May         Jun           Fuel Type         Jan         Feb         Mar         Apr         May         Jun           No. 1 Diesel & blends         133,556         134,135         134,652         133,866         131,824         139,866           No. 1 Diesel & blends         107,765         134,135         134,652         137,855         139,866         138,866         138,866         139,866         139,866         139,866         139,866         139,866         139,866         139,866         139,866         139,866         139,866         139,866         139,866         139,866         139,866         139,866         139,866         139,866         139,866         139,866													
1,738	29.6	20,4	19	31									
13736   137,723   656,448   366,684   1,702,093   476,93     2,649,997   2,362,166   2,378,305   2,368,272   393,124   2,257,73     3,1356   134,135   134,045   133,866   131,824   133,88     133,556   134,135   134,045   133,866   131,824   133,88     133,556   134,135   134,045   133,866   131,824   133,88     133,556   134,135   134,045   133,866   131,824   133,88     133,556   134,135   134,045   133,866   131,824   133,88     133,566   134,135   134,045   133,866   131,824   133,88     133,566   134,135   134,045   134,88   138,845   134,945     133,566   134,135   134,045   134,88   138,845     133,566   134,135   134,045   134,88   134,945     107,765   134,135   134,045   107,811   107,888   109,33     0,0020   0,003   0,003   0,0015   0,0015   0,0015     0,0010   0,0010   0,00110   0,00110   0,00110     140   140   140   140   140     150   150   150   150   150   150   150     150   150   150   150   150   150   150     150   150   150   150   150   150													
January   February   March   April   May   June						To	Total Fuel Usage (Gallons)	(Gallons)					
1,738   3,158   4,206   834   206,489   476,189     721,788   157,723   656,448   366,684   1,702,093   454,189     2,649,997   2,362,166   2,378,305   2,388,272   903,124   2,267,267,267,267,267,267,267,267,267,26	January	February	March	April	May	June	July	August	September	October	November	December	Total
1,738   3,158   4,206   834   206,489   476;				*	*	*		380	Si.	,	9		
13,723   15,723   656,448   366,684   1,702,093   454,1     2,649,997   2,362,166   2,378,305   2,368,272   903,124   2,267,2     13m   Feb   Mar   Apr   May   Jun     13m   Feb   Mar   Apr   138,645   13		3,158	4,206	834	206,489	476,935	3,286	2,184	2,893	1,696	1,678	4,886	709,983
136.00	1	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
Jan   Feb   Mar   Apr   May   Jun		**	13	20		19	9	10	*	10	. (*	24	85
Jan         Feb         Mar         Apr         May         Jun           133,556         134,135         134,045         133,866         131,824         133,613           133,556         134,135         134,045         138,645         138,645         133,81           133,556         134,135         134,045         138,666         131,824         133,81           133,556         134,135         134,045         138,666         131,824         133,81           133,556         134,135         134,045         133,866         131,824         133,81           137,765         134,135         134,045         137,811         107,888         109;           130         0.088         0.089         0.089         0.089         0.09           0.00150	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
Jan   Feb   Mar   Apr   May   Jun					2,277	٠	,	2,179		iit.	1,498	1,400	7,354
130,556   134,135   134,045   138,166   131,624   133,556   134,135   134,045   133,666   131,624   133,556   134,135   134,045   133,666   131,624   133,556   134,135   134,045   133,666   131,624   133,516   131,624   133,516   131,624   133,516   131,624   133,516   131,624   133,516   131,624   133,516   131,624   133,516   131,624   131,	-						Mend well Will land	fanil <sup>3</sup>					
133,556   134,135   133,045   133,866   131,824   133,615   133,556   134,135   137,835   133,666   131,824   133,515   133,556   134,135   134,	Jan	Feb	Mar	Apr	May	uniq	101	Ann	500	į			
133,556   134,135   134,045   133,666   131,824   133,556   133,556   133,256   133,	4:								do	3	AON	nec	Average
133,556   137,855   138,168   138,645   139,645   139,645   131,824   131,		134,135	134,045	133,866	131,824	133.867	133.774	97	135 480	120 751	122 643	120 021	, , , ,
133.556   134,135   134,045   133,866   131,824   133,		133,952	137,855	138,168	138,645	139,560	142,510		135.032	129,375	140 142	133 828	135,699
107,765	133,556	134,135	134,045	133,866	131,824	133,867	133,774	17	135,480	132.761	133.542	132,020	133 600
Jan         Feb         Mar         Apr         May         Jun           0.088         0.089         0.089         0.089         0.089         0.089         0.089         0.089           0.00150         0.00150         0.00150         0.00150         0.00150         0.00150         0.00150         0.00150           0.0020         0.0019         0.0017         0.0015         0.0015         0.0015         0.0015         0.0015           Jan         Feb         Mar         Apr         May         Jun	107,765	•	107,652	107,811	107,888	109,326	٠	109,400		118,898	106,470	106,398	109,068
1an   Feb   Mar   Apr   May   Jun													
100   100							Sulfur (max v	vt. pct. 5)					
0.088 0.089 0.089 0.089 0.089 0.108	791	reo	Mar	Apr	May	unr	In	Aug	Sep	Oct	Nov	Dec	Average
0.0020	•								e				×
0.504		680.0	0.089	6800	680.0	0.104	0.114	0.114	860"0	0,112	0,113	0,113	0.101
190   Feb   Mar   Apr   May   Jun		0.00150	0.304	0.46/	0.436	0.452	0.462	0.468	0.098	0.112	0,113	0,113	0.303
	00000	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150	0.00150	0,00150	0.00150	0,00150	0.0015
Jan Feb Mar Apr May Jun	02000	I STOO'O	71000	0.0013	0.0015	0.0015	0.0020	0,0014	0.0014	0.0020	0.0020	0.0026	0.0018
Jan Feb Mar Apr May Jun						100	Culfur funt	10.01					
, may , may , mark	Jan	Feb	Mar	Anr	May		Total Insurance	Die Control	133	100			
			,		0.0			Aug	Sep	50	Nov	Dec	Average
					7.0			0.2		÷	0.2	0.2	0.2

<sup>1</sup> Assumed
<sup>2</sup> 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
<sup>3</sup> From fuel test records
<sup>4</sup> Provided by the supplier;
<sup>5</sup> Estimate from vendor propane factor notifications

	Fuel Prices (\$/gallon) representative A	pril 2016		NPP			ZN	IP.
			Naphtha	LSR Turbine **	DF#1, DF#2	ULSD	DF#1, DF#2	ULSD
Α	PSI Base Price		\$1.127000	\$0.792619	\$1.492381	\$1.378810	\$1.492381	\$1.378810
В	PSI & Federal surcharges *		\$0.012405	\$0.012405	\$0.052405	\$0.012405	\$0.052405	\$0.012405
С	PSI Delivery Charge					\$0.155000		\$0.155000
D	PSI Fuel Surcharge	C * 15%				\$0.023250		\$0.023250
Ε	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

<sup>\*</sup> 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		
۵.		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	
<u>е</u>	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		
0		PSI & Federal surcharges *	-	-	-	-	\$0.003	\$0.003	\$0.003	\$0.003	-	-	-	-	-	-	-	-	\$0.003	\$0.003	\$0.003	\$0.003	\$0.003	-	\$0.003		
۵		PSI Ops Surcharge	-	-	-	-	\$0.05	\$0.05	\$0.05	\$0.05	-	-	-	-	-	-	-	-	\$0.05	\$0.05	\$0.05	\$0.05	\$0.05	-	\$0.050		
ے ا		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	
Ξ	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		
0		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		
Z		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	
<u> </u>	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		
בֿו		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	40.000	
<u> </u>		Big State Fuel Surcharge	18.5%	20.5%	20.5%	20.5%	-	4	-	4	23.0%	23.0%	23.0%	23.0%	24.0%	26.0%	26.0%	26.0%	-	-	-		-	26.0%	\$0.0066	\$2.093	
Ιĕ	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		
'7		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 20.5%	\$0.025 20.5%	\$0.025 20.5%	\$0.030 20.5%	\$0.030 20.5%	\$0.030 20.5%	\$0.030 19.0%	\$0.030 23.0%	\$0.030 23.0%	\$0.030 23.0%	\$0.030	\$0.030 24.0%	\$0.030 26.0%	\$0.030	\$0.030 26.0%	\$0.030 29.0%	\$0.030 27.0%	\$0.030 27.0%	\$0.030	\$0.030 26.0%	\$0.030	\$0.029	ć2 252 <u>ć0 242</u>	6
		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	4

## **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
L	SR 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
Г	DF2+10	PSI Base Price		-	-	-	-	\$1.625	\$1.576	\$1.621	\$1.708	-	-	-	-	-	-	-	-	\$2.150	\$2.286	\$2.395	\$2.400	\$2.408	-
7		PSI & Federal surcharges *		-	-	-	-	\$0.003	\$0.003	\$0.003	\$0.003	-	-	-	-	-	-	-	-	\$0.003	\$0.003	\$0.003	\$0.003	\$0.003	-
7		PSI Ops Surcharge		-	-	-	-	\$0.05	\$0.05	\$0.05	\$0.05	-	-	-	-	-	-	-	-	\$0.05	\$0.05	\$0.05	\$0.05	\$0.05	-
7		Delivery Charge		-	-	-	-	\$0.020	\$0.020	\$0.020	\$0.020	-	-	-	-	-	-	-	-	\$0.020	\$0.020	\$0.020	\$0.020	\$0.020	-
7		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	-
<u>e</u>	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
0		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
Δ.		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
된		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
0		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
Z	JLSD	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
0	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%	<u> </u>
-		Delivery Fuel Surchage (%*Delivery)	ć2.400	-	-	-	-	\$0.006	\$0.006	\$0.006	\$0.006	-	-	-	-	-	-	-	-	\$0.009	\$0.008	\$0.008	\$0.007	\$0.008	<u> </u>
	252.45	Total \$/Gallon	\$2.109		-	- 44.740	-	\$1.714	\$1.665	\$1.711	\$1.797	-	-	- 62.040	- 42.024	-	- 42.204	- 62.400	- 425	\$2.242	\$2.377	\$2.487	\$2.490	\$2.499	- do 400
F	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
ē ⊦		PSI Ops Surcharge		\$0.04 \$0.025	\$0.05 \$0.025	\$0.05 \$0.025	\$0.05 \$0.025	-	-	-	-	\$0.05 \$0.030	\$0.05 \$0.030	\$0.05 \$0.030	\$0.05 \$0.030	\$0.05 \$0.030	\$0.05 \$0.030	\$0.05 \$0.030	\$0.05 \$0.030	-	-	-	-	-	\$0.05 \$0.030
δŀ		Truck Delivery  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%
ĭ		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
اڃ		Total \$/Gallon	\$2.093	\$1.823	\$1.880	\$1. <b>795</b>	\$1.815	-		-		\$1.964	\$2.001	\$2.129	\$2.111	\$2.264	\$2.294	\$2.279	\$2.266	-		-			\$2.590
4	JLSD		Ş2.033	\$1.963		\$1.805	\$1.852	\$1.806	¢1 702	\$1.622	¢1 707	\$2.074	-	\$2.159	\$2.038	\$2.129		\$2.083		\$2.417	¢2 120	\$2.301	\$2.225	\$2.308	\$2.406
Ň		PSI Base Price PSI & Federal surcharges *		\$0.003	\$1.904 \$0.003	\$0.003	\$0.003	\$0.003	\$1.703 \$0.003	\$0.003	\$1.797 \$0.003	\$0.006	\$2.107 \$0.003	\$0.003	\$0.003	\$0.003	\$2.083 \$0.003	\$0.003	\$2.309 \$0.003	\$0.003	\$3.129 \$0.003	\$0.003	\$0.003	\$0.003	\$2.406
		PSI Delivery Charge		\$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 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
- I		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%
7		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
7		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
7		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%
7		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
7		Total \$/Gallon	\$2.352		\$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		\$2.664

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



PO Box 71249, Fairbanks, AK 99707-1249 • (907) 452-1151 • www.gvea.com



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	CY2019 Actual	Fee Estimate
	Permit No.	Emissions (Tons)	
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 <a href="mailto:nmknight@gvea.com">nmknight@gvea.com</a>. The certification from Frank E. Perkins, Vice President Power Supply Follows.

Sincerely,

Naomi Morton Knight, P.E.

**Environmental Officer** 

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## 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

Ass	essable Emi	ssions - Tor	s Per Year				
Description	NO <sub>X</sub>	CO	PM	VOC	SO <sub>2</sub>	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) <sup>1</sup>					
		NO <sub>X</sub>	CO	PM	VOC	SO <sub>2</sub>	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		923	22	8	345	5
	Fees Apply to Pollutant? 2	Yes	Yes	Yes	No	Yes	No
CY2019 Actual Emissions 1,568							
	Fee Estimate <sup>3</sup>	9 <sup>3</sup> \$67,346					

#### Notes:

<sup>&</sup>lt;sup>1</sup> Regulated air pollutant calculations based on emission factors shown in accompanying spreadsheets.

<sup>&</sup>lt;sup>2</sup> Fees paid on each pollutant emitted in quantities greater than 10 tpy per 18 AAC 50.410.

<sup>&</sup>lt;sup>3</sup> 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

		Fuel / Material	CY2019 Actual		
ID	Name	Description	Rating	Type	Operation <sup>1</sup>
1	Unit No. 1	Foster-Wheeler Boiler (w/ SNCR)	327 MMBtu/hr	Coal/ULSD	7,441 hours
'	Offict No. 1	1 Oster-Wheeler Boller (W/ SINGIN)	327 Minibita/iii	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).		Coal	2,510 hours <sup>2</sup>
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 <sup>2</sup>
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:

<sup>&</sup>lt;sup>1</sup> Hours are based on CY2019 operation in accordance with condition 112 Permit No. AQ0173TVP03.

<sup>&</sup>lt;sup>2</sup> 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	Detine
ID	ID Description		Make/Model Type		Rating
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 <sup>2</sup>	900 acfm
N/A	Urea Storage Silo A/B Bin Vent Filter	N/A	Urea	136 hours <sup>3</sup>	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 <sup>5</sup>	850 scfm

#### Note:

<sup>&</sup>lt;sup>1</sup> This emissions unit is associated with EU ID 2.

<sup>&</sup>lt;sup>2</sup> Estimated operation of 1,095 hours is assumed with each of the three units operating one hour per day.

<sup>&</sup>lt;sup>3</sup> 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)

<sup>&</sup>lt;sup>4</sup> 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)

<sup>&</sup>lt;sup>5</sup> 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			Fuel	Factor	NO <sub>X</sub> Emission	CY2019 Actual	CY2019 Actual	
ID	Description	Rating/Capacity	Type	Reference	Factor	Operation	NO <sub>X</sub> 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 <sup>3</sup> 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 <sup>3</sup> 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 <sup>1</sup>	
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 Emi	ssions - CY2019 Actua	al Emissions - NOX	277.8 tpy	
			Insignificant Emiss					
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	,	о гру	
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 Emi	ssions - CY2019 Actua	al Emissions - NOX	0 tpy	
	<u> </u>	<u> </u>	<u>'</u>	·	<u> </u>			
					CY2019 Actu	al Emissions - NOX	277.8 tpy	

Notes:

<sup>1</sup> 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, Ib/MMBtu) x (Rating, MMBtu/hr) x (Operation, hr/yr) / (Conversion, 2,000 lb/ton)

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

Emissions (tpy) = (Emission factor, Ib/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	Туре	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 <sup>3</sup> 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 <sup>3</sup> 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 <sup>1</sup>	
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 E	missions - CY2019 Act	ual Emissions - CO	922.8 tpy	
			Insignificant Emission	ons 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	0,557 110015	υ τργ	
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 - CY2019 Actual Emissions - CO								
					CY2019 Act	ual Emissions - CO	922.8 tpy	

#### Notes

<sup>1</sup> 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<sup>3</sup> gal) x (Fuel consumption, gal) / (Conversion, 1,000 gal/10<sup>3</sup> 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 <sup>3</sup> gal	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 <sup>3</sup> gal	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	e 5a	8,760 hours	3.0 tpy		
12	Coal Storage Pile	15 day supply	Coal	See Table	e 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 - CY2019 Actual Emissions - PM									
			Insignificant Emi	ssions 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	0,337 110015	υ.Ζ ιμγ		
N/A	Ash Handling	Not Applicable	Ash	See Table	e 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 - CY2019 Actual Emissions - PM									
					01/00/0	A street DM Freinging	00.4.6		
					CY2019	Actual PM Emissions	22.1 tpy		

#### Notes

<sup>1</sup> 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, Ib/MMBtu) x (Rating, MMBtu/hr) x (Operation, hr/yr) / (Conversion, 2,000 lb/ton)

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

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

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

Notes:

<sup>1</sup> Coal Haul Road

**Unpaved Road Emission Factor** 

AP-42, Section 13.2.2, Equation 1a:

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

$$k \qquad 4.9 \qquad \text{from AP-42, Table } 13.2.2-2$$

$$s = \text{surface material silt content (haul road)} \qquad 5.1 \qquad \text{percent, from AP-42, Table } 13.2.2-1$$

$$W = \text{mean vehicle weight} \qquad 193.75 \qquad \text{tons, estimate - average of full (} 262.5 \text{ ton)} \text{ and empty (} 125 \text{ ton)} \text{ truck}$$

$$a \text{ (empirical constant)} \qquad 0.7 \qquad \text{from AP-42, Table } 13.2.2-2$$

$$b \text{ (empirical constant)} \qquad 0.45 \qquad \text{from AP-42, Table } 13.2.2-2$$

$$E \text{ (uncontrolled)} = \qquad 17.56 \qquad \text{lb/VMT}$$

$$Efficiency = \qquad 60\% \qquad \text{assumed control efficiency for water application}$$

$$E \text{ (controlled)} = \qquad 7.03 \qquad \text{lb/VMT}$$

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<sub>ext</sub> = 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

$$E (controlled) = \frac{PM}{5.10} lb/VMT$$

## 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 throughout	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	Factor Reference	Emission Factor	CV2040 Actual Operation	CY2019 Actual PM Emissions
ID	Description	Factor Reference	Emission Factor	C12019 Actual Operation	C12019 Actual PM Emissions
	Truck Drop Onto Stockpile	AP-42, Section 13.2.4	2.43E-04 lb/ton	327,213 tpy	0.0 tpy <sup>1</sup>
12	Front End Loader Drop Into Grizzly	AP-42, Section 13.2.4	2.43E-04 lb/ton	327,213 tpy	0.0 tpy <sup>1</sup>
12	Front End Loader Movement - Coal Pile to Grizzly	AP-42, Section 13.2.2	3.27 lb/VMT	1,189 VMT	1.9 tpy <sup>2</sup>
	Stockpile Wind Erosion	AP-42, Section 13.2.5	0.00 g/m <sup>2</sup> -yr	10,150 m <sup>2</sup>	0.0 tpy <sup>3</sup>
			C'	Y2019 Actual PM Emissions	2.0 tpy

Notes:

<sup>1</sup> 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 0.74

\_\_\_

AP-42, Section 13.2.4

U = mean wind s

16.50 miles/hr 30.80 percent 43E-04 lb/ton

146,690 tons

Per MET data recorded at GVEA's Eva Creek Wind Farm CY2019, conservative estimation with higher winds than seen at the Healy Power Plant Weighted average from EU ID 1 and 2 CY2019 coal proximate analyses

 U = mean wind speed
 16.50

 M = coal moisture content
 30.80

 E =
 2.43E-04

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
EU ID 2 CY2019 actual coal throughput

from Healy environmental report from Healy environmental report

 U ID 2 CY2019 actual coal throughput
 180,524 tons

 Total CY2019 actual coal throughput
 327,213 tons

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

Size of load bucket
Density of coal
Coal moved per trip

11 yd<sup>3</sup> 52.63 lb/ft<sup>3</sup> 7.815555 tons

<sup>&</sup>lt;sup>2</sup> Front End Loader Movement Coal moved per trip:

#### 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:

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

$$k \qquad 4.9 \qquad \text{from AP-42, Table 13.2.2-2}$$

$$s = \text{surface material silt content (haul road)} \qquad 8.4 \qquad \text{percent, from AP-42, Table 13.2.2-1}$$

$$W = \text{mean vehicle weight} \qquad 33.2 \qquad \text{tons, estimate}$$

$$a \text{ (empirical constant)} \qquad 0.7 \qquad \text{from AP-42, Table 13.2.2-2}$$

$$b \text{ (empirical constant)} \qquad 0.45 \qquad \text{from AP-42, Table 13.2.2-2}$$

$$E \text{ (uncontrolled)} = \qquad 11.26 \qquad \text{lb/VMT}$$

$$E \text{fficiency} = \qquad 60\% \qquad \text{assumed control efficiency for water application}$$

$$E \text{ (controlled)} = \qquad 4.50 \qquad \text{lb/VMT}$$

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<sub>ext</sub> = 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

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

FY2021 Assessable Emissions Golden Valley Electric Association - Healy Power Plant

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

<sup>3</sup> Stockpile Wind Erosion Coal Pile Surface Area

Surface area of active face = 10,150 m<sup>2</sup> 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<sub>i</sub> = erosion potential corresponding to the fastest mile of wind for the ith period between disturbances, g/m<sup>2</sup>

AP-42 Section 13.2.5, Equation (3)

Erosion potential function for a dry exposed surface, P

$$P = 58 (u^* - u_r^*)^2 + 25 (u^* - u_r^*)$$

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

where

u\* = friction velocity (m/s)

u<sub>t</sub> = threshold friction velocity (m/s)

AP-42 Section 13.2.5, Equation (1)

Friction velocity, u\*

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

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<sub>o</sub> = roughness height, cm

Data:

u(z) z 10

Using average wind speed recorded at GVEA's Eva Creek Wind farm for each month in CY2019 (see table below)

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

				Uncrusted Coal Pile <sup>b</sup> (Table 13.2.5-2)				Ground Coal (Table 13.2.5-2)						
Month-Year	Average W (u(1		Wind Direction	Roughness Height (z <sub>o</sub> )	Threshold Friction Velocity (u <sub>t</sub> )	Calculated Friction Velocity (u*)	Erosion potential function,	Roughness Height (Z <sub>o</sub> )	Threshold Friction Velocity (u <sub>t</sub> )	Calculated Friction Velocity (u*)	Erosion potential function,	PxN	k	Emission Factor, EF
	mph	m/s	deg	cm	m/s	m/s		cm	m/s	m/s				g/m²-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 <sub>10</sub> Annual	Total						0				0.00	0.00	0.5	0.00

<sup>&</sup>lt;sup>a</sup> Per MET data recorded at GVEA's Eva Creek Wind farm CY2019.

<sup>&</sup>lt;sup>b</sup> 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	Factor Reference	Emission	Emission Factor	CY2019 Actual Operation	CY2019 Actual PM Emissions	
ID	Description	ractor Reference	EIIIISSIOII	EIIIISSIOII FACIOI	C12019 Actual Operation	C12019 Actual PM EIIIISSIONS	
	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 <sup>1</sup>	
N/A	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 <sup>2</sup>	
	Ash Drying Area Wind Erosion	AP-42, Section 13.2.5	PM	0.00 g/m <sup>2</sup>	4,800 m <sup>2</sup>	0 tpy <sup>3</sup>	
					CY2019 Actual PM Emissions	1.3E-01 tpy	

#### Notes:

AP-42, Section 13.2.4

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

0.74

U = mean wind speed 16.50 miles/hr M = ash moisture content 17.5 percent

Per MET data recorded at GVEA's Eva Creek Wind Farm CY2019, conservative estimation with higher winds than seen at the Healy Power Plant Avg of slag, bottom ash, and fly ash from Heat and Material Balance for HCCP - March 6, 1998

lb/ton

E (uncontrolled) = 5.37E-04

Efficiency = assumption because material is wet 50%

E (controlled) = 2.68E-04 lb/ton

Annual stockpile throughput:

EU ID 1 CY2019 Ash Throughput EU ID 2 CY2019 Ash Throughput 14,319 tons from Healy environmental report from Healy environmental report

19,657 tons Total Ash Throughput 33,976 tons

8 yd<sup>3</sup>

Ash moved per trip:

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

Size of load bucket Density of ash

60 lb/ft3 Ash moved per trip 6.48 tons

<sup>&</sup>lt;sup>1</sup> Front End Loader / Flyash Storage Silo Drop into Truck

<sup>&</sup>lt;sup>2</sup> Front End Loader Movement - Ash Pile to Truck

## 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

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

$$k \qquad 4.9 \qquad \text{from AP-42, Table 13.2.2-2}$$

$$s = \text{surface material silt content (haul road)} \qquad 8.4 \qquad \text{percent, from AP-42, Table 13.2.2-1}$$

$$W = \text{mean vehicle weight} \qquad 27 \qquad \text{tons, estimate}$$

$$a \text{ (empirical constant)} \qquad 0.7 \qquad \text{from AP-42, Table 13.2.2-2}$$

$$b \text{ (empirical constant)} \qquad 0.45 \qquad \text{from AP-42, Table 13.2.2-2}$$

$$E \text{ (uncontrolled)} = \qquad 10.26 \qquad \text{lb/VMT}$$

$$E \text{ (ficiency} = \qquad 60\% \qquad \text{assumed control efficiency for water application}$$

$$E \text{ (controlled)} = \qquad 4.10 \qquad \text{lb/VMT}$$

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<sub>ext</sub> = 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

	IVI	_
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

<sup>d</sup>From AP-42, Section 13.2.5, Industrial Wind Erosion

Ash Pile Surface Area

Surface area of active face = 4,800 m<sup>2</sup>

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

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

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<sub>i</sub> = erosion potential corresponding to the fastest mile of wind for the ith period between disturbances, g/m<sup>2</sup>

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

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

$$P=0\,for\,u^*\leq u_*^*$$

where  $u^* = friction v$ 

u\* = friction velocity (m/s) u<sub>t</sub> = 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)  $z_0$  = 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 <sup>a</sup>										
					(Table	13.2.5-2)					
Month-Year	Average W (u(1	/ind Speed 0)) <sup>b</sup>	Wind Direction	Roughness Height (z <sub>o</sub> )	Threshold Friction Velocity (u <sub>t</sub> )	Calculated Friction Velocity (u*)	Erosion potential function,	PxN	k	Emission Factor (uncontrolled), EF	Emission Factor (controlled), EF <sup>c</sup>
	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 <sub>10</sub> Ai	2018 PM <sub>10</sub> Annual Total							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.

<sup>&</sup>lt;sup>b</sup> Per www.ncdc.noaa.gov for CY2018, McKinley Airport ASOS (PAIN).

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

#### Notes:

#### **Unpaved Road Emission Factor**

AP-42, Section 13.2.2, Equation 1a:

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

$$k \qquad 4.9 \qquad \text{from AP-42, Table 13.2.2-2}$$

$$s = \text{surface material silt content (haul road)} \qquad 5.1 \qquad \text{percent, from AP-42, Table 13.2.2-1}$$

$$W = \text{mean vehicle weight} \qquad 151.25 \qquad \text{tons, estimate - average of full (197.5 ton) and empty (105 ton) truck}$$

$$a \text{ (empirical constant)} \qquad 0.7 \qquad \text{from AP-42, Table 13.2.2-2}$$

$$b \text{ (empirical constant)} \qquad 0.45 \qquad \text{from AP-42, Table 13.2.2-2}$$

$$E \text{ (uncontrolled)} = \qquad 15.71 \qquad \text{lb/VMT}$$

$$Efficiency = \qquad 60\% \qquad \text{assumed control efficiency for water application}$$

$$E \text{ (controlled)} = \qquad 6.28 \qquad \text{lb/VMT}$$

<sup>&</sup>lt;sup>1</sup>Ash Haul Road

## 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:

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

 $\mathsf{E}_\mathsf{ext}$  = 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

<sup>2</sup> Limestone/Lime/Sodium Bicarbonate Haul Road

#### **Paved Road Emission Factor**

AP-42, Section 13.2.1, Equation 1:

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

D ( , m ) - h(JD) ( )		
VMT) = $R(32)$ ( $V$ )	PM	
k = particle size multiplie	er 0.011	lb/VMT from AP-42 Table 13.2.1-1
sL = surface material silt content (haul road	d) 0.6	g/m <sup>2</sup> , from AP-42, Table 13.2.1-3
W = mean vehicle weigh	nt 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<sub>ext</sub> = 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:

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

$$k \qquad 4.9 \qquad \text{from AP-42, Table 13.2.2-2}$$

$$s = \text{surface material silt content (haul road)} \qquad 5.1 \qquad \text{percent, from AP-42, Table 13.2.2-1}$$

$$W = \text{mean vehicle weight} \qquad 122.5 \qquad \text{tons, estimate - average of full (135 ton) and empty (110 ton) loader/trailer}$$

$$a \text{ (empirical constant)} \qquad 0.7 \qquad \text{from AP-42, Table 13.2.2-2}$$

$$b \text{ (empirical constant)} \qquad 0.45 \qquad \text{from AP-42, Table 13.2.2-2}$$

$$E \text{ (uncontrolled)} = \qquad 14.29 \qquad \text{lb/VMT}$$

$$E \text{ fliciency} = \qquad 60\% \qquad \text{assumed control efficiency for water}$$

$$E \text{ (controlled)} = \qquad 5.72 \qquad \text{lb/VMT}$$

## 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<sub>ext</sub> = 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

Throughput

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

**Vehicle Miles Traveled (VMT)** 

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

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

<sup>&</sup>lt;sup>3</sup> Miscellaneous Traffic

#### **Paved Road Emission Factor**

AP-42, Section 13.2.1, Equation 1:

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

(VMT)	PM	
k = particle size multiplier	0.011	
sL = surface material silt content (haul road)	0.6	g/m <sup>2</sup> , 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<sub>ext</sub> = 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		Fuel	Factor	VOC Emission	CY2019 Actual	CY2019 Actual
ID	Description	Rating/Capacity	Туре	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	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 <sup>2</sup>
3	Auxiliary Boiler No. 1	12.554 MMBtu/hr	ULSD	AP-42, Table 1.3-3	0.34 lb/10 <sup>3</sup> 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 <sup>3</sup> 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 <sup>3</sup>
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 U	nits Emissions - CY2019 A	ctual Emissions - VOC	8.0 tpy
		Ir	significant Emissions				
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
	<u> </u>		Ins	significant Emissions Ur	nits Emissions - CY2019 A	ctual Emissions - VOC	0 tpy
					CY2019 Ac	ctual Emissions - VOC	8.0 tpy

#### Notes

<sup>1</sup> EU ID 1 actual coal throughput 146,690 tons <sup>2</sup> EU ID 2 actual coal throughput 180,524 tons

<sup>3</sup> 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/10³ gal) x (Fuel consumption, gal) / (Conversion, 1,000 gal/10³ gal) / (Conversion, 2,000 lb/ton)

Emissions (tpy) = (Emission factor, Ib/MMBtu) x (Fuel heat value, Btu/gal) / (Conversion, 1,000,000 Btu/MMBtu) x (Fuel consumption, gal) / (Conversion, 2,000 Ib/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 (SQ) Emissions Golden Valley Electric Association - Healy Power Plant

	Emissions Unit		Fuel	Factor	Maximum Fuel	SO <sub>2</sub> Emission	CY2019 Actual	CY2019 Actual
ID	Description	Rating/Capacity	Туре	Reference	Sulfur Content	Factor	Operation	SO <sub>2</sub> 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 <sup>1,2</sup>	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 <sup>1,2</sup>	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 <sup>1,2</sup>	29 gallons	0 tpy <sup>3</sup>
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 <sup>1,2</sup>	6 hours	8.8E-06 tpy 3.4
				Significar	nt Emissions Units Em	issions - CY2019 Actu	ual Emissions - SO <sub>2</sub>	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	O tou
N/A	Lime Storage Silo No. 2	1,800 acfm	Lime	N/A	N/A	N/A	0,337 110015	0 tpy
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
				Insignificar	nt Emissions Units Em	issions - CY2019 Acti	ual Emissions - SO <sub>2</sub>	0 tpy
			·					
						CY2019 Actu	ual Emissions - SO <sub>2</sub>	345.0 tpy

#### Notes:

For diesel units, the SO<sub>2</sub> emission factor is calculated based on the sulfur content in diesel fuel

Molar mass ratio is 32 lb S/mol : 64 lb SO<sub>2</sub>/mol; Stoichiometry: 1 mol S = 1 mol SO<sub>2</sub>

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

<sup>2</sup> Diesel Fuel Density 7.1 lb/gal AP 42, Table 3.4-1, footnote a

<sup>3</sup> Diesel Heating Value 133,450 Btu/gal lab analysis

<sup>4</sup> 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)

<sup>&</sup>lt;sup>1</sup> Mass balance:

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

	CY2019 Actual HAP Emissions by Emissions Unit Category (tons per year) <sup>1</sup>						
Hazardous Air Pollutant	Coal-Fired Boilers	Diesel Boilers and Heaters	Diesel Engines <600 hp	Diesel Engines >600 hp	Coal Preparation and Ash Handling <sup>2</sup>	Insignificant Units <sup>3</sup>	CY2019 Actual HAP Emissions
	2 2 2 2 2 2 2		4.055.00	1.005.00			0.005.00
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	1.50L-04					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  Polycyclic Organic Matter (POM)	2.62E-03	6 00 5 04	0.225.07	4.005.07			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

	CY2019 Actual HAP Emissions by Emissions Unit Category (tons per year) 1						
Hazardous Air Pollutant	Coal-Fired Boilers	Diesel Boilers and Heaters	Diesel Engines <600 hp	Diesel Engines >600 hp	Coal Preparation and Ash Handling <sup>2</sup>	Insignificant Units <sup>3</sup>	CY2019 Actual HAP Emissions
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

<sup>&</sup>lt;sup>1</sup> See individual emissions unit category emissions calculations for details on methodology and assumptions.

<sup>&</sup>lt;sup>2</sup> Emissions units in the coal preparation and handling, ash handling and coal storage pile systems do not have HAP emissions

<sup>&</sup>lt;sup>3</sup> 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**

Total CY2019 actual coal throughput	<u>327,213</u> t	tons
EU ID 2 CY2019 actual coal throughput	180,524 t	ons
EU ID 1 CY2019 actual coal throughput	146,690 t	ons

#### **CY2019 Actual Source Category Emission Calculations**

			ategory Emission Calculations
CAS No.	Chemical Name	Emission Factor 1	<b>Estimated Emissions</b>
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		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
	Hydrochloric acid - EU ID 1	1.42E-02 lb/ton <sup>2</sup>	1.04 tpy
7647010	Hydrochloric acid - EU ID 2	3.71E-04 lb/ton <sup>3</sup>	0.03 tpy
7664393	Hydrogen fluoride (Hydrofluoric acid) - EU ID 1	1.44E-03 lb/ton <sup>2</sup>	0.00 tpy 0.11 tpy
7664393	Hydrogen fluoride (Hydrofluoric acid) - EU ID 2	3.31E-04 lb/ton <sup>3</sup>	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
IN/A	Polycyclic aromatic compounds(PAH)	1.91E-03 lb/tol1	3.12L-03 tpy
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
190-09-0	5-methylchrysene	2.20E-08 lb/ton	3.60E-06 tpy
91-20-3	Naphthalene	1.30E-05 lb/ton	2.13E-03 tpy
0.200	Hapharaiono		00 .pj

FY2021 Assessable Emissions

Golden Valley Electric Association - Healy Power Plant

## Table 8a. FY2021 Assessable Emissions Calculations - Hazardous Air Pollutant (HAP) Emissions Coal-Fired Boilers

#### Golden Valley Electric Association - Healy Power Plant

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

#### **CY2019 Actual Source Category Emission Calculations**

CAS No.	Chemical Name	Emission Factor 1	<b>Estimated Emissions</b>
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 <sup>4</sup>	4.53E-04 tpy
	Mercury Compounds - EU ID 2	3.78E-05 lb/ton <sup>5</sup>	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:

#### Conversion Factors:

Coal Heating Value 14.37 MMBtu/ton CY2019 weighted average

<sup>&</sup>lt;sup>1</sup> Reference: AP-42, Tables 1.1-12, 1.1-13, 1.1-14, 1.1-15, 1.1-18

<sup>&</sup>lt;sup>2</sup> HCl and HF emission factors from EU ID 1 source test completed in November 2017

<sup>&</sup>lt;sup>3</sup> HCl and HF emission factors from EU ID 2 source test completed in December 2018

<sup>&</sup>lt;sup>4</sup> Emission factor from EU ID 1 source test completed in March 2019

<sup>&</sup>lt;sup>5</sup> Emission factor from EU ID 2 CEMS average 2019

# 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 <sup>1</sup>

		CY2019 Actual Source Categ	ory Emission Calculations
CAS No.	Chemical Name	Emission Factor 2,3	<b>Estimated Emissions</b>
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,I)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

<sup>1</sup> Total fuel use based	on actual	CY2019	operation a	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

<sup>&</sup>lt;sup>2</sup> Reference: AP-42, Tables 1.3-9, and 1.3-10.

<sup>&</sup>lt;sup>3</sup> 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 <sup>1</sup>

#### **CY2019 Actual Source Category Emission Calculations**

CAS No.	Chemical Name	Emission Factor <sup>2</sup>	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,I)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:

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

<sup>&</sup>lt;sup>1</sup> Total fuel use based on actual operation as noted below:

<sup>&</sup>lt;sup>2</sup> 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 <sup>1</sup>

#### **CY2019 Actual Source Category Emission Calculations**

CAS No.	Chemical Name	Emission Factor <sup>2</sup>	<b>Estimated Emissions</b>
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 compound	s(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
	CY20	19 Actual HAP Emissions:	2.15E-05 tpy

#### Notes:

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

<sup>2</sup> Reference: AP-42, Table 3.3-2.

<sup>&</sup>lt;sup>1</sup> Total fuel use based on actual operation as noted below:

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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 <sub>X</sub> CO PM <sub>10</sub> SO <sub>2</sub> 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	Re	Regulated Air Pollutant Emissions (tons per year) <sup>1</sup>								
Potential to Ennit	NO <sub>X</sub>	СО	PM <sub>10</sub>	VOC	SO <sub>2</sub>	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 <sup>3</sup>	\$59,695									

#### Notes:

<sup>&</sup>lt;sup>1</sup> Regulated air pollutant calculations based on emission factors shown in accompanying spreadsheets.

<sup>&</sup>lt;sup>2</sup> Fees paid on each pollutant emitted in quantities greater than 10 tpy per 18 AAC 50.410.

<sup>&</sup>lt;sup>3</sup> A fee rate of \$42.95 per ton applies in accordance with 18 AAC 50.410(b)(1).

<sup>&</sup>lt;sup>4</sup> 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
	Simple Cycle Gas		ULS			149,925 gal/yr
1	Turbine	GE Frame 7, Series 7001, Model BR	No. 1 Diesel	672 MMBtu/hr	392.6 hr/yr	82,294 gal/yr
	Turbine		No. 2 Diesel			805,827 gal/yr
	Simple Cycle Gas		ULS			1,055,209 gal/yr
2	Turbine	I GE Frame / Series /UU1 Model BR	No. 1 Diesel	672 MMBtu/hr	3,130.3 hr/yr	330,134 gal/yr
	Turbine		No. 2 Diesel			10,001,632 gal/yr
	Combined Cycle Gas		ULS			465,490 gal/yr
5	Turbine	GE LM6000PC	No. 1 Diesel	455 MMBtu/hr	8,458.7 hr/yr	0 gal/yr
	Turblife		Naphtha			25,706,042 gal/yr
	Combined Cycle Gas		ULS			0 gal/yr
6	Turbine	GE LM6000PC	No. 1 Diesel	455 MMBtu/hr	0 hr/yr	0 gal/yr
			Naphtha			0 gal/yr
7	Emergency	Mitsubishi 0A8829	ULSD	564.6 hp <sup>1</sup>	5.0 hr/yr	160 gal/yr
	Generator Engine		CLOD	'	3.0 111791	100 gali yi
11	Boiler	Bryan Steam RV500	Propane	5.0 MMBtu/hr	67.1 hr/yr	3,665 gal/yr
12	Boiler	Bryan Steam RV500	Topano	5.0 MMBtu/hr	37:1 1117y1	5,505 ganyi

<sup>&</sup>lt;sup>1</sup> 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/	Poting/Sizo	2019 Actual	2019 Actual
ID <sup>1</sup>	Description	Material	Rating/Size	Operation	Fuel Consumption
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	5,000 gai/yi
N/A	Burnham 17 A-T Boiler	No. 1 ULSD	0.222 MMBtu/hr	1,642 hr/yr	3,120 gal/yr

<sup>&</sup>lt;sup>1</sup> 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	Maximum	Fuel	Factor	NO <sub>X</sub> Emission	2019 Actual	2019 Actual NO <sub>X</sub>
ID	Description	Capacity	Type	Reference	Factor	Operation	Emissions
			Significant En	nission Units			
			ULS				
1	Simple Cycle Gas Turbine	672 MMBtu/hr	No. 1 Diesel	2019 CEMS Average <sup>1</sup>	243.3 lb/hr	392.6 hours	47.8 tpy
			No. 2 Diesel				
			ULS	<u> </u>		1,055,209 gal/yr	0.0 tpy
2	Simple Cycle Gas Turbine	672 MMBtu/hr	No. 1 Diesel	AP-42 Table 3.1-1	0.88 lb/MMBtu	330,134 gal/yr	19.4 tpy
			No. 2 Diesel			10,001,632 gal/yr	608.7 tpy
			ULS				
5	Combined Cycle Gas Turbine	455 MMBtu/hr	No. 1 Diesel	2019 CEMS Average <sup>1</sup>	99.3 lb/hr	8,458.7 hours	420.0 tpy
			Naphtha				
			ULS			0 gal/yr	0.0 tpy
6	Combined Cycle Gas Turbine	455 MMBtu/hr	No. 1 Diesel	AP-42 Table 3.1-1	0.24 lb/MMBtu	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 <sup>3</sup> gal	3,665 gal/yr	2.4E-02 tpy
12	Boiler	5.0 MMBtu/hr	Торапс			, ,	2. <del>4</del> L-02 tpy
				Significant I	Emission Units - 2019	Actual Emissions - NO <sub>X</sub>	1095.9 tpy
			Insignificant E	mission 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 <sup>3</sup> gal	5,068 gal/yr	4.6E-02 tpv
N/A	FHR Warehouse Boiler 2	0.784 MMBtu/hr	No. 2 Diesel	7 1 -42 Table 1.0-1		5,000 gai/yi	7.0L-02 ipy
N/A	Burnham 17 A-T Boiler	0.222 MMBtu/hr	No. 1 ULSD	AP-42 Table 1.3-1	18 lb/10 <sup>3</sup> gal	3,120 gal/yr	2.8E-02 tpy
				Insignificant I	Emission Units - 2019	Actual Emissions - NO <sub>X</sub>	7.4E-02 tpy
					2019	Actual Emissions - NO <sub>X</sub>	1096.0 tpy

#### Note:

#### 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)

Pailor Emissions true (Fig. 1) x (1,000 lb/ton) (Capacity, hp) x (Operation, hr/yr) / (2,000 lb/ton)

Boiler Emissions, tpy= (Emission factor, lb/10<sup>3</sup>gal) / (Conversion 1,000 gal/10<sup>3</sup>gal) 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)

<sup>&</sup>lt;sup>1</sup> The emission factors for EU IDs 1 and 5 are an average emission rate from 2019 measured using Continuous Emissions Monitoring Systems (CEMS).

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

	Emission Unit	Maximum	Fuel	Factor	CO Emission	2019 Actual	2019 Actual CO
ID	Description	Capacity	Type	Reference	Factor	Operation	Emissions
			ULS				
1	Simple Cycle Gas Turbine	672 MMBtu/hr	No. 1 Diesel	2019 CEMS Average1	13.6 lb/hr	392.6 hours	2.7 tpy
			No. 2 Diesel				
			ULS			1,055,209 gal/yr	0 tpy
2	Simple Cycle Gas Turbine	672 MMBtu/hr	No. 1 Diesel	AP-42 Table 3.1-1	0.0033 lb/MMBtu	330,134 gal/yr	0.07 tpy
			No. 2 Diesel			10,001,632 gal/yr	2.3 tpy
			ULS				
5	Combined Cycle Gas Turbine	455 MMBtu/hr	No. 1 Diesel	2019 CEMS Average1	2.3 lb/hr	8,458.7 hours	9.7 tpy
			Naphtha				
			ULS			0 gal/yr	0 tpy
6	Combined Cycle Gas Turbine	455 MMBtu/hr	No. 1 Diesel	AP-42 Table 3.1-1	0.076 lb/MMBtu	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 <sup>3</sup> gal	3,665 gal/yr	1.4E-02 tpy
12	Boiler	5.0 MMBtu/hr	riopane	711 42 Tuble 1.0 T	7.0 lb/10 gai	0,000 ganyi	1.42 02 tpy
				Significant	Emission Units - 2019	Actual Emissions - CO	14.8 tpy
			Insignificant Er	nission 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 <sup>3</sup> gal	5,068 gal/yr	1.3E-02 tpy
N/A	FHR Warehouse Boiler 2	0.784 MMBtu/hr	No. 2 Diesel		5.0 lb/10 gal	5,000 gai/yi	1.3E-02 tpy
N/A	Burnham 17 A-T Boiler	0.222 MMBtu/hr	No. 1 ULSD	AP-42 Table 1.3-1	5.0 lb/10 <sup>3</sup> gal	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:

#### 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, Ib/10<sup>3</sup>gal) / (Conversion 1,000 gal/10<sup>3</sup>gal) 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)

<sup>&</sup>lt;sup>1</sup> The emission factors for EU IDs 1 and 5 are an average emission rate from 2019 measured using Continuous Emissions Monitoring Systems (CEMS).

