

**ALASKA DEPARTMENT OF ENVIRONMENTAL CONSERVATION  
Air Permits Program**

**TECHNICAL ANALYSIS REPORT  
for  
Air Quality Control Construction Permit AQ0934CPT01**

**Donlin Gold LLC  
Donlin Gold Project**

**MINE CONSTRUCTION**

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### Abbreviations/Acronyms

AAC	Alaska Administrative Code
AAAQS	Alaska Ambient Air Quality Standards
BACT	Best Available Control Technology
CAA	Clean Air Act
C.F.R.	Code of Federal Regulations
Department	Alaska Department of Environmental Conservation
DLN	Dry Low NOx
EPA	Environmental Protection Agency
EU	Emission Unit
HAP	Hazardous Air Pollutant
MR&R	Monitoring, Recording, and Reporting
NA	Not Applicable
NESHAPS	National Emission Standards for Hazardous Air Pollutants
NSPS	New Source Performance Standards
ORL	Owner Requested Limit
PSD	Prevention of Significant Deterioration
PTE	Potential to Emit
RICE, ICE	Reciprocating Internal Combustion Engine, Internal Combustion Engine
SCR	Selective Catalytic Reduction
SIP	Alaska State Implementation Plan
TAR	Technical Analysis Report
ULSD	Ultra Low Sulfur Diesel
VE	Visible Emissions

### Units and Measures

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

### Pollutants

CO	Carbon Monoxide
CO <sub>2e</sub>	Carbon Dioxide Equivalent
GHG	Greenhouse Gases
HAP	Hazardous Air Pollutant
NOx	Oxides of Nitrogen
PM	Particulate Matter
PM-2.5	Particulate Matter with an aerodynamic diameter not exceeding 2.5 microns
PM-10	Particulate Matter with an aerodynamic diameter not exceeding 10 microns
SO <sub>2</sub>	Sulfur Dioxide
VOC	Volatile Organic Compound

## **1. INTRODUCTION**

This Technical Analysis Report (TAR) provides the Alaska Department of Environmental Conservation's (Department's) basis for issuing Air Quality Control Construction Permit AQ0934CPT01 to Donlin Gold LLC (Donlin) for their Donlin Gold Project (DGP). The project triggers Prevention of Significant Deterioration (PSD) review under 18 AAC 50.306 for oxides of nitrogen (NO<sub>x</sub>), carbon monoxide (CO), particulate matter (PM), particulate matter with an aerodynamic diameter not exceeding 10 microns (PM-10), particulate matter with an aerodynamic diameter not exceeding 2.5 microns (PM-2.5), volatile organic compounds (VOCs), and greenhouse gases (GHGs). This project is classified under 18 AAC 50.502(b)(3) for the construction, operation, or relocation of a stationary source containing a rock crusher with a rated capacity of at least five tons per hour. The project also includes an Owner Requested Limit (ORL) under 18 AAC 50.508(5) to avoid PSD review for sulfur dioxide (SO<sub>2</sub>) and to avoid Hazardous Air Pollutants major classification. Owner Requested Limit AQ0934ORL01 will be rescinded upon issuance of Construction Permit AQ0934CPT01.

### **1.1 Description of Source**

The DGP is an existing stationary source located on the western slopes of the Kuskokwim Mountains in the Yukon-Kuskokwim region of southwestern Alaska, approximately 280 miles west of Anchorage.

Donlin currently operates the stationary source under Owner Requested Limit AQ0934ORL01 issued January 9, 2009. This limit allowed Donlin to install and operate two electric generators, a waste incinerator, an auxiliary generator, and two standby generators while avoiding all permitting obligations under AS 46.14.130.

### **1.2 Application Description**

Donlin submitted an application for this project on October 15, 2015 and submitted several addenda through April 4, 2017. Donlin is requesting authorization to install and operate reciprocating internal combustion engines, boilers, heaters, autoclaves, incinerators, a gyratory crusher, a pebble crusher, carbon regeneration kilns, electrowinning circuit cells, a smelting furnace, a mercury retort, laboratories, and a tank farm to support gold mining and processing.

### **1.3 Project Description**

The DGP deposit consists of two main areas, ACMA and Lewis, which will ultimately be mined as a single open pit. In addition to the mining operations Donlin will be constructing a natural gas pipeline, a power generation facility, an onsite employee accommodation complex, roads, ports, shipping and barging infrastructure, and an airstrip. This permitting action covers only the mining and processing operations, power generation facility, haul roads, camp to mine site access road, airport to camp access road, and emission units supporting the onsite employee accommodation complex and airstrip.

Mining operations at DGP include surveying and drilling of blast holes. Donlin will use an ammonium nitrate and fuel oil (ANFO)-based explosive emulsion for blasting. Ore and waste will be loaded by front-end loaders and hydraulic shovels into end-dump haul trucks. The trucks will haul the waste rock to the waste rock facility while ore will be hauled to the gyratory crusher. From the gyratory crusher the ore will be directly fed to the gyratory crusher dump pocket with a rock breaker or stockpiled. Alternatively, the ore could be hauled to a long-term ore stockpile before being taken to the gyratory crusher.

Ore will be discharged from the gyratory crusher dump pocket onto the discharge conveyor and transferred to the stockpile feed conveyor where it will be discharged onto a covered coarse ore stockpile. The coarse ore will be transferred via four reclaim apron feeders to the semi-autogenous grinding (SAG) mill feed conveyor for transport to the SAG mill.

Donlin will utilize an open circuit SAG mill followed by a “mill-chemical-float-mill-chemical-float” (MCF2) circuit for the grinding process. Copper sulfate will be added to the SAG mill feed to activate sulfide mineralization. Discharge from the SAG mill will be screened to send oversized pebbles to two large cone pebble crushers. The oversized pebbles will be returned to the SAG mill feed via conveyors after passing through the pebble crushers. The MCF2 circuit following the SAG mill will consist of a primary ball mill and primary rougher flotation followed by a secondary ball mill, secondary rougher flotation, and thickening.

During this process several reagents, such as acidic solution from the pressure oxidation (POX) counter-current decantation (CCD), washing circuit, lime, copper sulfate, potassium amyl xanthate, soda ash, caustic soda, flocculants, dispersants, and frothers, will be added to condition the concentration slurry. Donlin will install associated process equipment for reagent handling and mixing.

The thickener concentrate from the MCF2 process will proceed to an acidulation circuit. Acidic solution recovered from the POX CCD washing circuit will be added to the concentrate slurry to reduce the carbonate gangue component. The acidulated concentrate slurry will be washed in a three-thickener CCD circuit to remove chlorides and pumped to the POX circuit.

Concentrate POX is carried out in one of two autoclaves operating in parallel. High-pressure steam will be supplied to the process when needed by two dual-fuel POX boilers. The dual-fuel oxygen plant boiler will provide high pressure oxygen gas for the POX reaction. Discharge from the autoclaves will be sent to flash vessels to depressurize the autoclaved concentrate slurry. The slurry will then be transferred to three POX hot cure tanks.

After the POX circuit the concentrate slurry will be washed in a four-thickener CCD circuit. Washed concentrate slurry in the underflow from the final thickener will be pumped to the CIL solids neutralization circuit and the overflow will be clarified and used within the plant to provide acidification to the acidulation circuit. The CIL neutralization circuit will consist of mechanically agitated tanks where lime slurry will be added to the concentrate slurry in the presence of oxygen to bring the pH to approximately 9 before being pumped to the CIL circuit.

The carbon-in-leach (CIL) circuit will consist of six CIL tanks that will hold the concentrate slurry for four hours. Here a sodium cyanide solution will be pumped into the CIL circuit for cyanide leaching. Lime slurry and caustic soda will be added to maintain a pH of approximately 10.5.

After the CIL circuit will be the cyanide destruction system which include an agitated tank where compressed air and gaseous SO<sub>2</sub> generated in the SO<sub>2</sub> burner will be added to oxidize the residual cyanide. Copper sulfate solution will be added to maintain the reaction kinetics and lime slurry will be used to maintain the pH level.

The loaded carbon from the CIL circuit will then be washed with a 3 percent nitric acid solution, neutralized with a caustic solution in two acid wash vessels, and pumped to two strip vessels. A solution of 1 percent sodium hydroxide and 1 percent sodium cyanide will be added to the strip vessels to strip the gold adsorbed on the carbon. The dual-fuel carbon elution heater will provide the hot glycol solution for the heat exchanger that the pregnant solution passes through after the strip vessels. After the heat exchanger the stripped carbon will be washed and sent to the carbon regeneration kiln for reuse in the CIL circuit, and the pregnant solution will be sent to the pregnant solution tank.

The pregnant solution will then be pumped through two parallel trains of electrowinning cells to remove the precious metals. The remaining solution will be sent to the barren solution tanks for recirculation through the strip vessels. The precious metal bearing sludge from the electrowinning circuit will be washed, press-filtered, and loaded into the mercury retort. Here it will be electrically heated for 12 hours to remove mercury. After the mercury retort, the sludge will be mixed with smelting fluxes and charged to the induction smelting furnace. Doré bars will be poured from the smelting furnace and shipped offsite for additional refining.

Donlin will generate electric power from a dual-fuel reciprocating engine onsite power plant with a steam turbine. The power plant will consist of 12 engines rated at 17 MW each, a steam turbine, two black start ULSD generators rated at 600 kW (used to restore power plant operations if there is a plant shutdown), and two ULSD fired engines rated at 200 kW each will be used to power the airstrip and associated operations.

Additional units include SO<sub>2</sub> burners, heaters, building space heating, a water conditioning system, a camp waste incinerator, a sewage sludge incinerator, a sample preparation laboratory, an assay analysis laboratory, a metallurgical analysis laboratory, and multiple fuel tanks.

#### **1.4 PSD Description**

The basic elements of the PSD program may be found in Title I, Part C of the Clean Air Act (CAA). Congress developed the program to protect public health, preserve, protect and enhance air quality in national areas of interest, ensure that economic growth will occur in a manner consistent with the preservation of existing clean air resources and ensure permitting decisions are made after careful evaluation of all consequences.

EPA promulgated the detailed requirements in 40 C.F.R. 51.166 (PSD requirements within a State Implementation Plan) and 40 C.F.R. 52.21 (federal implementation of the PSD program). The Department has adopted the various aspects of the federal PSD program by reference in 18 AAC 50.040(h), and requires PSD applicants to follow those provisions, except as noted, in 18 AAC 50.306.

40 C.F.R. 52.21(b)(1) of the federal PSD regulations defines a “major stationary source” as either (a) any of 28 designated stationary source categories with potential emissions of 100 tons per year (tpy) or more of any regulated attainment pollutant, (b) any other stationary source with potential emissions of 250 tpy or more of any regulated attainment pollutant, or (c) any physical change that would occur at a stationary source that would constitute a major stationary source by itself.

In addition, once a new stationary source has been determined to be a “major” source, it is subject to PSD review for each regulated attainment pollutant that the source would have the potential to emit in “significant” amounts, which in some cases is lower than the “major” thresholds. 40 C.F.R. 52.21(b)(50)(iv) includes pollutants “subject to regulation” as defined in 40 C.F.R. 52.21(b)(49) as regulated pollutants. For this project, Greenhouse Gas (GHG) emissions become a regulated pollutant if the project’s total GHG emissions on a CO<sub>2e</sub> basis equal or exceed 75,000 tpy.

### **1.5 Jungjuk Port and Port to Mine Access Road**

Donlin intends to construct a port along the Kuskokwim River near Jungjuk Creek/Angyaruq to support DGP. The Department determined on July 16, 2014 that the mine and port sites are separate stationary sources for air quality permitting purposes. The port emissions are therefore not included, nor authorized, in Construction Permit AQ0934CPT01. Donlin will need to submit a separate air quality permit application, *if warranted*, to seek Department approval to construct and operate the port site.

Donlin also intends to construct a 28-mile-long access road between the Jungjuk port and mine site to transport the cargo and supplies needed for DGP. The port to mine access road is not part of the DGP major stationary source, and therefore, the emissions are not included in Construction Permit AQ0934CPT01. Donlin will not need an air quality control permit to construct or operate the port to mine access road. However, they will need to control the fugitive dust emissions, as required under 18 AAC 50.045(d).

## **2. EMISSIONS SUMMARY AND PERMIT APPLICABILITY**

### **2.1. Emissions Summary and Permit Applicability**

Donlin is proposing to make physical changes that will classify the stationary source as a PSD “major stationary source” under 40 C.F.R. 52.21(b)(1)(i)(c). Potential emissions from the proposed project are significant for seven different PSD pollutants: NO<sub>x</sub>, CO, PM, PM-10, PM-2.5, VOC, and GHG. Table 1 lists total facility potential to emit<sup>1</sup> (PTE) relative to the PSD major source thresholds under 40 C.F.R. 52.21(b)(1)(i)(b) and the significant emissions rates under 40 C.F.R. 52.21(b)(23)(i) and 40 C.F.R. 52.21(b)(49)(iii) for PSD regulated pollutants. Fugitive emissions are not included in determining major stationary source status, per 40 C.F.R. 52.21(b)(1)(iii). However, fugitive emissions are included when comparing the project emissions to the significant emission rates.

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<sup>1</sup> PTE for the DGP were determined based on the maximum emission rates for the life of the mine.

**Table 1: Major Source and PSD Review Applicability**

Description	CO	NOx	PM-2.5	PM-10	PM	SO <sub>2</sub>	VOC	CO <sub>2e</sub> <sup>1</sup>
PTE for AQ0934CPT01 excluding fugitive emissions	1,255.8	1,230.2	598.9	599.5	610.6	25.6	1,167.6	1,727,638
Major Source Threshold	250	250	250	250	250	250	250	N/A
Major Source Triggered?	<b>Yes</b>	<b>Yes</b>	<b>Yes</b>	<b>Yes</b>	<b>Yes</b>	<b>No</b>	<b>Yes</b>	<b>No</b>
PTE for AQ0934CPT01 including fugitive emissions	3,177.0	1,281.8	809.1	1,963.3	5,257.8	25.7	1,164.6	1,736,083
PSD Significant Emissions Rates	100	40	10 <sup>2</sup>	15	25	40	40 <sup>3</sup>	75,000
PSD Review Triggered?	<b>Yes</b>	<b>Yes</b>	<b>Yes</b>	<b>Yes</b>	<b>Yes</b>	<b>No</b>	<b>Yes</b>	<b>Yes</b>

Table Notes:

<sup>1</sup>GHGs are subject to regulation because the stationary source is major for a non-GHG pollutant and the CO<sub>2e</sub> is at least 75,000 tpy.

<sup>2</sup>PSD review for PM-2.5 can also be triggered by NOx and SO<sub>2</sub> precursor emissions, as specified under 40 C.F.R. 52.21(b)(23)(i).

<sup>3</sup>VOC acts as a surrogate for ozone (O<sub>3</sub>). In addition to the VOC emissions trigger, PSD review for O<sub>3</sub> can also be triggered by NOx emissions, as specified under 40 C.F.R. 52.21(b)(23)(i).

CO, NOx, PM-2.5, PM-10, PM, and VOC emissions are all over the 250 ton per year major source threshold found in 40 C.F.R. 52.21(b)(1)(i)(b), therefore the source is subject to PSD review for each regulated NSR pollutant where the PTE is at least the significant emission rate. As shown in Table 1 SO<sub>2</sub> is the only NSR pollutant not subject to PSD review.

Table 2 shows a summary of the project’s PTE for CO, NOx, PM-2.5, PM-10, PM, VOC, and SO<sub>2</sub> for determining assessable emissions. Fugitive emissions are included in Table 2. Detailed emissions calculations are included in Appendix A.

**Table 2: Emissions from Stationary EUs at DGP, Tons per Year**

Description	CO	NOx	PM-2.5	PM-10	PM	SO <sub>2</sub>	VOC
PTE for AQ0934CPT01	3,177.0	1,281.8	809.1	1,963.3	5,257.8	25.7	1,164.6
<b>Assessable Emissions</b>	<b>3,177</b>	<b>1,282</b>	<b>N/A<sup>1</sup></b>	<b>N/A<sup>1</sup></b>	<b>5,258</b>	<b>26</b>	<b>1,165</b>
	<b>10,908</b>						

Table Notes:

<sup>1</sup> Camp Units not included in assessable emissions because they will be operated for a limited time as described in Section 2.2

Total assessable emissions for the source are 10,908 tpy.

Donlin’s application shows that the source’s PTE hazardous air pollutants (HAPs) are 23.0 tpy with the highest one at 9.7 tpy.