Table 5. FY2021 Assessable Emission Calculations - Particulate Matter (PM<sub>I0</sub>) Emissions Golden Valley Electric Association - North Pole Power Plant

	Emission Unit	Maximum	Fuel	Factor	PM <sub>10</sub> Emission	2019 Actual	2019 Actual PM10
ID	Description	Capacity	Type	Reference	Factor	Operation	Emissions
			ULS	AP-42 Table 3.1-2a 0.012 lb/MMBtu	149,925 gal/yr	0 tpy	
1	Simple Cycle Gas Turbine	672 MMBtu/hr	No. 1 Diesel AP-42 Table 3.1-		0.012 lb/MMBtu	82,294 gal/yr	0.07 tpy
			No. 2 Diesel			805,827 gal/yr	0.67 tpy
			ULS			1,055,209 gal/yr	0 tpy
2	Simple Cycle Gas Turbine	672 MMBtu/hr	No. 1 Diesel	AP-42 Table 3.1-2a	0.012 lb/MMBtu	330,134 gal/yr	0.3 tpy
			No. 2 Diesel			10,001,632 gal/yr	8.3 tpy
			ULS			465,490 gal/yr	0 tpy
5	Combined Cycle Gas Turbine	455 MMBtu/hr	No. 1 Diesel	AP-42 Table 3.1-2a	0.012 lb/MMBtu	0 gal/yr	0.00 tpy
			Naphtha			25,706,042 gal/yr	16.7 tpy
			ULS			0 gal/yr	0 tpy
6	Combined Cycle Gas Turbine	455 MMBtu/hr	No. 1 Diesel	AP-42 Table 3.1-2a	0.012 lb/MMBtu	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	Deserve	AP-42 Table 1.5-1	0.7 11.4403	2.665 ==1/	1.3E-03 tpy
12	Boiler	5.0 MMBtu/hr	Propane	AP-42 Table 1.5-1	0.7 lb/10 <sup>3</sup> gal	3,665 gal/yr	1.3⊑-03 tpy
				Significant En	nission Units - 2019 A	ctual Emissions - PM10	26.0 tpy
			Insignificant Er	nission 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			
N/A	FHR Warehouse Boiler 2	0.784 MMBtu/hr	No. 2 Diesel	and 1.3-2	1.7 lb/10 <sup>3</sup> gal	5,068 gal/yr	4.3E-03 tpy
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 <sup>3</sup> gal	3,120 gal/yr	2.7E-03 tpy
				Insignificant En	nission Units - 2019 A	ctual Emissions - PM10	7.0E-03 tpy
					2019 A	ctual 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, Ib/10³gal) / (Conversion 1,000 gal/10³gal) 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		Maximum	Fuel	Factor	Maximum Fuel	SO <sub>2</sub> Emission	2019 Actual	2019 Actual SO <sub>2</sub>
ID	Description	Capacity	Type	Reference	Sulfur Content 1	Factor	Operation	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 - St							253.0 tpy
			Insign	ificant Emission Units	5			
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			4.07 E-02 lb/gai		
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 - SO								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<sub>2</sub>/mol

Stoichiometry: 1 mol S = 1 mol SO<sub>2</sub>

Mass Balance Emission Factor, lb/gal = (Molar mass ratio, 2 lb SO<sub>2</sub>: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<sub>2</sub>) x (Conversion, 1.66E-7 lb SO<sub>2</sub>/scf / ppm SO<sub>2</sub>) x (F-factor, 8,710 scf/MMBtu) x (Conversion, 0.0216 MMBtu/lb) x (Conversion, mole SO<sub>2</sub>/64 lb SO<sub>2</sub>) x (Conversion, mole S/mole SO<sub>2</sub>) 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.
- <sup>2</sup> 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.
- <sup>3</sup> The engine specification datasheet indicates a maximum fuel throughput of 32 gal/hr.
- <sup>4</sup> 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 <sub>X</sub> CO PM <sub>10</sub> SO <sub>2</sub> 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	Re	gulated Air	Pollutant E	missions (t	ons per yea	ır) <sup>1</sup>	
Potential to Emit	NO <sub>X</sub>	СО	PM <sub>10</sub>	VOC	SO <sub>2</sub>	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 <sup>3</sup>	\$4,359						

#### Notes:

<sup>&</sup>lt;sup>1</sup> Regulated air pollutant calculations based on emission factors shown in accompanying spreadsheets.

<sup>&</sup>lt;sup>2</sup> Fees paid on each pollutant emitted in quantities greater than 10 tpy per 18 AAC 50.410.

<sup>&</sup>lt;sup>3</sup> A fee rate of \$42.95 per ton applies in accordance with 18 AAC 50.410(b)(1).

<sup>&</sup>lt;sup>4</sup> 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	Туре	Operation	Capacity	Fuel Consumption	
	Simple Cycle Gas		No. 1 ULS			2,288 gal/yr	
1	Turbine	General Electric Frame 5 MS 5001-M	No. 1 Diesel	61.3 hr/yr	268 MMBtu/hr	1,106 gal/yr	
	Turbine		No. 2 Diesel			60,457 gal/yr	
	Simple Cycle Gas		No. 1 ULS		268 MMBtu/hr	15,684 gal/yr	
2	Turbine	General Electric Frame 5 MS 5001-M	No. 1 Diesel	1,097.0 hr/yr		21,127 gal/yr	
	Turbine		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	200 gol/ur	
4	Diesel Generator Engine	General Motors Electro-Motive Diesel 20-645E4	No. 1 ULSD	0.5 III/yi	28 MMBtu/hr	- 299 gal/yr	
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	0,092 gal/yl	

Source: Air Quality Permit No. AQ0109TVP03

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

ID <sup>1</sup>	Emission Unit  Description	Fuel Type/ Material	Rating/Size	2019 Actual 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	13,117 gai/yi
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	1,174,000 SCI
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

<sup>&</sup>lt;sup>1</sup> Source: Renewal application for AQ0109TVP02

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

	Emission Unit	Maximum	Fuel	Factor	NO <sub>X</sub> Emission	2019 Actual	2019 Actual NO <sub>X</sub>			
ID	Description	Capacity	Туре	Reference	Factor	Operation	Emissions			
			Significant Emision l	Jnits						
			No. 1 ULS			2,288 gal/yr	0.1 tpy			
1	Simple Cycle Gas Turbine	268 MMBtu/hr	No. 1 Diesel	AP-42 Table 3.1-1	0.88 lb/MMBtu	1,106 gal/yr	0.1 tpy			
			No. 2 Diesel			60,457 gal/yr	3.5 tpy			
			No. 1 ULS			15,684 gal/yr	0.9 tpy			
2	Simple Cycle Gas Turbine	268 MMBtu/hr	No. 1 Diesel	AP-42 Table 3.1-1	0.88 lb/MMBtu	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	000	C CE 00 t			
4	Diesel Generator Engine	28 MMBtu/hr	No. 1 ULSD	AP-42 Table 3.4-1	3.2 ID/IVIIVIDIU	299 gal/yr	6.6E-02 tpy			
10	Boiler	1.7 MMBtu/hr	No. 2 Heating Oil	AP-42 Table 1.3-1	00 11 (403 1	0.0001/	0.07			
11	Boiler	1.7 MMBtu/hr	No. 2 Heating Oil	AP-42 Table 1.3-1	20 lb/10 <sup>3</sup> gal	6,892 gal/yr	0.07 tpy			
Significant Emision Units - 2019 Actual Emissions - NO <sub>X</sub>										
			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	AD 40 T-1-1-4-0-4	40 11 (403 1	40 447 1/	4.05.04.4			
9	Burnham Boiler	0.443 MMBtu/hr	No. 2 Heating Oil	AP-42 Table 1.3-1	18 lb/10 <sup>3</sup> gal	13,117 gal/yr	1.2E-01 tpy			
N/A	Burnham Boiler - FE Building	0.606 MMBtu/hr	Natural Gas	AP-42 Table 1.4-1	100 lb/10 <sup>6</sup> scf	1,174,080 scf	E 0			
N/A	Burnham Boiler - FE Building	0.606 MMBtu/hr	Natural Gas	AP-42 Table 1.4-1	100 lb/10 sct	1,174,000 SCI	5.9E-02 tpy			
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 <sup>3</sup> gal	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 <sup>3</sup> gal	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 <sup>3</sup> gal	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 <sup>3</sup> gal	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 <sup>3</sup> gal	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 <sup>3</sup> gal	5,100 gal/yr	4.8E-02 tpy			
				Insignificant	Emision Units - 2019 A	Actual Emissions - NO <sub>x</sub>	0.30 tpy			
					0040.4	-turi Frainciana NO				
					2019 A	ctual Emissions - NO <sub>X</sub>	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/10³gal) / (Conversion 1,000 gal/10³gal) x (Fuel Consumption, gal/yr) / (2,000 lb/ton)

Boiler Emissions, tpy= (Emission factor, lb/10⁵scf) / (Conversion 1,000,000 scf/10⁵scf) x (Fuel Consumption, scf) / (2,000 lb/ton)

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

	Emission Unit	Maximum	Fuel	Factor	CO Emission	2019 Actual	2019 Actual CO			
ID	Description	Capacity	Type	Reference	Factor	Operation	Emissions			
			No. 1 ULS			2,288 gal/yr	5.0E-04 tpy			
1	Simple Cycle Gas Turbine	268 MMBtu/hr	No. 1 Diesel	AP-42 Table 3.1-1	0.0033 lb/MMBtu	1,106 gal/yr	2.5E-04 tpy			
			No. 2 Diesel			60,457 gal/yr	1.4E-02 tpy			
			No. 1 ULS			15,684 gal/yr	3.5E-03 tpy			
2	Simple Cycle Gas Turbine	268 MMBtu/hr	No. 1 Diesel	AP-42 Table 3.1-1	0.0033 lb/MMBtu	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	AF-42 Table 5.4-1	0.65 ID/IVIIVIDIU	299 gai/yi	1.6E-02 tpy			
10	Boiler	1.7 MMBtu/hr	No. 2 Heating Oil	AP-42 Table 1.3-1	5 lb/10 <sup>3</sup> gal	6 900 gallyr	1.7E-02 tpy			
11	Boiler	1.7 MMBtu/hr	No. 2 Heating Oil	AF-42 Table 1:5-1 5 lb/10 gai		6,892 gal/yr	1.7 <b>⊑-</b> 02 tpy			
Significant Emission Units - 2019 Actual Emissions - CO										
			Insignificant Emission	n 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 <sup>3</sup> gal	13,117 gal/yr	3.3E-02 tpy			
9	Burnham Boiler	0.443 MMBtu/hr	No. 2 Heating Oil	AF-42 Table 1.5-1	J Ib/ IU gai	13,117 gai/yi	3.3L-02 tpy			
N/A	Burnham Boiler - FE Building	0.606 MMBtu/hr	Natural Gas	AP-42 Table 1.4-1	84 lb/10 <sup>6</sup> scf	1,174,080 scf	4.9E-02 tpy			
N/A	Burnham Boiler - FE Building	0.606 MMBtu/hr	Natural Gas	AF-42 Table 1.4-1	04 ID/ IU SCI	1,174,000 SCI	4.9 <b>⊑-</b> 02 tpy			
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 <sup>3</sup> gal	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 <sup>3</sup> gal	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 <sup>3</sup> gal	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 <sup>3</sup> gal	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 <sup>3</sup> gal	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 <sup>3</sup> gal	5,100 gal/yr	1.3E-02 tpy			
Insignificant Emission Units - 2019 Actual Emissions - CO										
					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<sup>3</sup>gal) / (Conversion 1,000 gal/10<sup>3</sup>gal) x (Fuel Consumption, gal/yr) / (2,000 lb/ton)

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

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

	Emission Unit	Maximum	Fuel	Factor	VOC Emission	2019 Actual	2019 Actual VOC
ID	Description	Capacity	Type	Reference	Factor	Operation	Emissions
			No. 1 ULS			2,288 gal/yr	6.3E-05 tpy
1	Simple Cycle Gas Turbine	268 MMBtu/hr	No. 1 Diesel	AP-42 Table 3.1-2a	0.00041 lb/MMBtu	1,106 gal/yr	3.1E-05 tpy
			No. 2 Diesel			60,457 gal/yr	1.7E-03 tpy
			No. 1 ULS			15,684 gal/yr	4.3E-04 tpy
2	Simple Cycle Gas Turbine	268 MMBtu/hr	No. 1 Diesel	AP-42 Table 3.1-2a	0.00041 lb/MMBtu	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	200 mal/sm	1.7E-03 tpy
4	Diesel Generator Engine	28 MMBtu/hr	No. 1 ULSD	AP-42 Table 5.4-1	U.UO ID/IVIIVIDIU	299 gal/yr	1.7 <b>⊑-</b> 03 tpy
10	Boiler	1.7 MMBtu/hr	No. 2 Heating Oil	AD 40 T-1-1- 4.0.0	0.04 !! (403	0.000 1/	4.05.00 +
11	Boiler	1.7 MMBtu/hr	No. 2 Heating Oil	AP-42 Table 1.3-3	0.34 lb/10 <sup>3</sup> gal	6,892 gal/yr	1.2E-03 tpy
				Significant Er	nission Units - 2019 A	ctual Emissions - VOC	3.8E-02 tpy
			Insignificant Emiss	sion 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	AD 40 T-1-1- 4.0.0	NP-42 Table 1.3-3 0.7 lb/10 <sup>3</sup> gal	40.447	4.75.00 5
9	Burnham Boiler	0.443 MMBtu/hr	No. 2 Heating Oil	AP-42 Table 1.3-3		13,117 gal/yr	4.7E-03 tpy
N/A	Burnham Boiler - FE Building	0.606 MMBtu/hr	Natural Gas	AP-42 Table 1.4-2	7.6 11 /4.06 . 6	1,174,080 scf	4 EE 02 to
N/A	Burnham Boiler - FE Building	0.606 MMBtu/hr	Natural Gas	AP-42 Table 1.4-2	7.6 lb/10 <sup>6</sup> scf	1,174,080 SCI	4.5E-03 tpy
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 <sup>3</sup> gal	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 <sup>3</sup> gal	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 <sup>3</sup> gal	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 <sup>3</sup> gal	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 <sup>3</sup> gal	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 <sup>3</sup> gal	5,100 gal/yr	2.6E-03 tpy
				Insignificant Er		ctual Emissions - VOC	1.5E-02 tpy
				·	2019 A	ctual 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<sup>3</sup>gal) / (Conversion 1,000 gal/10<sup>3</sup>gal) x (Fuel Consumption, gal/yr) / (2,000 lb/ton)

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

Table 6. FY2021 Assessable Emission Calculations - Particulate Matter (PM<sub>10</sub>) Emissions Golden Valley Electric Association - Zehnder Facility

	Emission Unit	Maximum	Fuel	Factor	PM <sub>10</sub> Emission	2019 Actual	2019 Actual PM10			
ID	Description	Capacity	Туре	Reference	Factor	Operation	Emissions			
			No. 1 ULS			2,288 gal/yr	1.8E-03 tpy			
1	Simple Cycle Gas Turbine	268 MMBtu/hr	No. 1 Diesel	AP-42 Table 3.1-2a	0.012 lb/MMBtu	1,106 gal/yr	9.2E-04 tpy			
			No. 2 Diesel			60,457 gal/yr	5.0E-02 tpy			
			No. 1 ULS			15,684 gal/yr	1.3E-02 tpy			
2	Simple Cycle Gas Turbine	268 MMBtu/hr	No. 1 Diesel	AP-42 Table 3.1-2a	0.012 lb/MMBtu	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							
4	Diesel Generator Engine	28 MMBtu/hr	No. 1 ULSD	AP-42 Table 3.4-2	0.0573 lb/MMBtu	299 gal/yr	1.2E-03 tpy			
10	Boiler	1.7 MMBtu/hr	No. 1 ULSD	AP-42 Tables 1.3-2 &	0.00	0.000 1/	0.05.00.4			
11	Boiler	1.7 MMBtu/hr	No. 2 Heating Oil	1.3-7	2.38 lb/10 <sup>3</sup> gal	6,892 gal/yr	8.2E-03 tpy			
Significant Emission Units - 2019 Actual Emissions - PM10										
			Insignificant Emissi	on 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 &	1.7 lb/10 <sup>3</sup> gal	13,117 gal/yr	1.1E-02 tpy			
9	Burnham Boiler	0.443 MMBtu/hr	No. 2 Heating Oil	1.3-2	1.7 lb/10 gai	13,117 gal/yl	1.1Ε-02 τργ			
N/A	Burnham Boiler - FE Building	0.606 MMBtu/hr	Natural Gas	AP-42 Table 1.4-2	5.5 lb/10 <sup>6</sup> scf	1,174,080 scf	3.2E-03 tpy			
N/A	Burnham Boiler - FE Building	0.606 MMBtu/hr	Natural Gas	711 12 14510 1.12	0.0 10/10 301	1,11 1,000 001	0.22 00 tpy			
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 <sup>3</sup> gal <sup>1</sup>	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 <sup>3</sup> gal <sup>1</sup>	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 <sup>3</sup> gal	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 <sup>3</sup> gal <sup>2</sup>	5,100 gal/yr	1.3E-04 tpy			
				Insignificant Em		tual Emissions - PM10	2.4E-02 tpy			
							•			
					2019 Ac	tual 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<sup>3</sup>gal) / (Conversion 1,000 gal/10<sup>3</sup>gal) x (Fuel Consumption, gal/yr) / (2,000 lb/ton)

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

<sup>&</sup>lt;sup>1</sup> Ash Content of 0.233 percent by weight was determined through testing conducted in December 2016.

<sup>&</sup>lt;sup>2</sup> 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<sub>2</sub>) Emissions Golden Valley Electric Association - Zehnder Facility

	Emission Unit	Fuel	Factor	Fuel	SO <sub>2</sub> Emission	2019 Actual	2019 Actual SO2				
ID	Description	Туре	Reference	Sulfur Content 1,2	Factor	Operation	Emissions				
		No. 1 ULS	Mass Balance	0.00027 wt. pct. S	0.000 lb/gal	2,288 gal/yr	0.00 tpy				
1	Simple Cycle Gas Turbine	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				
		No. 1 ULS	Mass Balance	0.00047 wt. pct. S	0.000 lb/gal	15,684 gal/yr	0.00 tpy				
2	Simple Cycle Gas Turbine	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 Dalansa	0.0045tt C	0.405.04 lb/mal	200 1/	2.25.05.4				
4	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				
10	Boiler	No. 2 Heating Oil	Mass Balance	0.0 urt not C	0.000 11/1/11	6 900 gal/vm	0.10 tm/				
11	Boiler	No. 2 Heating Oil	Mass Balance	0.2 wt. pct. S	0.028 lb/gal	6,892 gal/yr	0.10 tpy				
Significant Emission Units - 2019 Actual Emissions - SO2											
		In	significant Emission l	Jnits							
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	0.10 tou				
9	Burnham Boiler	No. 2 Heating Oil	Mass Balance	0.2 wt. pct. 5	0.0 lb/gal	13,117 gal/yl	0.19 tpy				
N/A	Burnham Boiler - FE Building	Natural Gas	AP-42 Table 1.4-2	2,000 gr/10 <sup>6</sup> scf	0.6 lb/10 <sup>6</sup> scf	1,174,080 scf	3.5E-04 tpy				
N/A	Burnham Boiler - FE Building	Natural Gas	AF-42 Table 1.4-2	2,000 gr/10 scr	0.0 ID/ 10 SCI	1,174,000 SCI	3.5E-04 tpy				
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 E	mission Units - 2019 A	Actual Emissions - SO2	0.26 tpy				
					2019 A	Actual Emissions - SO2	27.4 tpy				

Sample Calculations: 3

Molar mass ratio is 32 lb S/mol : 64 lb SO<sub>2</sub>/mol

Stoichiometry: 1 mol S = 1 mol SO<sub>2</sub>

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

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

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

#### Notes:

<sup>1</sup> Based on the weighted average of monthly maximum fuel sulfur content values for calendar year 2019 as received from supplier sampling.

<sup>&</sup>lt;sup>2</sup> For waste oil and waste transformer oil, fuel sulfur content was determined by testing conducted in December 2016.

<sup>&</sup>lt;sup>3</sup> 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 <sub>X</sub>	CO	PM <sub>10</sub>	SO <sub>2</sub>	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) <sup>1</sup>							
Potential to Emit	NO <sub>X</sub>	CO	PM <sub>10</sub>	SO <sub>2</sub>	VOC	HAP		
Significant	0.4			0.0				
Insignificant	0			0				
Total Emissions	0			0				
Use Assessable PTE <sup>2</sup>		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 <sup>4</sup>		\$0						

#### Notes:

<sup>&</sup>lt;sup>1</sup> Regulated air pollutant calculations based on emission factors shown in accompanying spreadsheets.

<sup>&</sup>lt;sup>2</sup> Actual emissions are provided for NO<sub>X</sub> and SO<sub>2</sub> 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.

<sup>&</sup>lt;sup>3</sup> Fees paid on each pollutant emitted in quantities greater than 10 tpy per 18 AAC 50.410.

<sup>&</sup>lt;sup>4</sup> 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			2019 Actual	Nominal	2019 Actual
ID	Description	Make/Model	Туре	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 <sup>1</sup>	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/	Rating/Size	2019 Actual
ID	Description	Material	Rating/Size	Operation
Tank	Fuel Oil Storage Tank	Fuel Oil	50,000 gallons	8,760 hr/yr

Table 3. FY2021 Assessable Emission Calculations - Oxides of Nitrogen (NO<sub>X</sub>) Emissions
Golden Valley Electric Association - Delta Power Plant

	Emission Unit		Fuel	Factor	NO <sub>X</sub> Emission	Actual	2019 Actual NO <sub>X</sub>
ID	Description	Rating/Capacity	Type	Reference	Factor Operation	Operation	Emissions
			Significant Er	nission 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 <sup>1</sup>	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 U	nits - Total Assessa	ble Emissions - NO <sub>X</sub>	0.38 tpy
			Insignificant E	mission Units		•	
Tank	Fuel Oil Storage Tank	50,000 gallons	Fuel Oil	N/A	NA	8,760 hr/yr	0 tpy
•			•	Insignificant Emission Ur	nits - Total Assessa	ble Emissions - NO <sub>X</sub>	0 tpy
						<del>!</del>	
					Total Assessa	ble Emissions - NO <sub>X</sub>	0.38 tpy

#### Notes:

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)

<sup>&</sup>lt;sup>1</sup> Operating hours were determined based on two startss during calendar year 2019 lasting an estimated duration of 5 minutes, each.

### Table 4. FY2021 Assessable Emission Calculations - Sulfur Dioxide (SC<sub>2</sub>) Emissions Golden Valley Electric Association - Delta Power Plant

	Emission Unit		Fuel	Maximum Fuel	Factor	SO <sub>2</sub> Emission	Actual	2019 Actual SO <sub>2</sub>
ID	Description	Rating/Capacity	Type	Sulfur Content	Reference	Factor	Operation	Emissions
			Significar	nt 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 <sup>1</sup>	Mass Balance 2,3	0.0002 lb/gal	4,825 gal/yr	4.8E-04 tpy
•					Significant Emission	Units - Total Assess	able Emissions - SO <sub>2</sub>	1.2E-03 tpy
			Insignifica	nt Emission Units				
Tank	Fuel Oil Storage Tank	50,000 gallons	Fuel Oil	NA	N/A	NA	8,760 hr/yr	0 tpy
				į.	nsignificant Emission	Units - Total Assess	able Emissions - SO <sub>2</sub>	0 tpy
						Total Assess	able Emissions - SO <sub>2</sub>	1.2E-03 tpy

#### Notes:

Molar mass ratio is 32 lb S/mol : 64 lb SO<sub>2</sub>/mol

Stoichiometry: 1 mol S = 1 mol SO<sub>2</sub>

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

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)

<sup>1</sup> The emission units fired ULSD in 2019.

<sup>&</sup>lt;sup>2</sup> Mass balance:

 $<sup>^3</sup>$  A fuel density of 6.7 lb/gal is assumed based on an API gravity of 43.3 from the February 2006 source test.

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PO Box 71249, Fairbanks, AK 99707-1249 • (907) 452-1151 • www.gvea.com



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	CY2020 Actual	Fee Estimate
	Permit No.	Emissions (Tons)	
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 <a href="mailto:nmknight@gvea.com">nmknight@gvea.com</a>. 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.

Digitally signed by Frank E Frank E

**Perkins** 

Date: 2021.03.30 08:02:52

-08'00'

Frank E. Perkins

**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

Assi	Assessable Emissions - Tons Per Year	ssions - Tor	is Per Year				
Description	NOx	00	ЫM	VOC	$SO_2$	HAPs	Total
Assessable PTE	909	086	198	14	707	13	2,518

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

	R	Regulated Air Pollutant Emissions (tons per year)	Pollutant E	missions (to	ns per year	1
	NOx	00	PM	NOC	SO <sub>2</sub>	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	6	406	9
Fees Apply to Pollutant? 2	Yes	Yes	Yes	ON	Yes	oN
CY2020 Actual Emissions			1,9	1,903		
Fee Estimate <sup>3</sup>			\$81,734	734		

# Notes:

<sup>1</sup> Regulated air pollutant calculations based on emission factors shown in accompanying spreadsheets.

<sup>2</sup> Fees paid on each pollutant emitted in quantities greater than 10 tpy per 18 AAC 50.410.

<sup>3</sup> A fee rate of \$42.95 per ton applies in accordance with 18 AAC 50.410(b)(1).

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

		Emissions Unit		Fuel / Material	CY2020 Actual
₽	Name	Description	Rating	Туре	Operation 1
8 3				on )	
7	t oN tion	Exeter Mheeler Boiler (m/ SNCB)	327 MMMRt11/hr	Coal/ULSD	8,330 hours
	Ollic No.	LOSIGI-WILGGIGI (W. SINCIN)	327 IVIIVIDIU/III	OLSD	198,169 gallons
c	C ON tier!	TDM/ International Province Company of the Company	GEO MANADIU/br	Coal/ULSD	5,707 hours
٧	Official S	I NW IIIIEgialeu Eililailleu Collibusioil System (W SCR)	000 IVIIVIDIU/III	OLSD	851,816 gallons
က	Auxiliary Boiler No. 1	Cleaver Brooks CB 189-300	12.554 MMBtu/hr	OLSD	3,329 gallons
4	Auxiliary Boiler No. 2	Cleaver Brooks CB 100-800	23.0 MMBtu/hr	OLSD	52,535 gallons
2	Diesel Generator Engine No. 1	Electro-Motive Diesel EMD 20-645-E4	2.75 MW	OLSD	0 gallons
9	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 <sup>2</sup>
7	Limestone Storage Silo	Limestone Storage Silo with Badhouse	800 cfm	Lime	0 hours
8	Flyash Storage Silo	Flyash Storage Silo with Baghouse	5,000 cfm	Flyash	8,446 hours
6	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 <sup>2</sup>
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	Coa	8,784 hours
13	Firewater Pump Engine	Caterpillar 3406B	264 hp	OLSD	6 hours

Notes:

<sup>1</sup> Hours are based on CY2020 operation in accordance with condition 112 Permit No. AQ0173TVP03.

 $^{\rm 2}$  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	201900
Q	Description	Make/Model	Type	Operation	Rating
N/A	Lime Storage Silo No. 1	N/A	Lime	F 707 P 1	1,800 acfm
N/A	Lime Storage Silo No. 2	N/A	Lime	o,ror nours	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 <sup>2</sup>	900 acfm
N/A	Urea Storage Silo A/B Bin Vent Filter	N/A	Urea	152 hours <sup>3</sup>	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 <sup>5</sup>	850 scfm

Note:

<sup>1</sup> This emissions unit is associated with EU ID 2.

<sup>2</sup> Estimated operation of 1,095 hours is assumed with each of the three units operating one hour per day.

<sup>3</sup> 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)

<sup>4</sup> 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)

<sup>5</sup> This emissions unit is associated with EU ID 1.

March 2021

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

	Emissions Unit		Fuel	Factor	NO <sub>x</sub> Emission	CY2020 Actual	CY2020 Actual
	Description	Rating/Capacity	Type	Reference	Factor	Operation	NO <sub>x</sub> Emissions
			Significant Emissions Units	ions Units		49.1	
	Unit No. 1	327 MMBtu/hr	Coal/ULSD	CY2020 CEMS Data (with SNCR)	57.5 lb/hr	8,330 hours	239.57 tpy
	Unit No. 2	_	Coal/ULSD	CY2020 CEMS Data (with SCR)	18.9 lb/hr	5,707 hours	61.95 tpy
	Auxiliary Boiler No. 1	12.554 MMBtu/hr	OLSD	AP-42 Table 1.3-1	20 lb/10 <sup>3</sup> gal	3,329 gallons	0.03 tpy
	Auxiliary Boiler No. 2	23.0 MMBtu/hr	ULSD	AP-42 Table 1.3-1	20 lb/10 <sup>3</sup> gal	52,535 gallons	0.53 tpy
	Diesel Generator Engine No. 1	2.75 MW	OLSD	AP-42 Table 3.4-1	3.2 lb/MMBtu	0 gallons	0 tpy 1
	Crusher System	12,000 cfm	Coal	N/A	N/A	2,719 hours	0 tpy
	Limestone Storage Silo	800 cfm	Lime	N/A	N/A	0 hours	0 tpy
	Flyash Storage Silo	5,000 cfm	Flyash	N/A	N/A	8,446 hours	0 tpy
	Sodium Bicarbonate Handling System	440 cfm	Sodium Bicarbonate	N/A	N/A	225 hours	0 tpy
1	Coal Handling System		Coal	N/A	N/A	2,719 hours	0 tpy
1	Haul Road	0.25 miles	Fugitive Dust	N/A	N/A	8,784 hours	0 tpy
	Coal Storage Pile	15 day supply	Coal	N/A	N/A	8,784 hours	0 tpy
	Firewater Pump Engine	264 hp	ULSD	AP-42, Table 3.3-1	0.031 lb/hp-hr	6 hours	0.02 tpy
. 1				Significant Emissions Units Emissions - CY2020 Actual Emissions - NOX	ssions - CY2020 Actu	al Emissions - NOX	302.1 tpy
1			Insignificant Emissions Units	sions Units			
	Lime Storage Silo No. 1	1,800 acfm	Lime	N/A	N/A	E 707 hours	und O
	Lime Storage Silo No. 2	1,800 acfm	Lime	N/A	N/A	Sinoli 101'c	o thy
	Ash Handling	Not Applicable	Ash	N/A	N/A	8,784 hours	0 tpy
	Miscellaneous Roads	Not Applicable	Not Applicable	N/A	N/A	8,784 hours	0 tpy
	AST Diesel Tanks (2)	25,000 gallons	Diesel	N/A	N/A	8,784 hours	0 tpy
	AST Diesel Tank	2,000 gallons	Diesel	N/A	N/A	8,784 hours	0 tpy
	AST Diesel Tank	300 gallons	Diesel	N/A	N/A	8,784 hours	0 tpy
	AST Diesel Tank	425 gallons	Diesel	N/A	N/A	8,784 hours	0 tpy
	Central Vac (3)	900 acfm	Coal	N/A	N/A	1,095 hours	0 tpy
	Urea Storage Silo A/B Bin Vent Filter	1,500 acfm	Urea	N/A	N/A	152 hours	0 tpy
	Urea Conveyor to Dissolver Tank Bin Vent Filter	400 acfm	Urea	N/A	N/A	190 hours	0 tpy
1000	Sodium Bicarbonate Unloading Portable Baghouse	850 scfm	Sodium Bicarbonate	N/A	N/A	23 hours	0 tpy
. 1				Insignificant Emissions Units Emissions - CY2020 Actual Emissions - NOX	ssions - CY2020 Actu	ial Emissions - NOX	0 tpy
ıl							
					ILANIUM UKUKALI	The second second	

Diesel Heating Value

lab analysis 133,141 Btu/gal

2,000 lb/ton Conversion factors:

Sample Calculations:

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

Emissions (tpy) = (Emission factor, lb/10³ gal) x (Fuel consumption, gal) / (Conversion, 1,000 gal/10³ 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)

March 2021

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

Description         RatingCapacity         Type         Reference         Factor         Operation         CO Emissions           Unit No. 1         327 MMBLufhr         CGal/U.SD         CY2020 CEMS Data         280 6 lbfnr         8.330 hours         1,168.71 tpy           Auxiliary Boiler No. 2         568 MMBLufhr         COal/U.SD         AP-42, Table 1.3-1         5 lb10 <sup>2</sup> gal         52.53 gallons         1.13 tpy           Auxiliary Boiler No. 2         2.30 MMBLufhr         ULSD         AP-42, Table 1.3-1         5 lb10 <sup>2</sup> gal         52.53 gallons         0.13 tpy           Consherator Engine No. 1         2.75 MW         ULSD         AP-42, Table 1.3-1         5 lb10 <sup>2</sup> gal         52.53 gallons         0.13 tpy           Limestone Storage Silo         600 cfm         Lime         Lime         NAA         NAA         1.719 hours         0 tpy           Limestone Storage Silo         600 cfm         Figative Dust         NAA         NAA         2.719 hours         0 tpy           Sodium Elevationale Miles         1.800 cfm         Engitican Engine         NAA         1.717.0 tpy         0 tpy           Coal Handling System         2.500 cfm         Engiticant Engistons Units         NAA         2.719 hours         0 tpy           Coal Storage Silo No. 2         1.800 cfm<
Significant Emissions Units           Significant Emissions Units         CY2020 CEMS Data         280.6 lb/hr         5.707 hours           658 MMBLu/hr         Coal/ULSD         CY2020 CEMS Data         2.96 lb/hr         5.707 hours           12.554 MMBLu/hr         ULSD         AP-42, Table 1.3-1         5 lb/10³ gal         5.2535 gallons           2.3.0 MMBLu/hr         ULSD         AP-42, Table 1.3-1         5 lb/10³ gal         5.2535 gallons           12.000 cfm         Line         N/A         N/A         0 logallons           12.000 cfm         Line         N/A         N/A         2.719 hours           1.2.000 cfm         Fiyash         N/A         N/A         8.46 hours           1.2.000 cfm         Fiyash         N/A         N/A         8.46 hours           2.000 cfm         Fiyash         N/A         N/A         8.734 hours           2.000 cfm         Elipse         N/A         N/A         8.734 hours           2.25 mlcs         Fugitive Dust         N/A         N/A         8.734 hours           2.64 hp         Lime         Lime         N/A         N/A         8.734 hours           1.300 acfm         Lime         N/A         N/A         N/A         8.734 hours
327 MMBtu/hr         Coal/ULSD         CY2020 CEMS Data         280.6 lb/hr         8,330 hours           658 MMBtu/hr         COAI/ULSD         CY2020 CEMS Data         2.96 lb/hr         5,707 hours           12.554 MMBtu/hr         ULSD         AP-42, Table 1.3-1         5 lb/10³ gal         5,253 gallons           2.75 MMBtu/hr         ULSD         AP-42, Table 3.4-1         0.85 lb/MBtu         0 gallons           12.000 cfm         Coal         AP-42, Table 3.4-1         0.85 lb/MBtu         0 gallons           12.000 cfm         Coal         N/A         N/A         2,719 hours           12.000 cfm         Sodium Bicarbonate         N/A         N/A         2,719 hours           10.000 cfm         Sodium Bicarbonate         N/A         1,719 hours         2,719 hours           1.5 day supply         Coal         N/A         N/A         2,719 hours           1.5 day supply         Coal         N/A         N/A         8,734 hours           1.5 day supply         ULSD         AP-42, Table 3.3-1         0.00668 lb/hp-hr         6 hours           1.5 day supply         ULSD         AP-42, Table 3.3-1         0.00668 lb/hp-hr         6 hours           1.5 day supply         ULSD         AP-42, Table 3.3-1         0.00668 lb/hp-hr
658 MMBtu/hr         Coal/ULSD         CY2020 CEMS Data         2.96 lb/hr         5,707 hours           12.554 MMBtu/hr         ULSD         AP-42, Table 1.3-1         5 lb/10³ gal         3,329 gallons           2.30 MMBtu/hr         ULSD         AP-42, Table 1.3-1         5 lb/10³ gal         5,535 gallons           12.00 cfm         Coal         N/A         N/A         2,719 hours           12.000 cfm         Flyash         N/A         N/A         2,719 hours           12.000 cfm         Coal         N/A         N/A         2,719 hours           12.000 cfm         Elyash         N/A         N/A         2,719 hours           12.000 cfm         Coal         N/A         N/A         2,719 hours           15.000 cfm         Eygitive Dust         N/A         1,719 hours           15.day supply         Coal         N/A         N/A         8,734 hours           15.day supply         Coal         AP-42, Table 3.3-1         0.00668 lb/hp-hr         6 hours           15.day supply         ULSD         AP-42, Table 3.3-1         0.00668 lb/hp-hr         6 hours           15.do acfm         Lime         N/A         N/A         8,734 hours           1,800 acfm         Lime         N/A         <
12.554 MMBtu/hr         ULSD         AP-42, Table 1.3-1         5 lb/10³ gal         3,329 gallons           23.0 MMBtu/hr         ULSD         AP-42, Table 1.3-1         5 lb/10³ gal         5,253 gallons           23.0 MMBtu/hr         ULSD         AP-42, Table 3.4-1         0.85 lb/MMBtu         0 gallons           12,000 cfm         Lime         N/A         N/A         2.719 hours           12,000 cfm         Flyash         N/A         N/A         0 hours           10,000 cfm         Flyash         N/A         N/A         2.719 hours           10,000 cfm         Flyash         N/A         8,446 hours           10,25 miles         Coal         N/A         N/A         8,749 hours           10,25 miles         Fugitive Dust         N/A         N/A         8,734 hours           10,25 miles         Coal         N/A         N/A         8,734 hours           1,50 d cfm         ULSD         AP-42, Table 3.3-1         0.00668 lb/hp-hr         6 hours           264 hp         ULSD         AP-42, Table 3.3-1         0.00668 lb/hp-hr         6 hours           1,800 acfm         Lime         N/A         N/A         8,734 hours           1,800 acfm         Lime         N/A         N/A
23.0 MMBtu/hr         ULSD         AP-42, Table 1.3-1         5 lb/10³ gal         52,535 gallons           2.75 MW         ULSD         AP-42, Table 3.4-1         0.85 lb/MMBtu         0 gallons           12,000 cfm         Coal         N/A         N/A         2.719 hours           12,000 cfm         Flyash         N/A         N/A         2.719 hours           10,000 cfm         Foliam Bicarbonate         N/A         N/A         8.746 hours           10,000 cfm         Coal         N/A         N/A         8.734 hours           15 day supply         Coal         N/A         8.734 hours           15 day supply         Coal         N/A         8.734 hours           15 day supply         ULSD         AP-42, Table 3.3-1         0.00668 lb/hp-hr         6 hours           264 hp         ULSD         Significant Emissions Units Emissions - CY2020 Actual Emission
2.75 MW         ULSD         AP-42, Table 3.4-1         0.85 IbMMBtu         0 gallons           12,000 cfm         Coal         N/A         N/A         2.719 hours           800 cfm         Lime         N/A         8,446 hours           1,000 cfm         Fugitive Dust         N/A         8,734 hours           20,000 cfm         Coal         N/A         1,79 hours           15 day supply         Coal         N/A         8,734 hours           15 day supply         Coal         N/A         8,734 hours           15 day supply         Coal         N/A         8,734 hours           15 day supply         Coal         AP-42, Table 3.3-1         0.00668 lb/hp-hr         6 hours           264 hp         Lime         N/A         8,734 hours         Coal           1,300 acfm         Lime         N/A         8,734 hours           1,300 acfm         Lime         N/A         8,734 hours           1,300 acfm         Lime         N/A         8,734 hours           25,000 gallons         Diesel         N/A         8,734 hours           25,000 gallons         Diesel         N/A         8,734 hours           300 acfm         Loos         N/A         8,734 hours
12,000 cfm
800 cfm         Lime         N/A         N/A         0 hours           5,000 cfm         Flyash         N/A         8,446 hours           1         20,000 cfm         Sodium Bicarbonate         N/A         2,25 hours           20,000 cfm         Coal         N/A         N/A         2,25 hours           20,000 cfm         Coal         N/A         N/A         8,734 hours           15 day supply         Coal         N/A         N/A         8,734 hours           264 hp         ULSD         AP-42, Table 3.3-1         0.00668 lb/hp-hr         6 hours           264 hp         Lime         N/A         N/A         8,734 hours           1,800 acfm         Diesel         N/A         N/A         8,734 hours           2,000 gallons         Diesel         N/A         N/A         8,734 hours           2,000 gallons         Diesel         N/A         N/A         8,734 hours           2,000 gallons         Diesel
5,000 cfm         Flyash         N/A         N/A         8,446 hours           1         440 cfm         Sodium Bicarbonate         N/A         225 hours           20,000 cfm         Coal         N/A         2,719 hours           0.25 miles         Coal         N/A         8,734 hours           15 day supply         Coal         N/A         8,734 hours           264 hp         ULSD         AP-42, Table 3.3-1         0.00668 lb/hp-hr         6 hours           1,800 acfm         Lime         N/A         8,734 hours           1,800 acfm         Lime         N/A         5,707 hours           1,800 acfm         Lime         N/A         8,734 hours           1,800 acfm         Lime         N/A         8,734 hours           25,000 gallons         Diesel         N/A         N/A         8,734 hours           2,000 gallons         Diesel         N/A         N/A         8,734 hours           2,000 gallons         Diesel         N/A         N/A         8,734 hours           2,000 gallons         Diesel         N/A         N/A         8,734 hours           300 gallons         Diesel         N/A         N/A         8,734 hours           425 gallons
15
20,000 cfm         Coal         N/A         N/A         2,719 hours           0.25 miles         Fugitive Dust         N/A         R,734 hours         8,734 hours           15 day supply         Coal         AP-42, Table 3.3-1         0.00668 lb/hp-hr         6 hours           Insignificant Emissions Units         Lime         N/A         N/A         S,707 hours           1,800 acfm         Lime         N/A         N/A         5,707 hours           Not Applicable         Not Applicable         N/A         N/A         8,734 hours           25,000 gallons         Diesel         N/A         N/A         8,734 hours           20,000 gallons         Diesel         N/A         N/A         8,734 hours           425 gallons         Diesel         N/A         N/A         8,734 hours           425 gallons         Diesel         N/A         8,734 hours           425 gallons         Diesel         N/A         1,095 hours           426 gallons         Diesel         N/A         1,095 hours           426 gallons         Diesel         N/A         1,095 hours
0.25 miles         Fugitive Dust         NI/A         NI/A         8,734 hours           15 day supply         Coal         NI/A         8,734 hours         8,734 hours           264 hp         ULSD         Significant Emissions Units         Emissions - CY2020 Actual Emissions - CY202
15 day supply   Coal   NI/A   NI/A   8,734 hours
1,800 acfm
Significant Emissions Units Emissions - CY2020 Actual Emissions - CO           Insignificant Emissions Units           1,800 acfm         Lime         N/A         N/A         5,707 hours           1,800 acfm         Lime         N/A         N/A         8,784 hours           Not Applicable         Not Applicable         Not Applicable         N/A         8,784 hours           25,000 gallons         Diesel         N/A         8,784 hours           300 gallons         Diesel         N/A         8,784 hours           425 gallons         Diesel         N/A         8,784 hours           450 acfm         Coal         N/A         8,784 hours           N/A         N/A         1,995 hours
1,300 acfm   Lime
1,300 acfm         Lime         N/A         N/A           1,300 acfm         Lime         N/A         N/A           Not Applicable         Ash         N/A         N/A           Not Applicable         Not Applicable         N/A         N/A           25,000 gallons         Diesel         N/A         N/A           300 gallons         Diesel         N/A         N/A           425 gallons         Diesel         N/A         N/A           900 acfm         Lica         N/A         N/A           1500 acfm         Lica         N/A         N/A
1,300 acfm         Lime         N/A         N/A           Not Applicable         Ash         N/A         N/A           Not Applicable         Not Applicable         N/A         N/A           25,000 gallons         Diesel         N/A         N/A           3:00 gallons         Diesel         N/A         N/A           425 gallons         Diesel         N/A         N/A           900 acfm         Lica         N/A         N/A
Not Applicable         Ash         N/A         N/A           Not Applicable         Not Applicable         N/A         N/A           25,000 gallons         Diesel         N/A         N/A           2,000 gallons         Diesel         N/A         N/A           300 gallons         Diesel         N/A         N/A           425 gallons         Diesel         N/A         N/A           400 acfm         Lical         N/A         N/A
Not Applicable         Not Applicable         Not Applicable         Not Applicable         N/A         N/A           25,000 gallons         Diesel         N/A         N/A         N/A           3:00 gallons         Diesel         N/A         N/A         N/A           425 gallons         Diesel         N/A         N/A         N/A           9:00 acfm         Lical         N/A         N/A         N/A
25,000 gallons         Diesel         N/A         N/A           2,000 gallons         Diesel         N/A         N/A           300 gallons         Diesel         N/A         N/A           425 gallons         Diesel         N/A         N/A           900 acfm         Lica         N/A         N/A           1500 ocfm         Lica         N/A         N/A
2,000 gallons         Diesel         N/A         N/A           300 gallons         Diesel         N/A         N/A           425 gallons         Diesel         N/A         N/A           000 acfm         Coal         N/A         N/A           1500 acfm         Lica         N/A         N/A
300 gallons         Diesel         N/A         N/A           425 gallons         Diesel         N/A         N/A           900 acfm         Coal         N/A         N/A
425 gallons         Diesel         N/A         N/A           900 acfm         Coal         N/A         N/A
900 acfm Coal N/A N/A N/A 1500 acfm Hrsa N/A N/A
1 500 acfm   1 500 acfm   N/A
NA 2011
acfm Urea N/A N/A N/A
Sodium Bicarbonate Unloading Portable Baghouse 850 scfm   Sodium Bicarbonate   N/A   23 hours
Insignificant Emissions - Units Emissions - CY2020 Actual Emissions - CO