## 2.2. Department Findings

Based on the review of the application, the Department finds that:



1. The DGP is classified as a major stationary source under 40 C.F.R. 52.21(b)(1)(i)(c) because the change to the stationary source by itself has the potential to emit at least 250 tpy of a regulated air pollutant.
2. The DGP has potential NO<sub>x</sub>, CO, PM, PM-10, PM-2.5, VOC, and GHG emissions that are PSD significant, per 40 C.F.R. 52.21(b)(23)(i) and 40 C.F.R. 52.21(b)(49)(iii). The GHGs are subject to regulation per 40 C.F.R. 52.21(b)(49)(iv)(a). Therefore, the project requires a PSD permit under 18 AAC 50.306(a) for these pollutants.
3. The Department included three mobile sources (water truck, grader, and dozer) in the emission unit inventory table of AQ0934CPT01. The tail pipe emissions of these mobile sources are not regulated under AQ0934CPT01, however these mobile sources are sources of fugitive dust and those emissions are included for permit applicability and assessable emissions.
4. Because Donlin is requesting ORLs the project is also classified under 18 AAC 50.508(5). This project is additionally classified under 18 AAC 50.502(b)(3) for the construction, operation, or relocation of a stationary source containing a rock crusher with a rated capacity of at least five tons per hour.
5. The project does not trigger a minor permit under 18 AAC 50.502(c)(3) or 18 AAC 50.502(c)(4) for SO<sub>2</sub>.
6. Donlin requested a limit to use only ULSD as fuel for any diesel fuel burning equipment to avoid PSD review for SO<sub>2</sub>. The Department has included conditions to comply with the requested SO<sub>2</sub> limit. The Department included both an operational limit and a tpy limit consistent with EPA policy on limiting PTE.
7. Donlin requested an emission limit for formaldehyde on EU IDs 1 through 12 to avoid classification as a HAPs major stationary source. The Department included both an operational limit and a tpy limit consistent with EPA policy on limiting PTE. The operational limit includes conditions for installation, operation, and maintenance of an oxidation catalyst to comply with the requested emission limit. The Department also included an initial source test requirement while firing natural gas. Unrestricted HAPs emissions from these units is not a concern while firing ULSD. Source testing is required on three of the units to account for emission rate variability among the twelve units.
8. Donlin proposed purchasing a camp waste incinerator (EU ID 27) that meets the control and emission standards required by 40 C.F.R. 60 Subpart CCCC.
9. For compliance with the BACT emission limits the Department required initial source testing for larger units with add-on controls. BACT limits for EU IDs 1 through 12 require source testing on three units, instead of one, as representation for all of the units to limit emission rate variability between the twelve units. Smaller units that are not likely to exceed the BACT limits are required to either submit to the Department a manufacturer's guarantee that the units will meet the BACT limits or source test the units to show they meet the BACT requirements.

10. The Department must rescind AQ0934ORL01 issued under 18 AAC 50.225 upon issuance of Construction Permit AQ0934CPT01 since AQ0934ORL01 will no longer allow Donlin to avoid all permitting obligations under AS 46.14.130. The title page of Construction Permit AQ0934CPT01 notes that the permit rescinds AQ0934ORL01.
11. Donlin needs to continue operating the existing EUs authorized under AQ0934ORL01 prior to commencing construction of the mine. Therefore, the Department incorporated the existing EU inventory and operational limits described in AQ0934ORL01 into Construction Permit AQ0934CPT01. However, Donlin will need to decommission/remove the existing EUs shortly after the new EUs of equivalent purpose become fully operational since they did not include the existing EUs in their ambient demonstration. The ambient air section of Construction Permit AQ0934CPT01 includes the authorization to continue operating the existing EUs during this interim period, as well as the requirement to decommission/remove the existing EUs once the replacement units become operational. The Department is taking this approach because AQ0934ORL01 ensures compliance with the Alaska Ambient Air Quality Standards (AAAQS) while allowing Donlin to avoid a minor permit.

### 3. PSD PERMIT REQUIREMENTS

PSD applicants must comply with the requirements of 40 C.F.R. 52.21, except as noted in 18 AAC 50.306.

40 C.F.R. 52.21(j)(1) requires that the major stationary source meet the applicable local standards, state requirements established in the Alaska State Implementation Plan (SIP), and federal standards of performance in 40 C.F.R. 60 and 61. The source must meet each applicable state and federal emissions standard described in Sections 3.1 and 3.2 of this TAR, the standards and associated monitoring requirements will be carried forward into the Title V operating permit for the source.

40 C.F.R. 52.21(j)(2) requires a major stationary source to apply Best Available Control Technology (BACT) for each regulated New Source Review pollutant that has the potential to emit greater than the significant amounts listed in 40 C.F.R. 52.21(b)(23)(i). Appendix B presents details of the BACT analysis for NO<sub>x</sub>, CO, VOC, PM, PM-10, PM-2.5, and GHGs.

40 C.F.R. 52.21(k) through (o) requires that the source contain the requirements under each section as applicable:

40 C.F.R. 52.21(k) - *Source Impact Analysis*: This includes a review of the allowable emissions increase concerning the AAAQS and increments;

40 C.F.R. 52.21(l) – *Air Quality Models*: Use of air quality models that are consistent with Appendix W of 40 C.F.R. 51;<sup>2</sup>

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<sup>2</sup> The Department used the 2005 version of Appendix W for the modeling review since that is the version currently adopted by reference in 18 AAC 50.040(f). EPA promulgated an update to Appendix W on January 17, 2017, but that update does not become effective until May 22, 2017. Permitting authorities also have a one-year transition period (which ends January 17, 2018) to incorporate the update into their New Source Review programs. The Department's use and reference to the 2005 version of Appendix W for this permitting action is therefore required under State rule and allowed under Federal rule.

40 C.F.R. 52.21(m) – *Air Quality Analysis*: Measured ambient air quality data, unless exempted under 40 C.F.R. 52.21(i)(5);

40 C.F.R. 52.21(n) - *Source Information*: Include all information about the source including a description of the nature, design capacity, location, schedule for modification and layout;

40 C.F.R. 52.21(o) – *Additional Impact Analyses*: The source must review air quality impacts on the project area, such as visibility; and

40 C.F.R. 52.21(p) – *Sources Impacting Federal Class I Areas*: Review air quality impacts on the Federal Class I area.

The requirements under 40 C.F.R. 52.21(k) through (p) are addressed in the modeling report in Appendix D of this TAR.

Donlin is required under 40 C.F.R. 52.21(r)(2) to commence construction of the stationary source within 18 months of permit issuance unless granted an extension in writing from the Department. Donlin would need to show that the extension is justified, in order for the Department to approve any request for an extension.

### **3.1. State Emission Standards**

40 C.F.R. 52.21(j)(1) requires the stationary source to meet each applicable limitation under the Alaska SIP. The stationary source will be subject to Title V permitting and the Title V permit, when issued, will require on-going MR&R with the state emission standards. The Department generally requires an initial compliance demonstration for state emission standards in a Title I permit if warranted.

Ongoing MR&R for EU IDs EG-1 through SG-2 was not included in the state emission standards as these are relatively small units that currently operate without ongoing MR&R for the state emission standards, and these units will be operating for a limited amount of time, as previously described in Section 2.2.

#### **3.1.1. 18 AAC 50.055(a)(1): Industrial Process and Fuel-Burning VE Standards**

Section 3 of the permit contains conditions that require initial compliance using 40 C.F.R. 60, Appendix A, Reference Method 9 observation to ensure the applicable diesel-fired equipment and crushers at the facility comply with the standard. Small natural gas-fired equipment was not included as it is unlikely that these units will exceed the VE standards.

#### **3.1.2. 18 AAC 50.055(b)(1): Industrial Process and Fuel-Burning PM Standards**

Industrial process equipment and fuel-burning equipment at the stationary source must comply with 18 AAC 50.055(b)(1), the state PM standards of 0.05 grains per dry standard cubic foot of exhaust. Initial compliance demonstrations were not included for PM as the PM emitting units are all subject to BACT limits and must demonstrate compliance with either a source test or submitting a manufacturer's guarantee. Compliance with the BACT limit will ensure compliance with the state PM standard.

### **3.1.3. 18 AAC 50.055(c): Sulfur Compound Emissions Standards**

Industrial process equipment and fuel-burning equipment at the stationary source must comply with 18 AAC 50.055(c), the state sulfur compounds emissions standard. Sulfur compound emissions, expressed as SO<sub>2</sub>, from an industrial process or from fuel-burning equipment may not exceed 500 parts per million by volume (ppmv) averaged over a period of three hours. This permit does not include SO<sub>2</sub> initial compliance demonstrations because these units will be subject to the ORL requiring the use of ULSD. The use of ULSD fuel will ensure compliance with the SO<sub>2</sub> state emission standard.

### **3.1.4. 18 AAC 50.050: Incinerator Emission Standards**

Incinerators at the stationary source must comply with 18 AAC 50.050, the state incinerator emission standards which includes a VE standard and a PM standard. The Department combined the VE standards for incinerators and for industrial process and fuel-burning equipment as the requirements are the same. EU IDs 27 and 28 are not subject to the incinerator PM standards because they have a rated capacity under 1,000 pounds per hour. They are included under the industrial process and fuel-burning standard requirements in the permit.

### **3.2. Standard Permit Conditions**

As required under 18 AAC 50.345 and 18 AAC 50.346, the Department must include the standard permit conditions (b) through (o). Section 10 of the permit lists these standard permit conditions.

## **4. PERMIT ADMINISTRATION**

The stationary source has the potential to emit more than 100 tpy of one or more pollutants. Therefore, a timely Title V application for the stationary source is due no later than 12 months after the stationary source commences operation. The Department will rescind AQ0934ORL01 upon issuance of AQ0934CPT01.

**APPENDIX A: EMISSIONS CALCULATIONS**

Table A-1 presents details of the EUs, their characteristics, and emissions. The Department obtained the emissions from Appendix B of the October 16, 2015 permit application.

**Table A-1: Detailed Permanent EU Inventory and Potential to Emit (tpy)**

ID	Hours per year <sup>1</sup>	Rating	CO			NOx			PM-2.5 PM-10 EF Units	PM-2.5		PM-10		PM		SO <sub>2</sub>			VOC		
			EF	Units	PTE	EF	Units	PTE		EF	PTE	EF	PTE	EF	PTE	EF	Units	PTE	EF	Units	PTE
1 <sup>2</sup>	8,760	16,786 kWe	0.18	g/kWe	<b>29.2</b>	0.53	g/kWe	<b>85.9</b>	g/kWe	0.29	<b>47.0</b>	0.29	<b>47.0</b>	0.29	<b>47.0</b>	0.0059	g/kWe	<b>1.0</b>	0.58	g/kWe	<b>94.0</b>
2 <sup>2</sup>	8,760	16,786 kWe	0.18	g/kWe	<b>29.2</b>	0.53	g/kWe	<b>85.9</b>	g/kWe	0.29	<b>47.0</b>	0.29	<b>47.0</b>	0.29	<b>47.0</b>	0.0059	g/kWe	<b>1.0</b>	0.58	g/kWe	<b>94.0</b>
3 <sup>2</sup>	8,760	16,786 kWe	0.18	g/kWe	<b>29.2</b>	0.53	g/kWe	<b>85.9</b>	g/kWe	0.29	<b>47.0</b>	0.29	<b>47.0</b>	0.29	<b>47.0</b>	0.0059	g/kWe	<b>1.0</b>	0.58	g/kWe	<b>94.0</b>
4 <sup>2</sup>	8,760	16,786 kWe	0.18	g/kWe	<b>29.2</b>	0.53	g/kWe	<b>85.9</b>	g/kWe	0.29	<b>47.0</b>	0.29	<b>47.0</b>	0.29	<b>47.0</b>	0.0059	g/kWe	<b>1.0</b>	0.58	g/kWe	<b>94.0</b>
5 <sup>2</sup>	8,760	16,786 kWe	0.18	g/kWe	<b>29.2</b>	0.53	g/kWe	<b>85.9</b>	g/kWe	0.29	<b>47.0</b>	0.29	<b>47.0</b>	0.29	<b>47.0</b>	0.0059	g/kWe	<b>1.0</b>	0.58	g/kWe	<b>94.0</b>
6 <sup>2</sup>	8,760	16,786 kWe	0.18	g/kWe	<b>29.2</b>	0.53	g/kWe	<b>85.9</b>	g/kWe	0.29	<b>47.0</b>	0.29	<b>47.0</b>	0.29	<b>47.0</b>	0.0059	g/kWe	<b>1.0</b>	0.58	g/kWe	<b>94.0</b>
7 <sup>2</sup>	8,760	16,786 kWe	0.18	g/kWe	<b>29.2</b>	0.53	g/kWe	<b>85.9</b>	g/kWe	0.29	<b>47.0</b>	0.29	<b>47.0</b>	0.29	<b>47.0</b>	0.0059	g/kWe	<b>1.0</b>	0.58	g/kWe	<b>94.0</b>
8 <sup>2</sup>	8,760	16,786 kWe	0.18	g/kWe	<b>29.2</b>	0.53	g/kWe	<b>85.9</b>	g/kWe	0.29	<b>47.0</b>	0.29	<b>47.0</b>	0.29	<b>47.0</b>	0.0059	g/kWe	<b>1.0</b>	0.58	g/kWe	<b>94.0</b>
9 <sup>2</sup>	8,760	16,786 kWe	0.18	g/kWe	<b>29.2</b>	0.53	g/kWe	<b>85.9</b>	g/kWe	0.29	<b>47.0</b>	0.29	<b>47.0</b>	0.29	<b>47.0</b>	0.0059	g/kWe	<b>1.0</b>	0.58	g/kWe	<b>94.0</b>
10 <sup>2</sup>	8,760	16,786 kWe	0.18	g/kWe	<b>29.2</b>	0.53	g/kWe	<b>85.9</b>	g/kWe	0.29	<b>47.0</b>	0.29	<b>47.0</b>	0.29	<b>47.0</b>	0.0059	g/kWe	<b>1.0</b>	0.58	g/kWe	<b>94.0</b>
11 <sup>2</sup>	8,760	16,786 kWe	0.18	g/kWe	<b>29.2</b>	0.53	g/kWe	<b>85.9</b>	g/kWe	0.29	<b>47.0</b>	0.29	<b>47.0</b>	0.29	<b>47.0</b>	0.0059	g/kWe	<b>1.0</b>	0.58	g/kWe	<b>94.0</b>
12 <sup>2</sup>	8,760	16,786 kWe	0.18	g/kWe	<b>29.2</b>	0.53	g/kWe	<b>85.9</b>	g/kWe	0.29	<b>47.0</b>	0.29	<b>47.0</b>	0.29	<b>47.0</b>	0.0059	g/kWe	<b>1.0</b>	0.58	g/kWe	<b>94.0</b>
13 <sup>3</sup>	8,760	200 kWe	4.38	g/kWe	<b>8.5</b>	0.5	g/kWe	<b>1.0</b>	g/kWe	0.03	<b>0.06</b>	0.03	<b>0.1</b>	0.03	<b>0.1</b>	0.0066	g/kWe	<b>0.01</b>	0.24	g/kWe	<b>0.5</b>
14 <sup>3</sup>	8,760	200 kWe	4.38	g/kWe	<b>8.5</b>	0.5	g/kWe	<b>1.0</b>	g/kWe	0.03	<b>0.06</b>	0.03	<b>0.1</b>	0.03	<b>0.1</b>	0.0066	g/kWe	<b>0.01</b>	0.24	g/kWe	<b>0.5</b>
15 <sup>4</sup>	8,760	29.29 MMBtu/hr	84	lb/ MMscf	<b>10.6</b>	0.02	lb/gal	<b>19.7</b>	lb/gal <sup>5</sup>	7.6	<b>0.96</b>	0.001	<b>0.99</b>	0.003	<b>3.25</b>	0.0016	lb/ MMBtu	<b>0.2</b>	5.5	lb/ MMscf	<b>0.7</b>
16 <sup>4</sup>	8,760	29.29 MMBtu/hr	84	lb/ MMscf	<b>10.6</b>	0.02	lb/gal	<b>19.7</b>	lb/gal <sup>5</sup>	7.6	<b>0.96</b>	0.001	<b>0.99</b>	0.003	<b>3.25</b>	0.0016	lb/ MMBtu	<b>0.2</b>	5.5	lb/ MMscf	<b>0.7</b>
17 <sup>4</sup>	8,760	20.66 MMBtu/hr	84	lb/ MMscf	<b>7.5</b>	0.02	lb/gal	<b>13.9</b>	lb/gal <sup>5</sup>	7.6	<b>0.67</b>	0.001	<b>0.7</b>	0.003	<b>2.29</b>	0.0016	lb/ MMBtu	<b>0.1</b>	5.5	lb/ MMscf	<b>0.5</b>
18 <sup>4</sup>	8,760	16 MMBtu/hr	84	lb/ MMscf	<b>5.8</b>	0.02	lb/gal	<b>10.8</b>	lb/gal <sup>5</sup>	7.6	<b>0.52</b>	0.001	<b>0.54</b>	0.003	<b>1.78</b>	0.0016	lb/ MMBtu	<b>0.1</b>	5.5	lb/ MMscf	<b>0.4</b>