<sup>1</sup> Diesel Heating Value	133,141 Btu/gal	lab a

Conversion factors:

2,000 lb/ton

Sample Calculations:  $\label{eq:calculations:} Emissions (tpy) = (Emission factor, lb/hr) \times (Operation, hr/yr) / (Conversion, 2,000 lb/ton)$ 

Emissions (tpy) = (Emission factor, lb/10³ gal) x (Fuel consumption, gal) / (Conversion, 1,000 gal/10³ 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		Fuel	Factor	PM Emission	CY2020 Actual	CY2020 Actual
Description	Rating/Capacity	Type	Reference	Factor	Operation	PM Emissions
		Significant Emissions Units	sions Units			
Unit No. 1	327 MMBtu/hr	Coal/ULSD	CY2020 CEMS Data	0.73 lb/hr	8,330 hours	2.98 tpy
Unit No. 2	658 MMBtu/hr	Coal/ULSD	CY2020 CEMS Data	0.51 lb/hr	5,707 hours	1.67 tpy
Auxiliary Boiler No. 1	12.554 MMBtu/hr	OLSD	AP-42, Tables 1.3-2 and 1.3-7	2.38 lb/10 <sup>3</sup> gal	3,329 gallons	4.E-03 tpy
Auxiliary Boiler No. 2	23.0 MMBtu/hr	ULSD	AP-42, Tables 1.3-2 and 1.3-7	2.38 lb/10 <sup>3</sup> gal	52,535 gallons	0.06 tpy
Diesel Generator Engine No. 1	2.75 MW	ULSD	AP-42 Table 3.4-2	0.0573 lb/MMBtu	0 gallons	0 tpy 1
Crusher System	12,000 cfm	Coal	Permit AQ0173TVP03, Table B	2.05 lb/hr	2,719 hours	2.79 tpy
Limestone Storage Silo	800 cfm	Lime	Permit AQ0173TVP03, Table B	0.14 lb/hr	0 hours	0 tpy
Flyash Storage Silo	5,000 cfm	Flyash	Permit AQ0173TVP03, Table B	0.86 lb/hr	8,446 hours	3.63 tpy
Sodium Bicarbonate Handling System	440 cfm	Sodium Bicarbonate	_	0.02 gr/dscf	225 hours	0.01 tpy
Coal Handling System	20,000 cfm	Coal	Permit AQ0173TVP03, Table B	3.43 lb/hr	2,719 hours	4.66 tpy
Haul Road	0.25 miles	Fugitive Dust	See Table 5a	e 5a	8,784 hours	0.84 tpy
Coal Storage Pile	15 day supply	Coal	See Table 5b	e 5b	8,784 hours	0.63 tpy
Firewater Pump Engine	264 hp	ULSD	AP-42, Table 3.3-1	0.0022 lb/hp-hr	6 hours	2.E-03 tpy
		18.00 18.00	Significant Emissions U	Significant Emissions Units Emissions - CY2020 Actual Emissions - PM	Actual Emissions - PM	17.3 tpy
		Insignificant Emissions Units	ssions Units	3		
Lime Storage Silo No. 1	1,800 acfm	Lime	Design Specifications	0.005 gr/dcf	E 707 house	10 00 to
Lime Storage Silo No. 2	1,800 acfm	Lime	Design Specifications	0.005 gr/dcf	Sinoil 101'c	0.22 tpy
Ash Handling	Not Applicable	Ash	ı	Table 5c	8,784 hours	0.03 tpy
Miscellaneous Roads	Not Applicable	Not Applicable	See Table 5d	e 5d	8,784 hours	0.14 tpy
AST Diesel Tanks (2)	25,000 gallons	Diesel	N/A	N/A	8,784 hours	0 tpy
AST Diesel Tank	2,000 gallons	Diesel	N/A	N/A	8,784 hours	0 tpy
AST Diesel Tank	300 gallons	Diesel	N/A	N/A	8,784 hours	0 tpy
AST Diesel Tank	425 gallons	Diesel	N/A	N/A	8,784 hours	0 tpy
Central Vac (3)	900 acfm	Coal	Engineering Estimate	0.05 gr/dcf	1,095 hours	0.21 tpy
Urea Storage Silo A/B Bin Vent Filter	1,500 acfm	Urea	Engineering Estimate	0.005 gr/dcf	152 hours	5.E-03 tpy
Urea Conveyor to Dissolver Tank Bin Vent Filter	400 acfm	Urea	Engineering Estimate	0.005 gr/dcf	190 hours	2.E-03 tpy
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	nits Emissions - CY2020 /	Actual Emissions - PM	0.61 tpy
				CCCCCC	CVOCO Action DAM Concord	470 4

lab analysis 133,141 Btu/gal Diesel Heating Value

2,000 lb/ton 7,000 grains/lb

Sample Calculations: Emission factor, lb/hr) x (Operation, hr/yr) / (Conversion, 2,000 lb/ton) Emissions (tpy) = (Emission factor, lb/hM/Btu) x (Operation, x (Operation, hr/yr) / (Conversion, 2,000 lb/ton)

Emissions (tpy) = (Emission factor, Ib/10³ gal) x (Fuel consumption, gal) / (Conversion, 1,000 gall/10³ gal) / (Conversion, 2,000 lb/ton)

Emissions (tpy) = (Emission factor, Ib/MMBtu) x (Fuel heat value, Btu/gal) / (Conversion, 1,000,000 Btu/MMBtu) x (Fuel consumption, gal) / (Conversion, 2,000 Ib/ton) Emissions (tpy) = (Emission factor, Ib/hp-hr) x (Rating, hp) x (Operation, hr/yr) / (Conversion, 2,000 Ib/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 Ib/ton)

Golden Valley Electric Association - Healy Power Plant FY2022 Assessable Emissions

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

	Emissions Unit	Control of Carton	Emission Factor	CY2020 Actual	CY2020 Actual PM
QI	Description	racioi neielelice	EIIIISSIOII FACIOI	Operation	Emissions
11	Coal Haul - Unpaved Portion	AP-42, Section 13.2.2	1.32 lb/VMT	1,275 VMT	0.84 tpy 1
			CY2020	CY2020 Actual PM Emissions	0.8 tpy

Coal Haul Road

Unpaved Road Emission Factor

AP-42, Section 13.2.2, Equation 1a:

MT) (12) (3)	PM	
	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) t
a (empirical constant)	6.0	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	Ib/vMT
Efficiency =	%09	assumed control efficiency for water application
E (controlled) =	1.81	Ib/vMT

truck

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:

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

 $E_{\rm ext}$  = annual size-specific emission factor extrapolated for water mitigation, Ib/VMT

E = emission factor from Equation 1a P = number of days in a year with at least 0.01 inches of precipitation

Table 5a. FY2022 Assessable Emissions Calculations - Haul Road Particulate Matter (PM) Emissions · Healy Power Plant

Association	
Electric	
Valley	
Golden	

oal Throughput	
i	Capacity $\left(\frac{MMBtu}{hr}\right) \times Operation\left(\frac{hr}{vear}\right)$
I.hroughput =	(MMBtu)

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

Vehicle Miles Traveled (VMT)

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

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

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

Emissions Unit	Control of Control		Cocco Control ococco	COCCO
Description	racioi kelerence	EIIISSION FACTOR	CT 2020 Actual Operation	CTZ0Z0 Actual Operation   CTZ0Z0 Actual FM Emissions
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 Ib/VMT	1,275 VMT	0.6 tpy 2
Stockpile Wind Erosion	AP-42, Section 13.2.5	0.00 g/m²-yr	10,150 m <sup>2</sup>	0.0 tpy <sup>3</sup>
			CY2020 Actual PM Emissions	0.6 thy

kpile and Front End Loader Drop to Gri	Emission Factor:
 1 Truck Drop onto Stor	Drop Operation

AP-42, Section 13.2.4

 $E\left(\frac{lb}{ton}\right) = \frac{k \times 0.0032 \times \left(\frac{U}{5}\right)^{1.3}}{2.2 \times 1.4}$ 

miles/hr percent lb/ton 16.5 PM 0.35 U = mean wind speed M = coal moisture content E =

AP-42, Section 13.24 for PM-10
Per MET data recorded at GVEA's Eva Creek Wind Farm CY2019, conservative estimation with higher winds than seen at the Healy Power Plant
Weighted average from EU ID 1 and 2 CY2020 coal proximate analyses

Annual Stockpile Throughput:

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

179,230 tons 171,470 tons EU ID 1 CY2020 actual coal throughput EU ID 2 CY2020 actual coal throughput

from Healy environmental report from Healy environmental report

> 350,700 tons Total CY2020 actual coal throughput

Coal Density  $\left(\frac{lb}{ft^3}\right) \times 27 \left(\frac{ft^3}{yd^3}\right) \times Bucket Size(yd^3)$ 2000 (1b)

<sup>2</sup> Front End Loader Movement

Coal moved per trip:

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

FY2022 Assessable Emissions Golden Valley Electric Association - Healy Power Plant

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Golden Valley Electric Association - Healy Power Plant FY2022 Assessable Emissions

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

**Emission Factor** 

assumed control efficiency for water application from AP-42, Table 13.2.2-2 for PM-10 from AP-42, Table 13.2.2-2 for PM-10 percent, from AP-42, Table 13.2.2-1 from AP-42, Table 13.2.2-2 **Ib/VMT** Ib/VMT 1.5 8.4 33.2 0.9 0.45 3.21 W = mean vehicle weight Efficiency = s = surface material silt content (haul road) a (empirical constant) b (empirical constant) E (uncontrolled) =  $E\left(\frac{lb}{VMT}\right) = k\left(\frac{s}{12}\right)^a \left(\frac{W}{3}\right)^b$ AP-42, Section 13.2.2, Equation 1a:

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:

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

E<sub>ext</sub> = annual size-specific emission factor extrapolated for water mitigation, Ib/VMT

E = emission factor from Equation 1a P = number of days in a year with at least 0.01 inches of precipitation

E (controlled) =

Vehicle Miles Traveled (VMT)

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

350,700 tons 7.815555 tons 150 feet Total Actual Coal Throughput Coal moved per trip Approximate distance from coal pile to grizzly (round trip)

1,275

VMT = vehicles miles traveled per year

Engineering estimate of projected use

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Golden Valley Electric Association - Healy Power Plant FY2022 Assessable Emissions

Appendix III.D.7.7-1261

<sup>3</sup> Stockpile Wind Erosion Coal Pile Surface Area

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

Surface area of active face =

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

P = erosion potential corresponding to the fastest mile of wind for the ith period between disturbances, g/m<sup>2</sup> k = particle size multiplier (AP-42 Section 13.2.5.3) N = number of disturbances per year 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  $u^* \le u_t^*$ 

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

AP-42 Section 13.2.5, Equation (1)

Friction velocity, u\*  $0.4 \times u(z) \\ u^* = \frac{0.4 \times u(z)}{\sqrt{z}} \text{ when } z > z_o$  $\ln\left(\frac{z}{z_o}\right)$ 

u\* = friction velocity (cm/s)

u(z) = wind speed at height z above test surface (cm/s) z = height above test surface (cm) z<sub>o</sub> = roughness height, cm Using average wind speed recorded at GVEA's Eva Creek Wind farm for each month in CY2019 (see table below)

disturbances/year for active face, estimated average disturbances/month 365

(Z) N

Data:

March 2021

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

			•											
					Uncrusted Coal Pile (Table 13.2.5-2)	Uncrusted Coal Pile <sup>b</sup> (Table 13.2.5-2)				e	Ground Coal (Table 13.2.5-2)			ê £
Month-Year	Average V	Average Wind Speed (u(10)) <sup>a</sup>	Wind Direction	Roughness Height (z <sub>o</sub> )	Threshold Friction Velocity (u,)	Calculated Friction Velocity (u*)	Erosion potential function,	Roughness Height (z <sub>o</sub> )	Threshold Friction Velocity (u,)	Calculated Friction Velocity (u*)	Erosion potential function, P	g × Z	×	Emission Factor, EF
	mph	s/m	deg	cm	s/m	s/m	_	cm	s/m	m/s				g/m²-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		ě.
Mar-19	19.9	8.9	179	0.3	1.12	0.44	0	0.01	0.55	0.31	0	0	8	
Apr-19	14.8	9.9	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	9.7	197	0.3	1.12	0.37	0	0.01	0.55	0.26	0	0	8	2
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 <sub>10</sub> Annual Total	II Total						0				0.00	0.00	0.5	0.00
	147,00	7	0,000,00											

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

	Emissions Unit	Courselod soften		and and and and	CV2020 Action	CV2020 Activit BM Emission
Ol	Description	Factor Reference	Emission	Emission ractor	C12020 Actual Operation	C12020 Actual PM Emission
	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
N/A	Front End Loader Movement - Ash Drying Area to Truck	AP-42, Section 13.2.2	PM	0.85 Ib/VMT	1MV 69	2.9E-02 tpy <sup>2</sup>
	Ash Drying Area Wind Erosion	AP-42, Section 13.2.5	PM	0.00 g/m <sup>2</sup>	4,800 m <sup>2</sup>	0 tpy 3
		9		(100 m) (100 m)	CY2020 Actual PM Emissions	3 0F-02 tov

Front End Loader / Flyash Storage Silo Drop into Truck

AP-42, Section 13.2.4

 $k \times 0.0032 \times \left(\frac{U}{5}\right)^{1.3}$ (lp)

percent 0.35 16.5 17.5 2.54E-04 50% M M = ash moisture content E (uncontrolled) = U = mean wind speed

Per MET data recorded at GVEA's Eva Creek Wind Farm CY2019, conservative estimation with higher winds than seen at the Healy Power Plant Avg of slag, bottom ash, and fly ash from Heat and Material Balance for HCCP - March 6, 1998 AP-42, Section 13.2.4 for PM-10

assumption because material is wet lb/ton

Efficiency =

E (controlled) =

Annual stockpile throughput:

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

<sup>2</sup> Front End Loader Movement - Ash Pile to Truck

Ash moved per trip:

Ash Density  $\left(\frac{lb}{ft^3}\right) \times 27 \left(\frac{ft^3}{yd^3}\right) \times Bucket Size(yd^3)$ 8 yd<sup>3</sup> 60 lb/ft<sup>3</sup> 6.48 tons  $2000 \left(\frac{lb}{ton}\right)$ Density of ash Ash moved per trip Size of load bucket Ash (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

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

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:

**Ib/VMT** 

E (controlled) =

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

 $E_{\rm ext}$  = annual size-specific emission factor extrapolated for water mitigation,  $\rm lb/MT$ 

E = emission factor from Equation 1a P = number of days in a year with at least 0.01 inches of precipitation

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

150 feet 68.77

<sup>1</sup>From AP-42, Section 13.2.5, Industrial Wind Erosion Ash Pile Surface Area

4,800 m<sup>2</sup> Surface area of active face =

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

k = particle size multiplier (0.5 for particle size < 10 microns, per AP 42 Section 13.2.5.3)

P<sub>i</sub> = erosion potential corresponding to the fastest mile of wind for the ith period between disturbances, g/m<sup>2</sup> N = number of disturbances per year

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

Erosion potential function for a dry exposed surface, P AP-42 Section 13.2.5, Equation (3)

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

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

where

u<sub>t</sub> = threshold friction velocity (m/s) u\* = friction velocity (m/s)

 $u^* = \frac{0.4 \times u(z)}{\ln\left(\frac{z}{z_o}\right)}$  when  $z > z_o$ Friction velocity, u\* AP-42 Section 13.2.5, Equation (1)

u\* = friction velocity (cm/s) where

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

z<sub>o</sub> = roughness height, cm

Use maximum wind gust speed recorded at McKinley Airport ASOS for each month in CY2018 (see table below)

(Z) N Z

Data:

disturbances/year for active face, estimated average disturbances/month 10 365 30

					Asi (Table	Ash pile <sup>a</sup> (Table 13.2.5-2)					
Month-Year	Average Wind Speed (u(10)) <sup>b</sup>	(ind Speed	Wind Direction	Roughness Height (z <sub>o</sub> )	Threshold Friction Velocity (u <sub>t</sub> )	Calculated Friction Velocity (u*)	Erosion potential function,	A N	×	Emission Factor (uncontrolled), EF	Emission Factor (controlled), EF °
	hdm	s/w	deg	шo	s/m	s/m				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	8.7	180	0.3	1.02	0.38	0	0.0			
Mar-19	19.9	6.8	179	0.3	1.02	0.44	0	0.0			
Apr-19	14.8	9.9	173	6.0	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	6.7	4.3	204	6.0	1.02	0.21	0	0.0			
Jul 19				1.	11.2		17.				
Aug-19	13.1	6.5	224	6.0	1.02	0.29	0	0.0			
Sep-19	16.9	9.7	197	6.0	1.02	0.37	0	0.0			
Oct-19	20	6.8	182	6.0	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	8.7	152	6.0	1.02	0.38	0	0.0			
CY2018 PM <sub>10</sub> Annual Total	innual Total						0	0.00	0.5	0.00	0.00

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

<sup>b</sup> Per www.ncdc.noaa.gov for CY2018, McKinley Airport ASOS (PAIN).

<sup>c</sup> 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	Control Defendance	Emission Costor	CY2020 Actual	CY2020 Actual PM
OI	Description	racioi Neieleilice	EIIIISSIOII LACIOI	Operation	Emissions
	Ash Haul - Unpaved (EU ID 1)	AP-42, Section 13.2.2	1.18 Ib/VMT	126 VMT	0.07 tpy 1
	Ash Haul - Unpaved (EU ID 2)	AP-42, Section 13.2.2	1.18 Ib/VMT	TMV 78	5.1E-02 tpy 1
A/N	Limestone/Lime Delivery - Paved Portion	AP-42, Section 13.2.1	0.08 Ib/VMT	TMV 54	1.8E-03 tpy <sup>2</sup>
	Limestone/Lime Delivery - Unpaved Portion	AP-42, Section 13.2.2	1.07 Ib/VMT	21 VMT	1.1E-02 tpy <sup>2</sup>
	Miscellaneous Traffic - Paved Portion	AP-42, Section 13.2.1	0.001 lb/VMT	5,185 VMT	3.4E-03 tpy 3
			CY2020	CY2020 Actual PM Emissions	0.14 tpy

Notes:

<sup>1</sup> Ash Haul Road

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

Section 13.2.2, Equation 1a:  $E\left(\frac{lb}{VMT}\right) = k\left(\frac{s}{12}\right)^a \left(\frac{W}{3}\right)^b$ 

	from AP-42, Table 13.2.2-2 for PM-10	percent, from AP-42, Table 13.2.2-1	tons, estimate - average of full (197.5 ton) and empty (105 ton) truck	from AP-42, Table 13.2.2-2 for PM-10	from AP-42, Table 13.2.2-2	Ib/vMT	assumed control efficiency for water application	Ib/VMT
PM	1.5	5.1	151.25	6.0	0.45	4.05	%09	1.62
$(VMT)^{-1}(12)(3)$	   	s = surface material silt content (haul road)	W = mean vehicle weight	a (empirical constant)	b (empirical constant)	E (uncontrolled) =	Efficiency =	E (controlled) =

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:

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

 $E_{\rm ext}$  = annual size-specific emission factor extrapolated for water mitigation, Ib/VMT

E = emission factor from Equation 1a P = number of days in a year with at least 0.01 inches of precipitation

Ib/VMT E (controlled) =

Ash Throughput

17,115 tons 15,686 tons EU ID 1 ash disposal throughput EU ID 2 ash disposal throughput

from Healy environmental report from Healy environmental report

Vehicle Miles Traveled (VMT)

Throughput (tons)  $\times$  Roundtrip Distance VMT

92.5 tons, estimate Haul Truck Capacity  $\left(\frac{tons}{trip}\right)$ Haul truck capacity

0.68 miles/trip 0.51 miles/trip 126.16 miles miles 86.71 Unpaved distance to ash drying area (round trip) EU ID 1 unpaved road VMT = EU ID 2 unpaved road VMT = Unpaved distance to EU ID 8 (round trip)

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

<sup>2</sup> Limestone/Lime/Sodium Bicarbonate Haul Road

Paved Road Emission Factor AP-42, Section 13.2.1, Equation 1:

	Ib/VMT from AP-42 Table 13.2.1-1 for PM-10	g/m², from AP-42, Table 13.2.1-2	tons, estimate - average of full (135 ton) and empty (110 ton) loader/trailer	Ib/vMT	assumed control efficiency for pavement cleaning
PM	0.0022	9.0	122.5	0.17	20%
$E\left(\overline{VMT}\right) = K(SL)^{0.31}(W)^{1.02}$	k = particle size multiplier	sL = surface material silt content (haul road)	W = mean vehicle weight	E (uncontrolled) =	Efficiency =

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

Ib/VMT

0.09

AP-42, Section 13.2.1, Equation 2:

 $E_{\rm ext}$  = annual size-specific emission factor extrapolated for water mitigation, Ib/VMT

E = emission factor from Equation 1a P = number of days in a year with at least 0.01 inches of precipitation

E (controlled) =

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

W = mean vehicle weight s = surface material silt content (haul road)

122.5

6.0

a (empirical constant)

tons, estimate - average of full (135 ton) and empty (110 ton) loader/trailer

from AP-42, Table 13.2.2-2 for PM-10

from AP-42, Table 13.2.2-2

from AP-42, Table 13.2.2-2 for PM-10

percent, from AP-42, Table 13.2.2-1

0.45 3.69 E (uncontrolled) = b (empirical constant)

%09

assumed control efficiency for water **Ib/VMT Ib/VMT** Efficiency = E (controlled) =

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Golden Valley Electric Association - Healy Power Plant FY2022 Assessable Emissions

# Table 5d. FY2022 Assessable Emissions Calculations - Miscellaneous Roads Particulate Matter (PM) Emissions

Healy Alaska annually has 100 days with rainfall greater than or equal to 0.01 inches per the Western Regional Climate Center. Golden Valley Electric Association - Healy Power Plant

AP-42, Section 13.2.2, Equation 2:

365 - P365  $E_{ext} = E$ 

 $E_{\rm ext}$  = annual size-specific emission factor extrapolated for water mitigation, Ib/VMT

E = emission factor from Equation 1a P = number of days in a year with at least 0.01 inches of precipitation

Ib/VMT E (controlled) =

Throughput

Limestone/Lime Throughput Sodium Bicarbonate Throughput

3,396 tons, CY2020 actual 573 tons, CY2020 actual

Throughput (tons)  $\times$  Roundtrip Distance

Vehicle Miles Traveled (VMT)

25 tons, estimate 0.28 miles/trip 0.13 miles/trip 45.10 miles miles 21.05 trip Haul Truck Capacity  $\left(\frac{tons}{trip}\right)$ Paved distance (round trip) Unpaved distance (round trip) Paved road VMT = Unpaved road VMT = Haul truck capacity VMT =

<sup>3</sup> Miscellaneous Traffic

Paved Road Emission Factor

AP-42, Section 13.2.1, Equation 1:

 $=k(sL)^{0.91}(W)^{1.02}$ VMT

9.0 sL = surface material silt content (haul road) W = mean vehicle weight

Ib/VMT from AP-42 Table 13.2.1-1 for PM-10

0.0022

k = particle size multiplier

g/m<sup>2</sup>, from AP-42, Table 13.2.1-2

tons, estimate

Ib/MT 0.00 20% E (uncontrolled) = Efficiency =

assumed control efficiency for pavement cleaning Ib/VMT .41E-03 E (controlled) =

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Golden Valley Electric Association - Healy Power Plant FY2022 Assessable Emissions

Table 5d. FY2022 Assessable Emissions Calculations - Miscellaneous Roads Particulate Matter (PM) Emissions

Healy Alaska annually has 100 days with rainfall greater than or equal to 0.01 inches per the Western Regional Climate Center. Golden Valley Electric Association - Healy Power Plant

AP-42, Section 13.2.1, Equation 2:

 $E_{ext} = E(1 -$ 

 $E_{\rm ext}$  = annual size-specific emission factor extrapolated for water mitigation, Ib/VMT

E = emission factor from Equation 1a P = number of days in a year with at least 0.01 inches of precipitation

Ib/VMT 0.001 E (controlled) =

Traffic volume Paved distance (round trip)

5,184.66 miles Paved road VMT =

50 trips per day 0.28 miles/trip

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
	Description	Rating/Capacity	Type	Reference	Factor	Operation	<b>VOC Emissions</b>
			Significant Emissions Units	Jnits			
Г	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
Г	Unit No. 2	658 MMBtu/hr	Coal/ULSD	AP-42, Table 1.1-19	0.04 lb/ton	5,707 hours	3.43 tpy <sup>2</sup>
Г	Auxiliary Boiler No. 1	12.554 MMBtu/hr	OLSD	AP-42, Table 1.3-3	0.34 lb/10 <sup>3</sup> gal	3,329 gallons	6E-04 tpy
	Auxiliary Boiler No. 2	23.0 MMBtu/hr	OLSD	AP-42, Table 1.3-3	0.34 lb/10 <sup>3</sup> gal	52,535 gallons	9E-03 tpy
_	Diesel Generator Engine No. 1	2.75 MW	OLSD	AP-42, Table 3.4-1	0.0819 lb/MMBtu	0 gallons	0 tpy 3
г	Crusher System	12,000 cfm	Coal	N/A	N/A	2,719 hours	0 tpy
	Limestone Storage Silo	800 cfm	Lime	N/A	N/A	0 hours	0 tpy
	Flyash Storage Silo	5,000 cfm	Flyash	N/A	N/A	8,446 hours	0 tpy
Т	Sodium Bicarbonate Handling System	440 cfm	Sodium Bicarbonate	N/A	N/A	225 hours	0 tpy
Г	Coal Handling System	20,000 cfm	Coal	N/A	N/A	2,719 hours	0 tpy
	Haul Road	0.25 miles	Fugitive Dust	N/A	N/A	8,784 hours	0 tpy
	Coal Storage Pile	15 day supply	Coal	N/A	N/A	8,784 hours	0 tpy
Т	Firewater Pump Engine	264 hp	OLSD	AP-42, Table 3.3-1	2.51E-03 lb/hp-hr	6 hours	2E-03 tpy
1	and the second s			Significant Emissions	Significant Emissions Units Emissions - CY2020 Actual VOC Emissions	Actual VOC Emissions	8.8 tpy
		-	Insignificant Emissions Units	Units			
Н	Lime Storage Silo No. 1	1,800 acfm	Lime	N/A	N/A	5 707 hours	Vot O
	Lime Storage Silo No. 2	1,800 acfm	Lime	N/A	N/A	O,ror Hours	o thy
П	Ash Handling	Not Applicable	Ash	N/A	N/A	8,784 hours	0 tpy
Н	AST Diesel Tanks (2)	25,000 gallons	Diesel	N/A	N/A	8,784 hours	0 tpy
Н	AST Diesel Tank	2,000 gallons	Diesel	N/A	N/A	8,784 hours	0 tpy
	AST Diesel Tank	300 gallons	Diesel	N/A	N/A	8,784 hours	0 tpy
Н	AST Diesel Tank	425 gallons	Diesel	N/A	N/A	8,784 hours	0 tpy
	Central Vac (3)	900 acfm	Coal	N/A	N/A	1,095 hours	0 tpy
Н	Urea Storage Silo A/B Bin Vent Filter	1,500 acfm	Urea	N/A	N/A	152 hours	0 tpy
	Urea Conveyor to Dissolver Tank Bin Vent Filter	400 acfm	Urea	N/A	N/A	190 hours	0 tpy
	Sodium Bicarbonate Unloading Portable Baghouse	850 scfm	Sodium Bicarbonate	N/A	N/A	23 hours	0 tpy
				Insignificant Emissions	Insignificant Emissions Units Emissions - CY2020 Actual VOC Emissions	Actual VOC Emissions	0 tpy
П				and the			10 m m m m m
					CY2020	CY2020 Actual VOC Emissions	8.8 tpy

EU ID 1 actual coal throughput

EU ID 2 actual coal throughput

Diesel Heating Value

lab analysis

133,141 Btu/gal 2,000 lb/ton

171,470 tons 179,230 tons

Conversion factors:

Sample Calculations:

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

Emissions (tpy) = (Emission factor, lb/10<sup>3</sup> gal) x (Fuel consumption, gal) / (Conversion, 1,000 gal/10<sup>3</sup> 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<sub>2</sub>) Emissions Golden Valley Electric Association - Healy Power Plant

1 Aux 3 Aux 4 Aux 5 Diesel G 6 C 7 Lime 8 Fly 9 Sodium Bloz 10 Coa 11 C	Description			ractor	Maximum del		CTZUZU ACTUAL	CI 2020 ACIUAL
		Rating/Capacity	Type	Reference	Sulfur Content	Factor	Operation	SO <sub>2</sub> Emissions
			Significant E	Significant Emissions Units				
	Unit No. 1	327 MMBtu/hr	Coal/ULSD	CY2020 CEMS Data	N/A	81.1 lb/hr	8,330 hours	337.90 tpy
	Unit No. 2	658 MMBtu/hr	Coal/ULSD	CY2020 CEMS Data	N/A	20.6 lb/hr	5,707 hours	68.31 tpy
	Auxiliary Boiler No. 1	12.554 MMBtu/hr	OLSD	Mass Balance	0.0015 wt. pct. S	0.00021 lb/gal <sup>1,2</sup>	3,329 gallons	4E-04 tpy 3
	Auxiliary Boiler No. 2	23.0 MMBtu/hr	OLSD	Mass Balance	0.0015 wt. pct. S	0.00021 lb/gal <sup>1,2</sup>	52,535 gallons	6E-03 tpy 3
	Diesel Generator Engine No. 1	2.75 MW	OLSD	Mass Balance	0.0015 wt. pct. S	0.00021 lb/gal <sup>1,2</sup>	0 gallons	0 tpy <sup>3</sup>
	Crusher System	12,000 cfm	Coal	N/A	N/A	N/A	2,719 hours	0 tpy
	Limestone Storage Silo	800 cfm	Lime	N/A	N/A	N/A	0 hours	0 tpy
	Flyash Storage Silo	5,000 cfm	Flyash	N/A	N/A	N/A	8,446 hours	0 tpy
	Sodium Bicarbonate Handling System	440 cfm	Sodium Bicarbonate	N/A	N/A	N/A	225 hours	0 tpy
	Coal Handling System	20,000 cfm	Coal	N/A	N/A	N/A	2,719 hours	0 tpy
	Haul Road	0.25 miles	Fugitive Dust	N/A	N/A	N/A	8,784 hours	0 tpy
	Coal Storage Pile	15 day supply	Coal	N/A	N/A	N/A	8,784 hours	0 tpy
	Firewater Pump Engine	264 hp	OLSD	Mass Balance	0.0015 wt. pct. S	0.00021 lb/gal 1,2	6 hours	9E-06 tpy 3.4
				Significa	Significant Emissions Units Emissions - CY2020 Actual Emissions - $\mathrm{SO}_2$	nissions - CY2020 Actu	al Emissions - SO <sub>2</sub>	406.2 tpy
The second secon	3 4100	0.000	Insignificant	Insignificant Emissions Units				
N/A Lime	Lime Storage Silo No. 1	1,800 acfm	Lime	N/A	N/A	N/A	E 707 hours	, ret, 0
N/A Lime	Lime Storage Silo No. 2	1,800 acfm	Lime	N/A	N/A	N/A	Sinoi 107,0	v.py
N/A	Ash Handling	Not Applicable	Ash	N/A	N/A	N/A	8,784 hours	0 tpy
N/A AST	AST Diesel Tanks (2)	25,000 gallons	Diesel	N/A	N/A	N/A	8,784 hours	0 tpy
	AST Diesel Tank	2,000 gallons	Diesel	N/A	N/A	N/A	8,784 hours	0 tpy
	AST Diesel Tank	300 gallons	Diesel	N/A	N/A	N/A	8,784 hours	0 tpy
	AST Diesel Tank	425 gallons	Diesel	N/A	N/A	N/A	8,784 hours	0 tpy
	Central Vac (3)	900 acfm	Coal	N/A	N/A	N/A	1,095 hours	0 tpy
	Urea Storage Silo A/B Bin Vent Filter	1,500 acfm	Urea	N/A	N/A	N/A	152 hours	0 tpy
	Urea Conveyor to Dissolver Tank Bin Vent Filter	400 acfm	Urea	N/A	N/A	N/A	190 hours	0 tpy
N/A Sodium Bicarbona	Sodium Bicarbonate Unloading Portable Baghouse	850 scfm	Sodium Bicarbonate	N/A	N/A	N/A	23 hours	0 tpy
				Insignifica	nsignificant Emissions Units Emissions - CY2020 Actual Emissions - SO <sub>2</sub>	nissions - CY2020 Actu	al Emissions - SO <sub>2</sub>	0 tpy
						CY2020 Actu	CY2020 Actual Emissions - SO <sub>2</sub>	406.2 tpy

Mass balance:

For diesel units, the SO<sub>2</sub> emission factor is calculated based on the sulfur content in diesel fuel

Molar mass ratio is 32 lb S/mol : 64 lb SO<sub>2</sub>/mol; Stoichiometry: 1 mol S = 1 mol SO<sub>2</sub>

SO<sub>2</sub> Emission Factor, Ib/gal = (Molar mass ratio, 2 lb SO<sub>2</sub>:1 lb S) x (weight % S in fuel) x (density of fuel, lb/gal) / 100%

<sup>2</sup> Diesel Fuel Density

AP 42, Table 3.4-1, footnote a lab analysis AP 42, Table 3.4-1, footnote e 7,000 Btu/hp-hr 7.1 lb/gal 133,141 Btu/gal <sup>3</sup> Diesel Heating Value <sup>4</sup> Engine Heat Rate

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)

FY2022 Assessable Emissions Golden Valley Electric Association - Healy Power Plant

Table 8. FY2022 Assessable Emissions Calculations - Hazardous Air Pollutants (HAP) Emissions Golden Valley Electric Association - Healy Power Plant

		I lented access	AD Emissions hy E.	oto tinil andionia	t (montage and )		
		C 1 2020 Actual IIA	AF EIIIISSIOIIS DY EI	CIZOZO ACIDAL MAR ELITISSIONS DY ELITISSIONS OTHICAREGOLY (1011S PET YEAR)	ory (tolls per year)		CY2020 Actual
Hazardous Air Pollutant	Coal-Fired Boilers	Diesel Boilers and Heaters	Diesel Engines <600 hp	Diesel Engines >600 hp	Coal Preparation and Ash Handling <sup>2</sup>	Insignificant Units <sup>3</sup>	HAP Emissions
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				3,000		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	-		1	-	1	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	1	-	1		1	6.1E-03
Methylene chloride (Dichloromethane)	5.1E-02				SCHOOL		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

		CY2020 Actual H	CY2020 Actual HAP Emissions by Emissions Unit Category (tons per year)	nissions Unit Categ	ory (tons per year) 1		
Hazardous Air Pollutant	Coal-Fired Boilers	Diesel Boilers and Heaters	Diesel Engines <600 hp	Diesel Engines >600 hp	Coal Preparation and Ash Handling 2	Insignificant Units <sup>3</sup>	CY2020 Actual HAP Emissions
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		****	The state of the s
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			8 22258	-	4.9E-02
Selenium Compounds	0.23	1.1E-03	-		-	1	0.23
Total HAPs - Maximum Individual HAP		1.8E-02	6.5E-06	0	0	0	1.93
Total VOC HAP Emissions		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

<sup>1</sup> See individual emissions unit category emissions calculations for details on methodology and assumptions.
<sup>2</sup> Emissions units in the coal preparation and handling, ash handling and coal storage pile systems do not have HAP emissions
<sup>3</sup> 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

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

CY2020 Actua	I Source	Category	Emission	Calculations
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			ategory Emission Calculations
CAS No.	Chemical Name	Emission Factor 1	<b>Estimated Emissions</b>
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
	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		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 <sup>2</sup>	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

FY2022 Assessable Emissions Golden Valley Electric Association - Healy Power Plant

# Table 8a. FY2022 Assessable Emissions Calculations - Hazardous Air Pollutants (HAP) Emissions Coal-Fired Boilers

### Golden Valley Electric Association - Healy Power Plant

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

### CY2020 Actual Source Category Emission Calculations

CAS No.	Chemical Name	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:

### Conversion Factors:

Coal Heating Value	14.37 MMBtu/ton	CY2020 weighted average

Unit 1 1.13 lb/TBtu Unit 2 2.80 lb/TBtu

<sup>&</sup>lt;sup>1</sup> Reference: AP-42, Tables 1.1-12, 1.1-13, 1.1-14, 1.1-15, 1.1-18

<sup>&</sup>lt;sup>2</sup> HCl and HF emission factors from EU ID 1 source test completed in November 2017

<sup>&</sup>lt;sup>3</sup> HCl and HF emission factors from EU ID 2 source test completed in December 2018

<sup>&</sup>lt;sup>4</sup> Emission factor from EU ID 1 source test completed in March 2019

<sup>&</sup>lt;sup>5</sup> Emission factor from EU ID 2 CEMS average 2020

# 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

		CY2020 Actual Source Category	ory Emission Calculations
CAS No.	Chemical Name	Emission Factor 2,3	<b>Estimated Emissions</b>
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
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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
rs.	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

Total CY2020 Heat Input: 147,233 MMBtu/yr

52,535 gallons 6,994.47 MMBtu/hr

<sup>1</sup> Total fuel use based on actual CY2020 operation as noted below:

Actual Heat Input:

<sup>&</sup>lt;sup>2</sup> Reference: AP-42, Tables 1.3-9, and 1.3-10.

<sup>&</sup>lt;sup>3</sup> 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 <sup>2</sup>	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
		CY2020 Actual HAP Emissions:	0.00E+00 tpy

### Notes:

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

<sup>&</sup>lt;sup>1</sup> Total fuel use based on actual operation as noted below:

<sup>&</sup>lt;sup>2</sup> Reference: AP-42, Worst Case Tables 3.2-1, 3.2-2, 3.2-3.

<sup>&</sup>lt;sup>3</sup> Diesel high heat value: 133,141 Btu/ga 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 <sup>2</sup>	<b>Estimated Emissions</b>
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 compound	s(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
	CY20	20 Actual HAP Emissions:	2.1E-05 tpy

### Notes:

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

<sup>2</sup> Reference: AP-42, Table 3.3-2.

<sup>&</sup>lt;sup>1</sup> Total fuel use based on actual operation as noted below:

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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

	Assessab	le Emission	s - Tons Pe	r Year			
Description	NO <sub>X</sub>	СО	PM <sub>10</sub>	SO <sub>2</sub>	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	Re	gulated Air	Pollutant E	missions (t	ons per yea	r) <sup>1</sup>
Potential to Emit	NO <sub>X</sub>	СО	PM <sub>10</sub>	voc	SO <sub>2</sub>	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	· · · · · · · · · · · · · · · · · · ·		1,6	606		
Fee Estimate <sup>3</sup>			\$68,	989		

### Notes:

<sup>&</sup>lt;sup>1</sup> Regulated air pollutant calculations based on emission factors shown in accompanying spreadsheets.

<sup>&</sup>lt;sup>2</sup> Fees paid on each pollutant emitted in quantities greater than 10 tpy per 18 AAC 50.410.

<sup>&</sup>lt;sup>3</sup> A fee rate of \$42.95 per ton applies in accordance with 18 AAC 50.410(b)(1).

<sup>&</sup>lt;sup>4</sup> 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
	Simple Cycle Gas		ULSD			222,153 gal/yr
1	Turbine	GE Frame 7, Series 7001, Model BR	No. 1 Diesel	672 MMBtu/hr	1,186.8 hr/yr	450,638 gal/yr
	Turbine	Big 10-11 on 14.5 (5.0 kg) B3 14 (5.0 kg)	No. 2 Diesel		959.5 .00,	2,445,052 gal/yr
	Simple Cycle Gas		ULSD			480,856 gal/yr
2	Turbine	GE Frame 7, Series 7001, Model BR	No. 1 Diesel	672 MMBtu/hr	4,049.7 hr/yr	2,902,310 gal/yr
	Turbine		No. 2 Diesel			8,438,903 gal/yr
200	Combined Cycle Gas		ULSD			132,442 gal/yr
5	Turbine	GE LM6000PC	No. 1 Diesel	455 MMBtu/hr	6,391.6 hr/yr	0 gal/yr
	Turbine	Company of the Compan	Naphtha	10.00		27,922,690 gal/yr
	Combined Cycle Gas		ULSD			0 gal/yr
6	Turbine	GE LM6000PC	No. 1 Diesel	455 MMBtu/hr	0 hr/yr	0 gal/yr
	~		Naphtha			0 gal/yr
7	Emergency Generator Engine	Mitsubishi 0A8829	ULSD	564.6 hp <sup>1</sup>	3.8 hr/yr	122 gal/yr
11	Boiler	Bryan Steam RV500	Dronono	5.0 MMBtu/hr	228.6 hr/yr	12,483 gal/yr
12	Boiler	Bryan Steam RV500	Propane	5.0 MMBtu/hr	220.6 H/yr	12,463 gallyr

<sup>&</sup>lt;sup>1</sup> 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

8,784 hr/yr 8,784 hr/yr hr 8,784 hr/yr hr 8,784 hr/yr hr 1,998 hr/yr		Emission Unit	Fuel Type/	Dating/Size	CY2020 Actual	CY2020 Actual
Fuel Oil Storage Tank         Diesel         50,000 gallons         8,784 hr/yr           Fuel Oil Storage Tank         Diesel         50,000 gallons         8,784 hr/yr           FHR Warehouse Boiler 1         No. 2 Diesel         0.784 MMBtu/hr         8,784 hr/yr           FHR Warehouse Boiler 2         No. 2 Diesel         0.784 MMBtu/hr         8,784 hr/yr           Burnham 17 A-T Boiler         No. 1 ULSD         0.222 MMBtu/hr         1,998 hr/yr	ID,	Description	Material	Natilig/Olde	Operation	Fuel Consumption
Fuel Oil Storage Tank         Diesel         50,000 gallons         8,784 hr/yr           FHR Warehouse Boiler 2         No. 2 Diesel         0.784 MMBtu/hr         8,784 hr/yr           FHR Warehouse Boiler 2         No. 2 Diesel         0.784 MMBtu/hr         8,784 hr/yr           Burnham 17 A-T Boiler         No. 1 ULSD         0.222 MMBtu/hr         1,998 hr/yr	3	Fuel Oil Storage Tank	Diesel	50,000 gallons	8,784 hr/yr	N/A
FHR Warehouse Boiler 1         No. 2 Diesel         0.784 MMBtu/hr         8,784 hr/yr           FHR Warehouse Boiler 2         No. 2 Diesel         0.784 MMBtu/hr         8,784 hr/yr           Burnham 17 A-T Boiler         No. 1 ULSD         0.222 MMBtu/hr         1,998 hr/yr	4	Fuel Oil Storage Tank	Diesel	50,000 gallons	8,784 hr/yr	N/A
FHR Warehouse Boiler 2         No. 2 Diesel         0.784 MMBtu/hr         8,784 hr/yr           Burnham 17 A-T Boiler         No. 1 ULSD         0.222 MMBtu/hr         1,998 hr/yr	N/A	FHR Warehouse Boiler 1	No. 2 Diesel	0.784 MMBtu/hr	8,784 hr/yr	#VICE 878 8
. No. 1 ULSD 0.222 MMBtu/hr 1,998 hr/yr	N/A	FHR Warehouse Boiler 2	No. 2 Diesel	0.784 MMBtu/hr	8,784 hr/yr	0,010 yaliyi
	N/A	Burnham 17 A-T Boiler	No. 1 ULSD	0.222 MMBtu/hr	1,998 hr/yr	3,797 gal/yr

<sup>1</sup> 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<sub>x</sub>) Emissions Golden Valley Electric Association - North Pole Power Plant

	Emission Unit	Maximum	Fuel	Factor	NO <sub>x</sub> Emission	CY2020 Actual	CY2020 Actual
QI	Description	Capacity	Type	Reference	Factor	Operation	NO <sub>x</sub> Emissions
			Significant Emission Units	nission Units			
			ULSD				
-	Simple Cycle Gas Turbine	672 MMBtu/hr	No. 1 Diesel	2019 CEMS Average <sup>1</sup>	243.3 lb/hr	1,186.8 hours	240.30 tpy
			No. 2 Diesel				
			OSTO			480,856 gal/yr	28.99 tpy
2	Simple Cycle Gas Turbine	672 MMBtu/hr	No. 1 Diesel	AP-42 Table 3.1-1	0.88 lb/MMBtu	2,902,310 gal/yr	169.51 tpy
	TROOF NO		No. 2 Diesel			8,438,903 gal/yr	508.69 tpy
			OSTO	4			
2	Combined Cycle Gas Turbine	455 MMBtu/hr	No. 1 Diesel	2019 CEMS Average <sup>1</sup>	99.3 lb/hr	6,391.6 hours	322.10 tpy
			Naphtha	3			
			OLSD			0 gal/yr	0 tpy
9	Combined Cycle Gas Turbine	455 MMBtu/hr	No. 1 Diesel	AP-42 Table 3.1-1	0.24 lb/MMBtu	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	0000000	AD 42 Toble 4 E 4	42 11 403	42 402 colber	2000
12	Boiler	5.0 MMBtu/hr	riopaire	AF-42 Lable 1.0-1	is ib/10 gai	12,403 gailyi	o.oo tpy
		8		Significant	Emission Units - 2020	Significant Emission Units - 2020 Actual Emissions - NO <sub>x</sub>	1269.70 tpy
			Insignificant Emission Units	mission 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	AD 42 Toklo 1 2 1	10 15/4031	8 679 collar	20 0
N/A	FHR Warehouse Boiler 2	0.784 MMBtu/hr	No. 2 Diesel	Ar -42 I dule 1.0-1	io ib/10 gai	o,or o gairyi	0.00 tpy
N/A	Burnham 17 A-T Boiler	0.222 MMBtu/hr	No. 1 ULSD	AP-42 Table 1.3-1	18 lb/10³gal	3,797 gal/yr	0.03 tpy
				Insignificant	Emission Units - 2020	Insignificant Emission Units - 2020 Actual Emissions - $NO_{\chi}$	0.09 tpy
					2020	2020 Actual Emissions - NOx	1269.8 tpy

Motor

<sup>1</sup> 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, Ib/MMBtu) x (Heat Value, Btu/gal) / (Conversion, 1,000,000 Btu/MMBtu) x (Fuel Consumption, gal/yr) / (2,000 Ib/ton) Engine Emissions, tpy= (Emission factor, Ib/hp-hr) x (Capacity, hp) x (Operation, hr/yr) / (2,000 lb/ton)

Boiler Emissions, tpy= (Emission factor, lb/10³gal) / (Conversion 1,000 gal/10³gal) 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)

FY2022 Assessable Emissions Golden Valley Electric Association - North Pole Power Plant

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

	Emission Unit	Maximum	Fuel	Factor	CO Emission	CY2020 Actual	CY2020 Actual
QI	Description	Capacity	Type	Reference	Factor	Operation	Emissions
			OLSD				
-	Simple Cycle Gas Turbine	672 MMBtu/hr	No. 1 Diesel	2019 CEMS Average1	13.6 lb/hr	1,186.8 hours	8.07 tpy
	\$ B		No. 2 Diesel	7			
			ULSD			480,856 gal/yr	0.11 tpy
2	Simple Cycle Gas Turbine	672 MMBtu/hr	No. 1 Diesel	AP-42 Table 3.1-1	0.0033 lb/MMBtu	2,902,310 gal/yr	0.64 tpy
			No. 2 Diesel			8,438,903 gal/yr	1.91 tpy
			ULSD		VELOCIO -		
2	Combined Cycle Gas Turbine	455 MMBtu/hr	No. 1 Diesel	2019 CEMS Average1	2.3 lb/hr	6,391.6 hours	8.30 tpy
			Naphtha				
			ULSD			0 gal/yr	0 tpy
9	Combined Cycle Gas Turbine	455 MMBtu/hr	No. 1 Diesel	AP-42 Table 3.1-1	0.076 lb/MMBtu	0 gal/yr	0 tpy
			Naphtha			0 gal/yr	0 tpy
7	Emergency Generator Engine	564.6 hp	OLSD	AP-42 Table 3.3-1	0.00668 lb/hp-hr	3.8 hr/yr	0.01 tpy
11	Boiler	5.0 MMBtu/hr		AD 42 Table 4 E 4	1-8041-11-32	40 400 201615	0.06
12	Boiler	5.0 MMBtu/hr	Propane	AP-42 Table 1.5-1	7.5 lb/10 gal	12,463 gailyr	on con
				Significant Er	nission Units - CY2020	Significant Emission Units - CY2020 Actual Emissions - CO	19.08 tpy
			Insignificant Emission Units	nission 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	AD 42 Takle 13.1	100801/41 0 3	37/100 878 8	, cd CO O
N/A	FHR Warehouse Boiler 2	0.784 MMBtu/hr	No. 2 Diesel	Ar-42 lable 1.3-1	o.o ib/ io gai	o,oro garryr	0.02 tpy
N/A	Burnham 17 A-T Boiler	0.222 MMBtu/hr	No. 1 ULSD	AP-42 Table 1.3-1	5.0 lb/10 <sup>3</sup> gal	3,797 gal/yr	0.01 tpy
				Insignificant Er	nission Units - CY2020	Insignificant Emission Units - CY2020 Actual Emissions - CO	0.03 tpy
						2	
					CY2020	CY2020 Actual Emissions - CO	19.1 tpy

Note:

<sup>1</sup> 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, Ib/MMBtu) x (Heat Value, Btu/gal) / (Conversion, 1,000,000 Btu/MMBtu) x (Fuel Consumption, gal/yr) / (2,000 Ib/ton) Boiler Emissions, tpy= (Emission factor, lb/10³gal) / (Conversion 1,000 gal/10³gal) x (Operation, 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)

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)

FY2022 Assessable Emissions Golden Valley Electric Association - North Pole Power Plant

Table 5. FY2022 Assessable Emission Calculations - Particulate Matter (PM<sub>o</sub>) Emissions Golden Valley Electric Association - North Pole Power Plant

	Emission Unit	Maximum	Fuel	Factor	PM <sub>10</sub> Emission	CY2020 Actual	CY2020 Actual
QI	Description	Capacity	Type	Reference	Factor	Operation	PM <sub>10</sub> Emissions
			NLSD			222,153 gal/yr	0.18 tpy
-	Simple Cycle Gas Turbine	672 MMBtu/hr	No. 1 Diesel	AP-42 Table 3.1-2a	0.012 lb/MMBtu	450,638 gal/yr	0.36 tpy
			No. 2 Diesel			2,445,052 gal/yr	2.01 tpy
			OLSD			480,856 gal/yr	0.40 tpy
2	Simple Cycle Gas Turbine	672 MMBtu/hr	No. 1 Diesel	AP-42 Table 3.1-2a	0.012 lb/MMBtu	2,902,310 gal/yr	2.3 tpy
	8		No. 2 Diesel			8,438,903 gal/yr	6.9 tpy
			OLSD			132,442 gal/yr	0.11 tpy
2	Combined Cycle Gas Turbine	455 MMBtu/hr	No. 1 Diesel	AP-42 Table 3.1-2a	0.012 lb/MMBtu	0 gal/yr	0 tpy
			Naphtha			27,922,690 gal/yr	18.12 tpy
			OLSD			0 gal/yr	0 tpy
9	Combined Cycle Gas Turbine	455 MMBtu/hr	No. 1 Diesel	AP-42 Table 3.1-2a	0.012 lb/MMBtu	0 gal/yr	0 tpy
	20102		Naphtha			0 gal/yr	0 tpy
7	Emergency Generator Engine	564.6 hp	OLSD	AP-42 Table 3.3-1	0.0022 lb/hp-hr	3.8 hr/yr	2E-03 tpy
11	Boiler	5.0 MMBtu/hr	Dronon	AD 42 Table 1 E 1	0.7 11.403-1	12 402 aclive	4E 03 thus
12	Boiler	5.0 MMBtu/hr	Proparie	AP-42 Table 1.3-1	0.7 lb/10 gai	12,403 gallyl	4E-03 tpy
				Significant E	mission Units - 2020 A	Significant Emission Units - 2020 Actual Emissions - PM <sub>10</sub>	30.43 tpy
			Insignificant Emission Units	nission 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			
N/A	FHR Warehouse Boiler 2	0.784 MMBtu/hr	No. 2 Diesel	and 1.3-2	1.7 lb/10³gal	6,678 gal/yr	6E-03 tpy
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/10³gal	3,797 gal/yr	3E-03 tpy
				Insignificant E	mission Units - 2020 A	Insignificant Emission Units - 2020 Actual Emissions - PM <sub>10</sub>	9E-03 tpy
						7	
					2020 A	2020 Actual Emissions - PM <sub>10</sub>	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, gallyr) / (2,000 lb/fon) 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/10³gal) / (Conversion 1,000 gal/10³gal) 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<sub>2</sub>) Emissions Golden Valley Electric Association - North Pole Power Plant

	Emission Unit	Maximum	Fuel	Factor	Maximum Fuel	SO <sub>2</sub> Emission	CY2020 Actual	CY2020 Actual
QI	Description	Capacity	Type	Reference	Sulfur Content	Factor	Operation	SO <sub>2</sub> Emissions
			ULSD	Mass Balance	4.1E-04 wt. pct. S	5.6E-05 lb/gal	222,153 gal/yr	0.01 tpy
-	Simple Cycle Gas Turbine	672 MMBtu/hr	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
			ULSD	Mass Balance	4.1E-04 wt. pct. S	5.6E-05 lb/gal	480,856 gal/yr	0.01 tpy
2	Simple Cycle Gas Turbine	672 MMBtu/hr	No. 1 Diesel	Mass Balance	0.099 wt. pct. S	0.013 lb/gal	2,902,310 gal/yr	19.47 tpy
	8		No. 2 Diesel	Mass Balance	0.329 wt. pct. S	0.048 lb/gal	8,438,903 gal/yr	202.52 tpy
			ULSD	Mass Balance	4.1E-04 wt. pct. S	5.6E-05 lb/gal	132,442 gal/yr	0.00 tpy
2	Combined Cycle Gas Turbine	455 MMBtu/hr	No. 1 Diesel	Mass Balance	0.099 wt. pct. S	0.013 lb/gal	0 gal/yr	0 tpy
	n e		Naphtha	Mass Balance	1.9E-03 wt. pct. S	2.2E-04 lb/gal	27,922,690 gal/yr	3.06 tpy
			ULSD	Mass Balance	4.1E-04 wt. pct. 3	5.6E-05 lb/gal	0 gal/yr	0 tpy
9	Combined Cycle Gas Turbine	455 MMBtu/hr	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		Mond Dolong	2 toc tu 90 30 7	6 GE 07 Ib/acl	40 400 00161	AE 08 to
12	Boiler	5.0 MMBtu/hr	Flopane	Mass balance	7.0E-UO WI. PUL. S	o.oE-07 lb/gal	12,463 gallyl	4E-00 tby
		Sign Sign			Significant Em	ission Units - CY2020	Significant Emission Units - CY2020 Actual Emissions - SO <sub>2</sub>	286.78 tpy
			Insign	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	Mond Dolong	S too to 000	0.046 15/20	2 6 7 9 0 0 0 1 km	0.45 to.
N/A	FHR Warehouse Boiler 2	0.784 MMBtu/hr	No. 2 Diesel	Mass balance	0.33 Wt. pct. 3	0.043 lb/gal	o,oro galryi	0.13 tpy
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
				S. C.	Insignificant Em	ission Units - CY2020	Insignificant Emission Units - CY2020 Actual Emissions - SO <sub>2</sub>	0.15 tpy
						CY2020	CY2020 Actual Emissions - SO <sub>2</sub>	286.9 tpy

Notes:

Molar mass ratio is 32 lb S/mol : 64 lb SO<sub>2</sub>/mol Sample Calculations: 2, 3, 4

Stoichiometry: 1 mol S = 1 mol SO<sub>2</sub>

Mass Balance Emission Factor, Ib/gal = (Molar mass ratio, 2 Ib SO<sub>2</sub>:1 Ib S) x (weight % S in fuel) x (density of fuel, Ib/gal) / 100%

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

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

Boiler wt. pct. S= (Sulfur compound content, ppmv SO<sub>2</sub>) x (Conversion, 1.66E-7 lb SO<sub>2</sub>/scf / ppm SO<sub>2</sub>) x (F-factor, 8,710 scf/MMBtu) x (Conversion, 0.0216 Boiler wt. pct. S= MMBtu/lb) x (Conversion, mole SO<sub>2</sub>/64 lb SO<sub>2</sub>) x (Conversion, mole SO<sub>2</sub>/scf / box (Sonversion, 32 lb S/ mole S)

Golden Valley Electric Association - North Pole Power Plant

<sup>&</sup>lt;sup>1</sup> Based on the weighted average of monthly maximum fuel sulfur content values for calendar year 2020 as received from supplier sampling.

<sup>&</sup>lt;sup>2</sup> 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.

Propane fuel analysis results from 2020 indicate a fuel sulfur content less than 0.5 ppmv. <sup>3</sup> The engire specification datasheet indicates a maximum fuel throughput of 32 gal/hr.

FY2022 Assessable Emissions

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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

	Assessabl	e Emission	sessable Emissions - Tons Per Year	r Year			
Description	NOx	CO	<b>PM</b> <sub>10</sub>	$SO_2$	VOC	HAPs	Total
Assessable PTE	2,115	20.9	30.4	580	2.6	1	2,749

From Table A of the TAR for AQ0109MSS01

time of leitenster	Re	gulated Air	Pollutant E	Regulated Air Pollutant Emissions (tons per year)	ons per yea	ır) 1
Potential to Emit	NOx	00	PM <sub>10</sub>	voc	SO <sub>2</sub>	HAP
Significant	123.1	9.0	1.7	0.1	44.8	
Insignificant	0.2	0.1	0.0	0.1	0.2	
Total Emissions	123	-	2	0	45	
Use Assessable PTE						0
Assessable Emission Subtotals	123	1	2	0	45	0
Fees Apply to Pollutant? <sup>2</sup>	Yes	No	No	No	Yes	No
CY2019 Actual Emissions			1	168		
Fee Estimate <sup>3</sup>			\$7,231	231		

# Notes:

<sup>1</sup> 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.

<sup>3</sup> A fee rate of \$42.95 per ton applies in accordance with 18 AAC 50.410(b)(1).

<sup>4</sup> 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

ID Description	intion		100	012020 Actual	Maximum	
i		Make/Model	Туре	Operation	Capacity	Fuel Consumption
i						
Cimpo	and olov		No. 1 ULS			2,601 gal/yr
1 Simple 1	Turbing	General Electric Frame 5 MS 5001-M	No. 1 Diesel	117.5 hr/yr	268 MMBtu/hr	25,543 gal/yr
5			No. 2 Diesel	20		117,723 gal/yr
Colomia	000000		No. 1 ULS			21,838 gal/yr
2 Simple C	Jurhing	General Electric Frame 5 MS 5001-M	No. 1 Diesel	1,567.6 hr/yr	268 MMBtu/hr	340,628 gal/yr
5	alle		No. 2 Diesel	82		1,569,863 gal/yr
3 Diesel G	Diesel Generator	General Motors Electro-Motive Diesel 20-645E4	No. 1 ULSD		28 MMBtu/hr	
	and and and			1.0 hr/yr		1,167 gal/yr
4 Diesel C	Diesel Generator Engine	General Motors Electro-Motive Diesel 20-645E4	No. 1 ULSD		28 MMBtu/hr	
10 Bo	Boiler	Weil McLain H-688	No. 2 Heating Oil	935 hr/yr	1.7 MMBtu/hr	22 056 331/4
11 Bo	Boiler	Weil McLain H-688	No. 2 Heating Oil	935 hr/yr	1.7 MMBtu/hr	22,000 gairyi

Source: Air Quality Permit No. AQ0109TVP03

# Table 2b. FY2022 Assessable Emissions Summary Golden Valley Electric Association - Zehnder Facility

	Emission Unit	Fuel Type/	O-iS/Si-C	CY2020 Actual
ID 1	Description	Material	ratilig/31ze	Operation
9	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	10 24E aplikir
6	Burnham Boiler	No. 2 Heating Oil	0.44 MMBtu/hr	12,343 yaliyi
N/A	Burnham Boiler - FE Building	Natural Gas	0.606 MMBtu/hr	12 169 cof
N/A	Burnham Boiler - FE Building	Natural Gas	0.606 MMBtu/hr	12, 100 301
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

<sup>1</sup> Source: Renewal application for AQ0109TVP03

EU ID 8 and 9 Fuel Throughput=

Energy Logic EL-340H Heater Fuel Throughput=

Metzger Boiler Fuel Throughput=

Lean Burn Inc. Heater Fuel Throughput=

Energy Logic EL-200H Heater Fuel Throughput= Energy Logic EL-350H Heater Fuel Throughput=

(estimate from	AQ0109TVP03 renewal	application)	(from nameplate)					
	3.2 gallon/hr		2 gallon/hr	2.25 gallon/hr	1 gallon/hr	1.4 gallon/hr	2.5 gallon/hr	

Table 3. FY2022 Assessable Emission Calculations - Oxides of Nitrogen (NQ) Emissions Golden Valley Electric Association - Zehnder Facility

1 Simple Cycle Gas Turbine 2 Simple Cycle Gas Turbine 3 Diesel Generator Engine 4 Diesel Generator Engine 10 Boiler 11 Bourham Boiler 12 Boiler 13 Burnham Boiler - FE Building 14 Burnham Boiler - FE Building 15 Burnham Boiler - FE Building 16 Burnham Boiler - FE Building 17 Burnham Boiler - FE Building 18 Burnham Burnham Boiler - FE Building 18 Burnham Bur	Tr.			0000			012020 Actual
		Capacity	Type	Reference	Factor	Operation	NO <sub>x</sub> Emissions
			Significant Emision Units	Units			
			No. 1 ULS			2,601 gal/yr	0.15 tpy
<del>                                     </del>	rbine	268 MMBtu/hr	No. 1 Diesel	AP-42 Table 3.1-1	0.88 lb/MMBtu	25,543 gal/yr	1.54 tpy
			No. 2 Diesel			117,723 gal/yr	6.91 tpy
			No. 1 ULS			21,838 gal/yr	1.28 tpy
<del></del>	rbine	268 MMBtu/hr	No. 1 Diesel	AP-42 Table 3.1-1	0.88 lb/MMBtu	340,628 gal/yr	20.53 tpy
			No. 2 Diesel			1,569,863 gal/yr	92.17 tpy
	gine	28 MMBtu/hr	No. 1 ULSD	A C CALCACA	O D INMANADE.	4 467 andba	20.00
	gine	28 MMBtu/hr	No. 1 ULSD	AP-42 I able 3.4-	3.2 ID/ININIDIU	I, Io/ gal/yi	0.20 tpy
H		1.7 MMBtu/hr	No. 2 Heating Oil	AD 42 Toble 4 2 4	70 IL (4031	22 056 acibir	, and 550 0
		1.7 MMBtu/hr	No. 2 Heating Oil	AP-42 Lable 1.5-	20 lb/10 gai	zz,uso garryr	0.22 tpy
				Significant	Emision Units - 2020 A	Significant Emision Units - 2020 Actual Emissions - NO	123.07 tpy
	5		Insignificant Emision Units	Units			
	ınk	50,000 gallons	No. 2 Diesel	N/A	N/A	8,784 hr/yr	0 tpy
	ınk	50,000 gallons	No. 2 Diesel	N/A	N/A	8,784 hr/yr	0 tpy
	ınk	12,000 gallons	No. 1 Diesel	N/A	N/A	8,784 hr/yr	0 tpy
		0.443 MMBtu/hr	No. 2 Heating Oil	AD 42 Toble 4 2 4	10 15 14 03	40 24E coller	4
		0.443 MMBtu/hr	No. 2 Heating Oil	AF-42 I dDIE 1.3-	lo lo/10 gai	12,343 gairyi	o. 1 1 tpy
	nilding	0.606 MMBtu/hr	Natural Gas	AD 42 Toble 1 4 2	100 IL (408-25	12 169 006	000
	nilding	0.606 MMBtu/hr	Natural Gas	Ar 42 I able 1.4-	100 ID/10 SCI	12,100 30	0.00 thy
	ad Shop Heater	0.28 MMBtu/hr	Waste Oil	AP-42 Table 1.11-2	19 lb/10³gal	0 gal/yr	0 tpy
	Heater	0.275 MMBtu/hr	Waste Oil	AP-42 Table 1.11-2	19 lb/10 <sup>3</sup> gal	750 gal/yr	7.1E-03 tpy
	Boiler	0.12 MMBtu/hr	No. 1 Diesel	AP-42 Table 1.3-1	18 lb/10 <sup>3</sup> gal	4,389 gal/yr	0.04 tpy
	Heater	0.20 MMBtu/hr	Waste Oil - Transformer	AP-42 Table 1.11-2	11 lb/10 <sup>3</sup> gal	2,500 gal/yr	0.01 tpy
	Heater	0.20 MMBtu/hr	Waste Oil - Transformer	AP-42 Table 1.11-2	11 lb/10 <sup>3</sup> gal	0 gal/yr	0 tpy
8	Heater	0.35 MMBtu/hr	Waste Oil - Transformer	AP-42 Table 1.11-2	19 lb/10 <sup>3</sup> gal	5,100 gal/yr	0.05 tpy
	88			Insignificant I	Emision Units - 2020 A	nsignificant Emision Units - 2020 Actual Emissions - NO <sub>x</sub>	0.22 tpy
						5	
					2020 A	2020 Actual Emissions - NO <sub>X</sub>	123.3 tpy

Sample Calculations:

Turbine and Engine Emissions, tyy= (Emission factor, Ib/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,  $lb/10^3$ gal) / (Conversion 1,000 gal/ $10^3$ gal) × (Fuel Consumption, gal/yr) / (2,000  $lb/10^3$ gol) × (Fuel Consumption, gal/yr) / (2,000  $lb/10^3$ gol) × (Fuel Consumption, scf) / (2,000  $lb/10^3$ gol) × (Fuel Consumption, scf) / (2,000  $lb/10^3$ gol)

(based on average of CY2020 fuel tests) (based on average of CY2020 fuel tests) 133,441 Btu/gal 136,998 Btu/gal HHV No. 1 Diesel = HHV No. 2 Diesel=

FY2022 Assessable Emissions Golden Valley Electric Association - Zehnder Power Plant

Table 4. FY2022 Assessable Emissions Calculations - Carbon Monoxide (CO) Emissions Golden Valley Electric Association - Zehnder Facility

	Emission Unit	Maximum	Fuel	Factor	CO Emission	CY2020 Actual	CY2020 Actual
QI	Description	Capacity	Туре	Reference	Factor	Operation	CO Emissions
			No. 1 ULS			2,601 gal/yr	6E-04 tpy
-	Simple Cycle Gas Turbine	268 MMBtu/hr	No. 1 Diesel	AP-42 Table 3.1-1	0.0033 lb/MMBtu	25,543 gal/yr	6E-03 tpy
			No. 2 Diesel			117,723 gal/yr	0.03 tpy
			No. 1 ULS			21,838 gal/yr	5E-03 tpy
2	Simple Cycle Gas Turbine	268 MMBtu/hr	No. 1 Diesel	AP-42 Table 3.1-1	0.0033 lb/MMBtu	340,628 gal/yr	0.08 tpy
			No. 2 Diesel			1,569,863 gal/yr	0.35 tpy
က	Diesel Generator Engine	28 MMBtu/hr	No. 1 ULSD	AD 42 Table 3.4.4	O OF INMADE	1 167 201615	, cat 200
4	Diesel Generator Engine	28 MMBtu/hr	No. 1 ULSD	AF -42 TADIE 3.4-	0.00 ID/ININIBIU	1,107 gally!	0.0 tpy
10	Boiler	1.7 MMBtu/hr	No. 2 Heating Oil	AD 40 Toble 1 9 4	F 11-1403	20.056.2016.2	, co 15
11	Boiler	1.7 MMBtu/hr	No. 2 Heating Oil	Ar-42 I able 1.3-	o lb/10 gai	22,000 gallyl	0E-02 tpy
				Significant Em	Significant Emission Units - CY2020 Actual Emissions - CO	Actual Emissions - CO	0.59 tpy
	1		Insignificant Emission Units	n Units			
9	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	AD 42 Table 1 2 4	F 11 (4031	10 94E 20 hr	0 00 tour
6	Burnham Boiler	0.443 MMBtu/hr	No. 2 Heating Oil	AL-42 I ADIE 1.3-	o lo/10 gai	12,343 gally!	0.03 tpy
N/A	Burnham Boiler - FE Building	0.606 MMBtu/hr	Natural Gas	AD 42 Toble 1.4.1	94 11-140622F	12 168 cof	, cot 00 0
N/A	Burnham Boiler - FE Building	0.606 MMBtu/hr	Natural Gas	Ar-42 (able 1.4-1	04 ID/ IU SCI	12, 100 501	0.00
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 <sup>3</sup> gal	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 <sup>3</sup> gal	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/10³gal	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 <sup>3</sup> gal	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 <sup>3</sup> gal	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 <sup>3</sup> gal	5,100 gal/yr	0.01 tpy
				Insignificant Em	Insignificant Emission Units - CY2020 Actual Emissions - CO	Actual Emissions - CO	0.06 tpy
						, fi	
					CY2020	CY2020 Actual Emissions - CO	0.65 tpy

Sample Calculations:

Turbine and Engine Emissions, tpy= (Emission factor, Ib/MMBtu) x (Heat Value, Btu/gal) / (Conversion, 1,000,000 Btu/MMBtu) x (Fuel Consumption, gal/yr) / (2,000 Ib/fon) Boiler Emissions, tpy= (Emission factor, Ib/10³gal) / (Conversion 1,000 gal/10³gal) x (Fuel Consumption, gal/yr) / (2,000 lb/ton) Boiler Emissions, tpy= (Emission factor, Ib/10°scf) / (Conversion 1,000,000 scf/10°scf) 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
Q	Description	Capacity	Type	Reference	Factor	Operation	VOC Emissions
			No. 1 ULS			2,601 gal/yr	7E-05 tpy
-	Simple Cycle Gas Turbine	268 MMBtu/hr	No. 1 Diesel	AP-42 Table 3.1-2a	0.00041 lb/MMBtu	25,543 gal/yr	7E-04 tpy
			No. 2 Diesel			117,723 gal/yr	3E-03 tpy
			No. 1 ULS			21,838 gal/yr	6E-04 tpy
2	Simple Cycle Gas Turbine	268 MMBtu/hr	No. 1 Diesel	AP-42 Table 3.1-2a	0.00041 lb/MMBtu	340,628 gal/yr	1E-02 tpy
			No. 2 Diesel			1,569,863 gal/yr	0.04 tpy
က	Diesel Generator Engine	28 MMBtu/hr	No. 1 ULSD	40 40 Table 9 4 4	0000	1 407	27 00 tr
4	Diesel Generator Engine	28 MMBtu/hr	No. 1 ULSD	AP-42 Table 5.4-1	U.US ID/MINIBIU	I, Io/ garyr	/ E-03 tby
10	Boiler	1.7 MMBtu/hr	No. 2 Heating Oil	AD 42 Table 4 2 2	0.24 11-14-03	and DEG and Item	4E 02 terr
11	Boiler	1.7 MMBtu/hr	No. 2 Heating Oil	AF-42 lable 1.3-3	0.54 lb/10 gal	zz,ubo galiyi	4E-03 tby
				Significant Emis	sion Units - CY2020 A	Significant Emission Units - CY2020 Actual Emissions - VOC	0.07 tpy
	8		Insignificant Emission Units	sion Units		8	
9	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	AD 42 Table 4 2 2	0 749 14 4031	42 24E 001km	AE 02 to
6	Burnham Boiler	0.443 MMBtu/hr	No. 2 Heating Oil	AP-42 Lable 1.5-5	0.7 IS ID/10 gal	12,345 garyr	4E-03 tby
N/A	Burnham Boiler - FE Building	0.606 MMBtu/hr	Natural Gas	AD 40 Table 4.4.0	n n 1406 - e	40 468 226	2F OF 45
N/A	Burnham Boiler - FE Building	0.606 MMBtu/hr	Natural Gas	AP-42 Lable 1.4-2	5.5 ID/10 SCI	12, 100 SCI	3E-03 tby
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/10³gal	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/10³gal	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 <sup>3</sup> gal	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 <sup>3</sup> gal	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/10³gal	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 <sup>3</sup> gal	5,100 gal/yr	3E-03 tpy
		67		Insignificant Emis	sion Units - CY2020 A	Insignificant Emission Units - CY2020 Actual Emissions - VOC	0.01 tpy
						5	
					CY2020 A	CY2020 Actual Emissions - VOC	0.08 tpy

Sample Calculations:

Turbine and Engine Emissions, tpy= (Emission factor, Ib/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,  $lb/10^3$ gal) / (Conversion 1,000 gal/ $10^3$ gal) x (Fuel Consumption, gal/yr) / (2,000 lb/lton) Boiler Emissions, tpy= (Emission factor,  $lb/10^3$ scf) / (Conversion 1,000,000 scf/ $10^3$ scf) x (Fuel Consumption, scf) / (2,000 lb/lton)

(based on average of CY2020 fuel tests) (based on average of CY2020 fuel tests) HHV No. 1 Diesel = 133,441 Btu/gal HHV No. 2 Diesel = 136,998 Btu/gal

Table 6. FY2022 Assessable Emission Calculations - Particulate Matter (PM<sub>10</sub>) Emissions Golden Valley Electric Association - Zehnder Facility

	Emission Unit	Maximum	Fuel	Factor	PM <sub>10</sub> Emission	CY2020 Actual	CY2020 Actual
Ω	Description	Capacity	Type	Reference	Factor	Operation	PM <sub>10</sub> Emissions
			No. 1 ULS			2,601 gal/yr	2E-03 tpy
-	Simple Cycle Gas Turbine	268 MMBtu/hr	No. 1 Diesel	AP-42 Table 3.1-2a	0.012 lb/MMBtu	25,543 gal/yr	0.02 tpy
	- Victor		No. 2 Diesel			117,723 gal/yr	0.10 tpy
			No. 1 ULS			21,838 gal/yr	0.02 tpy
2	Simple Cycle Gas Turbine	268 MMBtu/hr	No. 1 Diesel	AP-42 Table 3.1-2a	0.012 lb/MMBtu	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	AD 42 Toble 2.4.2	0.0579 Ib/MMAD4	1 167 coller	EE 03 to.
4	Diesel Generator Engine	28 MMBtu/hr	No. 1 ULSD	AF-42 Lable 3.4-2	U.O.S. S. ID/INIMIDIU	1, 107 gal/yl	SE-US thy
10	Boiler	1.7 MMBtu/hr	No. 1 ULSD	AP-42 Tables 1.3-2 &	1 200 11 1403	# y 0 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	00 TC
11	Boiler	1.7 MMBtu/hr	No. 2 Heating Oil	1.3-7	2.30 lb/10 gal	22,030 gal/yl	SE-UZ IDY
				Significant En	nission Units - 2020 Ac	Significant Emission Units - 2020 Actual Emissions - PM <sub>10</sub>	1.74 tpy
			Insignificant Emission Units	ion Units			
9	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 &	4.7 IL/403.21	12 345 aplier	, co 4 to 0
6	Burnham Boiler	0.443 MMBtu/hr	No. 2 Heating Oil	1.3-2	1.7 ID/10 gai	12,343 gallyl	0.01 tpy
N/A	Burnham Boiler - FE Building	0.606 MMBtu/hr	Natural Gas	AD 40 Toble 4.4.0	7.6 11.10.6	10 160 anf	LE OF text
N/A	Burnham Boiler - FE Building	0.606 MMBtu/hr	Natural Gas	AF-42 I dDIE 1.4-2	7.0 ID/10 SCI	12, 100 801	SE-US thy
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 <sup>3</sup> gal <sup>1</sup>	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 <sup>3</sup> gal <sup>1</sup>	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/10³gal	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 <sup>3</sup> gal <sup>2</sup>	5,100 gal/yr	1E-04 tpy
				Insignificant En	nission Units - 2020 Ac	Insignificant Emission Units - 2020 Actual Emissions - PM <sub>10</sub>	0.02 tpy
							A SALES AND A SALE
					2020 Ac	2020 Actual Emissions - PM <sub>10</sub>	1.76 tpy

Sample Calculations:

Turbine and Engine Emissions, tpy= (Emission factor, Ib/MMBtu) x (Heat Value, Btu/gal) / (Conversion, 1,000,000 Btu/MMBtu) x (Fuel Consumption, gal/yr) / (2,000 Ib/ton)
Boiler Emissions, tpy= (Emission factor, Ib/10³gal) / (Conversion 1,000 gal/10³gal) x (Fuel Consumption, gal/yr) / (2,000 Ib/ton)
Boiler Emissions, tpy= (Emission factor, Ib/10°scf) / (Conversion 1,000,000 scf/10°scf) x (Fuel Consumption, scf) / (2,000 Ib/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)

<sup>&</sup>lt;sup>1</sup> Ash Content of 0.233 percent by weight was determined through testing conducted in December 2016. <sup>2</sup> 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

<u>0</u> -	CONTROL OF THE PROPERTY OF THE		- actor		SO2 EIIIISSIOII	C 1 2020 ACIUAI	CIZOZO ACIDAL
-	Description	Type	Reference	Sulfur Content 1,2	Factor	Operation	SO <sub>2</sub> Emissions
-							
-		No. 1 ULS	Mass Balance	0.00051 wt. pct. S	0.000 lb/gal	2,601 gal/yr	9.E-05 tpy
	Simple Cycle Gas Turbine	No. 1 Diesel	Mass Balance	0.16408 wt. pct. S	0.022 lb/gal	25,543 gal/yr	0.29 tpy
	85 85	No. 2 Diesel	Mass Balance	0.33733 wt. pct. S	0.048 lb/gal	117,723 gal/yr	2.82 tpy
		No. 1 ULS	Mass Balance	0.00051 wt. pct. S	0.000 lb/gal	21,838 gal/yr	8.E-04 tpy
2	Simple Cycle Gas Turbine	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	Social Social	O 000 to the 200 0	2 04 by 15/201	1 167 coller	4 2F 04 tex
4	Diesel Generator Engine	No. 1 ULSD	Mass Dalalice	0.00 DW. pct. 3	2.04E-04 ID/gal	1, 107 gallyi	1.2E-04 tpy
10	Boiler	No. 2 Heating Oil	Man Dange	0 200	100/4I 900 0	20 056 2016.5	, co 4 to 0
1	Boiler	No. 2 Heating Oil	Mass balance	0.2 Wt. pct. 5	U.UZO ID/gal	22,030 gallyr	U.ST tpy
				Significant E	mission Units - 2020 A	Significant Emission Units - 2020 Actual Emissions - SO <sub>2</sub>	44.8 tpy
		ā	Insignificant Emission Units	Units			
9	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	V/N	N/A	N/A	8,784 hr/yr	0 tpy
8	Burnham Boiler	No. 2 Heating Oil	Mass Balance	0 200	[00)4I O O	40 24E aplice	0 10
6	Burnham Boiler	No. 2 Heating Oil	Mass Balance	0.2 Wt. pct. 3	o.o ingal	12,343 gallyl	o. to tpy
N/A	Burnham Boiler - FE Building	Natural Gas	C F F OIGHT CF GV	2.000 c	3 - 90 P - 10 O	12 168 cof	4E 06 to:
N/A	Burnham Boiler - FE Building	Natural Gas	AF-42 LADIE 1.4-2	2,000 gr/10 scr	0.0 ID/10 SCI	12, 100 30	4E-00 tpy
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 E	mission Units - 2020 A	Insignificant Emission Units - 2020 Actual Emissions - $\mathrm{SO}_2$	0.25 tpy
					2020 A	2020 Actual Emissions - SO <sub>2</sub>	45.1 tpy

Sample Calculations: 3

Molar mass ratio is 32 lb S/mol : 64 lb SO<sub>2</sub>/mol

Stoichiometry: 1 mol S = 1 mol SO<sub>2</sub>

Mass Balance Emission Factor, Ib/gal = (Molar mass ratio, 2 lb SO<sub>2</sub>: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 scf) / (Conversion 1,000,000 scf/10 scf) x (Fuel Consumption, scf) / (2,000 lb/ton)

Notos.

<sup>1</sup> Based on the weighted average of monthly maximum fuel sulfur content values for calendar year 2020 as received from supplier sampling.

<sup>2</sup> For waste oil and waste transformer oil, fuel sulfur content was determined by testing conducted in December 2016.
<sup>3</sup> 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.

FY2022 Assessable Emissions Golden Valley Electric Association - Zehnder Power Plant

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# 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

	Assessa	Assessable Emissions - Tons Per Year	- Tons Per Yea	ar			
Description	NOx	CO	PM <sub>10</sub>	SO <sub>2</sub>	NOC	HAPs	Total
Assessable PTE	249	-	E	72	-	Е	321

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

Dofontial to Emit		Regulated	Air Pollutant E	Regulated Air Pollutant Emissions (tons per year)	per year) 1	
roteiltial to Ellit	NOx	co	PM <sub>10</sub>	$so_z$	voc	НАР
Significant	0.7			0.1		
Insignificant	0			0		
Total Emissions	1			0		
Use Assessable PTE <sup>2</sup>		0	0		0	0
Assessable Emission Subtotals	1	0	0	0	0	0
Fees Apply to Pollutant? 3	No	No	No	No	No	oN
Total Assessable Emissions				0		
Fee Estimate 4			\$	\$0		

# Notes:

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

<sup>&</sup>lt;sup>2</sup> Actual emissions are provided for NO<sub>x</sub> and SO<sub>2</sub> 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.

<sup>&</sup>lt;sup>3</sup> Fees paid on each pollutant emitted in quantities greater than 10 tpy per 18 AAC 50.410.

<sup>&</sup>lt;sup>4</sup> 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

ID         Description         Make/Model         Type         Op           1         Gas Turbine         John Brown Ltd. Frame 5P         Fuel Oil         12.0           2         Black Start Engine         Delta Detroit         Fuel Oil         0.6           3         Furnace         Thermo Pride         Fuel Oil         1,93	Fuel	CY2020 Actual	Nominal	CY2020 Actual
Turbine       John Brown Ltd. Frame 5P       Fuel Oil         art Engine       Delta Detroit       Fuel Oil         nace       Thermo Pride       Fuel Oil		Operation	Capacity	Fuel Consumption
ingine Delta Detroit Fuel Oil Thermo Pride Fuel Oil		12.0 hr/yr	23.1 MW	14,469 gal/yr
3 Thermo Pride Fuel Oil	27.00	0.67 hr/yr 1	500 bhp	18 gal/yr
		1,931 hr/yr <sup>2</sup>	0.4 MMBtu/hr	5,806 gal/yr

Operating hours were determined based on two starts during calendar year 2020 lasting an estimated duration of 5 minutes, each.
 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	Firel Tyne/		CV2020 Actual
		'ada' ishe'	Dating/Size	סובסבס שבוממו
Q	Description	Material	Nating/Olze	Operation
Tank	Fuel Oil Storage Tank	Fuel Oil	50,000 gallons	8,760 hr/yr

March 2021

Table 3. FY2022 Assessable Emissions Calculations - Oxides of Nitrogen (NO<sub>x</sub>) Emissions Golden Valley Electric Association - Delta Power Plant

	Emission Unit		Fuel	Factor	NO <sub>x</sub> Emission	Actual	CY2020 Actual
	Description	Rating/Capacity	Type	Reference	Factor	Operation	NO <sub>x</sub> Emissions
			Significant Emission Units	nission Units			
	Gas Turbine	23.1 MW	Fuel Oil	AQ0880TVP03 Condition 10.2	0.70 lb/MMBtu	14,469 gal/yr	0.67 tpy
	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
	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 <sub>x</sub>	nits - Total Assessal	ble Emissions - NO <sub>X</sub>	0.73 tpy
			Insignificant Emission Units	mission Units			
Fank	Fuel Oil Storage Tank	50,000 gallons	Fuel Oil	N/A	NA	8,760 hr/yr	0 tpy
ű.			88	Insignificant Emission Units - Total Assessable Emissions - $NO_X$	nits - Total Assessal	ble Emissions - NO <sub>X</sub>	0 tpy
					Total Assessal	Total Assessable Emissions - NO <sub>X</sub>	0.73 tpy
l							

Fuel Heating Value

0.133021 MMBtu/gal

Example Calculations:

AQ0880TVP03, Condition 10.2

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<sub>2</sub>) Emissions Golden Valley Electric Association - Delta Power Plant

ID         Description         Rating/Capacity         Type         Sulfur Content Emission Units         Reference         Factor         Operation         So_Emi           1         Gas Turbine         23.1 MW         Fuel Oil         0.0950 wt, pct. S¹         Mass Balance 2³         0.0127 lb/gal         14,469 gal/yr         9.E-02           2         Black Start Engine         18 gal/hr         Fuel Oil         0.0950 wt, pct. S¹         Mass Balance 2³         0.0127 lb/gal         0.67 hr/yr         8.E-05           3         Furnace         0.4 MMBtu/hr         Fuel Oil         0.0950 wt, pct. S¹         Mass Balance 2³         0.0127 lb/gal         5,806 gal/yr         4.E-02           1         Armace         0.4 MMBtu/hr         Fuel Oil         0.0950 wt, pct. S¹         Mass Balance 2³         0.0127 lb/gal         5,806 gal/yr         4.E-02           1         Armace         0.4 MMBtu/hr         Fuel Oil         0.0950 wt, pct. S¹         Mass Balance 2³         0.0127 lb/gal         5,806 gal/yr         4.E-02           1         Armace         Arm	3	Emission Unit	8	Fuel	Maximum Fuel	Factor	SO <sub>2</sub> Emission	Actual	CY2020 Actual
Significant Emission Units           Gas Turbine         23.1 MW         Fuel Oil         0.0950 wt. pct. S¹ Mass Balance 2³ Mass Bala		Description	Rating/Capacity	Type	Sulfur Content	Reference	Factor	Operation	SO <sub>2</sub> Emissions
Gas Turbine         23.1 MW         Fuel Oil         0.0950 wt. pct. S¹         Mass Balance 2³         0.0127 lb/gal         14,469 gal/yr         14,469 gal/yr           Black Start Engine         18 gal/hr         Fuel Oil         0.0950 wt. pct. S¹         Mass Balance 2³         0.0127 lb/gal         0.67 hr/yr         0.67 hr/yr           Furnace         0.4 MMBtu/hr         Fuel Oil         0.0950 wt. pct. S¹         Mass Balance 2³         0.0127 lb/gal         5,806 gal/yr         5,806 gal/yr           Insignificant Emission Units         NA         N/A         N/A         8,760 hr/yr         8,760 hr/yr         7           Fuel Oil Storage Tank         50,000 gallons         Fuel Oil         NA         N/A         NA         8,760 hr/yr         8,760 hr/yr				Significant E	Emission Units				
Black Start Engine         18 gal/hr         Fuel Oil         0.0950 wt. pct. S¹         Mass Balance 2³         0.0127 lb/gal         0.67 hr/yr         Prof. pct. S¹         Mass Balance 2³         0.0127 lb/gal         5,806 gal/yr         Prof. pct. S¹         Assessable Emissions - SQ           Insignificant Emission Units         N/A         N/A         N/A         8,760 hr/yr         R           Fuel Oil Storage Tank         50,000 gallons         Fuel Oil         N/A         N/A         N/A         8,760 hr/yr         R           Total Assessable Emissions - SQ	$\vdash$	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
Fuel Oii Storage Tank   Fuel Oii   0.0950 wt. pct. S¹   Mass Balance 2.3   0.0127 lb/gal   5,806 gallyr		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
Significant Emission Units - Total Assessable Emissions - SQ   Insignificant Emission Units - Total Assessable Emissions - SQ		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
Fuel Oil Storage Tank						Significant Emission	Units - Total Assess	able Emissions - SO	1E-01 tpy
Fuel Oil Storage Tank         50,000 gallons         Fuel Oil         NA         N/A         N/A         NA         8,760 hr/yr         Puel Oil Storage Tank           Insignificant Emission Units - Total Assessable Emissions - SQ.				Insignificant	Emission Units				
	×	Fuel Oil Storage Tank	50,000 gallons	Fuel Oil	NA	N/A	NA	8,760 hr/yr	0 tpy
					-	nsignificant Emission	Units - Total Assess	able Emissions - SQ	0 tpy
							Total Assess	able Emissions - SO,	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.

<sup>2</sup> Mass balance:

Molar mass ratio is 32 lb S/mol : 64 lb SO<sub>2</sub>/mol

Stoichiometry: 1 mol S = 1 mol SO<sub>2</sub>

Mass Balance Emission Factor, Ib/gal = (Molar mass ratio, 2 lb SO<sub>2</sub>:1 lb S) x (weight % S in fuel) x (density of fuel, Ib/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, Ib/gal) x (Operation, gal/yr) / (2,000 lb/ton)

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



PO Box 71249, Fairbanks, AK 99707-1249 • (907) 452-1151 • www.gvea.com



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	CY2021 Actual	Fee Estimate
_	Permit No.	Emissions (Tons)	
Healy Power Plant	AQ0173TVP03	1,407	\$60,431
North Pole Power Plant	AQ0110TVP04,	1,222	\$52,498
	Rev. 1		
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 <a href="mailto:nmknight@gvea.com">nmknight@gvea.com</a>. The certification from Frank E. Perkins, Vice President Power Supply Follows.

Sincerely,

Naomi Morton Knight, P.E. Environmental Officer

Public Review Draft March 29, 2022 ADEC – FY2023 Assessable Emissions Page 2

### 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

Ass	essable Emi	ssions - Tor	ns Per Year				
Description	NO <sub>X</sub>	СО	PM	VOC	SO <sub>2</sub>	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.

	R	egulated Air	r Pollutant E	imissions (to	ons per year	) 1
	NO <sub>X</sub>	СО	PM	VOC	SO <sub>2</sub>	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			1,4	407		
Fee Estimate <sup>3</sup>			\$60	,431		

### Notes:

<sup>&</sup>lt;sup>1</sup> Regulated air pollutant calculations based on emission factors shown in accompanying spreadsheets.

<sup>&</sup>lt;sup>2</sup> Fees paid on each pollutant emitted in quantities greater than 10 tpy per 18 AAC 50.410.

<sup>&</sup>lt;sup>3</sup> 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	Туре	Operation <sup>1</sup>
1	Unit No. 1	Foster-Wheeler Boiler (w/ SNCR)	327 MMBtu/hr	Coal/ULSD	7,948 hours
'	Offictive: 1	1 Oster-Wheeler Boller (W/ SINCIN)	327 WIWIDIU/III	ULSD	216,822 gallons
2	Unit No. 2	TRW Integrated Entrained Combustion System (w SCR)	658 MMBtu/hr	Coal/ULSD	5,917 hours
	OTHERVO. 2			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
		2 grizzlies, 1 primary Stamler crusher, 2 belt feeders, 2 secondary Flextooth-			
6	Crusher System	Dresser crushers, 2 hoppers, and the No. 1 conveyor belt (tail-end), all	12,000 cfm	Coal	2,748 hours <sup>2</sup>
		commonly vented to Dust Collector No. 1 (baghouse/exhaust fan).			
7	Limestone Storage Silo	Limestone Storage Silo with Baghouse	800 cfm Lime		5,404 hours 7,809 hours
8	Flyash Storage Silo	Flyash Storage Silo with Baghouse	5,000 cfm	5,000 cfm Flyash	
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 <sup>2</sup>
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:

<sup>&</sup>lt;sup>1</sup> Hours are based on CY2021 operation in accordance with condition 112 Permit No. AQ0173TVP03.