ID	Hours per year <sup>1</sup>	Rating	CO			NOx			PM-2.5 PM-10 EF Units	PM-2.5		PM-10		PM		SO <sub>2</sub>			VOC		
			EF	Units	PTE	EF	Units	PTE		EF	PTE	EF	PTE	EF	PTE	EF	Units	PTE	EF	Units	PTE
19 <sup>4</sup>	8,760	16.5 MMBtu/hr	84	lb/MMscf	6.0	0.02	lb/gal	11.1	lb/gal <sup>5</sup>	7.6	0.54	0.001	0.56	0.003	1.83	0.0016	lb/MMBtu	0.1	5.5	lb/MMscf	0.4
20 <sup>4</sup>	8,760	16.5 MMBtu/hr	84	lb/MMscf	6.0	0.02	lb/gal	11.1	lb/gal <sup>5</sup>	7.6	0.54	0.001	0.56	0.003	1.	0.0016	lb/MMBtu	0.1	5.5	lb/MMscf	0.4
21 <sup>6</sup>	8,760	2 MMBtu/hr	84	lb/MMscf	0.7	0.02	lb/gal	0.9	lb/MMscf	7.6	0.1	7.6	0.1	7.6	0.1	0.6	lb/MMscf	0.01	5.5	lb/MMscf	0.1
22 <sup>7</sup>	8,760	2 MMBtu/hr	0.005	lb/gal	0.3	0.02	lb/gal	1.4	lb/gal	2.5 E-04	0.02	0.001	0.1	0.003	0.2	0.0016	lb/MMBtu	0.01	3.4 E-04	lb/gal	0.02
23 <sup>6,8</sup>	8,760	24.15 MMBtu/hr	40	lb/MMscf	4.2	94	lb/MMscf	9.8	lb/MMscf	7.6	0.8	7.6	0.8	7.6	0.8	0.6	lb/MMscf	0.06	5.5	lb/MMscf	0.57
24 <sup>6,9</sup>	8,760	95 MMBtu/hr	84	lb/MMscf	34.3	100	lb/MMscf	40.8	lb/MMscf	7.6	3.1	7.6	3.1	7.6	3.1	0.6	lb/MMscf	0.24	5.5	lb/MMscf	2.24
25 <sup>6,10</sup>	8,760	17.5 MMBtu/hr	84	lb/MMscf	6.3	100	lb/MMscf	7.5	lb/MMscf	7.6	0.6	7.6	0.6	7.6	0.6	0.6	lb/MMscf	0.05	5.5	lb/MMscf	0.41
26 <sup>7</sup>	8,760	17.2 MMBtu/hr	0.005	lb/gal	2.9	0.02	lb/gal	11.6	lb/gal	2.50E-04	0.1	0.001	0.6	0.0033	1.9	0.0016	lb/MMBtu	0.12	3.4 E-04	lb/gal	0.20
27 <sup>11</sup>	8,760	990 lb/hr	0.005461	g/MJ	0.03	0.127	g/MJ	0.7	g/MJ	0.11	4.79	0.11	4.79	0.11	4.79	0.0013	g/MJ	0.01	7.04 E-07	g/MJ	4.03E-06
28 <sup>12</sup>	8	0.058 kWe	0.023666	g/MJ	0.01	0.156976	g/MJ	0.1	g/MJ	2.35E-02	0.01	2.35E-02	0.01	2.35E-02	0.01	0.0271	g/MJ	0.01	1.78 E-11	g/MJ	6.74E-12
29 <sup>13</sup>	500	600 kWe	4.38	g/kWe	1.5	8	g/kWe	2.7	g/kWe	0.25	0.1	0.25	0.1	0.25	0.1	0.0066	g/kWe	0.002	8	g/kWe	2.65
30 <sup>13</sup>	500	600 kWe	4.38	g/kWe	1.5	8	g/kWe	2.7	g/kWe	0.25	0.1	0.25	0.1	0.25	0.1	0.0066	g/kWe	0.002	8	g/kWe	2.65
31 <sup>13</sup>	500	1,500 kWe	4.38	g/kWe	3.6	8	g/kWe	6.6	g/kWe	0.25	0.2	0.25	0.2	0.25	0.2	0.0066	g/kWe	0.005	8	g/kWe	6.61
32 <sup>13</sup>	500	1,500 kWe	4.38	g/kWe	3.6	8	g/kWe	6.6	g/kWe	0.25	0.2	0.25	0.2	0.25	0.2	0.0066	g/kWe	0.005	8	g/kWe	6.61
33 <sup>13</sup>	500	1,500 kWe	4.38	g/kWe	3.6	8	g/kWe	6.6	g/kWe	0.25	0.2	0.25	0.2	0.25	0.2	0.0066	g/kWe	0.005	8	g/kWe	6.61
34 <sup>13</sup>	500	1,500 kWe	4.38	g/kWe	3.6	8	g/kWe	6.6	g/kWe	0.25	0.2	0.25	0.2	0.25	0.2	0.0066	g/kWe	0.005	8	g/kWe	6.61
35 <sup>14</sup>	500	252 hp	3.3	g/hp-hr	0.5	3.7	g/hp-hr	0.5	g/hp-hr	0.19	0.03	0.19	0.03	0.19	0.03	0.0049	g/hp-hr	0.001	3.7	g/hp-hr	0.51
36 <sup>14</sup>	500	252 hp	3.3	g/hp-hr	0.5	3.7	g/hp-hr	0.5	g/hp-hr	0.19	0.03	0.19	0.03	0.19	0.03	0.0049	g/hp-hr	0.001	3.7	g/hp-hr	0.51
37 <sup>14</sup>	500	252 hp	3.3	g/hp-hr	0.5	3.7	g/hp-hr	0.5	g/hp-hr	0.19	0.03	0.19	0.03	0.19	0.03	0.0049	g/hp-hr	0.001	3.7	g/hp-hr	0.51
77 <sup>15</sup>	8,760	210 ton/hr	88	lb/hr	385.5	--	--	--	g/hr	100	1.0	100	1.0	100	1.0	507/144 <sup>16</sup>	g/hr	6.29	19	g/hr	0.18
81 <sup>15</sup>	8,760	210 ton/hr	88	lb/hr	385.5	--	--	--	g/hr	100	1.0	100	1.0	100	1.0	507/144 <sup>16</sup>	g/hr	6.29	19	g/hr	0.18

ID	Hours per year <sup>1</sup>	Rating	CO			NOx			PM-2.5 PM-10 EF Units	PM-2.5		PM-10		PM		SO <sub>2</sub>			VOC		
			EF	Units	PTE	EF	Units	PTE		EF	PTE	EF	PTE	EF	PTE	EF	Units	PTE	EF	Units	PTE
85 <sup>17</sup>	8,760	--	--	--	--	--	--	--	g/hr	181	<b>1.8</b>	181	<b>1.8</b>	181	<b>1.8</b>	--	--	--	--	--	--
86 <sup>17</sup>	8,760	--	--	--	--	--	--	--	g/hr	181	<b>1.8</b>	181	<b>1.8</b>	181	<b>1.8</b>	--	--	--	--	--	--
87 <sup>17</sup>	8,760	--	--	--	--	--	--	--	g/hr	181	<b>1.8</b>	181	<b>1.8</b>	181	<b>1.8</b>	--	--	--	--	--	--
88 <sup>18</sup>	8,760	1.65 ton/hr	0.0437	gr/SCF	<b>3.9</b>	0.0009	gr/SCF	<b>0.1</b>	gr/SCF	2.18 E-02	<b>1.9</b>	2.18 E-02	<b>1.9</b>	2.18 E-02	<b>1.9</b>	--	--	--	0.022	gr/SCF	<b>1.92</b>
91-94 <sup>19</sup>	8,760	211 gpm	--	--	--	--	--	--	gr/SCF	5.2 E-03	<b>0.8</b>	5.2 E-03	<b>0.8</b>	5.2 E-03	<b>0.8</b>	--	--	--	--	--	--
97 <sup>20</sup>	8,760	--	--	--	--	--	--	--	gr/SCF	1.75E-02	<b>0.1</b>	1.75E-02	<b>0.1</b>	1.75E-02	<b>0.1</b>	--	--	--	--	--	--
100 <sup>21</sup>	8,760	--	--	--	--	--	--	--	gr/SCF	5.03E-03	<b>4.2</b>	5.03E-03	<b>4.2</b>	5.03E-03	<b>4.2</b>	--	--	--	--	--	--
103-104 <sup>22</sup>	8,760	3,575 lb/day	--	--	--	--	--	--	lb/hr	0.45	<b>2.0</b>	0.45	<b>2.0</b>	0.45	<b>2.0</b>	--	--	--	--	--	--
106 <sup>23</sup>	8,760	3,575 lb/day	--	--	--	--	--	--	lb/hr	0.94	<b>4.1</b>	0.94	<b>4.1</b>	0.94	<b>4.1</b>	--	--	--	--	--	--
108-109 <sup>22</sup>	8,760	3,575 lb/day	--	--	--	--	--	--	lb/hr	0.45	<b>2.0</b>	0.45	<b>2.0</b>	0.45	<b>2.0</b>	--	--	--	--	--	--
111 <sup>24</sup>	8,760	1,500 SCFM	--	--	--	--	--	--	lb/hr	0.26	<b>1.13</b>	0.26	<b>1.13</b>	0.26	<b>1.13</b>	--	--	--	--	--	--
126 <sup>25</sup>	7,500,000	2,500,000 gal	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<b>0.10</b>
127 <sup>25</sup>	7,500,000	2,500,000 gal	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<b>0.10</b>
128 <sup>25</sup>	7,500,000	2,500,000 gal	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<b>0.10</b>
129 <sup>25</sup>	7,500,000	2,500,000 gal	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<b>0.10</b>
130 <sup>25</sup>	7,500,000	2,500,000 gal	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<b>0.10</b>
131 <sup>25</sup>	7,500,000	2,500,000 gal	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<b>0.10</b>
132 <sup>25</sup>	7,500,000	2,500,000 gal	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<b>0.10</b>
133 <sup>25</sup>	7,500,000	2,500,000 gal	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<b>0.10</b>
134 <sup>25</sup>	7,500,000	2,500,000 gal	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<b>0.10</b>
135 <sup>25</sup>	7,500,000	2,500,000 gal	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<b>0.10</b>
136 <sup>25</sup>	7,500,000	2,500,000 gal	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<b>0.10</b>

ID	Hours per year <sup>1</sup>	Rating	CO			NOx			PM-2.5 PM-10 EF Units	PM-2.5		PM-10		PM		SO <sub>2</sub>			VOC		
			EF	Units	PTE	EF	Units	PTE		EF	PTE	EF	PTE	EF	PTE	EF	Units	PTE	EF	Units	PTE
137 <sup>25</sup>	7,500,000	2,500,000 gal	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.10
138 <sup>25</sup>	7,500,000	2,500,000 gal	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.10
139 <sup>25</sup>	7,500,000	2,500,000 gal	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.10
140 <sup>25</sup>	7,500,000	2,500,000 gal	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.10
141 <sup>25</sup>	19,035,000	25,000 gal	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.02
142 <sup>25</sup>	19,035,000	25,000 gal	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.02
143 <sup>25</sup>	793,101	10,000 gal	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	2.36E-03
144 <sup>25</sup>	6,776	270 gal	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	4.50E-05
145 <sup>25</sup>	6,776	270 gal	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	4.50E-05
146 <sup>25</sup>	3,942,411	5,000 gal	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	4.02E-03
147 <sup>25</sup>	1,390,621	5,000 gal	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.98E-03
148 <sup>25</sup>	1,076,771	5,000 gal	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.56E-03
149 <sup>25</sup>	134,596	500 gal	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.95E-04
150 <sup>25</sup>	3,899,388	33,000 gal	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.01
151 <sup>25</sup>	3,899,388	33,000 gal	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.01
152 <sup>25</sup>	218,800	25,000 gal	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.76E-03
153 <sup>25</sup>	6,776	270 gal	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	4.50E-05
154 <sup>25</sup>	55,000	9,900 gal	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.08
155 <sup>25</sup>	55,000	9,900 gal	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.08
156 <sup>25</sup>	10,000	5,000 gal	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.09
157 <sup>25</sup>	252,695	9,900 gal	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.50E-03



ID	Hours per year <sup>1</sup>	Rating	CO			NOx			PM-2.5 PM-10 EF Units	PM-2.5		PM-10		PM		SO <sub>2</sub>			VOC		
			EF	Units	PTE	EF	Units	PTE		EF	PTE	EF	PTE	EF	PTE	EF	Units	PTE	EF	Units	PTE
<i>Subtotal:</i>			1,255.8			1,230.2				598.9		599.5		610.6		25.6			1,167.6		
<b>FUGITIVE EMISSIONS</b>																					
38 <sup>26</sup>	8,760	44,676,000 ton/yr	--	--	--	--	--	--	lb/ton	3.40E-05	<b>0.8</b>	2.30 E-04	<b>5.1</b>	4.80 E-04	<b>10.7</b>	--	--	--	--	--	--
39 <sup>27</sup>	8,760	25,015 ACFM	--	--	--	--	--	--	lb/hr	2.14	<b>9.4</b>	2.14	<b>9.4</b>	2.14	<b>9.4</b>	--	--	--	--	--	--
41	8,760	44,676,000 ton/yr	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
42	8,760	44,676,000 ton/yr	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
43	8,760	44,676,000 ton/yr	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
44 <sup>26</sup>	8,760	44,676,000 ton/yr	--	--	--	--	--	--	lb/ton	3.40E-05	<b>0.8</b>	2.30 E-04	<b>5.1</b>	4.80 E-04	<b>10.7</b>	--	--	--	--	--	--
45 <sup>26</sup>	8,760	5,100 ton/yr	--	--	--	--	--	--	lb/ton	3.40E-05	<b>0.8</b>	2.30 E-04	<b>5.1</b>	4.80 E-04	<b>10.7</b>	--	--	--	--	--	--
46 <sup>28</sup>	8,760	5,591 ACFM	--	--	--	--	--	--	lb/hr	0.48	<b>2.1</b>	0.48	<b>2.1</b>	0.48	<b>2.1</b>	--	--	--	--	--	--
48 <sup>28</sup>	8,760	5,591 ACFM	--	--	--	--	--	--	lb/hr	0.48	<b>2.1</b>	0.48	<b>2.1</b>	0.48	<b>2.1</b>	--	--	--	--	--	--
50 <sup>28</sup>	8,760	5,591 ACFM	--	--	--	--	--	--	lb/hr	0.48	<b>2.1</b>	0.48	<b>2.1</b>	0.48	<b>2.1</b>	--	--	--	--	--	--
52 <sup>28</sup>	8,760	5,591 ACFM	--	--	--	--	--	--	lb/hr	0.48	<b>2.1</b>	0.48	<b>2.1</b>	0.48	<b>2.1</b>	--	--	--	--	--	--
54 <sup>29</sup>	8,760	3,303 ton/hr	--	--	--	--	--	--	lb/ton	3.40E-05	<b>0.5</b>	2.30 E-04	<b>3.3</b>	4.80 E-04	<b>6.9</b>	--	--	--	--	--	--
55-56 <sup>30</sup>	8,760	30,017 ACFM	--	--	--	--	--	--	lb/hr	2.57	<b>11.3</b>	2.57	<b>11.3</b>	2.57	<b>11.3</b>	--	--	--	--	--	--
58 <sup>31</sup>	8,760	660 ton/hr	--	--	--	--	--	--	lb/ton	3.40E-05	<b>0.1</b>	2.30 E-04	<b>0.7</b>	4.80 E-04	<b>1.4</b>	--	--	--	--	--	--
59 <sup>32</sup>	8,760	1,500 ACFM	--	--	--	--	--	--	lb/hr	0.26	<b>1.1</b>	0.26	<b>1.1</b>	0.26	<b>1.1</b>	--	--	--	--	--	--
61 <sup>32</sup>	8,760	1,500 ACFM	--	--	--	--	--	--	lb/hr	0.26	<b>1.1</b>	0.26	<b>1.1</b>	0.26	<b>1.1</b>	--	--	--	--	--	--
63 <sup>32</sup>	8,760	628 ACFM	--	--	--	--	--	--	lb/hr	0.11	<b>0.5</b>	0.12	<b>0.5</b>	0.12	<b>0.5</b>	--	--	--	--	--	--
65 <sup>33</sup>	8,760	840 ACFM	--	--	--	--	--	--	lb/hr	0.14	<b>0.6</b>	0.14	<b>0.6</b>	0.14	<b>0.6</b>	--	--	--	--	--	--
67 <sup>33</sup>	8,760	1,324 ACFM	--	--	--	--	--	--	lb/hr	0.23	<b>1.0</b>	0.23	<b>1.0</b>	0.23	<b>1.0</b>	--	--	--	--	--	--
69 <sup>33</sup>	8,760	3,002 ACFM	--	--	--	--	--	--	lb/hr	0.51	<b>2.3</b>	0.51	<b>2.3</b>	0.51	<b>2.3</b>	--	--	--	--	--	--