<sup>&</sup>lt;sup>2</sup> 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	Dating
ID	Description	Make/Model	Туре	Operation	Rating
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 <sup>2</sup>	900 acfm
N/A	Urea Storage Silo A/B Bin Vent Filter	N/A	Urea	145 hours <sup>3</sup>	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 <sup>5</sup>	850 scfm

### Note:

<sup>&</sup>lt;sup>1</sup> This emissions unit is associated with EU ID 2.

<sup>&</sup>lt;sup>2</sup> Estimated operation of 1,095 hours is assumed with each of the three units operating one hour per day.

<sup>&</sup>lt;sup>3</sup> 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)

<sup>&</sup>lt;sup>4</sup> 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)

<sup>&</sup>lt;sup>5</sup> 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 <sub>x</sub> Emission	CY2021 Actual	CY2021 Actual
ID	Description	Rating/Capacity	Туре	Reference	Factor	Operation	NO <sub>X</sub> Emissions
			Significant Emiss	ions 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 <sup>3</sup> 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 <sup>3</sup> 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 <sup>1</sup>
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 tpv
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 Em	ssions - CY2021 Actu	al Emissions - NOX	288.5 tpy
			Insignificant Emis	sions 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	5,404 Hours	о гру
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 Em	ssions - CY2021 Actu	al Emissions - NOX	0 tpy
					0.0004		
					CY2021 Actu	al Emissions - NOX	288.5 tpy

Notes:

<sup>1</sup> 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, Ib/MMBtu) x (Rating, MMBtu/hr) x (Operation, hr/yr) / (Conversion, 2,000 lb/ton)

Emissions (tpy) = (Emission factor, lb/10<sup>3</sup> gal) x (Fuel consumption, gal) / (Conversion, 1,000 gal/10<sup>3</sup> 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 <sup>3</sup> 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 <sup>3</sup> 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 <sup>1</sup>
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 E	missions - CY2021 Act	tual Emissions - CO	752.8 tpy
			Insignificant Emission	ons Units			
N/A	Lime Storage Silo No. 1	1,800 acfm	Lime	N/A	N/A	5.404 hours	O tou
N/A	Lime Storage Silo No. 2	1,800 acfm	Lime	N/A	N/A	5,404 Hours	0 tpy
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
	-			nsignificant Emissions Units E	missions - CY2021 Act	tual Emissions - CO	0 tpy
					CY2021 Act	tual Emissions - CO	752.8 tpy

### Notes

<sup>1</sup> 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<sup>3</sup> gal) x (Fuel consumption, gal) / (Conversion, 1,000 gal/10<sup>3</sup> gal) / (Conversion, 2,000 lb/ton)

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

Emissions (tpy) = (Emission factor, Ib/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		Fuel	Factor	PM Emission	CY2021 Actual	CY2021 Actual
ID	Description	Rating/Capacity	Туре	Reference Factor		Operation	PM Emissions
			Significant Emis	sions 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 <sup>3</sup> gal	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 <sup>3</sup> gal	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	e 5a	8,760 hours	0.9 tpy
12	Coal Storage Pile	15 day supply	Coal	See Table	e 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 Ur	nits Emissions - CY2021 A	ctual Emissions - PM	23.3 tpy
			Insignificant Emi	ssions 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	5,404 Hours	0.21 tpy
N/A	Ash Handling	Not Applicable	Ash	See Table	e 5c	8,760 hours	0.05 tpy
N/A	Miscellaneous Roads	Not Applicable	Not Applicable	See Table	e 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 Ur	nits Emissions - CY2021 A	ctual Emissions - PM	0.64 tpy
					CY2021	Actual PM Emissions	23.9 tpy

### Notes

<sup>1</sup> 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, Ib/MMBtu) x (Rating, MMBtu/hr) x (Operation, hr/yr) / (Conversion, 2,000 lb/ton)

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

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

Emissions (tpy) = (Emission factor, Ib/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	CY2021 Actual PM	
ID	Description	Tactor Reference	Lillission i actor	Operation	Emissions	
11	Coal Haul - Unpaved Portion	AP-42, Section 13.2.2	1.32 lb/VMT	1,307 VMT	0.9 tpy <sup>1</sup>	
			CY202	1 Actual PM Emissions	0.9 tpy	

Notes:

### **Unpaved Road Emission Factor**

AP-42, Section 13.2.2, Equation 1a:

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

$$k \qquad 1.5 \qquad \text{from AP-42, Table 13.2.2-2}$$

$$s = \text{surface material silt content (haul road)} \qquad 5.1 \qquad \text{percent, from AP-42, Table 13.2.2-1}$$

$$W = \text{mean vehicle weight} \qquad 193.75 \qquad \text{tons, estimate - average of full (262.5 ton) and empty (125 ton) truck}$$

$$a \text{ (empirical constant)} \qquad 0.9 \qquad \text{from AP-42, Table 13.2.2-2}$$

$$b \text{ (empirical constant)} \qquad 0.45 \qquad \text{from AP-42, Table 13.2.2-2}$$

$$E \text{ (uncontrolled)} = \qquad 4.53 \qquad \text{lb/VMT}$$

$$Efficiency = \qquad 60\% \qquad \text{assumed control efficiency for water application}$$

$$E \text{ (controlled)} = \qquad 1.81 \qquad \text{lb/VMT}$$

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<sub>ext</sub> = 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

$$\frac{PM}{E \text{ (controlled)}} = \frac{PM}{1.32} \text{ lb/VMT}$$

<sup>&</sup>lt;sup>1</sup> Coal Haul Road

### 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	CV2021 Actual Operation	CY2021 Actual PM Emissions
ID	Description	Factor Reference	Ellission Factor	C12021 Actual Operation	C12021 Actual FW EIIIISSIOIIS
	Truck Drop Onto Stockpile	AP-42, Section 13.2.4	1.16E-04 lb/ton	359,378 tpy	0.02 tpy <sup>1</sup>
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 <sup>2</sup>
	Stockpile Wind Erosion	AP-42, Section 13.2.5	0.00 g/m <sup>2</sup> -yr	10,150 m <sup>2</sup>	0.0 tpy <sup>3</sup>
		_	С	Y2021 Actual PM Emissions	0.7 tpy

#### Notes:

<sup>1</sup> Truck Drop onto Stockpile and Front End Loader Drop to Grizzly

Drop Operation Emission Factor:

AP-42, Section 13.2.4

$$E\left(\frac{lb}{ton}\right) = \frac{k \times 0.0032 \times \left(\frac{U}{5}\right)^{1.5}}{\left(\frac{M}{2}\right)^{1.4}}$$

17.67

miles/hr 32.62 percent lb/ton 1.16E-04

AP-42, Section 13.2.4

Per MET data recorded at GVEA's Eva Creek Wind Farm CY2019, conservative estimation with higher winds than seen at the Healy Power Plant

Weighted average from EU ID 1 and 2 CY2021 coal proximate analyses

Annual Stockpile Throughput:

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

U = mean wind speed

M = coal moisture content

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

from Healy environmental report from Healy environmental report

<sup>2</sup> 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 Density of coal

11 yd<sup>3</sup> 52.63 lb/ft3

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:

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

$$k \qquad 1.5 \qquad \text{from AP-42, Table 13.2.2-2}$$

$$s = \text{surface material silt content (haul road)} \qquad 8.4 \qquad \text{percent, from AP-42, Table 13.2.2-1}$$

$$W = \text{mean vehicle weight} \qquad 33.2 \qquad \text{tons, estimate}$$

$$a \text{ (empirical constant)} \qquad 0.9 \qquad \text{from AP-42, Table 13.2.2-2}$$

$$b \text{ (empirical constant)} \qquad 0.45 \qquad \text{from AP-42, Table 13.2.2-2}$$

$$E \text{ (uncontrolled)} = \qquad 3.21 \qquad \text{lb/VMT}$$

$$E \text{fficiency} = \qquad 60\% \qquad \text{assumed control efficiency for water application}$$

$$E \text{ (controlled)} = \qquad 1.28 \qquad \text{lb/VMT}$$

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:

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

E<sub>ext</sub> = 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

Vehicle Miles Traveled (VMT)

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

Total Actual Coal Throughput 359,378 tons
Coal moved per trip 7.815555 tons

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

<sup>3</sup> Stockpile Wind Erosion Coal Pile Surface Area

10.150 m<sup>2</sup> Surface area of active face = 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

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

k = particle size multiplier (AP-42 Section 13.2.5.3)

N = number of disturbances per year

P<sub>i</sub> = erosion potential corresponding to the fastest mile of wind for the ith period between disturbances, g/m<sup>2</sup>

AP-42 Section 13.2.5, Equation (3)

Erosion potential function for a dry exposed surface, P

$$P = 58 (u^* - u_*^*)^2 + 25 (u^* - u_*^*)$$

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

where

u\* = friction velocity (m/s)

u<sub>t</sub> = threshold friction velocity (m/s)

AP-42 Section 13.2.5, Equation (1)

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

where

u\* = friction velocity (cm/s)

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

z = height above test surface (cm)

 $z_0$  = roughness height, cm

Data:

u(z)

Use maximum wind gust speed recorded at McKinley Airport ASOS for each month in CY2021 (see table below)

10

365 disturbances/year for active face, estimated

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 <sup>b</sup> (Table 13.2.5-2)				Ground Coal (Table 13.2.5-2)					
Month-Year	Average W (u(1	/ind Speed 0)) <sup>a</sup>	Wind Direction	Roughness Height (z <sub>o</sub> )	Threshold Friction Velocity (u <sub>t</sub> )	Calculated Friction Velocity (u*)	Erosion potential function,	Roughness Height (z <sub>o</sub> )	Threshold Friction Velocity (u <sub>t</sub> )	Calculated Friction Velocity (u*)	Erosion potential function,	PxN	k	Emission Factor, EF
	mph	m/s	deg	cm	m/s	m/s		cm	m/s	m/s				g/m²-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 <sub>10</sub> Annual	Total						0				0	0	0.5	0

<sup>&</sup>lt;sup>a</sup> Per https://mesonet.agron.iastate.edu/request/download.phtml?network=AK\_ASOS for CY2021, McKinley Airport ASOS (PAIN).

<sup>&</sup>lt;sup>b</sup> 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	Emissions Unit Factor Reference		Emission Factor	CY2021 Actual Operation	CY2021 Actual PM Emissions
ID	Description	ractor Reference	Emission	Ellission Factor	C12021 Actual Operation	C12021 Actual FM Ellissions
	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 <sup>1</sup>
N/A	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 <sup>2</sup>
	Ash Drying Area Wind Erosion	AP-42, Section 13.2.5	PM	0.00 g/m <sup>2</sup>	4,800 m <sup>2</sup>	0 tpy <sup>3</sup>
					CY2021 Actual PM Emissions	4.6E-02 tpy

#### Notes

<sup>1</sup> Front End Loader / Flyash Storage Silo Drop into Truck

AP-42, Section 13.2.4

$$E\left(\frac{lb}{ton}\right) = \frac{k \times 0.0032 \times \left(\frac{U}{5}\right)^{1.5}}{\left(\frac{M}{2}\right)^{1.4}}$$

percent

PM k 0.35 ed 17.67 miles/hr

U = mean wind speed 17.67 M = ash moisture content 17.5 Per MET data recorded at GVEA's Eva Creek Wind Farm CY2019, conservative estimation with higher winds than seen at the Healy Power Plant 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 EU ID 2 CY2021 Ash Throughput 17,232 tons 24,068 tons from Healy environmental report from Healy environmental report

Total Ash Throughput 41,300 tons

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

Density of ash
Ash moved per trip

8 yd<sup>3</sup> 60 lb/ft<sup>3</sup> 6.48 tons

FY2023 Assessable Emissions Golden Valley Electric Association - Healy Power Plant

<sup>&</sup>lt;sup>2</sup> Front End Loader Movement - Ash Pile to Truck

### 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

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

$$k \qquad 1.5 \qquad \text{from AP-42, Table 13.2.2-2}$$

$$s = \text{surface material silt content (haul road)} \qquad 8.4 \qquad \text{percent, from AP-42, Table 13.2.2-1}$$

$$W = \text{mean vehicle weight} \qquad 27 \qquad \text{tons, estimate}$$

$$a \text{ (empirical constant)} \qquad 0.9 \qquad \text{from AP-42, Table 13.2.2-2}$$

$$b \text{ (empirical constant)} \qquad 0.45 \qquad \text{from AP-42, Table 13.2.2-2}$$

$$E \text{ (uncontrolled)} = \qquad 2.92 \qquad \text{lb/VMT}$$

$$E \text{ (fficiency} = \qquad 60\% \qquad \text{assumed control efficiency for water application}$$

$$E \text{ (controlled)} = \qquad 1.17 \qquad \text{lb/VMT}$$

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<sub>ext</sub> = 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

$$\frac{PM}{E \text{ (controlled)} = 0.85} \text{ lb/VMT}$$

Approximate distance from ash pile to truck (round trip)

150 feet

VMT = vehicles miles traveled per year

105.52

<sup>d</sup>From AP-42, Section 13.2.5, Industrial Wind Erosion

Ash Pile Surface Area

Surface area of active face =  $4,800 \text{ m}^2$ 

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

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

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<sub>i</sub> = erosion potential corresponding to the fastest mile of wind for the ith period between disturbances, g/m<sup>2</sup>

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

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

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

where  $u^* = friction \ velocity \ (m/s)$ 

u<sub>t</sub> = threshold friction velocity (m/s)

AP-42 Section 13.2.5, Equation (1)

Friction velocity, u\*

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

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 <sup>a</sup> (Table 13.2.5-2)										
Month-Year	Average W (u(1	/ind Speed 0)) <sup>b</sup>	Wind Direction	$(z_0)$ $velocity   Velocity (u^*)   function,$		potential	PxN	k	Emission Factor (uncontrolled), EF	Emission Factor (controlled), EF <sup>c</sup>	
	mph	m/s	deg	cm	m/s	m/s	r			g/m <sup>2</sup> -yr	g/m²-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 <sub>10</sub> Ai	nnual Total						0	0	0.5	0	0

<sup>&</sup>lt;sup>a</sup> No emission factor exists for ash. Overburden is considered the most representative alternative because it includes both fine (ash) and coarse (slag) particles.

<sup>&</sup>lt;sup>b</sup> Per https://mesonet.agron.iastate.edu/request/download.phtml?network=AK\_ASOS for CY2021, McKinley Airport ASOS (PAIN).

<sup>&</sup>lt;sup>c</sup> 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	CY2021 Actual PM
ID	Description	Factor Reference	Ellission Factor	Operation	Emissions
	Ash Haul - Unpaved (EU ID 1)	AP-42, Section 13.2.2	1.18 lb/VMT	127 VMT	0.07 tpy <sup>1</sup>
	Ash Haul - Unpaved (EU ID 2)	AP-42, Section 13.2.2	1.18 lb/VMT	133 VMT	7.8E-02 tpy <sup>1</sup>
N/A	Limestone/Lime Delivery - Paved Portion	AP-42, Section 13.2.1	0.08 lb/VMT	34 VMT	1.4E-03 tpy <sup>2</sup>
	Limestone/Lime Delivery - Unpaved Portion	AP-42, Section 13.2.2	1.07 lb/VMT	16 VMT	8.5E-03 tpy <sup>2</sup>
	Miscellaneous Traffic - Paved Portion	AP-42, Section 13.2.1	0.001 lb/VMT	5,185 VMT	3.4E-03 tpy <sup>3</sup>
·			CY202	Actual PM Emissions	0.17 tpy

### Notes:

### **Unpaved Road Emission Factor**

AP-42, Section 13.2.2, Equation 1a:

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

$$k \qquad 1.5 \qquad \text{from AP-42, Table } 13.2.2-2$$

$$s = \text{surface material silt content (haul road)} \qquad 5.1 \qquad \text{percent, from AP-42, Table } 13.2.2-1$$

$$W = \text{mean vehicle weight} \qquad 151.25 \qquad \text{tons, estimate - average of full (197.5 ton) and empty (105 ton) truck}$$

$$a \text{ (empirical constant)} \qquad 0.9 \qquad \text{from AP-42, Table } 13.2.2-2$$

$$b \text{ (empirical constant)} \qquad 0.45 \qquad \text{from AP-42, Table } 13.2.2-2$$

$$E \text{ (uncontrolled)} = \qquad 4.05 \qquad \text{lb/VMT}$$

$$Efficiency = \qquad 60\% \qquad \text{assumed control efficiency for water application}$$

$$E \text{ (controlled)} = \qquad 1.62 \qquad \text{lb/VMT}$$

<sup>&</sup>lt;sup>1</sup>Ash Haul Road

### 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<sub>ext</sub> = 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

$$E (controlled) = \frac{PM}{1.18} Ib/VMT$$

**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

<sup>2</sup> Limestone/Lime/Sodium Bicarbonate Haul Road

#### **Paved Road Emission Factor**

AP-42, Section 13.2.1, Equation 1:

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

(VMT)	PM	
k = particle size multiplier	0.0022	
sL = surface material silt content (haul road)	0.6	g/m <sup>2</sup> , 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	Ib/VMT
Efficiency =	50%	assumed control efficiency for pavement cleaning
E (controlled) =	0.09	Ib/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<sub>ext</sub> = 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

E (controlled) = 0.08 lb/VMT	_	PM	_
	E (controlled) =	0.08	lb/VMT

### **Unpaved Road Emission Factor**

AP-42, Section 13.2.2, Equation 1a:

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

$$k \qquad 1.5 \qquad \text{from AP-42, Table 13.2.2-2}$$

$$s = \text{surface material silt content (haul road)} \qquad 5.1 \qquad \text{percent, from AP-42, Table 13.2.2-1}$$

$$W = \text{mean vehicle weight} \qquad 122.5 \qquad \text{tons, estimate - average of full (135 ton) and empty (110 ton) loader/trailer}$$

$$a \text{ (empirical constant)} \qquad 0.9 \qquad \text{from AP-42, Table 13.2.2-2}$$

$$b \text{ (empirical constant)} \qquad 0.45 \qquad \text{from AP-42, Table 13.2.2-2}$$

$$E \text{ (uncontrolled)} = \qquad 3.69 \qquad \text{lb/VMT}$$

$$Efficiency = \qquad 60\% \qquad \text{assumed control efficiency for water}$$

$$E \text{ (controlled)} = \qquad 1.47 \qquad \text{lb/VMT}$$

### 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<sub>ext</sub> = 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

$$E (controlled) = \frac{PM}{1.07} Ib/VMT$$

Throughput

Limestone/Lime Throughput 2,593 tons, CY2021 actual Sodium Bicarbonate Throughput 386 tons, CY2021 actual

Vehicle Miles Traveled (VMT)

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

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

<sup>&</sup>lt;sup>3</sup> Miscellaneous Traffic

### **Paved Road Emission Factor**

AP-42, Section 13.2.1, Equation 1: 
$$E\left(\frac{lb}{VMT}\right) = k(sL)^{0.91}(W)^{1.02}$$

k = particle size multiplier	0.0022	Ib/VMT from AP-42 Table 13.2.1-1
sL = surface material silt content (haul road)	0.6	g/m <sup>2</sup> , 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

PM

### 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<sub>ext</sub> = 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

	PIVI	
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		Fuel	Factor	VOC Emission	CY2021 Actual	CY2021 Actual	
ID	Description	Rating/Capacity	Туре	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	7,948 hours	4.8 tpy <sup>1</sup>	
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 <sup>3</sup> 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 <sup>3</sup> 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 I	Jnits Emissions - CY2021 A	Actual VOC Emissions	8.8 tpy	
			nsignificant Emissions					
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	5,404 Hours	υ τρу	
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 I	Jnits Emissions - CY2021 A	Actual VOC Emissions	0 tpy	
						•		
					CY2021 A	Actual VOC Emissions	8.8 tpy	

### Notes

<sup>1</sup> EU ID 1 actual coal throughput 160,733 tons <sup>2</sup> EU ID 2 actual coal throughput 198,645 tons

<sup>3</sup> 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<sup>3</sup> gal) x (Fuel consumption, gal) / (Conversion, 1,000 gal/10<sup>3</sup> gal) / (Conversion, 2,000 lb/ton)

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

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

Table 7. FY2022 Assessable Emissions Calculations - Sulfur Dioxide (SO<sub>2</sub>) Emissions Golden Valley Electric Association - Healy Power Plant

	Emissions Unit		Fuel	Factor	Maximum Fuel	SO <sub>2</sub> Emission	CY2021 Actual	CY2021 Actual	
ID	Description	Rating/Capacity	Туре	Reference	Sulfur Content	Factor	Operation	SO <sub>2</sub> 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 <sup>1,2</sup>	12,055 gallons	1.3E-03 tpy <sup>3</sup>	
4	Auxiliary Boiler No. 2	23.0 MMBtu/hr	ULSD	Mass Balance	0.0015 wt. pct. S	0.00021 lb/gal <sup>1,2</sup>	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 <sup>1,2</sup>	0 gallons	0 tpy <sup>3</sup>	
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 <sup>1,2</sup>	6 hours	8.9E-06 tpy 3.4	
				Significa	nt Emissions Units En	nissions - CY2021 Actu	ual Emissions - SO <sub>2</sub>	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	5,404 Hours	о гру	
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 - CY2021 Actual Emissions - SO <sub>2</sub>							0 tpy		
						CY2021 Actu	ual Emissions - SO <sub>2</sub>	341.9 tpy	

### Notes:

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<sub>2</sub>/mol; Stoichiometry: 1 mol S = 1 mol SO<sub>2</sub>

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

<sup>2</sup> Diesel Fuel Density 7.1 lb/gal AP 42, Table 3.4-1, footnote a

<sup>3</sup> Diesel Heating Value 133,366 Btu/gal lab analysis

<sup>4</sup> 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, Ib/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, Ib/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)

<sup>&</sup>lt;sup>1</sup> Mass balance:

Table 8. FY2023 Assessable Emissions Calculations - Hazardous Air Pollutants (HAP) Emissions
Golden Valley Electric Association - Healy Power Plant

	CY2021 Actual HAP Emissions by Emissions Unit Category (tons per year) <sup>1</sup>						
Hazardous Air Pollutant	Coal-Fired Boilers	Diesel Boilers and Heaters	Diesel Engines <600 hp	Diesel Engines >600 hp	Coal Preparation and Ash Handling <sup>2</sup>	Insignificant Units <sup>3</sup>	CY2021 Actual HAP Emissions
	100=01						
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

	CY2021 Actual HAP Emissions by Emissions Unit Category (tons per year) <sup>1</sup>						
Hazardous Air Pollutant	Coal-Fired Boilers	Diesel Boilers and Heaters	Diesel Engines <600 hp	Diesel Engines >600 hp	Coal Preparation and Ash Handling <sup>2</sup>	Insignificant Units <sup>3</sup>	CY2021 Actual HAP Emissions
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		1.41E-02	6.54E-06	0	0	0	1.98
Total VOC HAP Emissions		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

<sup>&</sup>lt;sup>1</sup> See individual emissions unit category emissions calculations for details on methodology and assumptions.

<sup>&</sup>lt;sup>2</sup> Emissions units in the coal preparation and handling, ash handling and coal storage pile systems do not have HAP emissions

<sup>&</sup>lt;sup>3</sup> 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

		CY2021 Actual Source Category Emission Calculation			
CAS No.	Chemical Name	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		

CAS No.	Chemical Name	Emission Factor	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 <sup>5</sup>	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

CY2021 Actual Source Category Emission Calculations

		O I ZOZ I Motadi Godio	o oatogory Emilodion oaloalation
CAS No.	Chemical Name	Emission Factor 1	<b>Estimated Emissions</b>
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 <sup>6</sup>	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:

#### Conversion Factors:

Coal Heating Value 14.24 MMBtu/ton CY2021 average Unit 1 1.21 lb/TBtu

<sup>&</sup>lt;sup>1</sup> Reference: AP-42, Tables 1.1-12, 1.1-13, 1.1-14, 1.1-18

 $<sup>^{2}\,\</sup>mathrm{HCl}$  emission factors from EU ID 1 source test completed in August 2020

<sup>&</sup>lt;sup>3</sup> HCl emission factors from EU ID 2 source test completed in September 2021

 $<sup>^4\,\</sup>mathrm{HF}$  emission factors from EU ID 1 source test completed in November 2017

 $<sup>^{\</sup>rm 5}\,{\rm HF}$  emission factors from EU ID 2 source test completed in December 2018

<sup>&</sup>lt;sup>6</sup> Emission factor from EU ID 1 source test completed September-October 2021

<sup>&</sup>lt;sup>7</sup> Emissions from EU ID 2 CEMS 2021

### 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

		CY2021 Actual Source Catego	ory Emission Calculations
CAS No.	Chemical Name	Emission Factor <sup>2,3</sup>	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

<sup>&</sup>lt;sup>1</sup> 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

<sup>&</sup>lt;sup>2</sup> Reference: AP-42, Tables 1.3-9, and 1.3-10.

<sup>&</sup>lt;sup>3</sup> 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

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CY2021 Actual	Source	Catedory	-mission	Calculations

		O I ZUZ I AUtual Couloc Gatogo	ry Emilodion Galcalations
CAS No.	Chemical Name	Emission Factor <sup>2</sup>	<b>Estimated Emissions</b>
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:

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

<sup>&</sup>lt;sup>1</sup> Total fuel use based on actual operation as noted below:

<sup>&</sup>lt;sup>2</sup> Reference: AP-42, Table 3.4-3

<sup>&</sup>lt;sup>3</sup> 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 <sup>1</sup>

CV2024 A	otical Course	Catagoni	Emissian	Calculations
CYZUZI AC	ctual Source	Catedory	-mission	Calculations

		C 1 202 1 Actual Source Cat	egory Emission Calculation
CAS No.	Chemical Name	Emission Factor <sup>2</sup>	<b>Estimated Emissions</b>
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 compound	ds(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
	CY202	21 Actual HAP Emissions:	2.15E-05 tpy

#### Notes:

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

<sup>&</sup>lt;sup>1</sup> Total fuel use based on actual operation as noted below:

<sup>&</sup>lt;sup>2</sup> 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 <sub>X</sub>	СО	PM <sub>10</sub>	SO <sub>2</sub>	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	Re	gulated Air	ed Air Pollutant Emissions (tons per year) <sup>1</sup>					
Potential to Emit	NO <sub>X</sub>	CO	PM <sub>10</sub>	voc	SO <sub>2</sub>	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 <sup>3</sup>	\$52,498							

### Notes:

<sup>&</sup>lt;sup>1</sup> Regulated air pollutant calculations based on emission factors shown in accompanying spreadsheets.

<sup>&</sup>lt;sup>2</sup> Fees paid on each pollutant emitted in quantities greater than 10 tpy per 18 AAC 50.410.

<sup>&</sup>lt;sup>3</sup> A fee rate of \$42.95 per ton applies in accordance with 18 AAC 50.410(b)(1).

<sup>&</sup>lt;sup>4</sup> 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
	Simple Cycle Gas		ULS			150 gal/yr
1	Turbine	GE Frame 7, Series 7001, Model BR	No. 1 Diesel	672 MMBtu/hr	169.0 hr/yr	801 gal/yr
	Turbine		No. 2 Diesel			371,324 gal/yr
	Simple Cycle Gas		ULS			7,115 gal/yr
2	Turbine	GE Frame 7, Series 7001, Model BR	No. 1 Diesel	672 MMBtu/hr	2,815.0 hr/yr	287,123 gal/yr
	Turbine		No. 2 Diesel			7,434,443 gal/yr
	Combined Cycle Gas		ULS			9,189 gal/yr
5	Turbine	GE LM6000PC	No. 1 Diesel	455 MMBtu/hr	8,247.8 hr/yr	0 gal/yr
	Turbino		Naphtha			27,185,671 gal/yr
	Combined Cycle Gas		ULS			0 gal/yr
6	Turbine	GE LM6000PC	No. 1 Diesel	455 MMBtu/hr	0 hr/yr	0 gal/yr
	Turbine		Naphtha			0 gal/yr
7	Emergency Generator	Mitsubishi 0A8829	ULSD	564.6 hp <sup>1</sup>	2.5 hr/yr	80 gal/yr
	Engine		0200	<u>'</u>	2.0 111/91	30 gai, yi
11	Boiler	Bryan Steam RV500	Propane	5.0 MMBtu/hr	100.8 hr/yr	5,505 gal/yr
12	Boiler	Bryan Steam RV500	Topane	5.0 MMBtu/hr	100.0 111/y1	5,555 gai/yi

<sup>&</sup>lt;sup>1</sup> 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/	Poting/Sizo	CY2021 Actual	CY2021 Actual
ID <sup>1</sup>	Description	Material	Rating/Size	Operation	Fuel Consumption
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	0,303 gai/yi
N/A	Burnham 17 A-T Boiler	No. 1 ULSD	0.222 MMBtu/hr	2,100 hr/yr	3,990 gal/yr

<sup>&</sup>lt;sup>1</sup> 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<sub>X</sub>) Emissions Golden Valley Electric Association - North Pole Power Plant

	Emission Unit	Maximum	Fuel	Factor	NO <sub>x</sub> Emission	CY2021 Actual	CY2021 Actual	
ID	Description	Capacity	Type	Reference	Factor	Operation	NO <sub>x</sub> Emissions	
			Significant Er	nission Units				
			ULS					
1	Simple Cycle Gas Turbine	672 MMBtu/hr	No. 1 Diesel	2021 CEMS Average <sup>1</sup>	292.9 lb/hr	169.0 hours	24.8 tpy	
			No. 2 Diesel					
			ULS			7,115 gal/yr	0.4 tpy	
2	Simple Cycle Gas Turbine	672 MMBtu/hr	No. 1 Diesel	AP-42 Table 3.1-1	0.88 lb/MMBtu	287,123 gal/yr	17.5 tpy	
			No. 2 Diesel			7,434,443 gal/yr	452.9 tpy	
			ULS					
5	Combined Cycle Gas Turbine	455 MMBtu/hr	No. 1 Diesel	2021 CEMS Average <sup>1</sup> 111.5 lb/	111.5 lb/hr	8,247.8 hours	459.8 tpy	
			Naphtha					
			ULS			0 gal/yr	0 tpy	
6	Combined Cycle Gas Turbine	455 MMBtu/hr	No. 1 Diesel A	AP-42 Table 3.1-1	0.24 lb/MMBtu	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	Propose	Propane	AP-42 Table 1.5-1	13 lb/10 <sup>3</sup> gal	5,505 gal/yr	3.6E-02 tpy
12	Boiler	5.0 MMBtu/hr	Flopalle	AF-42 Table 1.5-1	13 lb/10 gai	5,505 gai/yi	3.0L-02 tpy	
				Significant E	Emission Units - 2021	Actual Emissions - NO <sub>X</sub>	955.4 tpy	
			Insignificant E	mission 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 <sup>3</sup> gal	6,305 gal/yr	5.7E-02 tpy	
N/A	FHR Warehouse Boiler 2	0.784 MMBtu/hr	No. 2 Diesel	Ar-42 Iabie 1.3-1	TO ID/TU gal	0,303 gal/yi	J.1 E-UZ (þy	
N/A	Burnham 17 A-T Boiler	0.222 MMBtu/hr	No. 1 ULSD	AP-42 Table 1.3-1	18 lb/10 <sup>3</sup> gal	3,990 gal/yr	3.6E-02 tpy	
				Insignificant E	Emission Units - 2021	Actual Emissions - NO <sub>X</sub>	9.3E-02 tpy	
						<u>.                                      </u>		
					2021	Actual Emissions - NO <sub>X</sub>	955.5 tpy	

#### Note:

#### Sample Calculations:

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

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

 $\text{Boiler Emissions, tpy= (Emission factor, lb/10}^3 \text{gal}) \, / \, (\text{Conversion 1,000 gal/10}^3 \text{gal}) \, \times \, (\text{Operation, gal/yr}) \, / \, (2,000 \, \text{lb/ton}) \, / \, (2,000$ 

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)

<sup>&</sup>lt;sup>1</sup> The emission factors for EU IDs 1 and 5 are an average emission rate from 2021 measured using Continuous Emissions Monitoring Systems (CEMS).

Table 4. FY2023 Assessable Emissions Calculations - Carbon Monoxide (CO) Emissions
Golden Valley Electric Association - North Pole Power Plant

	Emission Unit	Maximum	Fuel	Factor	CO Emission	CY2021 Actual	CY2021 Actual
ID	Description	Capacity	Type	Reference	Factor	Operation	<b>Emissions</b>
			ULS				
1	Simple Cycle Gas Turbine	672 MMBtu/hr	No. 1 Diesel	2021 CEMS Average1	5.4 lb/hr	169.0 hours	0.5 tpy
			No. 2 Diesel				
			ULS			7,115 gal/yr	1.57E-03 tpy
2	Simple Cycle Gas Turbine	672 MMBtu/hr	No. 1 Diesel	AP-42 Table 3.1-1	0.0033 lb/MMBtu	287,123 gal/yr	0.07 tpy
			No. 2 Diesel			7,434,443 gal/yr	1.7 tpy
			ULS				
5	Combined Cycle Gas Turbine	455 MMBtu/hr	No. 1 Diesel	2021 CEMS Average1	2.3 lb/hr	8,247.8 hours	9.3 tpy
			Naphtha				
			ULS			0 gal/yr	0 tpy
6	Combined Cycle Gas Turbine	455 MMBtu/hr	No. 1 Diesel	AP-42 Table 3.1-1	0.076 lb/MMBtu	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 <sup>3</sup> gal	5,505 gal/yr	2.1E-02 tpy
12	Boiler	5.0 MMBtu/hr	FTOpane	AF-42 Table 1.5-1	7.5 lb/10 gai	5,505 gai/yi	2.1L-02 tpy
				Significant Em	nission Units - CY2021	Actual Emissions - CO	11.5 tpy
			Insignificant Er	mission 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 <sup>3</sup> gal	6,305 gal/yr	1.6E-02 tpy
N/A	FHR Warehouse Boiler 2	0.784 MMBtu/hr	No. 2 Diesel	7 Ar -42 Table 1.3-1	o.o ib/ io gai	0,303 gai/yi	1.0⊑-02 tpy
N/A	Burnham 17 A-T Boiler	0.222 MMBtu/hr	No. 1 ULSD	AP-42 Table 1.3-1	5.0 lb/10 <sup>3</sup> gal	3,990 gal/yr	1.0E-02 tpy
•				Insignificant Em	nission Units - CY2021	Actual Emissions - CO	2.6E-02 tpy
			· · · · · · · · · · · · · · · · · · ·				
					CY2021	Actual Emissions - CO	11.5 tpy

#### Note:

#### 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<sup>3</sup>gal) / (Conversion 1,000 gal/10<sup>3</sup>gal) 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)

<sup>&</sup>lt;sup>1</sup> The emission factors for EU IDs 1 and 5 are an average emission rate from 2021 measured using Continuous Emissions Monitoring Systems (CEMS).

Table 5. FY2023 Assessable Emission Calculations - Particulate Matter (PM<sub>10</sub>) Emissions Golden Valley Electric Association - North Pole Power Plant

	Emission Unit	Maximum	Fuel	Factor	PM <sub>10</sub> Emission	CY2021 Actual	CY2021 Actual
ID	Description	Capacity	Type	Reference	Factor	Operation	PM <sub>10</sub> Emissions
			ULS			150 gal/yr	1.20E-04 tpy
1	Simple Cycle Gas Turbine	672 MMBtu/hr	No. 1 Diesel	AP-42 Table 3.1-2a	0.012 lb/MMBtu	801 gal/yr	6.65E-04 tpy
			No. 2 Diesel			371,324 gal/yr	0.31 tpy
			ULS				5.71E-03 tpy
2	Simple Cycle Gas Turbine	672 MMBtu/hr	No. 1 Diesel	AP-42 Table 3.1-2a	0.012 lb/MMBtu	287,123 gal/yr	0.2 tpy
			No. 2 Diesel			7,434,443 gal/yr	6.2 tpy
			ULS			9,189 gal/yr	0.01 tpy
5	Combined Cycle Gas Turbine	455 MMBtu/hr	No. 1 Diesel	AP-42 Table 3.1-2a	0.012 lb/MMBtu	0 gal/yr	0 tpy
			Naphtha			27,185,671 gal/yr	17.9 tpy
			ULS			0 gal/yr	0 tpy
6	Combined Cycle Gas Turbine	455 MMBtu/hr	No. 1 Diesel	AP-42 Table 3.1-2a	0.012 lb/MMBtu	0 gal/yr	0 tpy
			Naphtha	1		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	Dranana	AP-42 Table 1.5-1	0.7 11 4403	E EOE gollyr	4.0F.02.tm./
12	Boiler	5.0 MMBtu/hr	Propane	AP-42 Table 1.5-1	0.7 lb/10 <sup>3</sup> gal	5,505 gal/yr	1.9E-03 tpy
•				Significant Er	nission Units - 2021 A	ctual Emissions - PM <sub>10</sub>	24.7 tpy
			Insignificant Er	nission 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			
N/A	FHR Warehouse Boiler 2	0.784 MMBtu/hr	No. 2 Diesel	and 1.3-2	1.7 lb/10 <sup>3</sup> gal	6,305 gal/yr	5.4E-03 tpy
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 <sup>3</sup> gal	3,990 gal/yr	3.4E-03 tpy
				Insignificant Er	nission Units - 2021 A	ctual Emissions - PM <sub>10</sub>	8.8E-03 tpy
						·	
					2021 A	ctual Emissions - PM <sub>10</sub>	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<sup>3</sup>gal) / (Conversion 1,000 gal/10<sup>3</sup>gal) 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<sub>2</sub>) Emissions
Golden Valley Electric Association - North Pole Power Plant

	Emission Unit	Maximum	Fuel	Factor	Maximum Fuel	SO <sub>2</sub> Emission	CY2021 Actual	CY2021 Actual
ID	Description	Capacity	Туре	Reference	Sulfur Content 1	Factor	Operation	SO <sub>2</sub> Emissions
			ULS	Mass Balance	0.0015 wt. pct. S	2.0E-04 lb/gal	150 gal/yr	0.00 tpy
1	Simple Cycle Gas Turbine	672 MMBtu/hr	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
			ULS	Mass Balance	0.0015 wt. pct. S	0.000 lb/gal	7,115 gal/yr	0.00 tpy
2	Simple Cycle Gas Turbine	672 MMBtu/hr	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	Balance	214.53 tpy		
			ULS	Mass Balance	0.0015 wt. pct. S	0.000 lb/gal	9,189 gal/yr	0.00 tpy
5	Combined Cycle Gas Turbine	455 MMBtu/hr	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
			ULS	Mass Balance	0.0015 wt. pct. S	0.000 lb/gal	0 gal/yr	0.00 tpy
6	Combined Cycle Gas Turbine	455 MMBtu/hr	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 Dalansa	7.04E.06.04 mat C	6 6F 07 lb/mal	E EOE	1.8E-06 tpy
12	Boiler	5.0 MMBtu/hr	Propane	Mass balance	7.81E-06 Wt. pct. 5	0.6E-07 ib/gai	5,505 gal/yi	1.8 <b>⊑</b> -06 tpy
•		•		•	Significant Em	ission Units - CY2021	Actual Emissions - SO <sub>2</sub>	230.4 tpy
			Insign	ificant Emission Unit	s		•	
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 Palanes	0.2052 ut not S	E 20E 02 lb/gol	6 20E gollyr	1.69E-01 tpy
N/A	FHR Warehouse Boiler 2	0.784 MMBtu/hr	No. 2 Diesel	Wiass Dalatice	0.3933 Wt. pct. 3	5.36E-02 lb/gai	0,303 gal/yl	1.09⊑-01 tpy
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 Em	ission Units - CY2021	Actual Emissions - SO <sub>2</sub>	1.7E-01 tpy
							-	
						CY2021	Actual Emissions - SO <sub>2</sub>	230.6 tpy

Notes:

Sample Calculations: 2, 3, 4

Molar mass ratio is 32 lb S/mol : 64 lb SO<sub>2</sub>/mol

Stoichiometry: 1 mol S = 1 mol SO<sub>2</sub>

Mass Balance Emission Factor, lb/gal = (Molar mass ratio, 2 lb SO<sub>2</sub>: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<sub>2</sub>) x (Conversion, 1.66E-7 lb SO<sub>2</sub>/scf / ppm SO<sub>2</sub>) x (F-factor, 8,710 scf/MMBtu) x (Conversion, 0.0216 MMBtu/lb) x (Conversion, mole SO<sub>2</sub>/64 lb SO<sub>2</sub>) x (Conversion, mole SO<sub>2</sub>/82 (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.
- <sup>2</sup> 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.
- <sup>3</sup> The engine specification datasheet indicates a maximum fuel throughput of 32 gal/hr.
- <sup>4</sup> 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

Α	ssessable	Emissions	- Tons Per \	ear/			
Description	NO <sub>X</sub>	CO	PM <sub>10</sub>	SO <sub>2</sub>	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	Re	egulated Air	· Pollutant E	missions (t	ons per yea	ar) <sup>1</sup>	
Potential to Ennit	NO <sub>X</sub>	СО	PM <sub>10</sub>	VOC	SO <sub>2</sub>	HAP <sup>4</sup>	
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 <sup>3</sup>	<sup>3</sup> \$5,342						

#### Notes:

<sup>&</sup>lt;sup>1</sup> Regulated air pollutant calculations based on emission factors shown in accompanying spreadsheets.

<sup>&</sup>lt;sup>2</sup> Fees paid on each pollutant emitted in quantities greater than 10 tpy per 18 AAC 50.410.

<sup>&</sup>lt;sup>3</sup> A fee rate of \$42.95 per ton applies in accordance with 18 AAC 50.410(b)(1).

<sup>&</sup>lt;sup>4</sup> 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	CY2021 Actual	Maximum	CY2021 Actual
ID <sup>1</sup>	Description	Make/Model	Type	Operation	Capacity	Fuel Consumption
	Simple Cycle Gas		No. 1 ULS			6,724 gal/yr
1	Turbine	General Electric Frame 5 MS 5001-M	No. 1 Diesel	480.6 hr/yr	268 MMBtu/hr	13,161 gal/yr
	Turbine		No. 2 Diesel			572,148 gal/yr
	Simple Cycle Gas		No. 1 ULS			27,715 gal/yr
2	Turbine	General Electric Frame 5 MS 5001-M	No. 1 Diesel	638.7 hr/yr	268 MMBtu/hr	17,459 gal/yr
	Turbine		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 gol/s
4	Diesel Generator Engine	General Motors Electro-Motive Diesel 20-645E4	No. 1 ULSD	1.5 hr/yr	28 MMBtu/hr	1,076 gal/yr
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	30,170 gai/yi

<sup>&</sup>lt;sup>1</sup> Source: Air Quality Permit No. AQ0109TVP04

## Table 2b. FY2023 Assessable Emissions Summary Golden Valley Electric Association - Zehnder Facility

	Emission Unit	Fuel Type/	Rating/Size	CY2021 Actual
ID <sup>1</sup>	Description	Material	Trating/0120	Operation
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	10,200 gai/yi
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	9,557 801
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

<sup>&</sup>lt;sup>1</sup> Source: Renewal application for AQ0109TVP04

Table 3. FY2023 Assessable Emission Calculations - Oxides of Nitrogen (NQ) Emissions
Golden Valley Electric Association - Zehnder Facility

	Emission Unit	Maximum	Fuel	Factor	NO <sub>X</sub> Emission	CY2021 Actual	CY2021 Actual			
ID	Description	Capacity	Type	Reference	Factor	Operation	NO <sub>x</sub> Emissions			
			Significant Emision U	Jnits						
			No. 1 ULS			6,724 gal/yr	0.4 tpy			
1	Simple Cycle Gas Turbine	268 MMBtu/hr	No. 1 Diesel	AP-42 Table 3.1-1	0.88 lb/MMBtu	13,161 gal/yr	0.8 tpy			
			No. 2 Diesel			572,148 gal/yr	34.9 tpy			
			No. 1 ULS			27,715 gal/yr	1.7 tpy			
2	Simple Cycle Gas Turbine	268 MMBtu/hr	No. 1 Diesel	AP-42 Table 3.1-1	0.88 lb/MMBtu	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 mal/sm	0.24 tm/			
4	Diesel Generator Engine	28 MMBtu/hr	No. 1 ULSD	AP-42 Table 3.4-1	3.2 ID/IVIIVIDIU	1,076 gal/yr	0.24 tpy			
10	Boiler	1.7 MMBtu/hr	No. 2 Heating Oil	AP-42 Table 1.3-1	20 11 (403 1	00.470	0.00 4			
11	Boiler	1.7 MMBtu/hr	No. 2 Heating Oil	AP-42 Table 1.3-1	20 lb/10 <sup>3</sup> gal	30,170 gal/yr	0.30 tpy			
Significant Emision Units - 2021 Actual Emissions - NO <sub>X</sub>										
			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	AD 40 T-61- 4 2 4	40,000	0.40 +				
9	Burnham Boiler	0.443 MMBtu/hr	No. 2 Heating Oil	AP-42 Table 1.3-1	18 lb/10 <sup>3</sup> gal	18,280 gal/yr	0.16 tpy			
N/A	Burnham Boiler - FE Building	0.606 MMBtu/hr	Natural Gas	AP-42 Table 1.4-1	100 lb/10 <sup>6</sup> scf	9,557 scf	4.78E-04 tpy			
N/A	Burnham Boiler - FE Building	0.606 MMBtu/hr	Natural Gas	AP-42 Table 1.4-1	100 lb/10°sct	9,557 SCI	4.76E-04 tpy			
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 <sup>3</sup> gal	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 <sup>3</sup> gal	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 <sup>3</sup> gal	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 <sup>3</sup> gal	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 <sup>3</sup> gal	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 <sup>3</sup> gal	5,100 gal/yr	0.05 tpy			
				Insignificant	Emision Units - 2021 A	ctual Emissions - NO <sub>x</sub>	0.29 tpy			
					0001.0					
					2021 A	ctual Emissions - NO <sub>X</sub>	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/10³gal) / (Conversion 1,000 gal/10³gal) x (Fuel Consumption, gal/yr) / (2,000 lb/ton)

Boiler Emissions, tpy= (Emission factor, lb/10⁵scf) / (Conversion 1,000,000 scf/10⁵scf) x (Fuel Consumption, scf) / (2,000 lb/ton)

Table 4. FY2023 Assessable Emissions Calculations - Carbon Monoxide (CO) Emissions
Golden Valley Electric Association - Zehnder Facility

	Emission Unit	Maximum	Fuel	Factor	CO Emission	CY2021 Actual	CY2021 Actual		
ID	Description	Capacity	Type	Reference	Factor	Operation	CO Emissions		
			No. 1 ULS			6,724 gal/yr	1.5E-03 tpy		
1	Simple Cycle Gas Turbine	268 MMBtu/hr	No. 1 Diesel	AP-42 Table 3.1-1	0.0033 lb/MMBtu	13,161 gal/yr	3.0E-03 tpy		
			No. 2 Diesel			572,148 gal/yr	1.3E-01 tpy		
			No. 1 ULS			27,715 gal/yr	6.3E-03 tpy		
2	Simple Cycle Gas Turbine	268 MMBtu/hr	No. 1 Diesel	AP-42 Table 3.1-1	0.0033 lb/MMBtu	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	AF-42 Table 5.4-1	0.05 ID/IVIIVIBLU	1,070 gairyi	0.3E-02 tpy		
10	Boiler	1.7 MMBtu/hr	No. 2 Heating Oil	AP-42 Table 1.3-1	5 lb/10 <sup>3</sup> gal	30,170 gal/yr	7.5E-02 tpy		
11	Boiler	1.7 MMBtu/hr	No. 2 Heating Oil	1.2, 10 gai		30, 170 gairyi	7.5⊑-02 tpy		
Significant Emission Units - CY2021 Actual Emissions - CO									
			Insignificant Emission	n 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 <sup>3</sup> gal	18,280 gal/yr	0.05 tpy		
9	Burnham Boiler	0.443 MMBtu/hr	No. 2 Heating Oil	A1 -42 Table 1.5-1	3 lb/10 gai	10,200 gai/yi	0.00 гру		
N/A	Burnham Boiler - FE Building	0.606 MMBtu/hr	Natural Gas	AP-42 Table 1.4-1	84 lb/10 <sup>6</sup> scf	9,557 scf	4.01E-04 tpy		
N/A	Burnham Boiler - FE Building	0.606 MMBtu/hr	Natural Gas	AF-42 Table 1.4-1	04 ID/ 10 SCI	9,007 501	4.01L-04 tpy		
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 <sup>3</sup> gal	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 <sup>3</sup> gal	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 <sup>3</sup> gal	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 <sup>3</sup> gal	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 <sup>3</sup> gal	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 <sup>3</sup> gal	5,100 gal/yr	0.01 tpy		
				Insignificant Em	ission Units - CY2021	Actual Emissions - CO	0.08 tpy		
	<u> </u>	·	·	<u>-</u>	·				
					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<sup>3</sup>gal) / (Conversion 1,000 gal/10<sup>3</sup>gal) x (Fuel Consumption, gal/yr) / (2,000 lb/ton)

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

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	Туре	Reference	Factor	Operation	VOC Emissions
			No. 1 ULS			6,724 gal/yr	1.9E-04 tpy
1	Simple Cycle Gas Turbine	268 MMBtu/hr	No. 1 Diesel	AP-42 Table 3.1-2a	0.00041 lb/MMBtu	13,161 gal/yr	3.7E-04 tpy
			No. 2 Diesel			572,148 gal/yr	0.02 tpy
			No. 1 ULS			27,715 gal/yr	7.9E-04 tpy
2	Simple Cycle Gas Turbine	268 MMBtu/hr	No. 1 Diesel	AP-42 Table 3.1-2a	0.00041 lb/MMBtu	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 mal/vm	6.1E-03 tpy
4	Diesel Generator Engine	28 MMBtu/hr	No. 1 ULSD	AF-42 Table 3.4-1	U.UO ID/IVIIVIDIU	1,076 gal/yr	0.1⊑-03 tpy
10	Boiler	1.7 MMBtu/hr	No. 2 Heating Oil	AP-42 Table 1.3-3	-bl- 4 2 2 0 0 24 II (40 <sup>3</sup> 1	20 170 mal/sm	F 1F 02 tm/
11	Boiler	1.7 MMBtu/hr	No. 2 Heating Oil	AP-42 Table 1.3-3	0.34 lb/10 <sup>3</sup> gal	30,170 gal/yr	5.1E-03 tpy
				Significant Emis	sion Units - CY2021 A	ctual Emissions - VOC	0.05 tpy
			Insignificant Emiss	sion 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	AD 40 T-bl- 4 0 0	0.7 11 (4.03 1	40.000	C FF 00 t
9	Burnham Boiler	0.443 MMBtu/hr	No. 2 Heating Oil	AP-42 Table 1.3-3	0.7 lb/10 <sup>3</sup> gal	18,280 gal/yr	6.5E-03 tpy
N/A	Burnham Boiler - FE Building	0.606 MMBtu/hr	Natural Gas	AP-42 Table 1.4-2	7.6 lb/10 <sup>6</sup> scf	9.557 scf	2 CF 05 tm:/
N/A	Burnham Boiler - FE Building	0.606 MMBtu/hr	Natural Gas	AP-42 Table 1.4-2	7.6 lb/10°scf	9,557 SCI	3.6E-05 tpy
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 <sup>3</sup> gal	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 <sup>3</sup> gal	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 <sup>3</sup> gal	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 <sup>3</sup> gal	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 <sup>3</sup> gal	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 <sup>3</sup> gal	5,100 gal/yr	2.6E-03 tpy
				Insignificant Emis	· ·	ctual Emissions - VOC	0.01 tpy
					CY2021 A	ctual 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/10³gal) / (Conversion 1,000 gal/10³gal) x (Fuel Consumption, gal/yr) / (2,000 lb/ton)

Boiler Emissions, tpy= (Emission factor, lb/10⁵scf) / (Conversion 1,000,000 scf/10⁵scf) x (Fuel Consumption, scf) / (2,000 lb/ton)

Table 6. FY2023 Assessable Emission Calculations - Particulate Matter (PM<sub>10</sub>) Emissions Golden Valley Electric Association - Zehnder Facility

	Emission Unit	Maximum	Fuel	Factor	PM <sub>10</sub> Emission	CY2021 Actual	CY2021 Actual			
ID	Description	Capacity	Туре	Reference	Factor	Operation	PM <sub>10</sub> Emissions			
			No. 1 ULS			6,724 gal/yr	5.6E-03 tpy			
1	Simple Cycle Gas Turbine	268 MMBtu/hr	No. 1 Diesel	AP-42 Table 3.1-2a	0.012 lb/MMBtu	13,161 gal/yr	1.1E-02 tpy			
			No. 2 Diesel	1		572,148 gal/yr	4.8E-01 tpy			
			No. 1 ULS			27,715 gal/yr	0.02 tpy			
2	Simple Cycle Gas Turbine	268 MMBtu/hr	No. 1 Diesel	AP-42 Table 3.1-2a	0.012 lb/MMBtu	17,459 gal/yr	0.01 tpy			
			No. 2 Diesel	1		758,983 gal/yr	0.63 tpy			
3	Diesel Generator Engine	28 MMBtu/hr	No. 1 Diesel							
4	Diesel Generator Engine	28 MMBtu/hr	No. 1 ULSD	AP-42 Table 3.4-2	0.0573 lb/MMBtu	1,076 gal/yr	4.3E-03 tpy			
10	Boiler	1.7 MMBtu/hr	No. 1 ULSD	AP-42 Tables 1.3-2 &	0.003	00.470	0.05.00.4			
11	Boiler	1.7 MMBtu/hr	No. 2 Heating Oil	1.3-7	2.38 lb/10 <sup>3</sup> gal	30,170 gal/yr	3.6E-02 tpy			
Significant Emission Units - 2021 Actual Emissions - PM <sub>10</sub>										
			Insignificant Emissi	ion Units		· <u> </u>	.,			
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 &	17 11-/4031	18,280 gal/yr	0.02 tpy			
9	Burnham Boiler	0.443 MMBtu/hr	No. 2 Heating Oil	1.3-2	1.7 lb/10 <sup>3</sup> gal	18,280 gai/yr	υ.υz ιργ			
N/A	Burnham Boiler - FE Building	0.606 MMBtu/hr	Natural Gas	AP-42 Table 1.4-2	5.5 lb/10 <sup>6</sup> scf	9.557 scf	2.6E-05 tpy			
N/A	Burnham Boiler - FE Building	0.606 MMBtu/hr	Natural Gas	AF-42 Table 1.4-2	3.3 ID/ TU SCI	9,557 501	2.0L-03 tpy			
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 <sup>3</sup> gal <sup>1</sup>	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 <sup>3</sup> gal <sup>1</sup>	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 <sup>3</sup> gal	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 <sup>3</sup> gal <sup>2</sup>	5,100 gal/yr	1.3E-04 tpy			
				Insignificant Em	nission Units - 2021 Ac		0.03 tpy			
			·		2021 Ac	tual Emissions - PM <sub>10</sub>	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/10³gal) / (Conversion 1,000 gal/10³gal) x (Fuel Consumption, gal/yr) / (2,000 lb/ton) Boiler Emissions, tpy= (Emission factor, lb/10⁵scf) / (Conversion 1,000,000 scf/10⁵scf) x (Fuel Consumption, scf) / (2,000 lb/ton)

<sup>&</sup>lt;sup>1</sup> Ash Content of 0.233 percent by weight was determined through testing conducted in December 2016.

<sup>&</sup>lt;sup>2</sup> 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<sub>2</sub>) Emissions
Golden Valley Electric Association - Zehnder Facility

	Emission Unit	Fuel	Factor	Fuel	SO <sub>2</sub> Emission	CY2021 Actual	CY2021 Actual				
ID	Description	Туре	Reference	Sulfur Content 1,2	Factor	Operation	SO <sub>2</sub> Emissions				
		No. 1 ULS	Mass Balance	0.00072 wt. pct. S	0.000 lb/gal	6,724 gal/yr	0.00 tpy				
1	Simple Cycle Gas Turbine	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				
		No. 1 ULS	Mass Balance	0.00072 wt. pct. S	0.000 lb/gal	27,715 gal/yr	0.00 tpy				
2	Simple Cycle Gas Turbine	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	Mass balance	0.0015 Wt. pct. 5	2.13E-04 lb/gai	1,076 gal/yi	1.1 <b>⊏-</b> 04 ιργ				
10	Boiler	No. 2 Heating Oil	Mass Balance	0.2 ust not C	0.028 lb/gal	30,170 gal/yr	0.43 tpy				
11	Boiler	No. 2 Heating Oil	Mass balance	0.2 wt. pct. S	0.026 lb/gai	30,170 gal/yl	0.43 tpy				
Significant Emission Units - 2021 Actual Emissions - SO <sub>2</sub>											
		In	significant 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 tm/				
9	Burnham Boiler	No. 2 Heating Oil	Mass Balance	0.2 Wt. pct. 5	0.0 lb/gal	10,200 gal/yi	0.26 tpy				
N/A	Burnham Boiler - FE Building	Natural Gas	AP-42 Table 1.4-2	2,000 gr/10 <sup>6</sup> scf	0.6 lb/10 <sup>6</sup> scf	9,557 scf	2.9E-06 tpy				
N/A	Burnham Boiler - FE Building	Natural Gas	AF-42 Table 1.4-2	2,000 gr/10 scr	0.0 ID/ 10 SCI	9,557 SCI	2.9 <b>⊑-</b> 00 tpy				
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 E	mission Units - 2021 A	Actual Emissions - SO <sub>2</sub>	0.33 tpy				
		·			2021 A	actual Emissions - SO <sub>2</sub>	38.5 tpy				

Sample Calculations: <sup>3</sup>

Molar mass ratio is 32 lb S/mol : 64 lb SO<sub>2</sub>/mol

Stoichiometry: 1 mol S = 1 mol SO<sub>2</sub>

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

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

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

#### Notes:

<sup>1</sup> Based on the weighted average of monthly maximum fuel sulfur content values for calendar year 2021 as received from supplier sampling.

<sup>&</sup>lt;sup>2</sup> For waste oil and waste transformer oil, fuel sulfur content was determined by testing conducted in December 2016.

<sup>&</sup>lt;sup>3</sup> 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 <sub>X</sub> CO PM <sub>10</sub> SO <sub>2</sub> VOC HAPs Tota							
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) <sup>1</sup>							
Potential to Emit	NO <sub>X</sub>	CO	PM <sub>10</sub>	SO <sub>2</sub>	VOC	HAP		
Significant	0.4			0.0				
Insignificant	0			0				
Total Emissions	0			0				
Use Assessable PTE <sup>2</sup>		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 <sup>4</sup>		\$0						

#### Notes:

<sup>&</sup>lt;sup>1</sup> Regulated air pollutant calculations based on emission factors shown in accompanying spreadsheets.

<sup>&</sup>lt;sup>2</sup> Actual emissions are provided for NO<sub>X</sub> and SO<sub>2</sub> 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.

<sup>&</sup>lt;sup>3</sup> Fees paid on each pollutant emitted in quantities greater than 10 tpy per 18 AAC 50.410.

<sup>&</sup>lt;sup>4</sup> 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			CY2021 Actual	Nominal	CY2021 Actual
ID	Description	Make/Model	Туре	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 <sup>1</sup>	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/	Rating/Size	CY2021 Actual	
ID	Description	Description Material		Operation	
Tank	Fuel Oil Storage Tank	Fuel Oil	50,000 gallons	8,760 hr/yr	

Table 3. FY2023 Assessable Emissions Calculations - Oxides of Nitrogen (NO<sub>X</sub>) Emissions Golden Valley Electric Association - Delta Power Plant

Emission Unit			Fuel	Factor	NO <sub>X</sub> Emission	Actual	CY2021 Actual		
ID	Description	Rating/Capacity	Type	Reference	Factor	Operation	NO <sub>X</sub> Emissions		
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 <sup>1</sup>	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 <sub>X</sub>									
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 <sub>X</sub>									
Total Assessable Emissions - NO <sub>X</sub>							0.42 tpy		

#### Notes:

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)

<sup>&</sup>lt;sup>1</sup> Operating hours were determined based on two starts during calendar year 2021 lasting an estimated duration of 5 minutes each.

### Table 4. FY2023 Assessable Emission Calculations - Sulfur Dioxide (SC<sub>2</sub>) Emissions Golden Valley Electric Association - Delta Power Plant

Emission Unit		Fuel	Maximum Fuel	Factor	SO <sub>2</sub> Emission	Actual	CY2021 Actual	
ID	Description	Rating/Capacity	Type	Sulfur Content	Reference	Factor	Operation	SO <sub>2</sub> Emissions
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 Assess	able Emissions - SO <sub>2</sub>	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 - SQ							0 tpy	
							•	
Total Assessable Emissions - SO <sub>2</sub>						1.4E-03 tpy		

#### Notes:

Molar mass ratio is 32 lb S/mol : 64 lb SO<sub>2</sub>/mol

Stoichiometry: 1 mol S = 1 mol SO<sub>2</sub>

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

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)

<sup>1</sup> The emission units fired ULSD in 2021.

<sup>&</sup>lt;sup>2</sup> Mass balance:

 $<sup>^3</sup>$  A fuel density of 6.7 lb/gal is assumed based on an API gravity of 43.3 from the February 2006 source test.

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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	CY2022 Actual	Fee Estimate	
,	Permit No.	Emissions (Tons)		
Healy Power Plant	AQ0173TVP03	1,513	\$127,512	
North Pole Power Plant	AQ0110TVP04,	1,003	\$84,504	
	Rev. 1			
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 <a href="mailto:nmknight@gvea.com">nmknight@gvea.com</a>. The certification from Christopher Forrest, Director of Power Supply follows.

Sincerely,

Naomi Morton Knight, P.E.

**Environmental Officer** 

March 29, 2023 ADEC – FY2024 Assessable Emissions Page 2

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### 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 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) <sup>1, 2</sup>					
		NO <sub>X</sub>	CO	PM <sub>10</sub> <sup>3</sup>	VOC	SO <sub>2</sub>	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	s 1,513					
	Fee Estimate <sup>5</sup>	<sup>5</sup> \$127,512					

### Notes:

<sup>&</sup>lt;sup>1</sup> Regulated air pollutant calculations based on emission factors shown in accompanying spreadsheets.

<sup>&</sup>lt;sup>2</sup> Assessable emission fees for GHGs have not been established under 18 AAC 50.

<sup>&</sup>lt;sup>3</sup> PM<sub>2.5</sub> emissions are a subset of PM<sub>10</sub> emissions and are excluded from the assessable emissions total to avoid a double payment.

<sup>&</sup>lt;sup>4</sup> 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.

<sup>&</sup>lt;sup>5</sup> 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	CY2022 Actual
ID	Name	Description	Rating	Туре	Operation <sup>1</sup>
1	Unit No. 1	Foster-Wheeler Boiler (w/ SNCR)	327 MMBtu/hr	Coal/ULSD	8,102 hours
'	Offic 140. 1	r oster writeder Boiler (w/ Ortort)	327 WIWIDIG/TII	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 <sup>2</sup>
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 <sup>2</sup>
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:

<sup>&</sup>lt;sup>1</sup> Hours are based on CY2022 operation in accordance with condition 112 Permit No. AQ0173TVP03.

 $<sup>^{\</sup>rm 2}$  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	Dating
ID	Description	Make/Model	Type	Operation	Rating
N/A	Lime Storage Silo No. 1	N/A	Lime	6,580 hours <sup>1</sup>	1,800 acfm
N/A	Lime Storage Silo No. 2	N/A	Lime	0,500 nours	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 <sup>2</sup>	900 acfm
N/A	Urea Storage Silo A/B Bin Vent Filter	N/A	Urea	148 hours <sup>3</sup>	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:

<sup>&</sup>lt;sup>1</sup> This emissions unit is associated with EU ID 2.

<sup>&</sup>lt;sup>2</sup> Estimated operation of 1,095 hours is assumed with each of the three units operating one hour per day.

<sup>&</sup>lt;sup>3</sup> 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)

<sup>&</sup>lt;sup>4</sup>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)

<sup>&</sup>lt;sup>5</sup> 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 <sub>X</sub> Emission	CY2022 Actual	CY2022 Actual
ID	Description	Rating/Capacity	Туре	Reference	Factor	Operation	NO <sub>X</sub> Emissions
			Significant Emiss	ions 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 <sup>3</sup> 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 <sup>3</sup> 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 Em	issions - CY2022 Actu	al Emissions - NOX	300.8 tpy
			Insignificant Emis	sions 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	,	υ τρу
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 Em	issions - CY2022 Actu	al Emissions - NOX	0 tpy
					CY2022 Actu	al 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		Fuel	Factor	CO Emission	CY2022 Actual	CY2022 Actual
ID	Description	Rating/Capacity	Туре	Reference	Factor	Operation	<b>CO Emissions</b>
			Significant Emission	s 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 <sup>3</sup> 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 <sup>3</sup> 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 I	Emissions - CY2022 Ac	tual Emissions - CO	835.0 tpy
			Insignificant Emission	ns 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	0,560 110015	υ τρу
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
			In	significant Emissions Units I	Emissions - CY2022 Ac	tual Emissions - CO	0 tpy
					CY2022 Ac	tual 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	Туре	Reference	Factor	Operation	<b>PM Emissions</b>
			Significant Emis	sions 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 <sup>3</sup> gal	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 <sup>3</sup> gal	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	ů i		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	e 5a	8,760 hours	0.9 tpy
12	Coal Storage Pile	15 day supply	Coal	See Table	e 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 U	nits Emissions - CY2022 A	Actual Emissions - PM	22.2 tpy
			Insignificant Emis	ssions Units			
N/A	Lime Storage Silo No. 1	1,800 acfm	Lime	Design Specifications	0.005 gr/dcf	6,580 hours	0.2 tou
N/A	Lime Storage Silo No. 2	1,800 acfm	Lime	Design Specifications	0.005 gr/dcf	0,500 110015	0.3 tpy
N/A	Ash Handling	Not Applicable	Ash	See Table	e 5c	8,760 hours	0.05 tpy
N/A	Miscellaneous Roads	Not Applicable	Not Applicable	See Table	e 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 U	nits Emissions - CY2022 A	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

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 <sup>1</sup>	1,385 VMT <sup>1</sup>	0.9 tpy			
CY2022 Actual PM Emissions								

Notes:

#### **Unpaved Road Emission Factor**

AP-42, Section 13.2.2, Equation 1a:

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

$$k \qquad 1.5 \qquad \text{from AP-42, Table 13.2.2-2}$$

$$s = \text{surface material silt content (haul road)} \qquad 5.1 \qquad \text{percent, from AP-42, Table 13.2.2-1}$$

$$W = \text{mean vehicle weight} \qquad 193.75 \qquad \text{tons, estimate - average of full (262.5 ton) and empty (125 ton) truck}$$

$$a \text{ (empirical constant)} \qquad 0.9 \qquad \text{from AP-42, Table 13.2.2-2}$$

$$b \text{ (empirical constant)} \qquad 0.45 \qquad \text{from AP-42, Table 13.2.2-2}$$

$$E \text{ (uncontrolled)} = \qquad 4.53 \qquad \text{lb/VMT}$$

$$Efficiency = \qquad 60\% \qquad \text{assumed control efficiency for water application}$$

$$E \text{ (controlled)} = \qquad 1.81 \qquad \text{lb/VMT}$$

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:

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

E<sub>ext</sub> = 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

$$E (controlled) = \frac{PM}{1.32} Ib/VMT$$

<sup>&</sup>lt;sup>1</sup> Coal Haul Road

### 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

EU ID 2 CY2022 actual coal throughput

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

Unpaved distance from coal pile to paved road (round trip)

138 tons, estimate

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	Footor Reference	Emissian Foster	CV2022 Actual Operation	CY2022 Actual PM Emissions						
ID	Description	Factor Reference	Emission Factor	C12022 Actual Operation	C 1 2022 Actual PM Emissions						
	Truck Drop Onto Stockpile	AP-42, Section 13.2.4	1.20E-04 lb/ton <sup>1</sup>	380,907 tpy <sup>1</sup>	0.02 tpy						
12	Front End Loader Drop Into Grizzly	AP-42, Section 13.2.4	1.20E-04 lb/ton <sup>1</sup>	380,907 tpy <sup>1</sup>	0.02 tpy						
12	Front End Loader Movement - Coal Pile to Grizzly	AP-42, Section 13.2.2	0.93 lb/VMT <sup>2</sup>	1,385 VMT <sup>2</sup>	0.6 tpy						
	Stockpile Wind Erosion	AP-42, Section 13.2.5	0 g/m²-yr <sup>3</sup>	10,150 m <sup>23</sup>	0 tpy						
	CY2022 Actual PM Emissions 0.7 tpy										

#### Notes:

<sup>1</sup> 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

U = mean wind speed 17.67 miles/hr M = coal moisture content 31.80 percent E = 1.20E-04 lb/ton

AP-42, Section 13.2.4

Per MET data recorded at GVEA's Eva Creek Wind Farm CY2019, conservative estimation with higher winds than seen at the Healy Power Plant

Weighted average from EU ID 1 and 2 CY2022 coal proximate analyses

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

EU ID 2 CY2022 actual coal throughput

Total CY2022 actual coal throughput

380,907 tons

<sup>2</sup> 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<sup>3</sup>

Density of coal 52.63 lb/ft<sup>3</sup>

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:

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

$$k \qquad 1.5 \qquad \text{from AP-42, Table 13.2.2-2}$$

$$s = \text{surface material silt content (haul road)} \qquad 8.4 \qquad \text{percent, from AP-42, Table 13.2.2-1}$$

$$W = \text{mean vehicle weight} \qquad 33.2 \qquad \text{tons, estimate}$$

$$a \text{ (empirical constant)} \qquad 0.9 \qquad \text{from AP-42, Table 13.2.2-2}$$

$$b \text{ (empirical constant)} \qquad 0.45 \qquad \text{from AP-42, Table 13.2.2-2}$$

$$E \text{ (uncontrolled)} = \qquad 3.21 \qquad \text{lb/VMT}$$

$$Efficiency = \qquad 60\% \qquad \text{assumed control efficiency for water application}$$

$$E \text{ (controlled)} = \qquad 1.28 \qquad \text{lb/VMT}$$

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<sub>ext</sub> = 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

$$\frac{PM}{E \text{ (controlled)} = 0.93} \text{ lb/VMT}$$

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

<sup>3</sup> Stockpile Wind Erosion Coal Pile Surface Area

Surface area of active face = 10,150 m<sup>2</sup> 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

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

k = particle size multiplier (AP-42 Section 13.2.5.3)

N = number of disturbances per year

P<sub>i</sub>= erosion potential corresponding to the fastest mile of wind for the ith period between disturbances, g/m<sup>2</sup>

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<sub>t</sub> = 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

I 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

						Coal Pile <sup>b</sup> 13.2.5-2)				(	Ground Coal Table 13.2.5-2)													
Month-Year	Average Wind Speed (u(10)) <sup>a</sup>												Wind Direction	Roughness Height $(z_0)$	Threshold Friction Velocity (u <sub>t</sub> )	Calculated Friction Velocity (u*)	Erosion potential function,	Roughness Height (z <sub>o</sub> )	Threshold Friction Velocity (u <sub>t</sub> )	Calculated Friction Velocity (u*)	Erosion potential function,	PxN	k	Emission Factor, EF
	mph	m/s	deg	cm	m/s	m/s	ı	cm	m/s	m/s				g/m²-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 <sub>10</sub> Annual	Total						0				0	0	0.5	0										

<sup>&</sup>lt;sup>a</sup> 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	Factor Reference	Emission	Emission Factor	CY2022 Actual Operation	CY2022 Actual PM Emissions	
ID	Description	Tactor Reference Linission		EIIIISSIOII FACIOI	C12022 Actual Operation	C12022 Actual FW EIIIISSIOIIS	
	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	
N/A	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 <sup>2</sup>	4,800 m <sup>2 2</sup>	0 tpy	
					CY2022 Actual PM Emissions	4.6E-02 tpy	

#### Notes:

<sup>1</sup> Front End Loader / Flyash Storage Silo Drop into Truck

AP-42, Section 13.2.4

$$E\left(\frac{lb}{ton}\right) = \frac{k \times 0.0032 \times \left(\frac{U}{5}\right)^{1.2}}{\left(\frac{M}{2}\right)^{1.4}}$$

PM k 0.35

U = mean wind speed 17.67 M = ash moisture content 17.5

miles/hr percent Per MET data recorded at GVEA's Eva Creek Wind Farm CY2019, conservative estimation with higher winds than seen at the Healy Power Plant 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

Ash moved per trip:

$$Ash (tons) = \frac{Ash Density(\frac{lb}{ft^3}) \times 27(\frac{ft^3}{yd^3}) \times Bucket Size(yd^3)}{2000(\frac{lb}{ton})}$$
Size of load bucket 8 yd<sup>3</sup>

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

<sup>&</sup>lt;sup>2</sup> Front End Loader Movement - Ash Pile to Truck

## 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

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

$$k \qquad 1.5 \qquad \text{from AP-42, Table 13.2.2-2}$$

$$s = \text{surface material silt content (haul road)} \qquad 8.4 \qquad \text{percent, from AP-42, Table 13.2.2-1}$$

$$W = \text{mean vehicle weight} \qquad 27 \qquad \text{tons, estimate}$$

$$a \text{ (empirical constant)} \qquad 0.9 \qquad \text{from AP-42, Table 13.2.2-2}$$

$$b \text{ (empirical constant)} \qquad 0.45 \qquad \text{from AP-42, Table 13.2.2-2}$$

$$E \text{ (uncontrolled)} = \qquad 2.92 \qquad \text{lb/VMT}$$

$$Efficiency = \qquad 60\% \qquad \text{assumed control efficiency for water application}$$

$$E \text{ (controlled)} = \qquad 1.17 \qquad \text{lb/VMT}$$

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:

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

 $E_{\text{ext}}$  = 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

$$E \text{ (controlled)} = \frac{PM}{0.85} \text{ lb/VMT}$$

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<sup>2</sup>

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

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

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<sub>i</sub> = erosion potential corresponding to the fastest mile of wind for the ith period between disturbances, g/m<sup>2</sup>

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

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

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

u\* = friction velocity (m/s) where

u<sub>t</sub> = threshold friction velocity (m/s)

AP-42 Section 13.2.5, Equation (1)

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

u\* = friction velocity (cm/s)

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

z = height above test surface (cm)

 $z_0$  = roughness height, cm

Data:

u(z) Use maximum wind gust speed recorded at McKinley Airport ASOS for each month in CY2021 (see table below)

10 Ζ

Ν 365 disturbances/year for active face, estimated

> 30 average disturbances/month

						n pile <sup>a</sup> 13.2.5-2)					
Month-Year	Average Wind Speed (u(10)) <sup>b</sup>		Wind Direction	Roughness Height (z <sub>o</sub> )	Threshold Friction Velocity (u <sub>t</sub> )	Calculated Friction Velocity (u*)	Erosion potential function,		k	Emission Factor (uncontrolled), EF	Emission Factor (controlled), EF <sup>c</sup>
	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 <sub>10</sub> Ai	nnual Total						0	0	0.5	0	0

<sup>&</sup>lt;sup>a</sup> No emission factor exists for ash. Overburden is considered the most representative alternative because it includes both fine (ash) and coarse (slag) particles.

<sup>&</sup>lt;sup>b</sup> Per https://mesonet.agron.iastate.edu/request/download.phtml?network=AK\_ASOS for CY2022, McKinley Airport ASOS (PAIN).

<sup>&</sup>lt;sup>c</sup> 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	Factor Reference	Emission Factor	CY2022 Actual	CY2022 Actual PM					
ID	Description	ractor Reference	Ellission Factor	Operation	Emissions					
	Ash Haul - Unpaved (EU ID 1)	AP-42, Section 13.2.2	1.18 lb/VMT <sup>1</sup>	127 VMT <sup>1</sup>	0.07 tpy					
	Ash Haul - Unpaved (EU ID 2)	AP-42, Section 13.2.2	1.18 lb/VMT <sup>1</sup>	133 VMT <sup>1</sup>	7.8E-02 tpy					
N/A	Limestone/Lime Delivery - Paved Portion	AP-42, Section 13.2.1	0.08 lb/VMT <sup>2</sup>	28 VMT <sup>2</sup>	1.1E-03 tpy					
	Limestone/Lime Delivery - Unpaved Portion	AP-42, Section 13.2.2	1.07 lb/VMT <sup>2</sup>	13 VMT <sup>2</sup>	7.1E-03 tpy					
	Miscellaneous Traffic - Paved Portion	AP-42, Section 13.2.1	0.001 lb/VMT <sup>3</sup>	5,185 VMT <sup>3</sup>	3.4E-03 tpy					
CY2022 Actual PM Emissions										

Notes:

#### **Unpaved Road Emission Factor**

AP-42, Section 13.2.2, Equation 1a:

in ro.z.z, Equation ra.		
$E\left(\frac{lb}{VMT}\right) = k\left(\frac{s}{12}\right)^{\alpha} \left(\frac{W}{3}\right)^{b}$	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	Ib/VMT
Efficiency =	60%	assumed control efficiency for water application
E (controlled) =	1.62	Ib/VMT

<sup>1</sup> Ash Haul Road

## 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:

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

E<sub>ext</sub> = 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**

<sup>2</sup> Limestone/Lime/Sodium Bicarbonate Haul Road

#### **Paved Road Emission Factor**

AP-42, Section 13.2.1, Equation 1: 
$$E\left(\frac{lb}{VMT}\right) = k(sL)^{0.91}(W)^{1.02}$$

(VMT)	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 <sup>2</sup> , 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	Ib/VMT
Efficiency =	50%	assumed control efficiency for pavement cleaning
E (controlled) =	0.09	Ib/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<sub>ext</sub> = 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:

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

$$k \qquad 1.5 \qquad \text{from AP-42, Table 13.2.2-2}$$

$$s = \text{surface material silt content (haul road)} \qquad 5.1 \qquad \text{percent, from AP-42, Table 13.2.2-1}$$

$$W = \text{mean vehicle weight} \qquad 122.5 \qquad \text{tons, estimate - average of full (135 ton) and empty (110 ton) loader/trailer}$$

$$a \text{ (empirical constant)} \qquad 0.9 \qquad \text{from AP-42, Table 13.2.2-2}$$

$$b \text{ (empirical constant)} \qquad 0.45 \qquad \text{from AP-42, Table 13.2.2-2}$$

$$E \text{ (uncontrolled)} = \qquad 3.69 \qquad \text{lb/VMT}$$

$$Efficiency = \qquad 60\% \qquad \text{assumed control efficiency for water}$$

$$E \text{ (controlled)} = \qquad 1.47 \qquad \text{lb/VMT}$$

## 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<sub>ext</sub> = 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

<sup>&</sup>lt;sup>3</sup> Miscellaneous Traffic

#### **Paved Road Emission Factor**

AP-42, Section 13.2.1, Equation 1:

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

k = particle size multiplier	0.0022	
sL = surface material silt content (haul road)	0.6	g/m <sup>2</sup> , 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

PM

## 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<sub>ext</sub> = 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

 $E (controlled) = \frac{PM}{0.001} Ib/VMT$ 

**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	71:-		Factor	Operation	VOC Emissions
		•	Significant Emissions U	<b>Jnits</b>			
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 <sup>1</sup>
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 <sup>2</sup>
3	Auxiliary Boiler No. 1	12.554 MMBtu/hr	ULSD	AP-42, Table 1.3-3	0.34 lb/10 <sup>3</sup> 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 <sup>3</sup> 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 I	Jnits Emissions - CY2022 /	Actual VOC Emissions	9.2 tpy
			nsignificant Emissions				
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	0,500 110015	υ τργ
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 I	Jnits Emissions - CY2022 /	Actual VOC Emissions	0 tpy
					CY2022 /	Actual VOC Emissions	9.2 tpy

#### Notes

153,568 tons

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)

<sup>&</sup>lt;sup>1</sup> EU ID 1 actual coal throughput

<sup>&</sup>lt;sup>2</sup> EU ID 2 actual coal throughput

Table 7. FY2024 Assessable Emissions Calculations - Sulfur Dioxide (SO<sub>2</sub>) Emissions Golden Valley Electric Association - Healy Power Plant

	Emissions Unit		Fuel	Factor	Maximum Fuel	SO <sub>2</sub> Emission	CY2022 Actual	CY2022 Actual
ID	Description	Rating/Capacity	Туре	Reference	Sulfur Content	Factor	Operation	SO <sub>2</sub> 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 <sup>1,2</sup>	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 <sup>1,2</sup>	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 <sup>1,2</sup>	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 <sup>1,2</sup>	6 hours	8.9E-06 tpy 3.4
		·		Significa	nt Emissions Units En		ual Emissions - SO <sub>2</sub>	344.9 tpy
			Insignifican	t Emissions Units				
N/A	Lime Storage Silo No. 1	1,800 acfm	Lime	N/A	N/A	N/A	C 500 h	0.1
N/A	Lime Storage Silo No. 2	1,800 acfm	Lime	N/A	N/A	N/A	6,580 hours	0 tpy
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
				Insignifica	nt Emissions Units En	nissions - CY2022 Actu	ual Emissions - SO <sub>2</sub>	0 tpy
						CY2022 Actu	ual Emissions - SO <sub>2</sub>	344.9 tpy

#### Notes:

For diesel units, the SO<sub>2</sub> 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<sub>2</sub> Emission Factor, lb/gal = (Molar mass ratio, 2 lb SO<sub>2</sub>:1 lb S) x (weight % S in fuel) x (density of fuel, lb/gal) / 100%

<sup>2</sup> Diesel Fuel Density 7.1 lb/gal AP 42, Table 3.4-1, footnote a

<sup>3</sup> Diesel Heating Value 133,117 Btu/gal lab analysis

<sup>4</sup> 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, Ib/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)

<sup>&</sup>lt;sup>1</sup> Mass balance:

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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) <sup>1,2</sup>						
	NO <sub>X</sub> CO PM <sub>10</sub> 3 VOC SO <sub>2</sub> HAP						
Significant	852.4	8.7	22.3	0.77	118.1		
Insignificant	0	0	0	0	0		
Total Emissions	s 853 9 22 1 118						
Assessable Emission Subtotals	853	9	22	1	118	0	
2022 Actual Emissions	1,003						
Fee Estimate <sup>5</sup>	\$84,504						

#### Notes:

<sup>&</sup>lt;sup>1</sup> Regulated air pollutant calculations based on emission factors shown in accompanying spreadsheets.

<sup>&</sup>lt;sup>2</sup> Assessable emission fees for GHGs have not been established under 18 AAC 50.

 $<sup>^{3}</sup>$  PM<sub>2.5</sub> emissions are a subset of PM<sub>10</sub> emissions and are excluded from the assessable emissions total to avoid a double payment.

<sup>&</sup>lt;sup>4</sup> 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.

<sup>&</sup>lt;sup>5</sup> 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	Maximum	CY2022 Actual	CY2022 Actual
ID	ID Description Make/Model		Type	Capacity	Operation	Fuel Consumption
	Simple Cycle Gas		ULSD			66,576 gal/yr
1	Turbine	GE Frame 7, Series 7001, Model BR	No. 1 Diesel	672 MMBtu/hr	169.0 hr/yr	115,669 gal/yr
	Turbine		No. 2 Diesel			305,184 gal/yr
	Simple Cycle Gas		ULSD			1,476,484 gal/yr
2	Turbine		No. 1 Diesel	672 MMBtu/hr	1,913.3 hr/yr	967,541 gal/yr
	Turbine		No. 2 Diesel			3,384,881 gal/yr
	Combined Cycle Gas		ULSD			262,514 gal/yr
5	Turbine	, (3E LM6000PC:	No. 1 Diesel	455 MMBtu/hr	8,100.0 hr/yr	0 gal/yr
	Turblife		Naphtha			26,058,464 gal/yr
	Combined Cycle Gas		ULSD			0 gal/yr
6	Turbine	GE LM6000PC	No. 1 Diesel	455 MMBtu/hr	0 hr/yr	0 gal/yr
	Turblife		Naphtha			0 gal/yr
7	Emergency Generator	Mitsubishi 0A8829	ULSD	564.6 hp <sup>1</sup>	1.8 hr/yr	58 gal/yr
	Engine		OLOD	304.0 Hp	1.0 111/y1	30 gai/yi
11	Boiler	Bryan Steam RV500	Propane	5.0 MMBtu/hr	134.7 hr/yr	7,354 gal/yr
12	Boiler	Bryan Steam RV500	Порапе	5.0 MMBtu/hr	104.7 III/yI	7,004 gai/yi

#### Notes:

<sup>&</sup>lt;sup>1</sup> 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/	Poting/Sizo	CY2022 Actual	CY2022 Actual	
ID <sup>1</sup>	Description	Material	Rating/Size	Operation	Fuel Consumption	
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 gallyr	
N/A	FHR Warehouse Boiler 2	No. 2 Diesel	0.784 MMBtu/hr	8,760 hr/yr	6,052 gal/yr	
N/A	Burnham 17 A-T Boiler	ULSD	0.222 MMBtu/hr	1,703 hr/yr	3,235 gal/yr	

<sup>&</sup>lt;sup>1</sup> 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<sub>x</sub>) Emissions
Golden Valley Electric Association - North Pole Power Plant

Emission Unit		Maximum	Fuel	Factor	NO <sub>X</sub> Emission	CY2022 Actual	CY2022 Actual		
ID	Description Capacity		Type	Reference	Factor	Operation	NO <sub>x</sub> Emissions <sup>2</sup>		
			Significant Er	nission Units					
			ULSD	2022 CEMS Average <sup>1</sup>					
1	Simple Cycle Gas Turbine	672 MMBtu/hr	No. 1 Diesel		307.8 lb/hr	169.0 hours	26.0 tpy		
			No. 2 Diesel						
			ULSD			1,476,484 gal/yr	86.9 tpy		
2	Simple Cycle Gas Turbine	672 MMBtu/hr	No. 1 Diesel	AP-42 Table 3.1-1	0.88 lb/MMBtu	967,541 gal/yr	58.2 tpy		
			No. 2 Diesel			3,384,881 gal/yr	203.4 tpy		
			ULSD						
5	Combined Cycle Gas Turbine	455 MMBtu/hr	No. 1 Diesel	2022 CEMS Average 1	118.0 lb/hr	8,100.0 hours	477.9 tpy		
			Naphtha						
	Combined Cycle Gas Turbine		ULSD	AP-42 Table 3.1-1	0.24 lb/MMBtu	0 gal/yr	0 tpy		
6		455 MMBtu/hr	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	D	Propane	AP-42 Table 1.5-1	12 15 (403 1	7,354 gal/yr	0.05 tpy	
12	Boiler	5.0 MMBtu/hr	Fropane	AF-42 Table 1.5-1	13 lb/10 <sup>3</sup> gal	7,354 gai/yi	0.05 τργ		
				Significant	Emission Units - 2022	Actual Emissions - NO <sub>X</sub>	852.4 tpy		
			Insignificant E	mission 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 16/4031	6,052 gal/yr	0.05 tpy		
N/A	FHR Warehouse Boiler 2	0.784 MMBtu/hr	No. 2 Diesel	Ar-42 Table 1.3-1	18 lb/10 <sup>3</sup> gal	0,002 gai/yi	υ.υο ιργ		
N/A	Burnham 17 A-T Boiler	0.222 MMBtu/hr	ULSD	AP-42 Table 1.3-1	18 lb/10 <sup>3</sup> gal	3,235 gal/yr	0.03 tpy		
Insignificant Emission Units - 2022 Actual Emissions - NO <sub>X</sub>									
		·			2022	Actual Emissions - NO <sub>X</sub>	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)

Pails Emissions to the first of the latter's and the conversion of the

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

#### Notes:

<sup>1</sup> The emission factors for EU IDs 1 and 5 are an average emission rate from 2022 measured using Continuous Emissions Monitoring Systems (CEMS).

 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)

<sup>&</sup>lt;sup>2</sup> Parameters:

Table 4. FY2024 Assessable Emissions Calculations - Carbon Monoxide (CO) Emissions
Golden Valley Electric Association - North Pole Power Plant

Emission Unit		Maximum	Fuel	Factor	CO Emission	CY2022 Actual	CY2022 Actual
ID	Description	Capacity	Туре	Reference	Factor	Operation	CO Emissions 2
	Simple Cycle Gas Turbine	No. 2 Diesel	ULSD				
1			No. 1 Diesel	2022 CEMS Average <sup>1</sup>	6.5 lb/hr	169.0 hours	0.5 tpy
			ULSD			1,476,484 gal/yr	0.3 tpy
2	Simple Cycle Gas Turbine	672 MMBtu/hr	No. 1 Diesel	AP-42 Table 3.1-1	0.0033 lb/MMBtu	967,541 gal/yr	0.2 tpy
			No. 2 Diesel			1,476,484 gal/yr 967,541 gal/yr 3,384,881 gal/yr 8,100.0 hours  0 gal/yr 0 gal/yr 0 gal/yr 1.8 hr/yr 7,354 gal/yr  022 Actual Emissions - CO	0.8 tpy
			ULSD				
5	Combined Cycle Gas Turbine	455 MMBtu/hr	No. 1 Diesel	2022 CEMS Average <sup>1</sup>	1.7 lb/hr	8,100.0 hours	6.8 tpy
			Naphtha				
	Combined Cycle Gas Turbine		ULSD	AP-42 Table 3.1-1	0.076 lb/MMBtu	0 gal/yr	0 tpy
6		455 MMBtu/hr	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 <sup>3</sup> gal	7 354 gal/yr	0.03 tpy
12	Boiler	5.0 MMBtu/hr	Tropane	741 42 Table 1.0 T	7.0 lb/10 gai	7,554 gai/yi	0.00 tpy
				Significant Er	mission Units - CY2022	Actual Emissions - CO	8.7 tpy
			Insignificant Er	mission 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 <sup>3</sup> gal	6.052 gal/yr	0.02 tpy
N/A	FHR Warehouse Boiler 2	0.784 MMBtu/hr	No. 2 Diesel	AF-42 TABLE 1.3-1	5.0 lb/10 gai	0,002 gai/yi	0.02 tpy
N/A	Burnham 17 A-T Boiler	0.222 MMBtu/hr	ULSD	AP-42 Table 1.3-1	5.0 lb/10 <sup>3</sup> gal	3,235 gal/yr	0.008 tpy
				Insignificant Er	nission Units - CY2022	Actual Emissions - CO	0.02 tpy
		-	· · · · · · · · · · · · · · · · · · ·			-	
		·	•	·	CY2022	Actual Emissions - CO	8.7 tpy

#### Sample Calculations:

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

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<sup>3</sup>gal) / (Conversion 1,000 gal/10<sup>3</sup>gal) x (Operation, gal/yr) / (2,000 lb/ton)

#### Notes:

<sup>1</sup> The emission factors for EU IDs 1 and 5 are an average emission rate from 2022 measured using Continuous Emissions Monitoring Systems (CEMS).