ID	Hours per year <sup>1</sup>	Rating	CO			NOx			PM-2.5 PM-10 EF Units	PM-2.5		PM-10		PM		SO <sub>2</sub>			VOC		
			EF	Units	PTE	EF	Units	PTE		EF	PTE	EF	PTE	EF	PTE	EF	Units	PTE	EF	Units	PTE
71 <sup>33</sup>	8,760	3,002 ACFM	--	--	--	--	--	--	lb/hr	0.51	2.3	0.51	2.25	0.51	2.3	--	--	--	--	--	--
73 <sup>33</sup>	8,760	2,000 ACFM	--	--	--	--	--	--	lb/hr	0.34	1.5	0.34	1.50	0.34	1.5	--	--	--	--	--	--
75 <sup>33</sup>	8,760	3,002 ACFM	--	--	--	--	--	--	lb/hr	0.51	2.3	0.51	2.25	0.51	2.25	--	--	--	--	--	--
113 <sup>34</sup>	--	141,512 holes/yr	--	--	--	--	--	--	lb/hole	0.04	2.8	0.68	47.8	1.3	92.0	--	--	--	--	--	--
114 <sup>35</sup>	--	620 blasts/yr	6,196.65	lb/blast	1920.96	166.48	lb/blast	51.61	lb/blast	17.46	5.41	302.62	93.81	581.97	180.41	0.55	lb/blast	0.2	--	--	--
115 <sup>36</sup>	8,760	13,059,932 ton/yr	--	--	--	--	--	--	lb/ton	2.27E-04	1.5	1.50	9.8	3.16	20.7	--	--	--	--	--	--
116 <sup>36</sup>	--	5,876,969 ton/yr	--	--	--	--	--	--	lb/ton	2.27E-04	0.7	1.50	4.4	3.16	9.3	--	--	--	--	--	--
117 <sup>36</sup>	--	0 ton/day	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
118 <sup>36</sup>	8,760	7,948,468 ton/yr	--	--	--	--	--	--	lb/ton	2.27E-04	0.9	1.50	5.95	3.16	12.6	--	--	--	--	--	--
119 <sup>36</sup>	8,760	152,286,568 ton/yr	--	--	--	--	--	--	lb/ton	2.27E-04	17.3	1.50	114	3.16	240.9	--	--	--	--	--	--
120 <sup>36</sup>	8,760	155,123,914 ton/yr	--	--	--	--	--	--	lb/ton	2.27E-04	17.4	1.50	115	3.16	243.2	--	--	--	--	--	--
121	13,986		--	--	--	--	--	--	lb/VMT <sup>37</sup>	0.22	1.8	2.19	17.8	9.00	73.3	--	--	--	--	--	--
122	75,495		--	--	--	--	--	--	lb/hr <sup>38</sup>	0.9	34.1	1.54	58.1	8.60	324.5	--	--	--	--	--	--
123	45,653		--	--	--	--	--	--	lb/VMT <sup>39</sup>	0.02	1.3	0.28	18.9	0.62	42.7	--	--	--	--	--	--
158 <sup>40</sup>	101,367	6.7 km	--	--	--	--	--	--	lb/VMT <sup>41</sup>	0.06	0.3	0.62	3.2	2.57	13.1	--	--	--	--	--	--
159 <sup>42</sup>	60,173	10.1 km	--	--	--	--	--	--	lb/VMT <sup>43</sup>	0.06	0.19	0.60	1.9	2.47	7.5	--	--	--	--	--	--
160 <sup>44</sup>	4,847,140		--	--	--	--	--	--	lb/VMT <sup>45</sup>	0.33	79.6	3.28	795.6	13.50	3,271.0	--	--	--	--	--	--
161 <sup>46</sup>			--	--	--	--	--	--			2.4		15.8		31.6	--	--	--	--	--	--
<i>Fugitives Subtotal:</i>			<i>1,1,921.2</i>			<i>51.7</i>			<i>210.2</i>		<i>1,363.8</i>		<i>4,646.9</i>		<i>0.2</i>			<i>0.0</i>			
<b>Total Emissions:</b>			<b>3,177.0</b>			<b>1,281.8</b>			<b>809.1</b>		<b>1,963.3</b>		<b>5,257.8</b>		<b>25.7</b>			<b>1,167.6</b>			

Table Notes: Mining activity rates are based on the highest CO, NOx, and PM-2.5 emissions year (LOM 16), and vary per year.

<sup>1</sup>For EU IDs 124-155 the values listed under “Hours per year” are annual throughput in gallons. For EU IDs 121-123 and 158-160 the values listed under “Hours per year” are annual vehicle miles travelled.

- <sup>2</sup>Emission factors provided by Wärtsilä. Assumed only diesel operation to determine worst case PTE, and applied SCR and oxidation catalyst controls as required by BACT. PM, PM-10, and PM-2.5 emissions include filterable and condensable emissions.
- <sup>3</sup>Emission factors from 40 C.F.R. 60.4204(b), 60.4201(a), and 1039.101, Table 1. A factor of 1.25 was applied per 40 C.F.R. 60.4204(d), 60.4212(b), and 1039.101(e)(2) and (3). SO<sub>2</sub> emissions based on 15 ppm per ORL to use only ULSD for diesel fuel.
- <sup>4</sup>CO, PM-2.5, and VOC emissions based on natural gas firing as worst case emissions for PTE. Emission factors taken from AP-42, Table 1.4-1. Assumed 1,020 Btu/scf for natural gas based on footnote to AP-42, Table 1.4-1 and 1.4-2. NO<sub>x</sub>, PM-10, and PM emissions based on diesel firing as worst case emissions for PTE. Emission factors taken from AP-42, Table 1.3-1 for NO<sub>x</sub> and PM and Table 1.3-6 for PM-10. SO<sub>2</sub> emissions based on 15 ppm per ORL to use only ULSD for diesel fuel.
- <sup>5</sup>Emission factor units for PM-2.5 are lb/MMscf
- <sup>6</sup>Emission factors taken from AP-42, Table 1.4-1 for CO and NO<sub>x</sub>, and Table 1.4-2 for PM-2.5, PM-10, PM, VOC, and SO<sub>2</sub>.
- <sup>7</sup>Emission factors taken from AP-42, Table 1.3-1 for CO and NO<sub>x</sub>, Table 1.3-6 for PM-2.5 and PM-10, Tables 1.3-1 and 1.3-2 for PM, and Table 1.3-3 for VOC. SO<sub>2</sub> emissions based on 15 ppm per ORL to use only ULSD for diesel fuel.
- <sup>8</sup>Covers 138 units.
- <sup>9</sup>Covers 19 units
- <sup>10</sup>Covers 7 units
- <sup>11</sup>Emission factors taken from 40 C.F.R. 60 Subpart CCCC, Table 8. Assumed 9,570 dscf/MMBtu at 0% O<sub>2</sub>, 0.26 Nm<sup>3</sup>/MJ at 0% O<sub>2</sub>, 4,500 Btu/lb waste.
- <sup>12</sup>Emission factors taken from 40 C.F.R. 60 Subpart LLLL, Table 2. Assumed 9,570 dscf/MMBtu at 0% O<sub>2</sub>, 0.26 Nm<sup>3</sup>/MJ at 0% O<sub>2</sub>, 7,700 Btu/lb dry sludge.
- <sup>13</sup>Emission factors for CO, NO<sub>x</sub>, PM-2.5, PM-10, PM, and VOC taken from 40 C.F.R. 60.4205(b), 60.4202(a)(2), and 89.112, Table 1. A factor of 1.25 was applied per 40 C.F.R. 60.4205(e) and 60.4212(c). SO<sub>2</sub> emissions based on 15 ppm per ORL to use only ULSD for diesel fuel.
- <sup>14</sup>Emission factors for CO, NO<sub>x</sub>, PM-2.5, PM-10, PM, and VOC taken from 40 C.F.R. 60.4205(c), Table 4. A factor of 1.25 was applied per 40 C.F.R. 4205(e) and 60.4212(d). SO<sub>2</sub> emissions based on 15 ppm per ORL to use only ULSD for diesel fuel.
- <sup>15</sup>CO emission factor from email from T. Krumins, Hatch. PM-2.5, PM-10, PM, Sulfur, and VOC emission factors from Hatch, Hg Emissions Control Summary.
- <sup>16</sup>507 g/hr is the SO<sub>2</sub> emission factor and 144 g/hr is the H<sub>2</sub>S emission factor. Both were used in determining the sulfur emissions from EU IDs 77 and 81.
- <sup>17</sup>PM-2.5, PM-10, and PM emission factors from Hatch, Hg Emissions Controls Summary.
- <sup>18</sup>Emission factors based on Barrick Goldstrike 2006-2011 source tests data for CO, 2006-2007 source test data for NO<sub>x</sub>, 2006-2012 source test data for PM-2.5, PM-10, and PM, and 2006-2011 source test data for VOC.
- <sup>19</sup>PM-2.5, PM-10, and PM emission factors based on Barrick Goldstrike 2008-2012 source test data.
- <sup>20</sup>PM-2.5, PM-10, and PM emission factors based on Barrick Goldstrike 2008-2012 source test data.
- <sup>21</sup>PM-2.5, PM-10, and PM emission factors based on Barrick Goldstrike 2004-2012 source test data.
- <sup>22</sup>Emission factors based on Barrick Goldstrike 2011 source test data.
- <sup>23</sup>Emission factors based on Barrick Goldstrike 2008-2012 source test data.
- <sup>24</sup>Emission factors based on vendor guarantee for dust collector (EU ID 112).
- <sup>25</sup>VOC emissions provided by TANKS.
- <sup>26</sup>Emission factors taken from AP-42, Section 13.2.4, Equation 1 where U = 1.3 mph and M = 1.8%.
- <sup>27</sup>Emission factors based on vendor guarantee of 0.01 gr/ACF for dust collector (EU ID 40).
- <sup>28</sup>Emission factors based on vendor guarantee of 0.01 gr/ACF for dust collectors (EU IDs 47, 49, 51, and 53).
- <sup>29</sup>Emission factors taken from AP-42, Section 13.2.4, Equation 1 where U = 1.3 mph, and M = 1.8%
- <sup>30</sup>Emission factors based on vendor guarantee of 0.01 gr/ACF for dust collector (EU ID 57).
- <sup>31</sup>Emission factors taken from 13.2.4, Equation 1 where U = 1.3 mph and M = 1.8%.
- <sup>32</sup>Emission factors based on vendor guarantee of 0.02 gr/ACF for dust collectors (EU IDs 60, 62, and 64).
- <sup>33</sup>Emission factors based on vendor guarantee of 0.02 gr/ACF for dust collectors (EU IDs 66, 68, 70, 72, 74, and 76).

<sup>34</sup>Emission factors taken from AP-42, Table 11.9-4.

<sup>35</sup>Emission factors taken from AP-42, Table 13.3-1 for CO, CSIRO for NOx, AP-42, Table 11.9-1 for PM-2.5, PM-10, and PM, and based on 15 ppm S in FO and maximum of 10% FO in ANFO.

<sup>36</sup>Emission factors taken from AP-42, Section 13.2.4, Equation 1 where  $U = 7.947$  mph,  $M = 2.5\%$ , and  $k$  taken from AP-42, Section 13.2.4.

<sup>37</sup>Emission factors taken from AP-42, Table 13.2.2-1, Equations 1a and 2, where  $s = 3.8\%$ ,  $W = 183$  tons,  $P = 129$ ,  $k = 0.15$  (PM-2.5); 1.5 (PM-10); and 4.9 (PM),  $a = 0.9$  (PM-2.5 and PM-10); 0.7 (PM), and  $b = 0.45$ . Assumes 90% emissions control.

<sup>38</sup>Emission factors taken from AP-42, Table 11.9-1, where  $M = 2.5\%$  and  $s = 3.8\%$ .

<sup>39</sup>Emission factors taken from AP-42, Table 11-1, where  $S = 3$  mph.

<sup>40</sup>Emissions include travel from bus, light vehicle, water truck, and grader.

<sup>41</sup>Emission factor listed is for bus/light vehicle/water truck and taken from AP-42, Table 13.2.2-1, Equations 1a and 2, where  $s = 3.8\%$ ,  $W = 10.3$  tons,  $P = 129$ ,  $k = 0.15$  (PM-2.5); 1.5 (PM-10); and 4.9 (PM),  $a = 0.9$  (PM-2.5 and PM-10); 0.7 (PM), and  $b = 0.45$ . Assumes 90% emissions control. Emission factors for the grader taken from AP-42, Table 11-1, where  $S = 3$  mph.

<sup>42</sup>Emissions include travel from bus, light vehicle, water truck, and grader.

<sup>43</sup>Emission factor listed is for bus/light vehicle/water truck and taken from AP-42, Table 13.2.2-1, Equations 1a and 2, where  $s = 3.8\%$ ,  $W = 11.2$  tons,  $P = 129$ ,  $k = 0.15$  (PM-2.5); 1.5 (PM-10); and 4.9 (PM),  $a = 0.9$  (PM-2.5 and PM-10); 0.7 (PM), and  $b = 0.45$ . Assumes 90% emissions control. Emission factors for the grader taken from AP-42, Table 11-1, where  $S = 3$  mph.

<sup>44</sup>Emissions for the Haul Road includes Ore Hauling and Waste Hauling.

<sup>45</sup>Emission factors taken from AP-42, Table 13.2.2-1, Equations 1a and 2, where  $s = 3.8\%$ ,  $W = 449.4$  tons,  $P = 129$ ,  $k = 0.15$  (PM-2.5); 1.5 (PM-10); and 4.9 (PM),  $a = 0.9$  (PM-2.5 and PM-10); 0.7 (PM), and  $b = 0.45$ . Assumes 90% emissions control

<sup>46</sup>See Emissions Calculations in Table A-2.

Table A-2 presents details of the EUs, their characteristics, and emissions. The Department obtained the emissions from Appendix B of the October 16, 2015 permit application. This table only includes wind erosion emissions at the stationary source.

**Table A-2: Detailed Wind Erosion and Tons Emittted per Year**

Description	Operation	Units	PM-2.5			PM-10			PM		
			Emission Factor	Units	PTE	Emission Factor	Units	PTE	Emission Factor	Units	PTE
Wind Erosion – Tailings <sup>1</sup>	798	acre			0.3			1.9			3.9
Wind Erosion - Inside Pit <sup>1</sup>	130.5	acre	0.006255	ton/acre-yr	0.08	0.0417	ton/acre-yr	0.5	0.0834	ton/acre-yr	1.1
Wind Erosion - Outside Pit <sup>1</sup>	84.2	acre	0.006255	ton/acre-yr	0.05	0.0417	ton/acre-yr	0.4	0.0834	ton/acre-yr	0.7
Wind Erosion - Camp to Mine <sup>1</sup>	15	acre	0.006255	ton/acre-yr	0.01	0.0417	ton/acre-yr	0.06	0.0834	ton/acre-yr	0.1
Wind Erosion - Airport to Camp <sup>1</sup>	22.4	acre	0.006255	ton/acre-yr	0.01	0.0417	ton/acre-yr	0.09	0.0834	ton/acre-yr	0.2
Wind Erosion - Waste Rock <sup>1</sup>					1.7			11.6			23.2
Wind Erosion - Short Term Stockpile <sup>1</sup>					0.02			0.2			0.03
Wind Erosion - Long Term Stockpile West <sup>1</sup>					0.03			0.2			0.4
Wind Erosion - Long Term Stockpile East <sup>1</sup>					0.05			0.3			0.7
Wind Erosion - Overburden					0.02			0.1			0.2
<b>Total Emissions</b>					<b>2.4</b>			<b>15.8</b>			<b>31.60</b>

Table Notes:

<sup>1</sup>Emission factors taken from AP-42, Section 13.2-5. Roads include 90% efficiency from water and chemical spray, tailings emissions does not.

Table A-3 presents details of the EUs and their GHG emissions. The Department obtained the emissions from Appendix B of the October 16, 2015 permit application.