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)

<sup>&</sup>lt;sup>2</sup> Parameters:

Table 5. FY2024 Assessable Emission Calculations - Particulate Matter (PM<sub>I0</sub>) Emissions Golden Valley Electric Association - North Pole Power Plant

Emission Unit		Emission Unit Maximum Fuel		Factor	PM <sub>10</sub> Emission	CY2022 Actual	CY2022 Actual			
ID	Description	Capacity	Type	Reference	Factor	Operation	PM <sub>10</sub> Emissions			
		672 MMBtu/hr	ULSD			66,576 gal/yr	0.053 tpy			
1	Simple Cycle Gas Turbine		No. 1 Diesel	AP-42 Table 3.1-2a	0.012 lb/MMBtu	115,669 gal/yr	0.09 tpy			
			No. 2 Diesel			305,184 gal/yr	0.3 tpy			
			ULSD			1,476,484 gal/yr	1.2 tpy			
2	Simple Cycle Gas Turbine	672 MMBtu/hr	No. 1 Diesel	AP-42 Table 3.1-2a	0.012 lb/MMBtu	967,541 gal/yr	0.8 tpy			
			No. 2 Diesel			3,384,881 gal/yr	2.8 tpy			
			ULSD			262,514 gal/yr	0.2 tpy			
5	Combined Cycle Gas Turbine	455 MMBtu/hr	No. 1 Diesel	AP-42 Table 3.1-2a	0.012 lb/MMBtu	0 gal/yr	0 tpy			
			Naphtha			26,058,464 gal/yr	17.0 tpy			
	Combined Cycle Gas Turbine		ULSD			0 gal/yr	0 tpy			
6		455 MMBtu/hr	No. 1 Diesel	AP-42 Table 3.1-2a	0.012 lb/MMBtu	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	_	AP-42 Table 1.5-1	0.7 11 /403	7.054 ==1/-	0.002 4=			
12	Boiler	5.0 MMBtu/hr	Propane	AP-42 Table 1.5-1	0.7 lb/10 <sup>3</sup> gal	7,354 gal/yr	0.003 tpy			
				Significant E	Significant Emission Units - 2022 Actual Emissions - PM <sub>10</sub>					
			Insignificant En	nission 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						
N/A	FHR Warehouse Boiler 2	0.784 MMBtu/hr	No. 2 Diesel	and 1.3-2	1.7 lb/10 <sup>3</sup> gal	6,052 gal/yr	0.005 tpy			
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 <sup>3</sup> gal	3,235 gal/yr	0.003 tpy			
				Insignificant E	mission Units - 2022 A	ctual Emissions - PM <sub>10</sub>	0.008 tpy			
	,									
					2022 A	ctual Emissions - PM <sub>10</sub>	22.3 tpy			

Sample Calculations:

Turbine Emissions, tpy= (Emission factor, Ib/MMBtu) x (Heat Value, Btu/gal) / (Conversion, 1,000,000 Btu/MMBtu) x (Fuel Consumption, gal/yr) / (2,000 Ib/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, Ib/10<sup>3</sup>gal) / (Conversion 1,000 gal/10<sup>3</sup>gal) x (Operation, gal/yr) / (2,000 lb/ton)

Notes:

<sup>1</sup> 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		Maximum	Fuel	Factor	VOC Emission	CY2022 Actual	CY2022 Actual		
ID	Description	Capacity	Type	Reference	Factor	Operation	VOC Emissions 1		
			ULSD	AP-42 Table 3.1-2a		66,576 gal/yr	1.8E-03 tpy		
1	Simple Cycle Gas Turbine	672 MMBtu/hr	No. 1 Diesel		0.00041 lb/MMBtu	115,669 gal/yr	0.003 tpy		
			No. 2 Diesel			305,184 gal/yr	0.01 tpy		
			ULSD			1,476,484 gal/yr	0.04 tpy		
2	Simple Cycle Gas Turbine	672 MMBtu/hr	No. 1 Diesel	AP-42 Table 3.1-2a	0.00041 lb/MMBtu	967,541 gal/yr	0.03 tpy		
			No. 2 Diesel	1		3,384,881 gal/yr	0.1 tpy		
			ULSD		0.00041 lb/MMBtu	262,514 gal/yr	0.007 tpy		
5	Combined Cycle Gas Turbine	455 MMBtu/hr	No. 1 Diesel	AP-42 Table 3.1-2a		0 gal/yr	0 tpy		
			Naphtha			26,058,464 gal/yr	0.6 tpy		
	Combined Cycle Gas Turbine		ULSD	AP-42 Table 3.1-2a	0.00041 lb/MMBtu	0 gal/yr	0 tpy		
6		455 MMBtu/hr	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	D	AP-42 Table 1.5-1	1.0 11- (4.031	7.254 gol/yr	0.004 tpy		
12	Boiler	5.0 MMBtu/hr	Propane	AP-42 Table 1.5-1	1.0 lb/10 <sup>3</sup> gal	7,354 gal/yr	0.004 tpy		
				Significant E	mission Units - 2022 A	Actual Emissions - VOC	0.8 tpy		
			Insignificant Em	nission Units		<u>.</u>			
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 <sup>3</sup> gal	6,052 gal/yr	0.002 tpy		
N/A	FHR Warehouse Boiler 2	0.784 MMBtu/hr	No. 2 Diesel	AF-42 Table 1.3-3	•	0,052 gai/yi			
N/A	Burnham 17 A-T Boiler	0.222 MMBtu/hr	ULSD	AP-42 Table 1.3-3	0.713 lb/10 <sup>3</sup> gal	3,235 gal/yr	0.001 tpy		
Insignificant Emission Units - 2022 Actual Emissions - VOC									
					2022 A	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, Ib/10<sup>3</sup>gal) / (Conversion 1,000 gal/10<sup>3</sup>gal) x (Operation, gal/yr) / (2,000 lb/ton)

Notes:

<sup>1</sup> 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<sub>2</sub>) Emissions
Golden Valley Electric Association - North Pole Power Plant

, <del></del>	Emission Unit	Maximum	Fuel	Factor	Maximum Fuel	SO <sub>2</sub> Emission	CY2022 Actual	CY2022 Actual
ID	Description	Capacity	Туре	Reference	Sulfur Content 1	Factor <sup>2</sup>	Operation	SO <sub>2</sub> Emissions
			ULSD	Mass Balance	0.0015 wt. pct. S	2.0E-04 lb/gal	66,576 gal/yr	6.8E-03 tpy
1	Simple Cycle Gas Turbine	672 MMBtu/hr	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
			ULSD	Mass Balance	0.0015 wt. pct. S	2.0E-04 lb/gal	1,476,484 gal/yr	0.15 tpy
2	Simple Cycle Gas Turbine	672 MMBtu/hr	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
			ULSD	Mass Balance	0.0015 wt. pct. S	2.0E-04 lb/gal	262,514 gal/yr	0.03 tpy
5 Co	Combined Cycle Gas Turbine	455 MMBtu/hr	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		ULSD	Mass Balance	0.0015 wt. pct. S	2.0E-04 lb/gal	0 gal/yr	0 tpy
		455 MMBtu/hr	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 <sup>3</sup>	2.6E-07 lb/gal	7,354 gal/yr	9.6E-07 tpy	
12	Boiler	5.0 MMBtu/hr	Fiopane	Mass Dalance	·			9.0⊑-07 tpy
					Significant Em	ission Units - CY2022	Actual Emissions - SO <sub>2</sub>	118.1 tpy
			Insig	nificant Emission Unit	S			
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	Mass Dalance	0.400 Wt. pct. 3	0.000 ib/gai	0,032 gai/yi	0.16 τργ
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
	<u> </u>				Insignificant Em	ission Units - CY2022	Actual Emissions - SO <sub>2</sub>	0.2 tpy
						CY2022	Actual Emissions - SO <sub>2</sub>	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<sub>2</sub>

Mass Balance Emission Factor, lb/gal = (Molar mass ratio, 2 lb SO<sub>2</sub>: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, Ib/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<sub>2</sub>) x (Conversion, 1.66E-7 lb SO<sub>2</sub>/scf / ppm SO<sub>2</sub>) x (F-factor, 8,710 scf/MMBtu) x (Conversion, 0.0216 MMBtu/lb) x (Conversion, mole SO<sub>2</sub>/64 lb SO<sub>2</sub>) x (Conversion, mole S/mole SO<sub>2</sub>) x (Conversion, 32 lb S/ mole S)

#### Notes:

- <sup>1</sup> Based on the average of monthly maximum fuel sulfur content values for calendar year 2022 as received from supplier sampling.
- <sup>2</sup> 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.
- <sup>3</sup> 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) <sup>1,2</sup>								
	NO <sub>X</sub>	СО	PM <sub>10</sub> <sup>3</sup>	VOC	SO <sub>2</sub>	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 <sup>5</sup>	imate <sup>5</sup> \$8,266								

#### Notes:

<sup>&</sup>lt;sup>1</sup> Regulated air pollutant calculations based on emission factors shown in accompanying spreadsheets.

<sup>&</sup>lt;sup>2</sup> Assessable emission fees for GHGs have not been established under 18 AAC 50.

<sup>&</sup>lt;sup>3</sup> PM<sub>2.5</sub> emissions are a subset of PM<sub>10</sub> emissions and are excluded from the assessable emissions total to avoid a double payment.

<sup>&</sup>lt;sup>4</sup>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.

<sup>&</sup>lt;sup>5</sup> 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 <sup>1</sup>	Description	Make/Model	Туре	Operation	Capacity	Fuel Consumption	
	Simple Cycle Gas		No. 1 ULS			8,213 gal/yr	
1 Turbine		General Electric Frame 5 MS 5001-M	No. 1 Diesel	896.9 hr/yr	268 MMBtu/hr	443,243 gal/yr	
	Turbine		No. 2 Diesel			548,946 gal/yr	
	Simple Cycle Gas		No. 1 ULS			5,372 gal/yr	
2	Turbine	General Electric Frame 5 MS 5001-M	No. 1 Diesel	250.1 hr/yr	268 MMBtu/hr	88,030 gal/yr	
	Turbine		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	1 219 col/m	
4	Diesel Generator Engine	General Motors Electro-Motive Diesel 20-645E4	No. 1 ULSD	1.8 hr/yr	28 MMBtu/hr	1,218 gal/yr	
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	17,535 gal/yr	

<sup>&</sup>lt;sup>1</sup> Source: Air Quality Permit No. AQ0109TVP04

# Table 2b. FY2024 Assessable Emissions Summary Golden Valley Electric Association - Zehnder Facility

	Emission Unit	Fuel Type/	Rating/Size	CY2022 Actual
ID <sup>1</sup>	Description	Material	Rating/Size	Operation
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	10,021 gal/yl
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	10,071 501
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

<sup>&</sup>lt;sup>1</sup> Source: Renewal application for AQ0109TVP04

Table 3. FY2024 Assessable Emission Calculations - Oxides of Nitrogen (NO<sub>X</sub>) Emissions
Golden Valley Electric Association - Zehnder Facility

	Emission Unit	Maximum	Fuel	Factor	NO <sub>x</sub> Emission	CY2022 Actual	CY2022 Actual
ID	Description	Capacity	Туре	Reference	Factor	Operation	NO <sub>x</sub> Emissions
			Significant Emision	on Units			
			No. 1 ULS			8,213 gal/yr	0.5 tpy
1	Simple Cycle Gas Turbine	268 MMBtu/hr	No. 1 Diesel	AP-42 Table 3.1-1	0.88 lb/MMBtu	443,243 gal/yr	26.6 tpy
			No. 2 Diesel	]		548,946 gal/yr	33.0 tpy
			No. 1 ULS			5,372 gal/yr	0.3 tpy
2	Simple Cycle Gas Turbine	268 MMBtu/hr	No. 1 Diesel	AP-42 Table 3.1-1	0.88 lb/MMBtu	88,030 gal/yr	5.3 tpy
			No. 2 Diesel	1		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	0.07 tm/
4	Diesel Generator Engine	28 MMBtu/hr	No. 1 ULSD	AP-42 Table 3.4-1	3.2 ID/IVIIVIDIU	1,216 gai/yi	0.27 tpy
10	Boiler	1.7 MMBtu/hr	No. 2 Heating Oil	AP-42 Table 1.3-1	20 lb/10 <sup>3</sup> gal	17,535 gal/yr	0.10 tou
11	Boiler	1.7 MMBtu/hr	No. 2 Heating Oil	AP-42 Table 1.3-1	20 lb/10 gai	17,535 gai/yi	0.18 tpy
				Significant Emision	on Units - CY2022 A	ctual Emissions - NO <sub>X</sub>	72.7 tpy
			Insignificant Emisi	on 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		10 CO7 gol/us	0.17 tou
9	Burnham Boiler	0.443 MMBtu/hr	No. 2 Heating Oil	AF-42 Table 1.5-1	18 lb/10 <sup>3</sup> gal	18,627 gal/yr	0.17 tpy
N/A	Burnham Boiler - FE Building	0.606 MMBtu/hr	Natural Gas	AP-42 Table 1.4-1	100 lb/10 <sup>6</sup> scf	10,671 scf	5.34E-04 tpy
N/A	Burnham Boiler - FE Building	0.606 MMBtu/hr	Natural Gas	AF-42 Table 1.4-1	100 lb/10 sct	10,071 SCI	5.54E-04 ipy
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 <sup>3</sup> gal	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 <sup>3</sup> gal	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 <sup>3</sup> gal	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 <sup>3</sup> gal	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 <sup>3</sup> gal	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 <sup>3</sup> gal	3,755 gal/yr	0.04 tpy
U				Insignificant Emision	on Units - CY2022 A	ctual Emissions - NO <sub>X</sub>	0.29 tpy
					0)/0000 1		
					CY2022 A	ctual Emissions - NO <sub>X</sub>	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<sup>3</sup>gal) / (Conversion 1,000 gal/10<sup>3</sup>gal) x (Fuel Consumption, gal/yr) / (2,000 lb/ton)

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

Table 4. FY2024 Assessable Emissions Calculations - Carbon Monoxide (CO) Emissions
Golden Valley Electric Association - Zehnder Facility

	Emission Unit	Maximum	Fuel	Factor	CO Emission	CY2022 Actual	CY2022 Actual	
ID	Description	Capacity	Туре	Reference	Factor	Operation	CO Emissions	
			No. 1 ULS			8,213 gal/yr	1.9E-03 tpy	
1	Simple Cycle Gas Turbine	268 MMBtu/hr	No. 1 Diesel	AP-42 Table 3.1-1	0.0033 lb/MMBtu	443,243 gal/yr	1.0E-01 tpy	
			No. 2 Diesel			548,946 gal/yr	1.2E-01 tpy	
			No. 1 ULS			5,372 gal/yr	1.2E-03 tpy	
2	Simple Cycle Gas Turbine	268 MMBtu/hr	No. 1 Diesel	AP-42 Table 3.1-1	0.0033 lb/MMBtu	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	AP-42 Table 3.4-1	U.03 ID/IVIIVIDIU	1,210 gai/yi	7.1E-02 tpy	
10	Boiler	1.7 MMBtu/hr	No. 2 Heating Oil	AP-42 Table 1.3-1	F. II. (4.0 <sup>3</sup>	17 F2F col/m	4.4E.00.tm.	
11	Boiler	1.7 MMBtu/hr	No. 2 Heating Oil	AP-42 Table 1.5-1	5 lb/10 <sup>3</sup> gal	17,535 gal/yr	4.4E-02 tpy	
Significant Emission Units - CY2022 Actual Emissions - CO								
			Insignificant Emis	sion 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	AD 40 Table 4.0.4	5 lb/10 <sup>3</sup> gal	10 607 gol/ur	0.05 tpy	
9	Burnham Boiler	0.443 MMBtu/hr	No. 2 Heating Oil	AP-42 Table 1.3-1		18,627 gal/yr		
N/A	Burnham Boiler - FE Building	0.606 MMBtu/hr	Natural Gas	AP-42 Table 1.4-1	04 11 (406 - 4	40.074	4 405 04 500	
N/A	Burnham Boiler - FE Building	0.606 MMBtu/hr	Natural Gas	AP-42 Table 1.4-1	84 lb/10 <sup>6</sup> scf	10,671 scf	4.48E-04 tpy	
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 <sup>3</sup> gal	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 <sup>3</sup> gal	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 <sup>3</sup> gal	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 <sup>3</sup> gal	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 <sup>3</sup> gal	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 <sup>3</sup> gal	3,755 gal/yr	0.01 tpy	
				Insignificant Em		Actual Emissions - CO	0.08 tpy	
					CY2022	Actual Emissions - CO	0.47 tpy	
					C12022	Actual Ellissions - CO	υ.4 <i>ι</i> τρ <b>y</b>	

### Sample Calculations:

Turbine and Engine Emissions, tpy= (Emission factor, Ib/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, Ib/10<sup>3</sup>gal) / (Conversion 1,000 gal/10<sup>3</sup>gal) x (Fuel Consumption, gal/yr) / (2,000 lb/ton)

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

Table 5. FY2024 Assessable Emission Calculations - Particulate Matter (PM<sub>10</sub>) Emissions Golden Valley Electric Association - Zehnder Facility

	Emission Unit	Maximum	Fuel	Factor	PM <sub>10</sub> Emission	CY2022 Actual	CY2022 Actual		
ID	Description	Capacity	Туре	Reference	Factor	Operation	PM <sub>10</sub> Emissions		
			No. 1 ULS			8,213 gal/yr	6.7E-03 tpy		
1	Simple Cycle Gas Turbine	268 MMBtu/hr	No. 1 Diesel	AP-42 Table 3.1-2a	0.012 lb/MMBtu	443,243 gal/yr	3.6E-01 tpy		
			No. 2 Diesel			548,946 gal/yr	4.5E-01 tpy		
			No. 1 ULS			5,372 gal/yr	0.00 tpy		
2	Simple Cycle Gas Turbine	268 MMBtu/hr	No. 1 Diesel	AP-42 Table 3.1-2a	0.012 lb/MMBtu	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	AD 40 T-11-0 4 0		4.040	4.05.00.4		
4	Diesel Generator Engine	28 MMBtu/hr	No. 1 ULSD	AP-42 Table 3.4-2	0.0573 lb/MMBtu	1,218 gal/yr	4.8E-03 tpy		
10	Boiler	1.7 MMBtu/hr	No. 1 ULSD	AP-42 Tables 1.3-2 &	0.00 # 44.53	47.505	0.45.00.4		
11	Boiler	1.7 MMBtu/hr	No. 2 Heating Oil	1.3-7	2.38 lb/10 <sup>3</sup> gal	17,535 gal/yr	2.1E-02 tpy		
Significant Emission Units - CY2022 Actual Emissions - PM <sub>10</sub>									
			Insignificant Emissi	on Units		· u	••		
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 &	1.7 lb/10 <sup>3</sup> gal	18,627 gal/yr	0.02 tpy		
9	Burnham Boiler	0.443 MMBtu/hr	No. 2 Heating Oil	1.3-2	1.7 ID/10 gai	10,027 gal/yi	0.02 τργ		
N/A	Burnham Boiler - FE Building	0.606 MMBtu/hr	Natural Gas	AP-42 Table 1.4-2	5.5 lb/10 <sup>6</sup> scf	10.671 scf	2.9E-05 tpy		
N/A	Burnham Boiler - FE Building	0.606 MMBtu/hr	Natural Gas	711 12 14510 1.12	0.0 lb/10 30l	10,071 001	2.02 00 tpy		
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 <sup>3</sup> gal <sup>1</sup>	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 <sup>3</sup> gal <sup>1</sup>	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 <sup>3</sup> gal	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 <sup>3</sup> gal <sup>2</sup>	3,755 gal/yr	9.6E-05 tpy		
Insignificant Emission Units - CY2022 Actual Emissions - PM <sub>10</sub>									
						•			
					CY2022 Ac	tual Emissions - PM <sub>10</sub>	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/10³gal) / (Conversion 1,000 gal/10³gal) x (Fuel Consumption, gal/yr) / (2,000 lb/ton) Boiler Emissions, tpy= (Emission factor, lb/10⁵scf) / (Conversion 1,000,000 scf/10⁵scf) x (Fuel Consumption, scf) / (2,000 lb/ton)

<sup>&</sup>lt;sup>1</sup> Ash Content of 0.233 percent by weight was determined through testing conducted in December 2016.

<sup>&</sup>lt;sup>2</sup> 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	Maximum	Fuel	Factor	VOC Emission	CY2022 Actual	CY2022 Actual
ID	Description	Capacity	Туре	Reference	Factor	Operation	VOC Emissions
			No. 1 ULS			8,213 gal/yr	2.3E-04 tpy
1	Simple Cycle Gas Turbine	268 MMBtu/hr	No. 1 Diesel	AP-42 Table 3.1-2a	0.00041 lb/MMBtu	443,243 gal/yr	1.2E-02 tpy
			No. 2 Diesel			548,946 gal/yr	0.02 tpy
			No. 1 ULS			5,372 gal/yr	1.5E-04 tpy
2	Simple Cycle Gas Turbine	268 MMBtu/hr	No. 1 Diesel	AP-42 Table 3.1-2a	0.00041 lb/MMBtu	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	AF-42 Table 3.4-1	U.UO ID/IVIIVIDIU	1,210 gal/yi	0.6E-03 tpy
10	Boiler	1.7 MMBtu/hr	No. 2 Heating Oil	AP-42 Table 1.3-3	0.24 # (4.03 )	17,535 gal/yr	3.0E-03 tpy
11	Boiler	1.7 MMBtu/hr	No. 2 Heating Oil	AP-42 Table 1.3-3	0.34 lb/10 <sup>3</sup> gal	17,535 gai/yi	3.0 <b>⊏-</b> 03 tpy
			-	Significant Emiss	sion Units - CY2022 Ac	ctual Emissions - VOC	0.04 tpy
			Insignificant Em	ssion 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 11 (4.03 )	40.007	6 6F 02 tov
9	Burnham Boiler	0.443 MMBtu/hr	No. 2 Heating Oil	AP-42 Table 1.3-3	0.7 lb/10 <sup>3</sup> gal	18,627 gal/yr	6.6E-03 tpy
N/A	Burnham Boiler - FE Building	0.606 MMBtu/hr	Natural Gas	AP-42 Table 1.4-2	706	40.074	4.4E.0E.t=
N/A	Burnham Boiler - FE Building	0.606 MMBtu/hr	Natural Gas	AP-42 Table 1.4-2	7.6 lb/10 <sup>6</sup> scf	10,671 scf	4.1E-05 tpy
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 <sup>3</sup> gal	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 <sup>3</sup> gal	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 <sup>3</sup> gal	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 <sup>3</sup> gal	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 <sup>3</sup> gal	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 <sup>3</sup> gal	3,755 gal/yr	1.9E-03 tpy
					sion Units - CY2022 Ac		0.01 tpy
				<u> </u>	CY2022 Ac	ctual 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/10³gal) / (Conversion 1,000 gal/10³gal) x (Fuel Consumption, gal/yr) / (2,000 lb/ton)

Boiler Emissions, tpy= (Emission factor, lb/10⁵scf) / (Conversion 1,000,000 scf/10⁵scf) x (Fuel Consumption, scf) / (2,000 lb/ton)

Table 7. FY2024 Assessable Emission Calculations - Sulfur Dioxide (SO₂) Emissions Golden Valley Electric Association - Zehnder Facility

	Emission Unit	Fuel	Factor	Fuel	SO <sub>2</sub> Emission	CY2022 Actual	CY2022 Actual				
ID	Description	Туре	Reference	Sulfur Content 1,2	Factor	Operation	SO <sub>2</sub> Emissions				
		No. 1 ULS	Mass Balance	0.00041 wt. pct. S	0.000 lb/gal	8,213 gal/yr	0.00 tpy				
1	Simple Cycle Gas Turbine	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				
		No. 1 ULS	Mass Balance	0.00041 wt. pct. S	0.000 lb/gal	5,372 gal/yr	0.00 tpy				
2	Simple Cycle Gas Turbine	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	Mass Dalatice	0.0015 Wt. pct. 3	2.13E-04 10/gai	ı,∠ıo gai/yı	1.3E-04 tpy				
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	Mass Dalatice	0.3013 Wt. pct. 3	0.043 lb/gai	17,555 gal/yl	0.36 tpy				
Significant Emission Units - CY2022 Actual Emissions - SO <sub>2</sub> 2											
		In	significant Emission (	Jnits							
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	0.3013 Wt. pct. 3	0.0 lb/gai	10,027 gal/yl	0.40 tpy				
N/A	Burnham Boiler - FE Building	Natural Gas	AP-42 Table 1.4-2	2,000 gr/10 <sup>6</sup> scf	0.6 lb/10 <sup>6</sup> scf	10,671 scf	3.2E-06 tpy				
N/A	Burnham Boiler - FE Building	Natural Gas	AF-42 Table 1.4-2	2,000 gr/10 scr	0.0 ID/10 SCI	10,071 301	3.2L-00 tpy				
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 Emis	sion Units - CY2022 A	ctual Emissions - SO <sub>2</sub>	0.44 tpy				
	<u> </u>	<u>-</u>		<u>-</u>			·				
					CY2022 A	actual Emissions - SO <sub>2</sub>	23.4 tpy				

Sample Calculations: 3

Molar mass ratio is 32 lb S/mol : 64 lb SO<sub>2</sub>/mol

Stoichiometry: 1 mol S = 1 mol SO<sub>2</sub>

Mass Balance Emission Factor, lb/gal = (Molar mass ratio, 2 lb SO<sub>2</sub>: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<sup>6</sup>scf) / (Conversion 1,000,000 scf/10<sup>6</sup>scf) x (Fuel Consumption, scf) / (2,000 lb/ton)

### Notes:

<sup>&</sup>lt;sup>1</sup> Based on the weighted average of monthly maximum fuel sulfur content values for calendar year 2021 as received from supplier sampling.

<sup>&</sup>lt;sup>2</sup> For waste oil and waste transformer oil, fuel sulfur content was determined by testing conducted in December 2016.

<sup>&</sup>lt;sup>3</sup> 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 <sub>X</sub>	CO	PM <sub>10</sub>	SO <sub>2</sub>	VOC	Total		
Assessable PTE	249	-	-	72	-	321		

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

Potential to Emit	Reg	Regulated Air Pollutant Emissions (tons per year) 1					
Potential to Emit	NO <sub>X</sub>	CO	PM <sub>10</sub>	SO <sub>2</sub>	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	3		1.65				
Fee Estimate	2		\$139				

### Notes:

<sup>&</sup>lt;sup>1</sup> Regulated air pollutant calculations based on emission factors shown in accompanying spreadsheets. <sup>2</sup> 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			CY2022 Actual	Nominal	CY2022 Actual
ID	Description	Make/Model	Туре	Operation	Capacity	Fuel Consumption
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 <sup>1</sup>	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	ion Unit Fuel Type/		
ID	Description	Material	Rating/Size	Operation
Tank	Fuel Oil Storage Tank	Fuel Oil	50,000 gallons	8,760 hr/yr

Table 3. FY2024 Assessable Emissions Calculations - Oxides of Nitrogen (NO<sub>X</sub>) Emissions Golden Valley Electric Association - Delta Power Plant

	Emission Unit		Fuel	Factor	NO <sub>X</sub> Emission	Actual	CY2022 Actual	
ID	Description	Rating/Capacity	Type	Type Reference		Operation	NO <sub>X</sub> Emissions	
			Significant Er	nission 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 <sup>1</sup>	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 U	nits - Total Assessa	ble Emissions - NO <sub>X</sub>	1.40 tpy	
			Insignificant E	mission Units		•		
Tank	Fuel Oil Storage Tank	50,000 gallons	Fuel Oil	N/A	NA	8,760 hr/yr	0 tpy	
		•	•	Insignificant Emission Ur	nits - Total Assessa	ble Emissions - NO <sub>X</sub>	0 tpy	
					Total Assessa	ble Emissions - NO <sub>X</sub>	1.40 tpy	

### Notes:

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)

<sup>&</sup>lt;sup>1</sup> Operating hours were determined based on seven starts during calendar year 2022 lasting an estimated duration of 5 minutes each.

Table 4. FY2024 Assessable Emissions Calculations - Carbon Monoxide (CO) Emissions
Golden Valley Electric Association - Delta Power Plant

	Emission Unit		Fuel	Factor	CO Emission	Actual	CY2022 Actual				
ID	Description	Rating/Capacity	Type	Reference	Factor	Operation	CO Emissions				
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 <sup>1</sup>	0.01 tpy				
			-	Significant Emissior	Units - Total Assess	able Emissions - CO	0.02 tpy				
			Insignificant Er	mission 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											
Total Assessable Emissions - CO											

### Notes:

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)

<sup>&</sup>lt;sup>1</sup> Operating hours were determined based on seven starts during calendar year 2022 lasting an estimated duration of 5 minutes each.

Table 5. FY2024 Assessable Emissions Calculations - Particulate Matter (PM<sub>10</sub>) Emissions Golden Valley Electric Association - Delta Power Plant

Emission Unit		Fuel Factor I		PM <sub>10</sub> Emission	Actual	CY2022 Actual				
ID	Description	Rating/Capacity	Type	Reference	Factor	Operation	PM <sub>10</sub> Emissions			
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 <sup>1</sup>	4.9E-03 tpy			
		•	•	Significant Emission Ur	nits - Total Assessal	ole Emissions - PM <sub>10</sub>	0.01 tpy			
			Insignificant E	mission 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 <sub>10</sub>										
						<del>.</del>				
Total Assessable Emissions - PM <sub>10</sub>										

### Notes:

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)

<sup>&</sup>lt;sup>1</sup> Operating hours were determined based on seven starts during calendar year 2022 lasting an estimated duration of 5 minutes each.

### Table 6. FY2024 Assessable Emission Calculations - Sulfur Dioxide (SC<sub>2</sub>) Emissions Golden Valley Electric Association - Delta Power Plant

Emission Unit		Emission Unit Fuel Maximum Fue		Maximum Fuel	Factor	SO <sub>2</sub> Emission	Actual	CY2022 Actual				
ID	Description	Rating/Capacity	Type	Sulfur Content	Reference	Factor	Operation	SO <sub>2</sub> Emissions				
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 Assess	able Emissions - SO <sub>2</sub>	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 - SQ												
							•					
Total Assessable Emissions - SO <sub>2</sub>												

### Notes:

Molar mass ratio is 32 lb S/mol : 64 lb SO<sub>2</sub>/mol

Stoichiometry: 1 mol S = 1 mol SO<sub>2</sub>

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

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)

<sup>&</sup>lt;sup>1</sup> The fuel received at Delta during 2022 had a maximum sulfur analysis result of 0.110 weight percent.

<sup>&</sup>lt;sup>2</sup> Mass balance:

 $<sup>^3</sup>$  A fuel density of 6.7 lb/gal is assumed based on an API gravity of 43.3 from the February 2006 source test.

Table 7. FY2024 Assessable Emissions Calculations - Volatile Organic Compound (VOC) Emissions
Golden Valley Electric Association - Delta Power Plant

Emission Unit		Fuel	Factor	VOC Emission	Actual	CY2022 Actual					
ID	Description	Rating/Capacity	Type	Reference	Factor	Operation	<b>VOC Emissions</b>				
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 <sup>1</sup>	2.1E-03 tpy				
		•		Significant Emission	Units - Total Assessal	ole Emissions - VOC	0.002 tpy				
			Insignificant E	mission 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 Assessal	ole Emissions - VOC	4.5E-03 tpy				
						•					
Total Assessable Emissions - VOC											

### Notes:

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, Ib/kgal) / (Heating value, MMBtu/gal) / (Conversion, 1,000 gal/kgal) x (Operation, hr/yr) / (2,000 lb/ton)

<sup>&</sup>lt;sup>1</sup> Operating hours were determined based on seven starts during calendar year 2022 lasting an estimated duration of 5 minutes each.

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 <sub>S</sub>	N/A	60
Color	N/A	White
Capacity (gal)	N/A	50,000
Diesel Throughput (gal/yr) <sup>1</sup>	N/A	28,980
Paint Condition	N/A	Average
Standing Loss (L <sub>s</sub> ) Calculations		
D <sub>E</sub> (ft)	AP-42, Section 7.1, Equation 1-14	30.278
H <sub>E</sub> (ft)	AP-42, Section 7.1, Equation 1-15	9.42
K <sub>E</sub> (per day)	AP-42, Section 7.1, Equation 1-12	0.033
H <sub>VO</sub> (ft)	AP-42, Section 7.1, Equation 1-16	4.71
K <sub>s</sub>	AP-42, Section 7.1, Equation 1-21	0.998
T <sub>AA</sub> (°R)	AP-42, Section 7.1, Equation 1-30	487.40
T <sub>B</sub> (°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 <sup>3</sup> )	AP-42, Section 7.1, Equation 1-22	1.98E-04
L <sub>S</sub> (lb/yr)	AP-42, Section 7.1, Equation 1-4	8.20
Working Loss (L <sub>w</sub> ) Calculations		
Q (bbl)	42 gal/bbl	690
$V_Q$ (ft <sup>3</sup> )	AP-42, Section 7.1, Equation 1-39	3,874
ΣH <sub>QI</sub> (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 <sub>N</sub>	AP-42, Section 7.1, Equation 1-35 note	52.72
L <sub>W</sub> (lb/yr)	AP-42, Section 7.1, Equation 1-35	0.77
TOTAL VOCs L <sub>T</sub> (tpy)	AP-42, Section 7.1, Equation 1-1	4.5E-03

### Note:

Meteorological Inputs (Fairbanks, AK):

For turnovers ≤36

Wicken ological impats (Fallbanks, 71	<b>v</b> ).		
	$T_{AX} =$	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	=	838 Btu/ft <sup>2</sup> -d	
		From the 1995 version of	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 <sub>VA</sub> =	0.008 psi	Jet A, Diesel #1
AP-42, Section 7.1, Note below	K <sub>P</sub> =	1	Diesel
equation 1-37	K <sub>R</sub> =	1	Diesel

<sup>&</sup>lt;sup>1</sup> Assumed equal to maximum fuel consumption for EU ID 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 <sup>1</sup>

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

<sup>&</sup>lt;sup>1</sup> 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

			LSHO #1	NO. 1 ULS	NO. 2 ULS
Month	HS #2+10	HS #2-15	<1000 ppm	<15 ppm	<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

### Naomi Morton Knight, P.E.

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### Safety: You Have The Power!

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Table 5-1. Summary of Available SO<sub>2</sub> Emission Control Technology

	Emission Unit	Avanable Emission Control
		ULSD
1, 2	Simple Cycle Gas Turbine	Low Sulfur Fuel
		Good Combustion Practices
		ULSD
5, 6	Combined Cycle Gas Turbine	LSR
5, 6	Combined Cycle Gas Turbline	Limited Operation
		Good Combustion Practices
		ULSD
7	Emergency Concretor Engine	Low Sulfur Fuel
,	Emergency Generator Engine	Limited Operation
		Good Combustion Practices
11 12	Dranana Fired Bailer	Low Sulfur Fuel
11, 12	Propane-Fired Boiler	Good Combustion Practices

Table 5-2. Summary of Technically Feasible SO₂ Emission Control Technology

	Emission Unit	Technically I easible Control	
		ULSD	
1, 2	Simple Cycle Gas Turbine	Low Sulfur Fuel	
		Good Combustion Practices	
		ULSD	
5, 6	Combined Cycle Gas Turbine	Good Combustion Practices and	
	•	LSR	
		ULSD	
7	Emergency Generator Engine	Low Sulfur Fuel	
/	Emergency Generator Engine	Limited Operation	
		Good Combustion Practices	
11 12	Propago Fired Reiler	Low Sulfur Fuel	
11, 12	Propane-Fired Boiler	Good Combustion Practices	

Table 5-3. Ranking of Technically Feasible  $\mathrm{SO}_2$  Emission Control Technology

Emission Unit		Emission Control Technology	Control Efficiency (pct.)	SO <sub>2</sub> Emissions (tpy)	SO <sub>2</sub> Emissions Reduction (tpy)	
		ULSD (0.0015 wt. pct. S)	99.7	4.5	1,481.9	
1	Simple Cycle Turbine	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	
		Limited Operation + ULSD (0.0015 wt. pct. S)	99.7	4.1	1,352.0	
2	Simple Cycle Turbine	Simple Cycle Turbine Limited Operation + Low Sulfur Fuel (0.05 wt. pct. \$		90.0	135.6	1,220.5
		Good Combustion Practices (0.50 wt. pct. S) (existing)	0	1,356.1	0	
		ULSD (0.0015 wt. pct. S)	70.0%	2.9	6.7	
5, 6	Combined Cycle Gas Turbines (per turbine)	ULSD (0.0015 wt. pct. S) compared to JetA/No. 1	0	36.0	0.0	
3, 0	Combined Cycle Gas Turbines (per turbine)	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	
		ULSD (0.0015 wt. pct. S) + Limited Operation	98.5%	0.00018	0.0116	
7	Emergency Generator Engine	gine Low Sulfur Fuel (0.05 wt. pct. S) + Limited Operation		0.006	0.0059	
		Limited Operation (0.1 wt. pct. S) (existing)		0.0118	0	
11, 12	Propane-Fired Boiler	Low Sulfur Fuel (existing)	0	0.0002	0	

August 19, 2024 Public Review Draft

### Table 5-4. Annualized Costs for ULSD on the Diesel-fired Simple Cycle Gas Turbine (EU ID 1)

_						Shaded cells i	ndicat	te user inpu
Proje	ect: GVEA North Pole - PM <sub>2.5</sub> BACT Analysis (EU ID 1 - GE Frame	7 CT)				Prepared E	Зу:	
						Checked E	Ву:	
						Re	ev:	
			Annualized Costs					
DIRE	CT ANNUAL COSTS	QTY	UNIT	TOTAL MATERIALS COST	TOTAL	L 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			\$	8,377,25
Tota	Direct Annual Costs (TDAC)					TDAC	= \$	8,377,25
	RECT ANNUAL COSTS							
(5)	Overhead		%	excluded in this estimate	\$	-	\$	
(6)	Administrative Charges, Property Taxes, Insurance	0.0024	% of capital		>	-	\$	
(7)	Capital Recovery Factor [see inputs below]	0.0931				CRF * TCI	_ ^	
(7)	Capital Recovery					CKF TCI	= >	
Tota	Indirect Annual Costs (TIAC) (refer to Table 5-10)					TIAC	<b>=</b> \$	1,446,96
тот	AL ANNUALIZED COSTS (TAC)					TAC = (TDAC) + (TIAC)	= \$	9,824,22
		Cost F	ffectiveness Summar					
		Cost E	mectiveness Summar	у				
тот	AL TONS SO <sub>2</sub> AVOIDED PER YEAR						=	1,482
	T EFFECTIVENESS (\$ PER TON AVOIDED BASED ON PTE)					(TAC)/(TPY)		
	T EFFECTIVENESS (\$ PER TON AVOIDED BASED ON ACTUAL HIST		_	ER YEAR) <sup>†</sup>		(TAC)/(TPY)	= \$	9,65
cos	T EFFECTIVENESS (S PER TON PM AVOIDED BASED ON 6 TONS S		(TAC)/(TPV)	_ ¢	57 92			

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					

<sup>1</sup> 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.

<sup>&</sup>lt;sup>2</sup> 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 inp			
Proje	ct: GVEA North Pole - PM <sub>2.5</sub> BACT Analysis (EU ID 1 - GE Frame	7 CT)					Prepared	d By:		
							Checked	d By:		
								Rev:		
		A	Annualized Costs	5						
DIRE	CT ANNUAL COSTS	QTY	UNIT		TOTAL MATERIALS COST	TOT/	AL LABOR COST			TOTAL
(1)	Operating & Maintenance Costs		%			\$	-		\$	
(2)	Repair & Replacement Costs		%		_	\$	-		\$	
(3)	Maintenance Materials		LOT		excluded in this estimate					
(4)	Utilities		_		<u>=</u>					
	(a) ULSD Costs:	45,282,462	GAL	0.424	\$ 19,199,764				\$	19,199,76
Tota	Direct Annual Costs (TDAC)						TDAC	C =	\$	19,199,764
IND	RECT ANNUAL COSTS									
(5)	Overhead		%		excluded in this estimate	\$	-		Ś	
(6)	Administrative Charges, Property Taxes, Insurance		% of capital			Ś	-		Ś	
( - /	Capital Recovery Factor [see inputs below]	0.0931								
(7)	Capital Recovery						CRF * TC	1 =	\$	
Tota	Indirect Annual Costs (TIAC) (refer to Table 5-10)						TIAC	C =	\$	1,446,967
тот	AL ANNUALIZED COSTS (TAC)						TAC = (TDAC) + (TIAC	c) =	\$	20,646,731
	. ,						, , ,	_		
		Cost Ef	ffectiveness Sun	nmary						
								1		
101	AL TONS SO₂ AVOIDED PER YEAR							=		1,482
cos	T EFFECTIVENESS (\$ PER TON AVOIDED BASED ON PTE)						(TAC)/(TPY	() =	\$	13,932
cos	T EFFECTIVENESS (\$ PER TON AVOIDED BASED ON ACTUAL HISTO	ORIC RUN TIMES. AVO	IDING 142.3 TO	NS PER YEAR)	1		(TAC)/(TPY	/) =	Ś	16,885
	F EFFECTIVENESS (\$ PER TON PM AVOIDED BASED ON 6 TONS SO						(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					

<sup>&</sup>lt;sup>1</sup> 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.

<sup>&</sup>lt;sup>2</sup> 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<sub>x</sub> emissions result in the same reduction in ambient PM<sub>2.5</sub> concentration as the reduction of one ton of directly emitted PM<sub>2.5</sub>".

### Table 5-5. Annualized Costs for ULSD on the Diesel-fired Simple Cycle Gas Turbine (EU ID 2)

_							Shaded cells in	dica	te user inputs
Proje	ect: GVEA North Pole - PM <sub>2.5</sub> BACT Analysis (EU ID 2 - GE Frame 7 C	T)					Prepared B	y:	
		<del></del>					Checked B	y:	
							Re	v:	
		ı	Annualized Co	osts					
DIRE	ECT ANNUAL COSTS	QTY	UNIT		TOTAL MATERIALS COST	TOTAL	L 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
Tota	l Direct Annual Costs (TDAC)						TDAC :	= \$	7,642,811
INIDI	RECT ANNUAL COSTS								
(5)	Overhead Overhead		%		excluded in this estimate	\$		ė	
(5) (6)	Administrative Charges, Property Taxes, Insurance		% of capital		excluded III tills estillate	ş S	-	ڊ خ	-
(6)	Capital Recovery Factor [see inputs below]	0.0931	% OI Capitai			ş	-	۶	-
(7)	Capital Recovery	0.0931					CRF * TCI =	\$	-
Tota	I Indirect Annual Costs (TIAC) (refer to Table 5-10)						TIAC :	= \$	1,446,967
	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,								
TOT	AL ANNUALIZED COSTS (TAC)						TAC = (TDAC) + (TIAC) =	= \$	9,089,779
		Cost E	ffectiveness	Summary					
				• •					
тот	AL TONS SO₂ AVOIDED PER YEAR							=	1,352.0
cos	T EFFECTIVENESS (\$ PER TON AVOIDED BASED ON PTE)						(TAC)/(TPY)	= \$	6,723
	T EFFECTIVENESS (\$ PER TON AVOIDED BASED ON ACTUALS, AVOID	DING 422 3 TONE D	ED VEAD)1				(TAC)/(TPY)		
	T EFFECTIVENESS (\$ PER TON AVOIDED BASED ON ACTUALS, AVOIDED BASED ON 6 TONS SO.)			ON DNA AVOIDED\2					-
LUS	I EFFECTIVENESS (S PER TON PIVI AVOIDED BASED ON 6 TONS SO2	AVUIDED = EQUIVA	ALENI IO I I	UN PIVI AVUIDED)			(TAC)/(TPY)	= S	41.786

Data Inputs for Capital Recovery Factor:

Annual Interest Rate (EPA OAQPS Control Cost Manual)

Project Life (EPA OAQPS Control Cost Manual)

30 years

<sup>&</sup>lt;sup>1</sup> 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.

<sup>&</sup>lt;sup>2</sup> 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<sub>x</sub> emissions result in the same reduction in ambient PM<sub>2.5</sub> concentration as the reduction of one ton of directly emitted PM<sub>2.5</sub>".

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### Table 5-5. Annualized Costs for ULSD on the Diesel-fired Simple Cycle Gas Turbine (EU ID 2)

_							Shaded cells	indic	ate	user input
Proje	ect: GVEA North Pole - PM <sub>2.5</sub> BACT Analysis (EU ID 2 - GE Frame 7	CT)					Prepared	By:		
							Checked	By:		
							R	Rev:		
			Annualized Cos	its						
DIRE	CT ANNUAL COSTS	QTY	UNIT		TOTAL MATERIALS COST	TOTA	AL 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				\$ 1	17,516,497
Tota	Direct Annual Costs (TDAC)						TDAC	=	\$ 1	17,516,497
INDI	RECT ANNUAL COSTS									
(5)	Overhead		%		excluded in this estimate	\$			Ś	
(6)	Administrative Charges, Property Taxes, Insurance		% of capital			\$			\$	
,	Capital Recovery Factor [see inputs below]	0.0931								
(7)	Capital Recovery						CRF * TCI	=	\$	
Tota	Indirect Annual Costs (TIAC) (refer to Table 5-10)						TIAC	=	\$	1,446,967
тот	AL ANNUALIZED COSTS (TAC)						TAC = (TDAC) + (TIAC)	=	\$ 1	18.963.464
							(12110)			,,
		Cost E	ffectiveness Su	ımmary						
								_		
тот	AL TONS SO <sub>2</sub> AVOIDED PER YEAR							=		1,352.0
cos	T EFFECTIVENESS (\$ PER TON AVOIDED BASED ON PTE)						(TAC)/(TPY)	_	\$	14,026
cos	T EFFECTIVENESS (\$ PER TON AVOIDED BASED ON ACTUALS, AVOI	DING 422.3 TONS P	PER YEAR)1				(TAC)/(TPY)			14,196
	T EFFECTIVENESS (\$ PER TON PM AVOIDED BASED ON 6 TONS SO			N PM AVOIDED12			(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							

<sup>1</sup> 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.