**Table A-3: Detailed GHG Emitted per Year**

EU IDs	Operation	Fuel <sup>1</sup>	Emission Factor Units	CO <sub>2</sub>		CH <sub>4</sub>		N <sub>2</sub> O		CO <sub>2</sub> -e <sup>2</sup>
				Emission Factor <sup>3</sup>	PTE (tpy)	Emission Factor <sup>3</sup>	PTE (tpy)	Emission Factor <sup>3</sup>	PTE (tpy)	PTE (tpy)
1-12	15,081,772 MMBtu/yr	Diesel	kg/MMBtu	73.96	1,299,570	0.003	49.87	0.0006	9.98	1,233,790
13-14	32,893 MMBtu/yr	Diesel	kg/MMBtu	73.96	2,682	0.003	0.11	0.0006	0.02	2,691
15-16	181,013 MMBtu/yr	Diesel	kg/MMBtu	73.96	14,757	0.003	0.6	0.0006	0.12	14,808
17	513,172 MMBtu/yr	Diesel	kg/MMBtu	73.93	41,837	0.003	1.7	0.0006	0.34	41,981
18	140,160 MMBtu/yr	Diesel	kg/MMBtu	73.96	11,427	0.003	0.46	0.0006	0.09	11,466
19-20	298,080 MMBtu/yr	Diesel	kg/MMBtu	73.96	23,568	0.003	0.98	0.0006	0.19	23,649
21	17,520 MMBtu/yr	Natural Gas	kg/MMBtu	53.06	1,025	0.001	0.02	0.0001	0.002	1,026
22	17,520 MMBtu/yr	Diesel	kg/MMBtu	73.96	1,428	0.003	0.06	0.0006	0.01	1,433
23	211,544 MMBtu/yr	Natural Gas	kg/MMBtu	53.06	12,374	0.001	0.23	0.0001	0.02	12,386
24	832,200 MMBtu/yr	Natural Gas	kg/MMBtu	53.06	48,674	0.001	0.92	0.0001	0.09	48,725
25	153,300 MMBtu/yr	Natural Gas	kg/MMBtu	53.06	8,966	0.001	0.17	0.0001	0.02	8,976
26	150,672 MMBtu/yr	Diesel	kg/MMBtu	73.96	12,284	0.003	0.5	0.0006	0.1	12,326
29-30	5,632 MMBtu/yr	Diesel	kg/MMBtu	73.96	459	0.003	0.19	0.0006	0.004	461
31-34	28,481 MMBtu/yr	Diesel	kg/MMBtu	73.96	2,322	0.003	0.09	0.0006	0.02	2,330
35-37	2,646 MMBtu/yr	Diesel	kg/MMBtu	73.96	216	0.003	0.01	0.0006	0.002	216
27-28	5,253 MMBtu/yr	Municipal Waste	kg/MMBtu	90.7	525	0.032	0.19	0.0042	0.02	537
77 and 81	8,760 hr/yr	N/A	ton/hr	2.15	37,659	--	--	--	--	37,659
122	8,760 hr/yr	N/A	ton/hr	9.57	83,816	--	--	--	--	83,816
123	8,760 hr/yr	N/A	ton/hr	21.6	189,359	--	--	--	--	189,359
<i>Subtotal</i>					<i>1,722,949</i>		<i>56.1</i>		<i>11.03</i>	<i>1,727,638</i>
<b>FUGITIVE EMISSIONS</b>										
114	103,236 MMBtu/yr <sup>4</sup>	Diesel	kg/MMBtu	73.96	8,416	0.003	0.34	0.0006	0.07	8,445
<i>Fugitives Subtotal</i>					<i>8,416</i>		<i>0.34</i>		<i>0.07</i>	<i>8,445</i>
<b>Total Emissions</b>					<b>1,731,365</b>		<b>56.4</b>		<b>11.1</b>	<b>1,736,083</b>

Table Notes:

<sup>1</sup>Fuel type for dual-fuel EUs was chosen to determine the worst case GHG PTE.

<sup>2</sup>CO<sub>2</sub>-e is determined by combining CO<sub>2</sub>, CH<sub>4</sub>, and N<sub>2</sub>O emissions using factors of 25 for CH<sub>4</sub> and 298 for N<sub>2</sub>O. Factors taken from 40 C.F.R. 98, Table A-1.

<sup>3</sup>Emission factors based on fuel type taken from 40 C.F.R. 98, Tables C-1 and C-2.

<sup>4</sup>Based on 793,101 gal/yr and heating value of 103,167 Btu/gal

## APPENDIX B: BEST AVAILABLE CONTROL TECHNOLOGY

### 1.0 Introduction

The Donlin Gold Project (DGP) triggered Prevention of Significant Deterioration (PSD) requirements for carbon monoxide (CO), oxides of nitrogen (NO<sub>x</sub>), particulate matter (PM), particulate matter with an aerodynamic diameter less than or equal to a nominal 10 micrometers (PM-10), particulate matter with an aerodynamic diameter less than or equal to a nominal 2.5 micrometers (PM-2.5), volatile organic compounds (VOC), and greenhouse gases (GHG). This appendix reviews Donlin Gold, LLC.'s (Donlin's) Best Available Control Technology (BACT) analysis for CO, NO<sub>x</sub>, PM, PM-10, PM-2.5 (the Department will refer to PM, PM-10, and PM-2.5 as particulates in this BACT analysis), VOC, and GHG for its technical accuracy and adherence to accepted engineering cost estimation practices.

### 2.0 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 C.F.R. 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 Donlin Gold Project (DGP) that emit CO, NO<sub>x</sub>, particulates, VOC, and GHG, establish emission limits which represent BACT, and assess the level of monitoring, recordkeeping, and reporting requirements (MR&Rs) necessary to ensure Donlin 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 2-1 presents the EUs subject to BACT review.

**Table 2-1: EUs Subject to BACT Review**

EU ID	Description of EU
1 – 12	Main Power Plant
13 – 14	Small Diesel Engines
15 – 26	Boilers and Heaters
27 – 28	Camp Waste and Sewage Sludge Incinerators
29 – 37	Black Start and Emergency Diesel Engines
38, 39, 41 – 46, 48, 50, 52, 54 – 56, & 58	Ore Crushing and Transfers
59, 61, 63, 65, 57, 69, 71, 73, & 75	Mill Reagents Handling
77 & 81	Autoclaves
85 – 87	Pressure Oxidation Hot Cure
88	Carbon Regeneration Kiln
91 – 94	Electrowinning Cells
97	Mercury Retort
100	Induction Smelting Furnace
103, 104, 106, 108, and 109	Laboratories
111	Reagent Handling for Water Treatment
113 – 114	Drilling and Blasting
115 – 120	Material Loading and Unloading
124 – 125	Acidulation and Neutralization Tanks
126 – 157	Fuel Tanks

EU ID	Description of EU
158, 159, & 160	Unpaved Roads
161	Wind Erosion

***Five-Step BACT Determinations***

The following sections explain the steps used to determine BACT for CO, NOx, Particulates, VOC, and GHG for the applicable equipment.

**Step 1 Identify All Potentially Available Control Options**

The Department identifies all available control options 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 NOx, CO, Particulates, VOC, and GHG emissions from equipment similar to those listed in Table B-1.

**Step 2 Eliminate Technically Infeasible Control Options:**

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 options deemed technically infeasible due to physical, chemical, and engineering difficulties.

**Step 3 Rank Remaining Control Technologies by Control Effectiveness**

The Department ranks the remaining control options 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 permit application about the control efficiency, emission rate, emission reduction, cost, environmental, and energy impacts for each option to decide the final level of control. The applicant must present an objective evaluation of both the beneficial and adverse energy, environmental, and economic impacts. An applicant proposing 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.



### 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 DGP’s BACT analysis and made BACT determinations for NOx, CO, Particulates, VOC, and GHG for various EUs based on the information submitted by Donlin in their application, information from vendors, suppliers, sub-contractors, RBLC, and a comprehensive internet search.

### 3.0 Main Power Plant

Electric power for the mine will be generated from a dual-fuel fired (natural gas and ultra-low sulfur diesel [ULSD]) reciprocating-engine onsite power plant with a steam turbine utilizing waste heat recovered from the engines (combined cycle power plant). The combined cycle power plant will consist of 12 Wärtsilä Model 18V50DF engines, each rated at approximately 17 megawatts (MW), for a total of 205 MW (gross) from the engines and an additional 15 MW (gross) from the steam turbine. The total gross power output from the plant will be 220 MW.

The power plant will emit CO, NOx, SO<sub>2</sub>, particulates, VOC, and GHG. The following sections provide the BACT review for each of these pollutants (except SO<sub>2</sub>) for each fuel type.

#### 3.1 CO

Possible CO 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 horsepower [hp]). The search results for gas-fired and oil-fired engines are summarized in Table 3-1 and Table 3-2, respectively.

**Table 3-1. CO Control for Large Gas-Fired Engines**

Control Technology	Number of Determinations	Emission Limits (g/hp-hr)
Oxidation Catalyst	13	0.08 - 1.0
NSPS JJJJ	2	2.8 - 4.4
Good Combustion Practices	15	1.5 - 5.2
No Control Specified	25	0.8 - 8.5

**Table 3-2. CO Control for Large Oil-Fired Engines**

Control Technology	Number of Determinations	Emission Limits (g/hp-hr)
Oxidation Catalyst	1	2.6
NSPS IIII	14	0.2 - 2.6
Good Combustion Practices	36	0.0008 - 2.7
No Control Specified	36	0.13 - 23.2

### Step 1 – Identification of CO Control Technologies for Large Engines

From research, the Department identified the following technologies as available for CO control of engines rated at 500 hp or greater:

- (a) Oxidation Catalyst

CO catalysts oxidize CO and hydrocarbon compounds to carbon dioxide and water vapor. The reaction is spontaneous and no reactants are required. CO catalysts can achieve up to 90% reduction in CO emissions.

(b) Good Combustion Practices (GCP)

GCP typically include the following elements:

1. Sufficient residence time to complete combustion;
2. Providing and maintaining proper air/fuel ratio;
3. High temperatures and low oxygen levels in the primary combustion zone;
4. High enough overall excess oxygen levels to complete combustion and maximize thermal efficiency;
5. Proper fuel gas supply system designed to minimize effects of contaminants or fluctuations in pressure and flow on the fuel gas delivered.

Combustion efficiency is dependent on the gas residence time, the combustion temperature, and the amount of mixing in the combustion zone. GCP is accomplished primarily through combustion chamber design as it relates to residence time, combustion temperature, air-to-fuel mixing, and excess oxygen levels.

(c) Good Operating Practices (GOP)

GOP typically include the following elements:

1. All operators and supervisors shall be properly trained to operate and ensure maintenance of a system in accordance with the guidelines and procedures established by the manufacturer.
2. Training shall include good operating practices as well as methods for minimizing excess emissions.

**Step 2 – Elimination of Technically Infeasible CO Control Options for Large Engines**

All three control technologies listed above are technically feasible.

**Step 3 – Ranking of Remaining CO Control Options for Large Engines**

The following control technologies have been identified and ranked for control of CO from the large engines:

- |                               |                         |
|-------------------------------|-------------------------|
| (a) Oxidation Catalyst        | (90% Control)           |
| (b) Good Combustion Practices | (Less than 90% Control) |
| (c) Good Operating Practices  | (Less than 90% Control) |

**Step 4 – Evaluate the Most Effective Controls**

An oxidation catalyst will reduce CO emissions from EU IDs 1 - 12 while having minimal energy and environmental impacts. This system requires no consumables and does not produce waste effluents or by-products aside from catalyst replacement and recycling as necessary. Engine efficiency will be minimally impacted by the oxidation catalyst.

**RBLC Review**

A review of similar units in the RBLC indicates that an oxidation catalyst and good combustion practices are the principle CO control technologies installed on large engines.

**Applicant Proposal**

Donlin proposed to install an oxidation catalyst and maintain good combustion practices for each of EU IDs 1 - 12 as BACT for reducing CO emissions from natural gas and ULSD combustion. Catalytic oxidation and good combustion practices will reduce CO emissions to below the applicable CO emission limit in NSPS Subpart JJJJ for firing natural gas. The CO BACT emission rates will be 0.18 g/kW-hr when firing ULSD and 0.12 g/kW-hr when firing natural gas in EU IDs 1 - 12.

**3.2 NOx**

Possible NOx 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 gas-fired and oil-fired engines are summarized in Table 3-3 and Table 3-4, respectively.

**Table 3-3. NOx Control for Large Gas-Fired Engines**

Control Technology	Number of Determinations	Emission Limits (g/hp-hr)
Selective Catalytic Reduction	3	0.08 - 0.21
Other Add-On Control	3	0.07 - 3.0
NSPS JJJJ	2	0.5 - 2.2
Good Combustion Practices	22	0.4 - 2.6
No Control Specified	33	0.5 - 6.9

**Table 3-4. NOx Control for Large Oil-Fired Engines**

Control Technology	Number of Determinations	Emission Limits (g/hp-hr)
Selective Catalytic Reduction	3	0.5 - 0.7
Other Add-On Control	1	1.0
NSPS IIII	12	3.0 - 6.9
Good Combustion Practices	29	3.0 - 13.5
No Control Specified	60	2.8 - 14.1

**Step 1 – Identification of NOx Control Technologies for Large Engines**

From research, the Department identified the following technologies as available for NOx control of engines rated at 500 hp or greater:

(a) Selective Catalytic Reduction (SCR)

SCR is a post-combustion gas treatment technique for reducing nitric oxide (NO) and nitrogen dioxide (NO<sub>2</sub>) in the turbine exhaust stream to molecular nitrogen (N<sub>2</sub>), water, and oxygen (O<sub>2</sub>). In the SCR process, aqueous or anhydrous ammonia (NH<sub>3</sub>) is injected into the flue gas upstream of a catalyst bed. The catalyst lowers the activation energy of the NO<sub>x</sub> decomposition reaction. NO<sub>x</sub> and NH<sub>3</sub> combine at the catalyst surface forming an ammonium salt intermediate, which subsequently decomposes to produce elemental N<sub>2</sub> and water. Depending on the overall NH<sub>3</sub>-to-NO<sub>x</sub> ratio, removal efficiencies are generally 80 to 90 percent.

(b) Lean-Burn Combustion Technology (Natural Gas)

Natural gas and air are combined before being introduced into the cylinders. The low fuel/air ration (lean-burn) reduces NO<sub>x</sub> emissions due to a lower combustion temperature.

(c) Low NO<sub>x</sub> Combustion (ULSD)

This process includes late fuel injection start, a high compression ratio, an optimized combustion chamber, an optimized fuel injection rate profile, early inlet valve closing, and high boost pressure to reduce peak combustion temperature for the control of NO<sub>x</sub>.

(d) Direct Water Injection (DWI)

NO<sub>x</sub> emissions can be reduced through DWI by 40 percent if high quality water is injected at a rate of 50 to 60 percent of the fuel consumption.

(e) Good Combustion Practices

See description in Section 3.1.

**Step 2 – Elimination of Technically Infeasible NO<sub>x</sub> Control Options for Large Engines**

DWI is the only NO<sub>x</sub> control option that is technically infeasible because this technology has not yet been designed for the engine model of EU IDs 1-12.

**Step 3 – Ranking of Remaining NO<sub>x</sub> Control Options for Large Engines**

The following control technologies have been identified and ranked for control of NO<sub>x</sub> from the large engines:

- (a) SCR (70% - 95% Control)
- (b) Good Combustion Practices (Less than 40% Control)

**Step 4 – Evaluate the Most Effective Controls**

SCR is the most common and effective NO<sub>x</sub> control for engines of this size. Environmental impacts are that the SCR adds exhaust back pressure that decreases the engine's efficiency and requiring additional fuel consumption; the SCR catalyst does need to be replaced and recycled as necessary, and the SCR will emit ammonia from the ammonia slip of the system. The ammonia slip is expected to be less than or equal to 9 parts per million.

**RBLC Review**

A review of similar units in the RBLC indicates that SCR and good combustion practices are the principle NOx control technologies installed on large engines.

**Applicant Proposal**

Donlin proposed to install SCR and use good combustion practices for EU IDs 1 - 12 as BACT for reducing NOx emissions from combustion of natural gas and ULSD. Using SCR and good combustion practices will reduce NOx emissions to below the applicable NOx emission limit in NSPS Subpart JJJJ for firing natural gas. The NOx BACT emission rates will be 0.08 g/kW-hr when firing natural gas and 0.53 g/kW-hr when firing ULSD in EU IDs 1 - 12.

**3.3 Particulates**

Possible particulate 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 gas-fired and oil-fired engines are summarized in Table 3-5.

**Table 3-5. Particulate Control for Large Gas-Fired and Oil-Fired Engines**

Control Technology	Number of Determinations	Emission Limits (g/hp-hr)
Clean Fuel	128	Gas: 0.003 – 0.40 Oil: 0.015 – 1.9
Good Combustion Practices		
No Control Specified		

**Step 1 – Identification of Particulate Control Technologies for Large Engines**

From research, the Department identified the following technologies as available for particulates control of engines rated at 500 hp or greater:

- (a) Add-On Controls  
 Add-on controls would include control devices such as a dust collector, electrostatic precipitator, or wet scrubber.
- (b) Clean Fuel  
 Clean fuel for particulate matter control is fuel with a low ash content.
- (c) Good Combustion Practices  
 See description in Section 3.1.

**Step 2 – Elimination of Technically Infeasible Particulate Control Options for Large Engines**

Add-on controls options were eliminated because they are ineffective in capturing small particulates from ULSD and natural gas combustion.

**Step 3 – Ranking of Remaining Particulate Control Options for Large Engines**

The following control technologies have been identified and ranked for control of particulates from the large engines:

- (a) Clean Fuel
- (b) Good Combustion Practices

**Step 4 – Evaluate the Most Effective Controls**

According to the RBLC clean fuel and good combustion practices are the applicable controls for particulate matter for EU IDs 1 - 12. Since these are not add-on controls, there are no additional environmental impacts

**RBLC Review**

A review of similar units in the RBLC indicates that good combustion practices are the principle particulate control technologies installed on large engines.

**Applicant Proposal**

Donlin proposed to use clean fuel and good combustion practices for EU IDs 1 - 12 as BACT for reducing particulate emissions from combustion of natural gas and ULSD. Natural gas is the cleanest fossil fuel and Donlin has proposed to use fuel oil No. 1 for ULSD as it has a negligible fuel ash content. Using these particulate control methods will reduce particulate emissions to below the applicable particulate emission limit in NSPS Subpart IIII for firing ULSD. Particulate BACT emission rates will be 0.13 g/kW-hr when firing natural gas and 0.15 g/kW-hr (0.29 g/kW-hr including condensable) when firing ULSD in EU IDs 1 - 12.

**3.4 VOC**

Possible VOC 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 gas-fired and oil-fired engines are summarized in Table 3-6 and Table 3-7, respectively.

**Table 3-6. VOC Control for Large Gas-Fired Engines**

Control Technology	Number of Determinations	Emission Limits (g/hp-hr)
Oxidation Catalyst	13	0.12 – 0.8
NSPS JJJJ	2	0.16 – 1.0
Good Combustion Practices	7	0.15 – 1.0
No Control Specified	19	0.15 – 5.8

**Table 3-7. VOC Control for Large Oil-Fired Engines**

Control Technology	Number of Determinations	Emission Limits (g/hp-hr)
Oxidation Catalyst	1	No Data
NSPS IIII	6	0.6 – 4.8
Good Combustion Practices	27	0.03 – 4.8
No Control Specified	26	0.01 – 2.2*

\*Listed as 0.68 lb/hr at 14 MMBtu/hr in the RBLC and converted to g/hp-hr assuming 7,000 Btu/hp-hr

**Step 1 – Identification of VOC Control Technologies for Large Engines**

From research, the Department identified the following technologies as available for VOC control of engines rated at 500 hp or greater:

- (a) Oxidation Catalyst  
 See description in Section 3.1.
- (b) Good Combustion Practices  
 See description in Section 3.1.

**Step 2 – Elimination of Technically Infeasible VOC Control Options for Large Engines**

None of the control options are technically infeasible.

**Step 3 – Ranking of Remaining VOC Control Options for Large Engines**

The following control technologies have been identified and ranked for control of VOC from the large engines:

- (a) Oxidation Catalyst (90% Control)
- (b) Good Combustion Practices (Less than 90% Control)

**Step 4 – Evaluate the Most Effective VOC Controls**

An oxidation catalyst will reduce VOC emissions from EU IDs 1 - 12 while having minimal energy and environmental impacts. This system requires no consumables and does not produce waste effluents or by-products aside from catalyst replacement and recycling as necessary. Engine efficiency will be minimally impacted by the oxidation catalyst.

**RBLC Review**

A review of similar units in the RBLC indicates that an oxidation catalyst and good combustion practices are the principle VOC control technologies installed on large engines.

**Applicant Proposal**

Donlin proposed to install an oxidation catalyst and good combustion practices for EU IDs 1 - 12 as BACT for reducing particulate emissions from combustion of natural gas and ULSD. Using an oxidation catalyst and good combustion practices will reduce VOC emissions to below the applicable VOC emission limit in NSPS Subpart JJJJ for firing natural gas. VOC BACT emission rates will be 0.09 g/kW-hr when firing natural gas and 0.21 g/kW-hr when firing ULSD in EU IDs 1 - 12.

**3.5 GHG**

Possible GHG 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 gas-fired and oil-fired engines are summarized in Table 3-8.

**Table 3-8. GHG Control for Large Gas-Fired and Oil-Fired Engines**

Control Technology	Gas-Fired Emission Limits (g/hp-hr)	Oil-Fired Emission Limits (g/hp-hr)
Good Combustion Practices	372 – 421	392 – 535
No Control Specified	--	--

### **Step 1 – Identification of GHG Control Technologies for Large Engines**

From research, the Department identified the following technologies as available for GHG control of engines rated at 500 hp or greater:

(a) Carbon Capture and Sequestration (CCS)

The EPA Guidance classifies CCS as “an add-on pollution control technology that is ‘available’ for facilities emitting CO<sub>2</sub> in large amounts.” Donlin has included a description of CCS, and a review of the technology in their permit application.

CCS is a broad term that includes a number of technologies that involves three general steps: 1) capturing the carbon dioxide directly at its source and compressing it, 2) transporting, and 3) storing it in non-atmospheric reservoirs. Capture, the most energy-intensive of all the processes, can be done either through pre-combustion methods or post-combustion methods. Pre-combustion requires the use of oxygen instead of air to combust the fuel. In general, pre-combustion reduces the energy required and the cost to remove CO<sub>2</sub> emissions from the combustion process. The concentration of CO<sub>2</sub> in the untreated gas stream is higher in pre-combustion capture, thereby requiring less and cheaper equipment. The other method is post-combustion, applied to conventional combustion techniques using air and carbon-containing fuels in order to isolate CO<sub>2</sub> from the combustion exhaust gases.

After capture, the CO<sub>2</sub> is compressed to a near-liquid state, and transported via pipeline to a designated storage area. These reservoirs are deep enough for the pressure of the earth to keep it in a liquidized form where it will be sequestered for thousands of years. Depleted oil and gas reservoirs are the most practical places for storing CO<sub>2</sub> emissions that would otherwise be emitted back into the atmosphere. Other options for storage include deep saline formations, un-mineable coal seams, and even offshore storage. The stored CO<sub>2</sub> is expected to remain underground for as long as thousands, even millions of years.

(b) Good Combustion Practices

See description in Section 3.1.

### **Step 2 – Elimination of Technically Infeasible GHG Control Options for Large Engines**

CCS is technically infeasible as there are no CCS systems commercially available for full-scale power plants in the United States.

### **Step 3 – Ranking of Remaining GHG Control Options for Large Engines**

Donlin has accepted the only feasible control option. Therefore, ranking is not required.

### **Step 4 – Evaluate the Most Effective Controls**

Good combustion practices will reduce GHG emissions from EU IDs 1 - 12 while having minimal energy and environmental impacts.



**RBLC Review**

A review of similar units in the RBLC indicates that good combustion practices are the principle GHG control technologies installed on large engines.

**Applicant Proposal**

Donlin proposed to install new energy efficient Wärtsilä Model 18V50DF engines operated in combined cycle and good combustion practices for EU IDs 1 - 12 as BACT for reducing GHG emissions from combustion of natural gas and ULSD. Waste heat from the engines will be recovered to enhance power output efficiency. The heat rate of the combined cycle plant will be 6,953 Btu/kW-hr (gross) for natural gas firing and 7,366 Btu/kW-hr (gross) for ULSD firing. GHG BACT emission rates will be 869,621 tpy (or 305 g/hp-hr) when firing natural gas and 1,299,630 tpy (or 440 g/hp-hr) when firing ULSD in EU IDs 1 - 12.

**4.0 Ore Crushing and Transfers**

The DGP ore crushing circuit includes ore gyratory crushing, coarse ore transfers, and recycle pebble crushing. Mined ore will be loaded through a dump pocket with a rock breaker (EU ID 38) to the gyratory crusher (EU ID 41). The gyratory crusher discharges through a surge pocket (EU ID 42) and apron feeder (EU IDs 43). Additional EUs associated with this system are the gyratory crusher circuit (EU ID 39) and gyratory crusher discharge conveyor (EU ID 44).

Ore will then be moved by conveyor (EU ID 45) to the coarse ore stockpile. Four apron feeders (EU IDs 46, 48, 50, 52) will reclaim and transfer the coarse ore stockpile to the semi-autogenous grinding (SAG) mill feed conveyor (EU ID 54).

The SAG mill is a wet process that does not produce particulate emissions and is not included in the BACT analysis for this reason. Material discharge from the SAG mill will be washed and screened, and the oversize material will be transferred to the pebble crushers (EU IDs 55 and 56). After crushing, the ore will be discharged to the pebble discharge conveyor (EU ID 58) which transfers material to the SAG mill feed conveyor.

The ore crushers and conveyors will only emit particulates. The following section provides the BACT review for particulates.

**4.1 Particulates**

Possible particulate emission control technologies for crushers and conveyors were obtained from the RBLC. The RBLC was searched for all determinations in the last 10 years under the process name description containing the keywords “crush” or “conveyor”, and under the process codes 80 to 90.999, Metallurgical Industry and Mineral Products. The search results for crushers and conveyors are summarized in Table 4-1 and Table 4-2, respectively.

**Table 4-1. Particulate Control for Crushers**

<b>Control Technology</b>	<b>Number of Determinations</b>	<b>Emission Limits (lb/ton)</b>
Dust Collector	22	0.001 - 0.13
Water Sprays	8	0.00025 - 0.00586
High Moisture Material	2	0.01076 - 0.13
Enclosure	0	No Data
No Control Specified	6	0.00353

**Table 4-2. Particulate Control for Conveyors**

<b>Control Technology</b>	<b>Number of Determinations</b>	<b>Emission Limits</b>
Dust Collector	15	0.002 - 0.008 gr/dscf
Enclosure	8	0.00005 - 0.00104 lb/ton
Water Sprays	3	0.001 - 0.1857 lb/ton
Wet Scrubber	1	0.005 gr/dscf
No Control Specified	6	No Data

**Step 1 – Identification of Particulate Control Technologies for Crushers and Conveyors**

From research, the Department identified the following technologies as available for particulate control of crushers and conveyors:

(a) Dust Collectors

Dust collectors or 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. Fabric filters 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% ([EPA-452/F-03-024](#), [EPA-452/F-03-025](#), and [EPA-452/F-03-026](#), Air Pollution Control Technology Fact Sheets for Fabric Filters), and are generally specified to meet a discharge concentration of filterable particulate (e.g., 0.01 grains per dry standard cubic feet).

(b) Water Sprays

Water sprays are used to wet the material to minimize the amount of fugitive dust.

(c) High Moisture Material

A higher moisture material will produce less particulate emissions when transported via conveyor or sent through a crusher.

(d) Enclosure

Enclosure structures shelter material from wind entrainment and are used to control particulate emissions. Enclosures can either fully or partially enclose the source and control efficiency is dependent on the level of enclosure.

(e) Wet Scrubber

Wet Scrubbers use a scrubbing solution to remove particulate matter from exhaust 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 flows in the opposite direction as the gas flow.

(f) Electrostatic Precipitator (ESP)

ESPs remove particulates from a gas stream by electrically charging particles with a discharge electrode in the gas path and then collecting the charged particles on the grounded.

### **Step 2 – Elimination of Technically Infeasible Particulate Control Options for Crushers and Conveyors**

Due to design of the conveyors it is infeasible to install dust collectors or ESPs for them.

### **Step 3 – Ranking of Remaining Particulate Control Options for Crushers and Conveyors**

The following control technologies have been identified and ranked for control of particulates from the crushers and conveyors:

- |                            |                         |
|----------------------------|-------------------------|
| (a) Enclosure              | (>99% Control)          |
| (b) Wet Scrubber           | (50% - 99%)             |
| (c) High Moisture Material | (less than 99% Control) |
| (d) Water Sprays           | (up to 90% Control)     |

### **Step 4 – Evaluate the Most Effective Controls**

For the gyratory crusher, dump pocket, and conveyors where a dust collector is infeasible (EU IDs 38, 44, 45, 54, and 58) an enclosure is the most effective method of control for particulates. For the gyratory crusher circuit, crusher, surge pocket, and apron feeders (EU IDs 39, 41 – 43, 46, 48, 50, 52, 55, and 56) dust collectors are the most effective control method.

### **RBLC Review**

A review of similar units in the RBLC indicates that dust collectors and enclosures are the principle particulate control technologies installed on crushers and conveyors. A cost analysis was not necessary as Donlin chose to use the most effective of the technically feasible control devices for the crushers and conveyors.

### **Applicant Proposal**

Donlin proposed to use dust collectors for EU IDs 39, 41 - 43, 46, 48, 50, 52, 55, and 56 as BACT for reducing particulate emissions. Donlin proposed to use enclosures for EU IDs 38, 44, 45, 54, and 58 as BACT for reducing particulate emissions on the conveyors. The particulate BACT emission rates for the units with dust collectors will be 0.01 gr/dscf which is below the applicable NSPS Subpart LL limit. The particulate BACT emission rates for the units with enclosures will be 0.00048 lb/ton and will be able to achieve the required no more than 10 percent opacity requirement for fugitive emissions under NSPS Subpart LL.

## **5.0 Autoclaves**

The autoclave circuit includes two autoclaves (EU IDs 77 and 81) operating in parallel. The autoclaves will be used for the oxidation of gold-bearing sulfide minerals to metal sulfates using a combination of heat, acid, and oxygen sparging. The autoclaves will emit CO, particulates, VOC, SO<sub>2</sub>, H<sub>2</sub>S, and GHG. The following sections provide a BACT review for each of these pollutants (except SO<sub>2</sub> and H<sub>2</sub>S).

The RBLC currently does not have determinations for autoclaves with the same function as the EUs at DGP. The only autoclave entry is for an autoclave used for pitch impregnation.

## 5.1 CO

Possible CO emission control technologies for autoclaves were determined based on research for similar ore autoclaves. Nevada currently has three gold mines using similar units with a total of 9 EUs.

### Step 1 – Identification of CO Control Technologies for Autoclaves

From research, the Department identified the following technologies as available for CO control of autoclaves:

#### (a) Thermal Oxidation

The thermal oxidizer has a stabilized flame maintained by a combination of auxiliary fuel, waste gas compounds, and supplemental air added when necessary. This technology is typically applied for destruction of organic vapors, nevertheless it is also considered as a technology for controlling CO emissions. Upon passing through the flame, the gas containing CO is heated from its inlet temperature to its ignition temperature (the temperature at which the combustion reaction rate (and consequently the energy production rate) exceeds the rate of heat losses, thereby raising the temperature of the gases to some higher value). Thus, any CO/air mixture will ignite if its temperature is raised to a sufficiently high level. The CO-containing mixture ignites at some temperature between the preheat temperature and the reaction temperature. The ignition occurs at some point during the heating of a waste stream. The mixture continues to react as it flows through the combustion chamber.

Most thermal units are designed to provide no more than 1 second of residence time to the waste gas with typical temperatures of 1,200 °F to 2,000 °F. Once the unit is designed and built, the residence time is not easily changed, so that the required reaction temperature becomes a function of the particular gaseous species and the level of control. Regenerative thermal oxidizers consist of direct contact heat exchangers constructed of a ceramic material that can tolerate the high temperatures needed to achieve ignition of the waste stream.

The inlet gas first passes through a hot ceramic bed thereby heating the stream (and cooling the bed) to its ignition temperature. The hot gases then react (releasing energy) in the combustion chamber and while passing through another ceramic bed, thereby heating it to the combustion chamber outlet temperature. The process flows are then switched, feeding the inlet stream to the hot bed. This cyclic process affords high energy recovery (up to 95%). The higher capital costs associated with these high-performance heat exchangers and combustion chambers may be offset by the auxiliary fuel savings to make such a system economical.

(b) Catalytic Oxidation

Catalytic oxidation is also a widely used control technology to control pollutants where the waste gas is passed through a flame area and then through a catalyst bed for complete combustion of the waste in the gas. This technology is typically applied for destruction of organic vapors; nevertheless it is considered a technology for controlling CO emissions. A catalyst is an element or compound that speeds up a reaction at lower temperatures (compared to thermal oxidation) without the catalyst undergoing change itself. Catalytic oxidizers operate at 650°F to 1000°F and require approximately 1.5 to 2.0 ft<sup>3</sup> of catalyst per 1000 standard ft<sup>3</sup> gas flow.

Emissions from some emission units may contain significant amount of particulates. These particulates can poison the catalyst resulting in the failure of catalytic oxidation. For some fuels, such as coal and residual oil, contaminants would likely be present in such concentrations so as to foul catalysts quickly thereby making such systems infeasible due to the need to constantly replace catalyst materials. In addition, the use of oxidation catalysts on units with high sulfur fuels can also result in the creation of sulfuric acid mist through the conversion of SO<sub>2</sub> to SO<sub>3</sub> and subsequent combination with moisture in the exhaust gas.

(c) Good Operating Practices

See description in Section 3.1.

**Step 2 – Elimination of Technically Infeasible CO Control Options for Autoclaves**

All control technologies listed above are technically feasible. However, thermal and catalytic oxidation controls are not commercially installed on ore autoclaves and are not considered a viable option of CO control.

**Step 3 – Ranking of Remaining CO Control Options for Autoclaves**

Donlin has accepted the only feasible control option. Therefore, ranking is not required.

**Step 4 – Evaluate the Most Effective Controls**

Good operating practices is the best CO control technology for EU IDs 77 and 81.

**Applicant Proposal**

Donlin proposed to use good operating practices for controlling CO emissions from the autoclaves. The CO BACT emission rate will be 88.0 lb/hr for EU IDs 77 and 81.

**5.2 Particulates**

Possible particulate emission control technologies for autoclaves were determined based on research for similar ore autoclaves. Nevada currently has three gold mines using similar units with a total of 9 EUs. The search results for ore autoclaves is summarized in Table 5-1.

**Table 5-1. Particulate Control for Autoclaves**

Control Technology	Number of Determinations	Emission Limits (lb/hr)
Venturi Scrubber	5	2.28 or 8.4
Primary and Secondary Venturi Scrubber	3	10.50 (3 EU combined limit)
Wet Scrubber	1	No Data

**Step 1 – Identification of Particulate Control Technologies for Autoclaves**

From research, the Department identified the following technologies as available for particulate control of ore autoclaves:

- (a) Venturi Scrubber  
 Venturi scrubbers are a variety of wet scrubbers that removes air pollutants, primarily particulates, by inertial and diffusional interception.
- (b) Wet Scrubber  
 See description in Section 4.1.
- (c) Dust Collector  
 See description in Section 4.1.
- (d) ESP  
 See description in Section 4.1.