<sup>&</sup>lt;sup>2</sup> 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<sub>x</sub> emissions result in the same reduction in ambient PM<sub>2.5</sub> concentration as the reduction of one ton of directly emitted PM<sub>2.5</sub>".

# Table 5-6. Annualized Costs for ULSD on the Diesel-fired Combined Cycle Gas Turbines (EU IDs 5 and 6)

						Sha	aded cells ind	icat	e user inputs
Proje	ect: GVEA North Pole - PM <sub>2.5</sub> BACT Analysis (EU IDs 5 and 6 - G	E LM6000PC CT)					Prepared By:		
		· <del></del>					Checked By:		
							Rev:		
			Annualized Co	osts					
DIRE	ECT ANNUAL COSTS	QTY	UNIT		TOTAL MATERIALS COST	TOTAL LABOR COST	r		TOTAL
(1)	Operating & Maintenance Costs		%			\$	-	\$	-
(2)	Repair & Replacement Costs		%		_	\$	-	\$	_ !
(3)	Maintenance Materials		LOT		excluded in this estimate				ŀ
(4)	Utilities				· 				ŀ
	(a) ULSD Costs:	29,057,000	GAL	0.588	\$ 17,085,516			\$	17,085,516
Total	I Direct Annual Costs (TDAC)						TDAC =	\$	17,085,516
INDI	RECT 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	I Indirect Annual Costs (TIAC)						TIAC =	\$	-
TOT	AL ANNUALIZED COSTS (TAC)					TAC - (TDAC	C) - (TIAC) -	ė	17,085,516
1017	IL ANNOALIZED COSTS (TAC)					IAC - (IDAC	) + (IIAC) -	ڔ	17,000,010
		Cost E	ffectiveness S	ummary					
								_	
тот/	AL TONS SO <sub>2</sub> AVOIDED PER YEAR						=		6.7
cos	T EFFECTIVENESS (\$ PER TON AVOIDED)					<b>(T</b> /	AC)/(TPY) =	\$	2,559,025

Data Inputs for Cap	ital Recovery Factor:			
Annual Interest Rat	e (EPA OAQPS Control Cost Manual)	8.50	%	
Project Life (EPA OA	OPS Control Cost Manual)	30	vears	

# Table 5-6. Annualized Costs for ULSD on the Diesel-fired Combined Cycle Gas Turbines (EU IDs 5 and 6)

						Sha	aded cells ind	icat	e user inputs
Proje	ect: GVEA North Pole - PM <sub>2.5</sub> BACT Analysis (EU IDs 5 and 6 - G	E LM6000PC CT)					Prepared By:		
		·					Checked By:		
							Rev:		
		- 1	Annualized Co	ests					
DIRE	ECT ANNUAL COSTS	QTY	UNIT		TOTAL MATERIALS COST	TOTAL LABOR COST	г		TOTAL
(1)	Operating & Maintenance Costs		%			\$	-	\$	-
(2)	Repair & Replacement Costs		%			\$	-	\$	_ [
(3)	Maintenance Materials		LOT		excluded in this estimate				
(4)	Utilities				•				ļ
	(a) ULSD Costs:	29,057,000	GAL	1.117	\$ 32,456,669			\$	32,456,669
Total	I Direct Annual Costs (TDAC)						TDAC =	\$	32,456,669
INDI	RECT 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	I Indirect Annual Costs (TIAC)						TIAC =	\$	-
TOT	AL ANNUALIZED COSTS (TAC)					TAC - (TDAC	C) + (TIAC) =	ė	22 456 660
10.7	TE ANNOALIZED COSTS (TAC)					IAC - (IDAC	.) + (TIAC) -	ڔ	32,430,003
		Cost E	ffectiveness S	Summary					
								_	
TOT	AL TONS SO <sub>2</sub> AVOIDED PER YEAR						=		6.7
cos	T EFFECTIVENESS (\$ PER TON AVOIDED)					<b>(T</b> /	AC)/(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				
Proje	ct: GVEA North Pole - PM <sub>2.5</sub> BACT Analysis (EU ID 7 - General	Gen Set Engine)				Prepared By:					
							Checked By	r:			
							Rev				
			Annualized	Costs			ii.c.				
DIRE	CT ANNUAL COSTS	QTY	UNIT		TOTAL MATERIALS COST	TOTAL LAB	OR COST		TOTAL		
(1)	Operating & Maintenance Costs	<u> </u>	%		TOTAL MATERIALS COST	¢	-	\$	- IOIAL		
(2)	Repair & Replacement Costs		%			ė.	-	ب	_		
	Maintenance Materials		LOT		excluded in this estimate	ş	-	۶	-		
(3)	Utilities		LOT		excluded in this estimate						
(4)					14						
	(a) ULSD Costs:	1,664	GAL	0.2668	\$ 444			\$	444		
Total	Direct Annual Costs (TDAC)						TDAC =	\$	444		
INDI	RECT 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 =	\$			
	, ,										
TOT	AL ANNUALIZED COSTS (TAC)					TAC	= (TDAC) + (TIAC) =	\$	444		
		Cost	Effectivenes	s Summary							
TOT	AL TONS SO <sub>2</sub> AVOIDED PER YEAR							=	0.012		
coc	FEFFECTIVENESS (¢ DER TON AVOIDED)						(TAC) ((TD))		20.450		
LUS	r effectiveness (\$ per ton avoided)						(TAC)/(TPY) =	٠ >	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)

_						Shac	ded cells inc	licat	e user inputs
Proje	ct: GVEA North Pole - PM <sub>2.5</sub> BACT Analysis (EU ID 7 - Generac	Gen Set Engine)				P	repared By	:	
							Checked By	:	
							Rev		
			Annualized	Costs			11.01		
DIRE	CT ANNUAL COSTS	QTY	UNIT		TOTAL MATERIALS COST	TOTAL LABOR COST			TOTAL
(1)	Operating & Maintenance Costs	٩	%			¢ .		\$	
(2)	Repair & Replacement Costs		%			ė .		ć	
(3)	Maintenance Materials		LOT		excluded in this estimate	-		ڔ	
	Utilities		LOT		excluded in this estimate				
(4)		4.664	CAL	0.654	4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4			,	4 000
	(a) ULSD Costs:	1,664	GAL	0.651	\$ 1,083			\$	1,083
Total	Direct Annual Costs (TDAC)						TDAC =	\$	1,083
INDI	RECT 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					c	RF * TCI =	\$	-
								_	
Total	Indirect Annual Costs (TIAC)						TIAC =	\$	-
TOTA	AL ANNUALIZED COSTS (TAC)					TAC = (TDAC)	+ (TIAC) =	¢	1,083
1017	REALITORELES COSTO (TAC)					TAC - (TDAC)	· (mac) =	,	1,003
		Cost	Effectivenes	s Summary					
TOTA	AL TONS SO <sub>2</sub> AVOIDED PER YEAR						=		0.012
I									
cos	EFFECTIVENESS (\$ PER TON AVOIDED)					(TA	C)/(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<sub>2</sub> BACT Cost Effectiveness

Summary<sup>1</sup> for Each Emission Unit Based on PTE

		ii ziiiioololi oliit Ba								
Simple Cycle Gas Turbine (EU ID 1)										
ULSD (0.0015 wt. pct. S) 4 \$10,875,319 \$20,646,731 \$19,199,764										
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	~	~	~	~					
-		•	•	•	•					
C	ombined Cycle (	Gas Turbines (EU I	Ds 5 and 6)							
ULSD (0.0015 wt. pct. S)	3	~	\$32,456,669	~	\$4,861,277					
pct. S, 1.5x10^6 gal/yr) Good Combustion	10	~	~	~	~					
	Emergency G	enerator Engine (E	טוט /)	I	1					
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<sup>1</sup> for Each Emission Unit Based on Actuals

Sun	nmary for Each	Emission Unit Base	ed on Actuals								
Control Technology Option	SO <sub>2</sub> Emissions (tpy)	Total Installed Capital (\$)	Total Annualized Cost (\$/year)	Annual O&M Cost (\$/year)	Cost Effectiveness (\$/ton SO <sub>2</sub> removed)						
	Simple Cycl	e 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 Cycl	e 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	~	~	~	~						
С	ombined Cycle G	Sas Turbines (EU II	Ds 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	~	~	~	~						
		enerator Engine (E									
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	~	~	~	~						

<sup>&</sup>lt;sup>1</sup>All emission costs are on a per emission unit basis.

Table 5-9. GVEA North Pole Facility - Proposed SO<sub>2</sub> BACT and Associated Emission Rate for Each Emission Unit

ID	Description		Description	Emission Rate <sup>1</sup>	
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	

<sup>&</sup>lt;sup>1</sup> 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** 

	E	North Pole Us 1 and 2 ximum Fuel Use		Zehnder Us 1 and 2 ximum Fuel Use	Е	North Pole Us 1 and 2 Actual Fuel Use	E	Zehnder Us 1 and 2 ctual Fuel Use
Capital Cost Estimate		\$30,42	5,00	0		\$21,0	50,0	00
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)

Project Life (EPA OAQPS Control Cost Manual)

8.50 pct.

years

30

Administrative Charges, Property Taxes

4.00%

Insurance (percentage of total capital cost)

Capital cost estimate for 1.27 million gallons of storage capacity.

#### **GVEA Zehnder BACT Cover Page**

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03.23.24 2024 Final Zehnder BACT Determination

03.27.24 Zehnder PM<sub>2.5</sub> BACT MR&R

03.27.24 Zehnder  $SO_2$  BACT MR&R

A04\_FuelPrices\_1810

Updated Department Zehnder Power Plant SO2 Controls Economic Analysis

# 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

	Abbreviations/Acronyms
AAC	Alaska Administrative Code
AAAQS	Alaska Ambient Air Quality Standards
	Alaska Department of Environmental Conservation
	Best Available Control Technology
	Circulating Fluidized Bed
	Code of Federal Regulations
	Mechanical Separators
	Diesel Particulate Filter
	Dry Low NOx
	Diesel Oxidation Catalyst
	Environmental Protection Agency
	Electrostatic Precipitator
	Emission Unit
	Fuel Injection Timing Retard
	Good Combustion Practices
	Hazardous Air Pollutant
	Ignition Timing Retard
	Low Excess Air
	Low NOx Burners
	Monitoring, Recording, and Reporting
	National Emission Standards for Hazardous Air Pollutants
	Non-Selective Catalytic Reduction
	New Source Performance Standards
	Owner Requested Limit
	Prevention of Significant Deterioration
	Potential to Emit
	Reciprocating Internal Combustion Engine, Internal Combustion Engine
SIP	Alaska State Implementation Plan
	Selective Non-Catalytic Reduction
	Ultra Low Sulfur Diesel
Units and Measures	
	gallons per hour
	grams per kilowatt hour
	grams per horsepower hour
	hours per day
	hours per year
	horsepower
	pounds per hour
	pounds per million British thermal units
	pounds per 1,000 gallons
kW	
	million British thermal units per hour
	million standard cubic feet per hour
	parts per million by volume
	tons per year
Pollutants	
	Carbon Monoxide
	Oxides of Nitrogen
SO <sub>2</sub>	Sulfur Dioxide
	Particulate Matter with an aerodynamic diameter not exceeding 2.5 microns
	Particulate Matter with an aerodynamic diameter not exceeding 10 microns
I 17I [ ]	

August 19, 2024 March 23, 2024 BACT Determination Addendum

#### 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 dieselfired 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<sub>2.5</sub>) 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<sub>2.5</sub> nonattainment area. The designation of the area as "Serious" with regard to nonattainment of the 2006 24-hour PM<sub>2.5</sub> 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.

The 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.<sup>2</sup> The EPA's Air Plan Partial Approval and Partial Disapproval; AK, Fairbanks North Star Borough; 2006 24-hour PM<sub>2.5</sub> Serious Area and 189(d) Plan<sup>3</sup> published in the Federal Register on December 5, 2023 (88 Fed. Reg. 84658) disapproved of Alaska's initial BACT determinations for PM2.5 and SO2 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 PM2.5, and the BACT analysis for sulfur dioxide (SO2) emissions, which is a precursor pollutant that can form PM2.5 in the atmosphere post combustion. Note that the section for oxides of nitrogen (NOx), which is also a precursor pollutant that can form PM<sub>2.5</sub> in the atmosphere post combustion, has been removed from this addendum because the EPA has approved<sup>3</sup> of the Department's comprehensive NOx precursor demonstration under 40 C.F.R. 51.1006(a)(1) and 51.1010(a)(2)(ii).

<sup>&</sup>lt;sup>1</sup> Federal Register, Vol. 82, No. 89, Wednesday May 10, 2017 (<a href="https://dec.alaska.gov/air/anpms/comm/docs/2017-09391-CFR.pdf">https://dec.alaska.gov/air/anpms/comm/docs/2017-09391-CFR.pdf</a>)

<sup>&</sup>lt;sup>2</sup> Background and detailed information regarding Fairbanks PM<sub>2.5</sub> State Implementation Plan (SIP) can be found at <a href="http://dec.alaska.gov/air/anpms/communities/fbks-pm2-5-serious-sip/">http://dec.alaska.gov/air/anpms/communities/fbks-pm2-5-serious-sip/</a>.

<sup>&</sup>lt;sup>3</sup> The EPA's Air Plan Partial Approval and Partial Disapproval; AK, Fairbanks North Star Borough; 2006 24-hour PM<sub>2.5</sub> Serious Area and 189(d) Plan can be found at <a href="https://www.regulations.gov/document/EPA-R10-OAR-2022-0115-0426">https://www.regulations.gov/document/EPA-R10-OAR-2022-0115-0426</a>.

<sup>&</sup>lt;sup>4</sup> 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<sub>2.5</sub> and SO<sub>2</sub>, 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.

**Installation or EU ID Description of EU** Rating/Size Construction Date 268 MMBtu/hr 1 Fuel Oil-Fired Regenerative Simple Cycle Gas Turbine 1971 (18.4 MW)268 MMBtu/hr 2 Fuel Oil-Fired Regenerative Simple Cycle Gas Turbine 1972 (18.4 MW) 28 MMBtu/hr 3 Diesel-Fired Emergency Generator Engine 1970 (2.75 MW)28 MMBtu/hr 4 1970 Diesel-Fired Emergency Generator Engine (2.75 MW)Diesel-Fired Boiler 10 1.7 MMBtu/hr 2012 Diesel-Fired Boiler 11 1.7 MMBtu/hr 2012

**Table A: Emission Units Subject to BACT Review** 

#### **Five-Step BACT Determinations**

The following sections explain the steps used to determine BACT for PM<sub>2.5</sub> and SO<sub>2</sub> 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<sub>2.5</sub> and SO<sub>2</sub> 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<sub>2.5</sub> and SO<sub>2</sub>.

#### 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<sub>2.5</sub> and SO<sub>2</sub> 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 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 PM2.5 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. 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<sub>2.5</sub> Serious Area and 189(d) Plan published in the Federal Register on December 5, 2023 (88 Fed. Reg. 84658).

#### 4. BACT DETERMINATION FOR PM<sub>2.5</sub>

The Department based its PM<sub>2.5</sub> 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<sub>2.5</sub> BACT for the Fuel Oil-Fired Simple Cycle Gas Turbines (EUs 1 and 2)

Possible PM<sub>2.5</sub> 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<sub>2.5</sub> Control for Simple Cycle Gas Turbines

Control Technology	Number of Determinations	<b>Emission Limits</b>	
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<sub>2.5</sub> emission rate listed in the RBLC is 0.0038 lb/MMBtu.

Step 1 - Identification of PM<sub>2.5</sub> Control Technology for the Simple Cycle Gas Turbines From research, the Department identified the following technologies as available for control of PM<sub>2.5</sub> 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<sub>2.5</sub> 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

 $<sup>^{5}\ \</sup>underline{https://www.gpo.gov/fdsys/pkg/FR-2016-08-24/pdf/2016-18768.pdf}$ 

combustion components. EUs 1 and 2 are fired exclusively on distillate fuel which is a form of refined fuel, and potential PM<sub>2.5</sub> 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. <u>High enough overall excess oxygen levels to complete combustion and maximize thermal efficiency.</u>

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<sub>2.5</sub> 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<sub>2.5</sub> 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<sub>2.5</sub> emissions from the fuel oil-fired simple cycle gas turbines.

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

(d) Good Combustion Practices (Less than 40% Control)

(b) Low Ash Fuel(c) Limited Operation(d% Control)(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<sub>2.5</sub> 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<sub>2.5</sub> 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<sub>2.5</sub> 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<sub>2.5</sub> emission limit will be demonstrated by conducting a performance test to obtain an emission rate; and
- (d) PM<sub>2.5</sub> emissions from EUs 1 & 2 shall not exceed 0.012 lb/MMBtu<sup>6</sup> over a 3-hour averaging period.

Table 4-2 lists the proposed PM<sub>2.5</sub> BACT determination for this facility along with those for other fuel oil-fired simple cycle gas turbines located in the Serious PM<sub>2.5</sub> nonattainment area.

Table 4-2. Comparison of PM2.5 BACT for Simple Cycle Gas Turbines at Nearby Power Plants

Facility	Process Description	Capacity	Limitation	Control Method
GVEA –	Two Fuel Oil-Fired Simple	1,344 MMBtu/hr	0.012 lb/MMBtu <sup>6</sup>	Good Combustion Practices
North Pole	Cycle Gas Turbines	1,344 MINIBIU/III	(3-hour averaging period)	Good Combustion Fractices
GVEA –	Two Fuel Oil-Fired Simple	536 MMBtu/hr	0.012 lb/MMBtu <sup>6</sup>	Good Combustion Practices
Zehnder	Cycle Gas Turbines	330 MMBlu/nr	(3-hour averaging period)	Good Combustion Practices

#### 4.2 PM<sub>2.5</sub> BACT for the Large Diesel Fired Engines

Possible PM<sub>2.5</sub> 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<sub>2.5</sub> 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

<sup>&</sup>lt;sup>6</sup> 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<sub>2.5</sub> Control Technology for the Large Diesel-Fired Engines** From research, the Department identified the following technologies as available for controls of PM<sub>2.5</sub> 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<sub>2.5</sub> 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<sub>2.5</sub> 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<sub>2.5</sub> 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<sub>2.5</sub> emissions. The Department considers GCPs a technically feasible control technology for the large diesel-fired engines.

Step 2 - Eliminate Technically Infeasible PM<sub>2.5</sub> Control Technologies for the Large Engines PM<sub>2.5</sub> 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<sub>2.5</sub> Control Technologies for the Large Diesel-Fired Engines The following control technologies have been identified and ranked by efficiency for the control of PM<sub>2.5</sub> 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<sub>2.5</sub> emissions from EUs 3 and 4 shall not exceed 0.1 lb/MMBtu<sup>7</sup> over a 4-hour averaging period.

Department Evaluation of BACT for PM<sub>2.5</sub> Emissions from the Large Diesel-Fired Engines The Department reviewed GVEA's proposal finds that PM<sub>2.5</sub> emissions from the large diesel-fired engines can also be controlled by good combustion practices.

#### Step 5 - Selection of PM<sub>2.5</sub> BACT for the Large Diesel-Fired Engines

The Department's finding is that the BACT for PM<sub>2.5</sub> 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) PM<sub>2.5</sub> emissions from EUs 3 and 4 shall not exceed 0.32 g/hp-hr<sup>7</sup> over a 3-hour averaging period; and
- (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<sub>2.5</sub> BACT determination for the facility along with those for other diesel-fired engines rated at more than 500 hp located in the Serious PM<sub>2.5</sub> nonattainment area.

Table 4-4. Comparison of PM2.5 BACT for Large Diesel Engines at Nearby Power Plants

Facility	<b>Process Description</b>	Capacity	Limitation	Control Method
				Positive Crankcase Ventilation
UAF	Large Diesel-Fired Engines	> 500 hp	<b>0.05</b> - 0.32 g/hp-hr	Limited Operation
				Ultra-Low Sulfur Diesel
	inwright 8 Large Diesel-Fired Engines	> 500 hp	0.15 – 0.32 g/hp-hr	Limited Operation
Fort Wainwright				Ultra-Low Sulfur Diesel
				Federal Emission Standards
GVEA North Pole	Pole Large Diesel-Fired Engine	600 hp	0.22 -/ 1	Positive Crankcase Ventilation
GVEA NOITH FOR			0.32 g/hp-hr	Good Combustion Practices
CVEA 7.1.1	2 Lance Diesel Fined Engines	11,000 hp	0.22 ~/bm bm	Limited Operation
GVEA Zehnder	2 Large Diesel-Fired Engines	(each)	0.32 g/hp-hr	Good Combustion Practices

#### 4.3 PM<sub>2.5</sub> BACT for the Diesel Fired Boilers

Possible PM<sub>2.5</sub> 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 PM2.5 Control for Diesel Fired Boilers

Control Technology	Number of Determinations	<b>Emission Limits</b>

<sup>&</sup>lt;sup>7</sup> Table 3.4-1 of US EPA's AP-42 Emission Factors (PM). <a href="https://www3.epa.gov/ttn/chief/ap42/ch03/final/c03s04.pdf">https://www3.epa.gov/ttn/chief/ap42/ch03/final/c03s04.pdf</a>

		0.25 lb/gal
Good Combustion Practices	3	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<sub>2.5</sub> control technology determined for small diesel-fired boilers. The lowest PM<sub>2.5</sub> emission rate listed in the RBLC is 0.1 tpy.

#### Step 1 - Identification of PM<sub>2.5</sub> Control Technology for the Diesel Fired Boilers

From research, the Department identified the following technologies as available for control of PM<sub>2.5</sub> emissions from diesel-fired boilers:

#### (a) Wet Scrubbers

Wet scrubbers use a scrubbing solution to remove PM/PM<sub>10</sub>/PM<sub>2.5</sub> 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%. 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<sub>2.5</sub> 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<sub>2.5</sub> emissions. The Department considers GCPs a technically feasible control technology for the diesel-fired boilers.

# Step 2 - Eliminate Technically Infeasible PM<sub>2.5</sub> Control Technologies for the Diesel Fired Boilers All identified control devices are technically feasible for the diesel-fired boilers.

#### Step 3 - Rank the Remaining PM2.5 Control Technologies for the Diesel Fired Boilers

The following control technologies have been identified and ranked by efficiency for the control of PM<sub>2.5</sub> 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**

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<sub>2.5</sub> emissions from the diesel-fired boilers:

- (a) Good Combustion Practices; and
- (b) PM<sub>2.5</sub> emissions shall not exceed 2.13 lb/1,000 gallons<sup>9</sup> over a 4-hour averaging period.

#### Department Evaluation of BACT for PM<sub>2.5</sub> 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<sub>2.5</sub> BACT for the Diesel-Fired Boilers

The Department's finding is that BACT for PM<sub>2.5</sub> emissions from the diesel-fired boilers is as follows:

- (a) PM<sub>2.5</sub> emissions from the diesel-fired boilers shall not exceed <u>**0.016 lb/MMBtu**</u><sup>10</sup> 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<sub>2.5</sub> BACT determination for this facility along with those for other diesel-fired boilers rated at less than 100 MMBtu/hr in the Serious PM<sub>2.5</sub> nonattainment area.

Table 4-6. Comparison of PM2.5 BACT for the Diesel-Fired Boilers at Nearby Power Plants

Facility Process Description  UAF 6 Small Diesel-Fired Boilers		Capacity	Limitation	Control Method
		< 100 MMBtu/hr	<u>0.016</u> lb/MMbtu <sup>10</sup>	Limited Operation & Good Combustion Practices
Fort Wainwright	4 Small Diesel-Fired Boilers	< 100 MMBtu/hr	<u>0.016</u> lb/MMbtu <sup>10</sup>	Good Combustion Practices
GVEA Zehnder	2 Small Diesel-Fired Boilers	1.7 MMBtu/hr (each)	<u>0.016</u> lb/MMbtu <sup>10</sup>	Good Combustion Practices

#### 5. BACT DETERMINATION FOR SO<sub>2</sub>

The Department based its SO<sub>2</sub> 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.

<sup>&</sup>lt;sup>9</sup> Tables 1.3-2 & 1.3-7 of US EPA's AP-42 Emission Factors: <a href="https://www3.epa.gov/ttn/chief/ap42/ch01/final/c01s03.pdf">https://www3.epa.gov/ttn/chief/ap42/ch01/final/c01s03.pdf</a>

<sup>&</sup>lt;sup>10</sup> 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<sub>2.5</sub> size-specific factor from distillate oil, <u>0.83 lb/1,000 gal)</u> converted to lb/MMBtu. <u>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.</u>

#### 5.1 SO<sub>2</sub> BACT for the Fuel Oil-Fired Simple Cycle Gas Turbines

Possible SO<sub>2</sub> 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<sub>2</sub> 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<sub>2</sub> control technologies determined as BACT for fuel oil-fired simple cycle gas turbines. The lowest SO<sub>2</sub> emission rate listed in the RBLC is combustion of ULSD at 0.0015 % S by wt.

# Step 1 - Identification of SO<sub>2</sub> Control Technology for the Simple Cycle Gas Turbines From research, the Department identified the following technologies as available for control of SO<sub>2</sub> 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<sub>2</sub> 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<sub>2</sub> 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<sub>2</sub> 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<sub>2</sub> 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<sub>2.5</sub> 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<sub>2</sub>. The Department considers GCPs a technically feasible control technology for the fuel oil-fired simple cycle gas turbines.

Step 2 - Eliminate Technically Infeasible SO<sub>2</sub> 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<sub>2</sub> Control Technologies for the Simple Cycle Gas Turbines The following control technologies have been identified and ranked for control of SO<sub>2</sub> 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<sub>2</sub> 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<sub>2</sub> reduction does not justify the fuel switch to ULSD in the simple cycle turbines based on the excessive cost per ton of SO<sub>2</sub> removed per year.

GVEA proposes the following as BACT for SO<sub>2</sub> emissions from the simple cycle gas turbines:

- (a) SO<sub>2</sub> 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<sub>2</sub> 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 <u>left the existing 580 ton per year</u>

<u>sulfur limit for the facility and</u> 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<sub>2</sub> 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<sub>2</sub> 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<sub>2</sub> BACT for the Simple Cycle Gas Turbines

The Department's finding is that BACT for SO<sub>2</sub> emissions from the fuel oil-fired simple cycle gas turbines is as follows:

- (a) SO<sub>2</sub> 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<sub>2</sub> BACT determination for this facility along with those for other fuel oil-fired simple cycle gas turbines located in the Serious PM<sub>2.5</sub> nonattainment area.

Table 5-4. Comparison of SO<sub>2</sub> BACT for Simple Cycle Gas Turbines at Nearby Power Plants

Facility	<b>Process Description</b>	Capacity	Limitation	Control Method
GVEA – North	Two Fuel Oil-Fired Simple	1.344 MMBtu/hr	0.0015 % S wt.	ULSD
Pole	Cycle Gas Turbines	1,344 WIMBu/III	0.0013 70 S WL	ULSD
GVEA –	Two Fuel Oil-Fired Simple	536 MMBtu/hr	0.0015 % S wt.	ULSD
Zehnder	Cycle Gas Turbines	330 MIMBIU/III	0.0013 % S WL	ULSD

#### 5.2 SO<sub>2</sub> BACT for the Large Diesel-Fired Engines

Possible SO<sub>2</sub> 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<sub>2</sub> 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<sub>2</sub> control technologies installed on large diesel-fired engines. The lowest SO<sub>2</sub> emission rate listed in the RBLC is 0.001 g/hp-hr.

Step 1 - Identification of SO<sub>2</sub> Control Technology for the Large Diesel-Fired Engines From research, the Department identified the following technologies as available for control of SO<sub>2</sub> 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<sub>2</sub> 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<sub>2.5</sub> 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<sub>2</sub> emissions. The Department considers GCPs a technically feasible control technology for the large diesel-fired engines.

## Step 2 - Eliminate Technically Infeasible SO<sub>2</sub> 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<sub>2</sub> Control Technologies for the Large Diesel-Fired Engines The following control technologies have been identified and ranked by efficiency for the control of SO<sub>2</sub> emissions from the large diesel-fired engines.

(a) Ultra-Low Sulfur Diesel(b) Limited Operation(c) Limited Operation(d) 4% Control(e) 4% Control(f) 4% 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 dieselfired 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<sub>2</sub> 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<sub>2</sub> emissions from the diesel-fired engines:

- (a) SO<sub>2</sub> 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<sub>2</sub> 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<sub>2.5</sub> 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<sub>2</sub> 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<sub>2</sub> BACT for the Large Diesel Fired Engines

The Department's finding is that the BACT for SO<sub>2</sub> emissions from the diesel-fired engines is as follows:

- (a) SO<sub>2</sub> 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<sub>2</sub> BACT determination for this facility along with those for other diesel-fired engines rated at more than 500 hp located in the Serious PM<sub>2.5</sub> nonattainment area.

Table 5-7. Comparison of SO<sub>2</sub> BACT for Large Diesel-Fired Engines at Nearby Power Plants

Facility	<b>Process Description</b>	Capacity	Limitation	Control Method
				Limited Operation
Fort Wainwright	8 Large Diesel-Fired Engines	> 500 hp	15 ppmw S in fuel	Good Combustion Practices
				Ultra-Low Sulfur Diesel
				Limited Operation
UAF	Large Diesel-Fired Engine	13,266 hp	15 ppmw S in fuel	Good Combustion Practices
				Ultra-Low Sulfur Diesel
CVEAN A D	I D: 1E: 1E :	600.1	4.5 0: 0.1	Limited Operation
GVEA North Pole	Large Diesel-Fired Engine	600 hp	15 ppmw S in fuel	Good Combustion Practices
CVEA 7.1.1	D. 1E. 1E .	11 000 1	15 0 0 . 1	Good Combustion Practices
GVEA Zehnder	2 Large Diesel-Fired Engines	11,000 hp	15 ppmw S in fuel	Ultra-Low Sulfur Diesel

#### 5.3 SO<sub>2</sub> BACT for the Diesel Fired Boilers

Possible SO<sub>2</sub> 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<sub>2</sub> 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<sub>2</sub> control technologies installed on diesel-fired boilers. The lowest SO<sub>2</sub> emission rate listed in the RBLC is 0.0005 lb/MMBtu.

#### Step 1 - Identification of SO<sub>2</sub> Control Technology for the Diesel Fired Boilers

From research, the Department identified the following technologies as available for SO<sub>2</sub> 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<sub>2</sub> 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<sub>2</sub> 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<sub>2.5</sub> 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<sub>2</sub> emissions. The Department considers GCPs a technically feasible control technology for the diesel-fired boilers.

Step 2 - Eliminate Technically Infeasible SO<sub>2</sub> 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<sub>2</sub> Control Technologies for the Diesel-Fired Boilers
The following control technologies have been identified and ranked by efficiency for the control of SO<sub>2</sub> 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<sub>2</sub> emissions from the diesel-fired boilers:

(a) Combust only ULSD.

#### Department Evaluation of BACT for SO<sub>2</sub> Emissions from Diesel-Fired Boilers

The Department reviewed GVEA's proposal and finds that SO<sub>2</sub> emissions from the diesel-fired boilers can additionally be controlled with good combustion practices.

#### Step 5 - Selection of SO<sub>2</sub> BACT for the Diesel-Fired Boilers

The Department's finding is that BACT for SO<sub>2</sub> emissions from the diesel-fired boilers is as follows:

- (a) SO<sub>2</sub> 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<sub>2</sub> BACT determination for this facility along with those for other diesel-fired boilers rated at less than 100 MMBtu/hr in the Serious PM<sub>2.5</sub> nonattainment area.

Table 5-9. Comparison of SO<sub>2</sub> BACT for the Diesel-Fired Boilers at Nearby Power Plants

Facility	<b>Process Description</b>	Capacity	Limitation	Control Method
				Limited Operation
Fort Wainwright	<u>4</u> Diesel-Fired Boilers	< 100 MMBtu/hr	15 ppmw S in fuel	Good Combustion Practices
				Ultra-Low Sulfur Diesel
UAF	6 Diagol Finad Dailons	< 100 MMDtv/ba	15 ppmw S in fuel	Good Combustion Practices
UAF	<u><b>6</b></u> Diesel-Fired Boilers	< 100 MMBtu/hr	13 ppmw S m ruei	Ultra-Low Sulfur Diesel
GVEA Zehnder	2 Diesel-Fired Boilers	< 100 MMBtu/hr	15 mmy C in first	Good Combustion Practices
GVEA Zennder	2 Diesei-Fired Bollers	100 MIMBIU/nr	15 ppmw S in fuel	Ultra-Low Sulfur Diesel

#### 6. BACT DETERMINATION SUMMARY

#### **Table 6-1. Proposed NOx BACT Limits**

EU ID	Description of EU	Capacity	<b>Proposed BACT Limit</b>	Proposed BACT Control
All	N/A	N/A		mprehensive precursor demonstration for NOx etails in the Section 1 Introduction

#### Table 6-2. Proposed PM2.5 BACT Limits

EU ID	Description of EU	Capacity	<b>Proposed BACT Limit</b>	Proposed BACT Control
1	Fuel Oil-Fired Regenerative Gas Simple Cycle Gas Turbine	268 MMBtu/hr	0.012 lb/MMBtu	Low Ash Fuel
2	Fuel Oil-Fired Regenerative Gas Simple Cycle Gas Turbine	268 MMBtu/hr	0.012 lb/MMBtu	Good Combustion Practices
3	Diesel-Fired Emergency Generator Engine	28 MMBtu/hr	0.32 g/hp-hr	Good Combustion Practices
4	Diesel-Fired Emergency Generator Engine	28 MMBtu/hr	0.32 g/hp-hr	Limited Operation (100 hours/year each, for non-emergency operation)
10	Diesel-Fired Boiler	1.7 MMBtu/hr	<u><b>0.016</b></u> lb/MMBtu	
11	Diesel-Fired Boiler	1.7 MMBtu/hr	<u><b>0.016</b></u> lb/MMBtu	Good Combustion Practices

### Table 6-3. Proposed SO<sub>2</sub> BACT Limits

EU ID	Description of EU	Capacity	<b>Proposed BACT Limit</b>	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	Olda Low Sulful Diesel
3	Diesel-Fired Emergency Generator Engine	28 MMBtu/hr	15 ppmw S in Fuel	Ultra Low Sulfur Diesel
			Transconding	Good Combustion Practices
4	Diesel-Fired Emergency Generator Engine	28 MMBtu/hr	15 ppmw S in Fuel	Limited Operation (100 hours/year each, for non-emergency operation)
10	Diesel-Fired Boiler	1.7 MMBtu/hr	15 ppmw S in Fuel	Ultra Low Sulfur Diesel
11	Diesel-Fired Boiler	1.7 MMBtu/hr	15 ppmw S in Fuel	Good Combustion Practices

Stationary Source: Zehnder Facility

Emission Units: EU IDs 1 and 2 (268 MMBtu/hr (18.4 MW) Simple Cycle Turbines)

Pollutant of Concern: PM <sub>2.5</sub>				
<b>BACT Measure</b>	Monitoring, Recordkeeping and Reporting Requirements <sup>1</sup>			
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 <sub>2</sub> concentrations in the flue gas, at			
	least once during each quarter that the emission unit operates, measure			
	CO and O <sub>2</sub> 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 <sub>2.5</sub>				
BACT Measure	Monitoring, Recordkeeping and Reporting Requirements <sup>1</sup>				
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).				

<sup>&</sup>lt;sup>1</sup> 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 <sub>2.5</sub>										
<b>BACT Measure</b>	Monitoring, Recordkeeping and Reporting Requirements <sup>1</sup>										
0.16 lb/MMBtu/hr (3-hr	Demonstrate compliance by complying with the NESHAP Subpart										
avg);	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	Demonstrate compliance by complying with the NESHAP Subpart										
Practices	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 <sub>2</sub>										
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	<ul> <li>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.</li> <li>Include in each semi-annual operating report, a summary of fuel test results or shipping receipts from the reporting period.</li> </ul>										
Good Combustion Practices	<ul> <li>Keep records of maintenance conducted on emission units to comply with this BACT measure.</li> <li>Keep a copy of the manufacturer's and the operator's recommended maintenance procedures.</li> </ul>										

Emission Units: EU IDs 3 and 4 (28.5 MMBtu/hr (2.75 MW) Emergency Diesel Engines)

	Pollutant of Concern: SO <sub>2</sub>										
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	<ul> <li>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.</li> <li>Include in each semi-annual operating report, a summary of fuel test results or shipping receipts from the reporting period.</li> </ul>										
Limited Operation (100 hours of non-emergency operation per year)	<ul> <li>Demonstrate compliance by complying with the NESHAP Subpart ZZZZ emissions limitations, operating limitations, and other requirements listed in 40 CFR 63.6640(f).</li> </ul>										
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 <sub>2</sub>										
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	<ul> <li>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.</li> </ul>									

	Include in each semi-annual operating report, a summar 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			ZN	NP.
			Naphtha	LSR Turbine **	DF#1, DF#2	ULSD	DF#1, DF#2	ULSD
Α	PSI Base Price		\$1.127000	\$0.792619	\$1.492381	\$1.378810	\$1.492381	\$1.378810
В	PSI & Federal surcharges *		\$0.012405	\$0.012405	\$0.052405	\$0.012405	\$0.052405	\$0.012405
С	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

<sup>\*</sup> 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		
a.		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	
<u>е</u>	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		
0		PSI & Federal surcharges *	-	-	-	-	\$0.003	\$0.003	\$0.003	\$0.003	-	-	-	-	-	-	-	-	\$0.003	\$0.003	\$0.003	\$0.003	\$0.003	-	\$0.003		
۵		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	
l <u></u> ≒	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		
<u> </u>		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		
Z		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	40.400	
		Big State Fuel Surcharge	-	-	-	-	20.5%	20.5%	20.5%	19.0%	-	-	40.040	-	40.474	-	-	40.475	29.0%	27.0%	27.0%	23.5%	26.0%	-	\$0.0071	\$2.109	
ē	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		
Ιĕ		PSI & Federal surcharges *	\$0.003	\$0.003	\$0.003	\$0.003	-	-	-	-	\$0.003	\$0.003	\$0.003 \$0.05	\$0.003	\$0.003	\$0.003	\$0.003	\$0.003	-	-	-	-	-	\$0.003	\$0.003		
<u>~</u>		PSI Ops Surcharge Big State Delivery	\$0.04 \$0.025	\$0.05 \$0.025	\$0.05 \$0.025	\$0.05 \$0.025	-	-	-	-	\$0.05 \$0.030	\$0.05 \$0.030	\$0.030	\$0.05 \$0.030	\$0.05 \$0.030	\$0.05 \$0.030	\$0.05 \$0.030	\$0.03	-	-	-	-	-	\$0.05 \$0.030	\$0.049 \$0.028		
ع ا		Big State Delivery  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%	\$0.028	\$2.093	
l to	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	\$2.093	
ΙŽ	ULSD			\$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			
l . •		PSI & Federal surcharges *	\$0.003 \$0.155	\$0.003	\$0.003	\$0.003	\$0.003	\$0.003	\$0.003	\$0.003	\$0.006 \$0.155	\$0.003	\$0.003	\$0.003	\$0.003	\$0.003 \$0.155	\$0.003	\$0.003	\$0.003	\$0.003	\$0.003	\$0.003	\$0.003	\$0.003	\$0.003 \$0.155		
		PSI Delivery Charge PSI Fuel Surcharge	16.5%	17.5%	\$0.155 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%	\$0.155		
		PSI Fuel Surcharge PSI Truck Freight	15.0%	17.5%	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%	\$0.0292		
		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	\$0.0276		
I		Big State Delivery  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%	\$0.029	\$2.352 \$0.243	
		big State Fuel Suffillinge	10.3%	20.5%	20.5%	20.5%	20.3%	20.5%	20.5%	15.0%	23.0%	23.0%	23.0%	23.0%	24.0%	20.0%	20.0%	20.0%	25.0%	27.0%	27.0%	23.5%	20.0%	20.0%	30.0008	30.243	

#### **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
L	SR 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
Г	DF2+10	PSI Base Price		-	-	-	-	\$1.625	\$1.576	\$1.621	\$1.708	-	-	-	-	-	-	-	-	\$2.150	\$2.286	\$2.395	\$2.400	\$2.408	-
7		PSI & Federal surcharges *		-	-	-	-	\$0.003	\$0.003	\$0.003	\$0.003	-	-	-	-	-	-	-	-	\$0.003	\$0.003	\$0.003	\$0.003	\$0.003	-
7		PSI Ops Surcharge		-	-	-	-	\$0.05	\$0.05	\$0.05	\$0.05	-	-	-	-	-	-	-	-	\$0.05	\$0.05	\$0.05	\$0.05	\$0.05	-
7		Delivery Charge		-	-	-	-	\$0.020	\$0.020	\$0.020	\$0.020	-	-	-	-	-	-	-	-	\$0.020	\$0.020	\$0.020	\$0.020	\$0.020	-
7		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	-
<u>e</u>	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
0		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
Δ.		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
된		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
0		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
Z	JLSD	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
0	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%	<u> </u>
-		Delivery Fuel Surchage (%*Delivery)	ć2.400	-	-	-	-	\$0.006	\$0.006	\$0.006	\$0.006	-	-	-	-	-	-	-	-	\$0.009	\$0.008	\$0.008	\$0.007	\$0.008	<u> </u>
	252.45	Total \$/Gallon	\$2.109		-	- 44.740	-	\$1.714	\$1.665	\$1.711	\$1.797	-	-	- 62.040	- 42.024	-	- 42.204	- 62.400	- 425	\$2.242	\$2.377	\$2.487	\$2.490	\$2.499	- do 400
F	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
ē ⊦		PSI Ops Surcharge		\$0.04 \$0.025	\$0.05 \$0.025	\$0.05 \$0.025	\$0.05 \$0.025	-	-	-	-	\$0.05 \$0.030	\$0.05 \$0.030	\$0.05 \$0.030	\$0.05 \$0.030	\$0.05 \$0.030	\$0.05 \$0.030	\$0.05 \$0.030	\$0.05 \$0.030	-	-	-	-	-	\$0.05 \$0.030
δŀ		Truck Delivery  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%
ĭ		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
اڃ		Total \$/Gallon	\$2.093	\$1.823	\$1.880	\$1. <b>795</b>	\$1.815	-		-		\$1.964	\$2.001	\$2.129	\$2.111	\$2.264	\$2.294	\$2.279	\$2.266	-		-			\$2.590
4	JLSD		Ş2.033	\$1.963		\$1.805	\$1.852	\$1.806	¢1 702	\$1.622	¢1 707	\$2.074	-	\$2.159	\$2.038	\$2.129		\$2.083		\$2.417	¢2 120	\$2.301	\$2.225	\$2.308	\$2.406
Ň		PSI Base Price PSI & Federal surcharges *		\$0.003	\$1.904 \$0.003	\$0.003	\$0.003	\$0.003	\$1.703 \$0.003	\$0.003	\$1.797 \$0.003	\$0.006	\$2.107 \$0.003	\$0.003	\$0.003	\$0.003	\$2.083 \$0.003	\$0.003	\$2.309 \$0.003	\$0.003	\$3.129 \$0.003	\$0.003	\$0.003	\$0.003	\$2.406
		PSI Delivery Charge		\$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 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
- I		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%
7		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
7		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
7		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%
7		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
7		Total \$/Gallon	\$2.352		\$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		\$2.664

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 inc	dicat	e user inputs
Cos	t Effectiveness Determination - ULSD Fuel Switch - No A	Additional Tank Stor	age				Date	:	
Proje	ct: GVEA Zhender - SO <sub>2</sub> BACT Analysis (EU ID 1 and 2 - Frame 5	CTs, cost per turbine)					Prepared By	:	
							Checked By	:	
							Rev		
		Ar	nualized (	Costs					
DIR	CT ANNUAL COSTS	QTY	UNIT		TOTAL MATERIALS COST	TOT	AL 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	3		\$	4,532,828
Tota	Direct Annual Costs (TDAC)						TDAC =	\$	4,532,828
	RECT ANNUAL COSTS								
(5)	Overhead		%			\$	-	\$	-
(6)	Administrative Charges, Property Taxes, Insurance		% of capit	al		\$	-	\$	-
	Capital Recovery Factor [see inputs below]	0.0931							
(7)	Capital Recovery						CRF * TCI =	\$	-
Tota	Indirect Annual Costs (TIAC) (refer to Table 5-10)						TIAC =	\$	577,064
тот	AL ANNUALIZED COSTS (TAC)						TAC = (TDAC) + (TIAC) =	\$	5,109,893
	,						, , , ,		
		Cost Eff	ectiveness	Summary					
								_	
тот	AL TONS SO2 AVOIDED PER YEAR						=	-	578
cos	T 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 OAOPS Control Cost Manual)	30	vears	

Table 5-10. Capital Cost for New ULSD Storage Based on PTE Maximum Fuel Use and Historic Actual Use

	EU	orth Pole Is 1 and 2 kimum Fuel Use		Zehnder Us 1 and 2 ximum Fuel Use	E	North Pole Us 1 and 2 tual Fuel Use		Zehnder EUs 1 and 2 tual Fuel Use
Capital Cost Estimate		\$30,42	5,00	0		\$21,0	50,0	00
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)

Project Life (EPA OAQPS Control Cost Manual)

Administrative Charges, Property Taxes Insurance (percentage of total capital cost)

30 years