**Step 2 – Elimination of Technically Infeasible Particulate Control Options for Autoclaves**

The feasibility of using a dust collector or ESP for controlling particulates from an autoclave is unknown as they are not currently in use. It is unlikely that they would be more effective than a venturi scrubber.

**Step 3 – Ranking of Remaining Particulate Control Options for Autoclaves**

The following control technologies have been identified and ranked for control of NOx from the autoclaves.

- (a) Venturi Scrubber (70%-99% Control)
- (b) Wet Scrubber (50%-99% Control)

**Step 4 – Evaluate the Most Effective Controls**

A venturi scrubber for each of the autoclaves would be the most effective particulate control.

**Applicant Proposal**

Donlin proposed to use a venturi scrubber on each autoclave stack to reduce particulate emissions from EU IDs 77 and 81. The particulate BACT emission rates will be 0.22 lb/hr for EU IDs 77 and 81.

**5.3 VOC**

Possible VOC emission control technologies for autoclaves were determined based on research for similar ore autoclaves. Nevada currently has three gold mines using similar units with a total of 9 EUs.

### **Step 1 – Identification of VOC Control Technologies for Autoclaves**

From research, the Department identified the following technologies as available for VOC control of autoclaves:

- (a) Thermal Oxidation  
See description in Section 5.1.
- (b) Catalytic Oxidation  
See description in Section 5.1.
- (c) Good Operating Practices  
See description in Section 3.1.

(d) Activated Carbon Adsorbers

Adsorption is a surface phenomenon in which VOCs are selectively adsorbed on the surface of activated carbon. Physical adsorption is the result of the intermolecular forces of attraction between molecules of the solid and of the substance adsorbed. For example, when the intermolecular attractive forces between a solid and gas are greater than those existing between the molecules of the gas itself, the gas will condense on the surface of the solid. Activated carbon is effective in adsorbing organic compounds from a humid gas stream because it does not show a higher affinity for the polar water molecules, due to the neutral carbon atoms with no electrical gradients between molecules.

### **Step 2 – Elimination of Technically Infeasible VOC Control Options for Autoclaves**

All control technologies listed above are technically feasible. However, thermal and catalytic oxidation controls are not commercially installed on ore autoclaves and are not considered a viable option of VOC control.

### **Step 3 – Ranking of Remaining VOC Control Options for Autoclaves**

Donlin has accepted the only feasible control option. Therefore, ranking is not required.

### **Step 4 – Evaluate the Most Effective Controls**

Carbon adsorption is the best VOC control technology for EU IDs 77 and 81.

### **Applicant Proposal**

Donlin proposed to use carbon adsorption for controlling VOC emissions from the autoclaves. The VOC BACT emission rate will be 0.04 lb/hr for each EU IDs 77 and 81.

### **5.4 GHG**

Possible GHG emission control technologies for autoclaves were determined based on research for similar ore autoclaves. Nevada currently has three gold mines using similar units with a total of 9 EUs.

### **Step 1 – Identification of GHG Control Technologies for Autoclaves**

From research, the Department identified the following technologies as available for GHG control of autoclaves:

- (a) CCS  
See description in Section 3.5.
- (b) Good Operating Practices  
See description in Section 3.1.

### **Step 2 – Elimination of Technically Infeasible GHG Control Options for Autoclaves**

CCS is technically infeasible as there are no CCS systems commercially available.

### **Step 3 – Ranking of Remaining GHG Control Options for Autoclaves**

Donlin has accepted the only feasible control option. Therefore, ranking is not required.

### **Step 4 – Evaluate the Most Effective Controls**

Good operating practices will reduce GHG emissions from EU IDs 77 and 81 while having minimal energy and environmental impacts.

### **Applicant Proposal**

Donlin proposed to use good operating practices for controlling GHG emissions from the autoclaves. The GHG BACT emission limit will be 37,659 tons per year of CO<sub>2</sub> combined for EU IDs 77 and 81.

## **6.0 Boilers and Heaters**

The DGP will have three boilers (EU IDs 15 - 17) that will be fueled by both natural gas and ULSD, three heaters (EU IDs 18 - 20) that will be fueled by both natural gas and ULSD, and 19 air handler heaters (EU ID 24) that will be fueled by natural gas. ULSD will be used for EU IDs 15 - 20 when natural gas is unavailable.

EU IDs 15 and 16 are classified as process heaters and are exempt from NSPS Subpart Dc. EU IDs 17 - 20 and 24 are subject to requirements under NSPS Subpart Dc, but are not subject to any NSPS emissions limits.

DGP will also have two SO<sub>2</sub> burners, one operating off of natural gas (EU ID 21) and one off of ULSD (EU ID 22), 138 building heaters (EU ID 23), seven 2.5 MMBtu/hr air handler heaters (EU ID 25), and 20 portable heaters (EU ID 26).

The boilers and heaters will emit CO, NO<sub>x</sub>, SO<sub>2</sub>, particulates, VOC, and GHG. The following sections provide a BACT review for each of these pollutants (except SO<sub>2</sub>) for each fuel type.



## 6.1 CO

Possible CO emission control technologies for boilers and heaters were obtained from the RBLC. The RBLC was searched for all determinations in the last 10 years under the process code 13, Commercial/Institutional-Sized Boilers/Furnaces (<100 MMBtu/hr), subcategories 13.31 Gaseous Fuel and Gaseous Fuel Mixtures and 13.22, Distillate Fuel Oil. The search results for boilers and heaters are summarized in Table 6-1 and Table 6-2, respectively.

**Table 6-1. CO Control for Gas-Fired Boilers and Heaters**

Control Technology	Number of Determinations	Emission Limits (lb/MMBtu)
Oxidation Catalyst	1	0.016
Good Combustion Practices	79	0.0073 - 0.84
No Control Specified	51	0.0084 - 0.15

**Table 6-2. CO Control for Oil-Fired Boilers and Heaters**

Control Technology	Number of Determinations	Emission Limits (g/hp-hr)
Oxidation Catalyst	0	N/A
Good Combustion Practices	5	0.036 - 0.084
No Control Specified	2	0.036 - 0.077

### Step 1 – Identification of CO Control Technologies for Boilers and Heaters

From research, the Department identified the following technologies as available for CO control of boilers and heaters with a rating of less than 100 MMBtu/hr:

- (a) Oxidation Catalyst  
See description in Section 3.1.
- (b) Good Combustion Practices  
See description in Section 3.1

### Step 2 – Elimination of Technically Infeasible CO Control Options for Boilers and Heaters

Both control technologies listed above are technically feasible.

### Step 3 – Ranking of Remaining CO Control Options for Boilers and Heaters

The following control technologies have been identified and ranked for control of CO from the boilers and heaters:

- (a) Oxidation Catalyst (90% Control)
- (b) Good Combustion Practices (Less than 90% Control)

### Step 4 – Evaluate the Most Effective Controls

An oxidation catalyst would provide the best control for a boiler rated at less than 100 MMBtu/hr. However, the only BACT determination in the RBLC is for a larger 60 MMBtu/hr non-dual fuel boiler which is not a similar unit to EU IDs 15 - 26.

**RBLC Review**

A review of similar units in the RBLC indicates that good combustion practices are the principle CO control technologies installed on boilers and heaters.

**Applicant Proposal**

Donlin provided an economic analysis of the installation of catalytic oxidation on the boilers and heaters to demonstrate that the use of catalytic oxidation is not economically feasible on these units. Potential annual CO emissions from the boilers and heaters are between 1.8 and 10.6 tpy per unit. The Department refined the analysis based on these potential emissions. The results are as follows:

<b>Control Alternative</b>	<b>Captured Emissions (tpy)</b>	<b>Emission Reduction (tpy)</b>	<b>Capital Cost (\$)</b>	<b>Operating Costs (\$/year)</b>	<b>Total Annualized Costs (\$/year)</b>	<b>Cost Effectiveness (\$/ton)</b>
Catalytic Oxidation	1.8	1.6	\$85,000	\$51,000	\$59,024	\$36,890
Catalytic Oxidation	10.6	9.5	\$227,000	\$136,000	\$157,429	\$16,571
Capital Recovery Factor = 0.0944 (7% for a 20 year life cycle)						

The economic analysis indicates the level of CO reduction does not justify the use of catalytic oxidation on the boilers and heaters. Based on the excessive cost per ton of CO removed per year, installing catalytic oxidation on the boilers and heaters is not considered a feasible option for reducing CO emissions.

Donlin proposed to use good combustion practices as BACT control for CO emissions from EU IDs 15 - 26. The resulting CO BACT emission rate for the boilers and heaters is 0.0824 lb/MMBtu when firing natural gas and 0.0384 lb/MMBtu when firing ULSD in EU IDs 15 - 26.

**6.2 NOx**

Possible NOx emission control technologies for the boilers and heaters were obtained from the RBLC. The RBLC was searched for all determinations in the last 10 years under the process code 13, Commercial/Institutional-Size Boilers/Furnaces (<100 MMBtu/hr), subcategories 13.31 Gaseous Fuel & Gaseous Fuel Mixtures and 13.22, Distillate Fuel Oil. The search results for boilers and heaters are summarized in Table 6-3 and Table 6-4, respectively.

**Table 6-3. NOx Control for Gas-Fired Boilers and Heaters**

<b>Control Technology</b>	<b>Number of Determinations</b>	<b>Emission Limits (lb/MMBtu)</b>
Selective Catalytic Reduction	2	0.009 - 0.015
Low-NOx Burner	101	0.009 - 0.37
Good Combustion Practices	12	0.041 - 0.24
No Control Specified	38	0.0035 - 0.14

**Table 6-4. NOx Control for Oil-Fired Boilers and Heaters**

<b>Control Technology</b>	<b>Number of Determinations</b>	<b>Emission Limits (g/hp-hr)</b>
Selective Catalytic Reduction	0	N/A
Low-NOx Burner	8	0.023 - 0.14
Good Combustion Practices	1	No Data
No Control Specified	2	0.070 - 0.12

**Step 1 – Identification of NOx Control Technologies for Boilers and Heaters**

From research, the Department identified the following technologies as available for NOx control of boilers and heaters rated at 100 MMBtu/hr or less:

(a) Selective Catalytic Reduction (SCR)

See description in Section 3.2.

(b) Low-NOx Burners (LNB)

Using LNBs can reduce formation of NOx through careful control of the fuel-air mixture during combustion. Control techniques used in LNBs includes staged air, and staged fuel, as well as other methods that effectively lower the flame temperature. Experience suggests that significant reduction in NOx emissions can be realized using LNBs. The U.S. EPA reports that LNBs have achieved reduction up to 80%, but actual reduction depends on the type of fuel and varies considerably from one installation to another. Typical reductions range from 40% - 60% but under certain conditions, higher reductions are possible.

(c) Good Combustion Practices

See description in Section 3.1.

**Step 2 – Elimination of Technically Infeasible NOx Control Options for Boilers and Heaters**

Low-NOx burners for dual-fuel fired boilers that meet the project specifications are not available for EU IDs 15 - 18. Low-NOx burners are also not available for EU ID 24.

**Step 3 – Ranking of Remaining NOx Control Options for Boilers and Heaters**

The following control technologies have been identified and ranked for control of NOx from the boilers and heaters:

- (a) SCR (70% - 90% Control)
- (b) Low-NOx Burner (60% Control)
- (c) Good Combustion Practices (Less than 40% Control)

**Step 4 – Evaluate the Most Effective Controls**

For EU IDs 19 and 20, low-NOx burner technology is the most effective NOx control for the dual-fuel fired boilers. For EU IDs 15 - 18 and 24 where low-NOx burners are not available, good combustion practices are the most effective controls. EU IDs 21 - 23, 25, and 26 are small emission units, adding Low-NOx burners or SCR would not be cost effective. For EU IDs 21 - 23, 25, and 26, good combustion practices are the most effective controls.

### **RBLC Review**

A review of similar units in the RBLC indicates that Low-NOx burners and good combustion practices are the principle NOx control technologies installed on boilers and heaters rated at 100 MMBtu/hr or less.

### **Applicant Proposal**

Donlin proposed to use good combustion practices for EU IDs 15 - 18 and 21 - 26 as BACT for reducing NOx emissions from combustion of natural gas and ULSD. The NOx BACT emission rates will be 0.098 lb/MMBtu when firing natural gas and 0.154 lb/MMBtu when firing ULSD in EU IDs 15 - 18 and 21 - 26.

Donlin proposed to install low-NOx burners and use good combustion practices for EU IDs 19 and 20 as BACT for reducing NOx emissions from combustion of natural gas and ULSD. The NOx BACT emission rates will be 0.049 lb/MMBtu when firing natural gas and 0.154 lb/MMBtu when firing ULSD in EU IDs 19 and 20.

### **6.3 Particulates**

Possible particulate emission control technologies for the boilers and heaters were obtained from the RBLC. The RBLC was searched for all determinations in the last 10 years under the process code 13, Commercial/Institutional-Size Boilers/Furnaces (<100 MMBtu/hr), subcategories 13.31 Gaseous Fuel & Gaseous Fuel Mixtures and 13.22, Distillate Fuel Oil. The search results for boilers and heaters are summarized in Table 6-5 and Table 6-6, respectively.

**Table 6-5. Particulate Control for Gas-Fired Boilers and Heaters**

<b>Control Technology</b>	<b>Number of Determinations</b>	<b>Emission Limits (lb/MMBtu)</b>
Good Combustion Practices	61	0.0009 - 0.018
Clean Fuel	0	N/A
Wet Scrubber	0	N/A
No Control Specified	95	0.001 - 0.15

**Table 6-6. Particulate Control for Oil-Fired Boilers and Heaters**

<b>Control Technology</b>	<b>Number of Determinations</b>	<b>Emission Limits (lb/MMBtu)</b>
Good Combustion Practices	7	0.0003 - 0.02
Clean Fuel	2	0.015 - 0.024
Wet Scrubber	1	0.017
No Control Specified	5	0.0015 - 0.030

### **Step 1 – Identification of Particulate Control Technologies for Boilers and Heaters**

From research, the Department identified the following technologies as available for particulate control of boilers and heaters rated at 100 MMBtu/hr or less:

- (a) Good Combustion Practices

See description in Section 3.1.

(b) Clean Fuel  
See description in Section 3.3.

(c) Wet Scrubber  
See description in Section 4.1.

(d) ESP  
See description in Section 4.1.

### **Step 2 – Elimination of Technically Infeasible Particulate Control Options for Boilers and Heaters**

The wet scrubber and ESP were eliminated because they are ineffective in capturing small particulates from ULSD and natural gas combustion.

### **Step 3 – Ranking of Remaining Particulate Control Options for Boilers and Heaters**

Donlin has accepted the only feasible control options. Therefore, ranking is not required.

### **Step 4 – Evaluate the Most Effective Controls**

Use of clean fuel and good combustion practices are the most effective controls for particulates from natural gas and ULSD fired boilers and heaters rated at 100 MMBtu/hr or less.

### **RBLC Review**

A review of similar units in the RBLC indicates that use of clean fuels and good combustion practices are the principle control methods for particulates from boilers firing natural gas or ULSD rated at 100 MMBtu/hr or less.

### **Applicant Proposal**

Donlin proposed to use clean fuel and good combustion practices for EU IDs 15 - 26 as BACT for reducing particulate emissions from combustion of natural gas and ULSD. The resulting particulate BACT emission rates will be 0.0075 lb/MMBtu when firing natural gas and 0.0254 lb/MMBtu when firing ULSD in EU IDs 15 - 26.

### **6.4 VOC**

Possible VOC emission control technologies for the boilers and heaters were obtained from the RBLC. The RBLC was searched for all determinations in the last 10 years under the process code 13, Commercial/Institutional-Size Boilers/Furnaces (<100 MMBtu/hr), subcategories 13.31 Gaseous Fuel & Gaseous Fuel Mixtures and 13.22, Distillate Fuel Oil. The search results for boilers and heaters are summarized in Table 6-7 and Table 6-8, respectively.

**Table 6-7. VOC Control for Gas-Fired Boilers and Heaters**

Control Technology	Number of Determinations	Emission Limits (lb/MMBtu)
Oxidation Catalyst	1	0.002
Good Combustion Practices	57	0.0014 - 0.166
No Control Specified	49	0.0015 - 0.034

**Table 6-8. VOC Control for Oil-Fired Boilers and Heaters**

Control Technology	Number of Determinations	Emission Limits (lb/MMBtu)
Oxidation Catalyst	0	N/A
Good Combustion Practices	4	0.003 - 0.009
No Control Specified	2	0.0015 - 0.0041

**Step 1 – Identification of VOC Control Technologies for Boilers and Heaters**

From research, the Department identified the following technologies as available for VOC control of boilers and heaters rated at 100 MMBtu/hr or less:

- (a) Oxidation Catalyst  
See description in Section 3.1.
- (b) Good Combustion Practices  
See description in Section 3.1.

**Step 2 – Elimination of Technically Infeasible VOC Control Options for Boilers and Heaters**

Both control technologies are technically feasible for VOC control.

**Step 3 – Ranking of Remaining VOC Control Options for Boilers and Heaters**

The following control technologies have been identified and ranked for control of VOC from the boilers and heaters:

- (a) Oxidation Catalyst (90% Control)
- (b) Good Combustion Practices (Less than 90% Control)

**Step 4 – Evaluate the Most Effective Controls**

An oxidation catalyst would provide the best VOC control for boilers and heaters rated at less than 100 MMBtu/hr. However, the only BACT determination in the RBLC is for a liquefied natural gas vaporization heater which is not a similar unit to any of EU IDs 15 - 26. Clean fuel and good combustion practices is the most effective controls for these units.

**RBLC Review**

A review of similar units in the RBLC indicates that good combustion practices is the principle control method for VOC from boilers and heaters rated at 100 MMBtu/hr or less.

### **Applicant Proposal**

Donlin proposed to use good combustion practices for EU IDs 15 - 26 as BACT for reducing VOC emissions from combustion of natural gas and ULSD. The BACT VOC emission rates will be 0.0054 lb/MMBtu when firing natural gas and 0.00154 lb/MMBtu when firing ULSD in EU IDs 15 - 26.

### **6.5 GHG**

Possible GHG emission control technologies for the boilers and heaters were obtained from the RBLC. The RBLC was searched for all determinations in the last 10 years under the process code 13, Commercial/Institutional-Size Boilers/Furnaces (<100 MMBtu/hr), subcategories 13.31 Gaseous Fuel & Gaseous Fuel Mixtures and 13.22, Distillate Fuel Oil. The search identified good combustion practices or no controls as BACT for GHG emission from gas- and oil-fired boilers and heaters.

#### **Step 1 – Identification of GHG Control Technologies for Boilers and Heaters**

From research, the Department identified the following technologies as available for VOC control of boilers and heaters rated at 100 MMBtu/hr or less:

- (a) CCS  
See description in Section 3.5.
- (b) Good Combustion Practices  
See description in Section 3.1.

#### **Step 2 – Elimination of Technically Infeasible Particulate Control Options for Boilers and Heaters**

CCS is technically infeasible as there are no CCS systems commercially available in the United States.

#### **Step 3 – Ranking of Remaining GHG Control Options for Boilers and Heaters**

Donlin has accepted the only feasible control option. Therefore, ranking is not required.

#### **Step 4 – Evaluate the Most Effective Controls**

Good combustion practices will reduce GHG emissions from EU IDs 15 - 26 while having minimal energy and environmental impacts.

### **RBLC Review**

A review of similar units in the RBLC indicates that good combustion practices is the principle control method for GHG from boilers and heaters rated at 100 MMBtu/hr or less.

### **Applicant Proposal**

Donlin proposed to use good combustion practices for EU IDs 15 - 26 as BACT for reducing GHG emissions from combustion of natural gas and ULSD. The BACT GHG emission limit will be 176,347 tons per year of CO<sub>2</sub> emissions combined for EU IDs 15 - 26.

## 7.0 Black Start and Emergency Diesel Engines

Donlin will have several emergency engines on site that include two black start generators (EU IDs 29 and 30), four camp site emergency engines (EU IDs 31 - 34), and three fire pump engines (EU IDs 35 - 37). EU IDs 29 - 37 are all considered limited use engines.

The black start and emergency engines will emit CO, NO<sub>x</sub>, SO<sub>2</sub>, particulates, VOC, and GHG. The following sections provide a BACT review for each of these pollutants (except SO<sub>2</sub>).

### 7.1 CO

Possible CO emission control technologies for limited use engines were obtained from the RBLC. The RBLC was searched for all determinations in the last 10 years under the process code 17, Large Internal Combustion Engines (>500 hp) and were filtered to include diesel-fired engines listed as limited use, emergency, fire pump, and backup engines. The search results for the black start and emergency diesel engines are summarized in Table 7-1.

**Table 7-1. CO Control for Black Start and Emergency Diesel Engines**

Control Technology	Number of Determinations	Emission Limits (g/hp-hr)
Good Combustion Practices	175	2.69 - 4.96
NSPS IIII	58	3.48
No Control Specified	260	0.67 - 5

#### Step 1 – Identification of CO Control Technologies for Black Start and Emergency Diesel Engines

From research, the Department identified the following technologies as available for CO control of limited use engines rated at 500 hp or greater:

- (a) Oxidation Catalyst  
See description in Section 3.1.
- (b) Good Combustion Practices  
See description in Section 3.1

#### Step 2 – Elimination of Technically Infeasible CO Control Options for Black Start and Emergency Diesel Engines

Both control technologies listed above are technically feasible.

#### Step 3 – Ranking of Remaining CO Control Options for Black Start and Emergency Diesel Engines

The following control technologies have been identified and ranked for control of CO from the emergency engines:

- (a) Oxidation Catalyst (90% Control)
- (b) Good Combustion Practices (Less than 90% Control)



#### **Step 4 – Evaluate the Most Effective Controls**

Catalytic oxidation will reduce CO emissions from EU IDs 29 - 37 while having minimal energy and environmental impacts. This system requires no consumables and does not produce waste effluents or by-products aside from catalyst replacement and recycling as necessary. Engine efficiency will be minimally impacted by the oxidation catalyst.

#### **RBLC Review**

A review of similar units in the RBLC indicates add-on control technology is not practical for limited use engines. Based on the small potential to emit associated with these units (less than 7 tpy), catalytic oxidation is not a cost effective control technology for the limited use engines.

#### **Applicant Proposal**

Donlin proposed to use good combustion practices and install engines certified to meet NSPS Subpart IIII as BACT for CO. For EU IDs 29 - 34 the BACT CO emission rate will be 4.38 g/kW-hr. For EU IDs 35 - 37 the BACT CO emission rate will be 3.30 g/hp-hr.

#### **7.2 NO<sub>x</sub> and VOC**

Possible NO<sub>x</sub> and VOC emission control technologies for limited use engines were obtained from the RBLC. The RBLC was searched for all determinations in the last 10 years under the process code 17, Large Internal Combustion Engines (>500 hp) and were filtered to include diesel-fired engines listed as limited use, emergency, fire pump, and backup engines. The search results for the black start and emergency diesel engines are summarized in Table 7-2.

**Table 7-2. NO<sub>x</sub> and VOC Control for Black Start and Emergency Diesel Engines**

<b>Control Technology</b>	<b>Number of Determinations</b>	<b>Emission Limits (g/hp-hr)</b>
Good Combustion Practices	175	3.83 - 12.73
NSPS IIII	58	4.02 - 10.46
No Control Specified	260	3.48 - 7.51

#### **Step 1 – Identification of NO<sub>x</sub> and VOC Control Technologies for Black Start and Emergency Diesel Engines**

From research, the Department identified the following technologies as available for NO<sub>x</sub> and VOC control of limited use engines rated at 500 hp or greater:

- (a) Selective Catalytic Reduction (SCR)  
See description in Section 3.2
- (b) Good Combustion Practices  
See description in Section 3.1.

#### **Step 2 – Elimination of Technically Infeasible NO<sub>x</sub> and VOC Control Options for Black Start and Emergency Diesel Engines**

SCR will reduce NO<sub>x</sub> and VOC emissions from EU IDs 29 - 37 while having minimal energy and environmental impacts. Engine efficiency will be minimally impacted by SCR.

### Step 3 – Ranking of Remaining NOx and VOC Control Options for Black Start and Emergency Diesel Engines

The following control technologies have been identified and ranked for control of NOx from the engines:

- (a) SCR (70% - 95% Control)
- (b) Good Combustion Practices (Less than 40% Control)

### Step 4 – Evaluate the Most Effective Controls

A review of similar units in the RBLC indicates add-on control technology is not practical for limited use engines. Based on the small potential to emit associated with these units (less than 7 tpy), SCR is not a cost effective control technology for the limited use engines.

### RBLC Review

A review of similar units in the RBLC indicates that good combustion practices is the principle NOx and VOC control technology for limited use diesel engines.

### Applicant Proposal

Donlin proposed to use good combustion practices and install engines certified to meet NSPS Subpart IIII as BACT for NOx + VOC. For EU IDs 29 - 34 the BACT NOx + VOC emission rate will be 8.00 g/kW-hr. For EU IDs 35 - 37 the BACT NOx + VOC emission rate will be 3.70 g/hp-hr.

### 7.3 Particulates

Possible particulate emission control technologies for limited use engines were obtained from the RBLC. The RBLC was searched for all determinations in the last 10 years under the process code 17, Large Internal Combustion Engines (>500 hp) and were filtered to include diesel-fired engines listed as limited use, emergency, fire pump, and backup engines. The search results for the black start and emergency diesel engines are summarized in Table 7-3.

**Table 7-3. Particulate Control for Black Start and Emergency Diesel Engines**

Control Technology	Number of Determinations	Emission Limits (g/hp-hr)
Good Combustion Practices	175	0.20 - 0.53
NSPS IIII	58	0.20 - 0.54
No Control Specified	260	0.027 - 0.40

### Step 1 – Identification of Particulate Control Technologies for Black Start and Emergency Diesel Engines

From research, the Department identified the following technologies as available for particulate control of limited use engines rated at 500 hp or greater:

- (a) Good Combustion Practices  
 See description in Section 3.1.

### Step 2 – Elimination of Technically Infeasible Particulate Control Options for Black Start and Emergency Diesel Engines

Good combustion practices is a technically feasible particulate control method.

### **Step 3 – Ranking of Remaining Particulate Control Options for Black Start and Emergency Diesel Engines**

Donlin has accepted the only feasible control option. Therefore, ranking is not required.

### **Step 4 – Evaluate the Most Effective Controls**

Good combustion practices will reduce particulate emissions from EU IDs 29 - 37 while having minimal environmental impacts.

### **RBLC Review**

A review of similar units in the RBLC indicates that good combustion practices are the principle particulate control technologies installed on limited use diesel engines.

### **Applicant Proposal**

Donlin proposed to clean fuel, good combustion practices, and install engines certified to meet NSPS Subpart III as BACT for PM. For EU IDs 29 - 34 the particulate emission rate will be 0.25 g/kW-hr. For EU IDs 35 - 37 the BACT particulate emission rate will be 0.19 g/hp-hr.

## **7.4 GHG**

Possible GHG emission control technologies for limited use engines were obtained from the RBLC. The RBLC was searched for all determinations in the last 10 years under the process code 17, Large Internal Combustion Engines (>500 hp), and were filtered to include diesel-fired engines listed as limited use, emergency, fire pump, and backup engines. The search results for the black start and emergency diesel engines are summarized in Table 7-4.

**Table 7-4. GHG Control for Black Start and Emergency Diesel Engines**

<b>Control Technology</b>	<b>Number of Determinations</b>	<b>Emission Limits (tpy)</b>
Good Combustion Practices	15	0.29 - 3083
NSPS III	1	15.6
No Control Specified	9	19 - 892

### **Step 1 – Identification of GHG Control Technologies for Black Start and Emergency Diesel Engines**

From research, the Department identified the following technologies as available for GHG control of engines rated at 500 hp or less:

- (a) CCS  
See description in Section 3.5.
- (b) Good Combustion Practices  
See description in Section 3.1.

### **Step 2 – Elimination of Technically Infeasible GHG Control Options for Black Start and Emergency Diesel Engines**

CCS is technically infeasible as there are no CCS systems commercially available in the United States.

### **Step 3 – Ranking of Remaining GHG Control Options for Black Start and Emergency Diesel Engines**

Donlin has accepted the only feasible control option. Therefore, ranking is not required.

### **Step 4 – Evaluate the Most Effective Controls**

Good combustion practices will reduce GHG emissions from EU IDs 29 - 37 while having minimal energy and environmental impacts.

### **RBLC Review**

A review of similar units in the RBLC indicates that good combustion practices is the principle control method for GHG from black start and emergency diesel engines.

### **Applicant Proposal**

Donlin proposed to use good combustion practices for EU IDs 29 - 37 as BACT for reducing GHG emissions from black start and emergency diesel engines. The BACT GHG emission limit will be 3,000 tons per year of CO<sub>2</sub> emissions combined for EU IDs 29 - 37.

## **8.0 Small Diesel Engines**

Electric power for the airport will be generated from two reciprocating-engines (EU IDs 13 and 14). Each engine will be rated at 200 kWe. The airport generators will emit CO, NO<sub>x</sub>, SO<sub>2</sub>, particulates, VOC, and GHG. The following sections provide a BACT review for each of these pollutants (except SO<sub>2</sub>) for each fuel type.

### **8.1 CO**

Possible CO emission control technologies for small diesel engines were obtained from the RBLC. The RBLC was searched for all determinations in the last 10 years under the process code 17.21, Small Internal Combustion Engines (<500 hp), subcategory Fuel Oil. The search results for small diesel engines are summarized in Table 8-1.

**Table 8-1. CO Control for Small Diesel Engines**

<b>Control Technology</b>	<b>Number of Determinations</b>	<b>Emission Limits (g/kW-hr)</b>
Good Combustion Practices	134	2.69 - 4.96
NSPS IIII	17	3.48
No Control Specified	152	0.67 - 5

### **Step 1 – Identification of CO Control Technologies for Small Diesel Engines**

From research, the Department identified the following technologies as available for CO control of engines rated at 500 hp or less:

- (a) Oxidation Catalyst  
See description in Section 3.1.
- (b) Good Combustion Practices

See description in Section 3.1

**Step 2 – Elimination of Technically Infeasible CO Control Options for Small Diesel Engines**

Both control technologies listed above are technically feasible.

**Step 3 – Ranking of Remaining CO Control Options for Small Diesel Engines**

The following control technologies have been identified and ranked for control of CO from the small engines:

- (a) Oxidation Catalyst (90% Control)
- (b) Good Combustion Practices (Less than 90% Control)

**Step 4 – Evaluate the Most Effective Controls**

Catalytic oxidation will reduce CO emissions from EU IDs 13 and 14 while having minimal energy and environmental impacts. This system requires no consumables and does not produce waste effluents or by-products aside from catalyst replacement and recycling as necessary. Engine efficiency will be minimally impacted by the oxidation catalyst.

**RBLC Review**

A review of similar units in the RBLC indicates add-on control technology is not practical for small engines. Based on the small potential to emit associated with these units (less than 9 tpy), catalytic oxidation is not a cost effective control technology for the limited use engines.

**Applicant Proposal**

Donlin proposed to use clean fuel, good combustion practices, and install engines certified to meet NSPS Subpart IIII as BACT for CO. For EU IDs 13 and 14 the BACT CO emission rate will be 4.38 g/kW-hr.

**8.2 NOx**

Possible NOx emission control technologies for small diesel engines were obtained from the RBLC. The RBLC was searched for all determinations in the last 10 years under the process code 17.21, Small Internal Combustion Engines (<500 hp), subcategory Fuel Oil. The search results for small diesel engines are summarized in Table 8-2.

**Table 8-2. NOx Control for Small Diesel Engines**

Control Technology	Number of Determinations	Emission Limits (g/kW-hr)
Good Combustion Practices	134	3.83 - 12.73
NSPS IIII	17	4.02 - 10.46
No Control Specified	152	3.48 - 7.51

**Step 1 – Identification of NOx Control Technologies for Small Diesel Engines**

From research, the Department identified the following technologies as available for NOx control of engines rated at 500 hp or less:

- (a) Selective Catalytic Reduction (SCR)  
 See description in Section 3.2
- (b) Good Combustion Practices  
 See description in Section 3.1.

**Step 2 – Elimination of Technically Infeasible NOx Control Options for Small Diesel Engines**

SCR will reduce NOx and VOC emissions from EU IDs 13 and 14 while having minimal energy and environmental impacts. Engine efficiency will be minimally impacted by SCR.

**Step 3 – Ranking of Remaining NOx Control Options for Small Diesel Engines**

The following control technologies have been identified and ranked for control of NOx from the small diesel engines:

- (a) SCR (70% - 95% Control)
- (b) Good Combustion Practices (Less than 40% Control)

**Step 4 – Evaluate the Most Effective Controls**

A review of similar units in the RBLC indicates add-on control technology is not practical for limited use engines. Based on the small potential to emit associated with these units (less than 1 tpy), SCR is not a cost effective control technology for the limited use engines.

**RBLC Review**

A review of similar units in the RBLC indicates that good combustion practices is the principle NOx control technology for small diesel engines.

**Applicant Proposal**

Donlin proposed to use good combustion practices and install engines certified to meet NSPS Subpart III as BACT for NOx. For EU IDs 13 and 14 the BACT NOx emission rate will be 0.50 g/kW-hr.

**8.3 Particulates**

Possible particulate emission control technologies for small diesel engines were obtained from the RBLC. The RBLC was searched for all determinations in the last 10 years under the process code 17.21, Small Internal Combustion Engines (<500 hp), subcategory Fuel Oil. The search results for small diesel engines are summarized in Table 8-3.

**Table 8-3. Particulate Control for Small Diesel Engines**

Control Technology	Number of Determinations	Emission Limits (g/kW-hr)
Good Combustion Practices	134	0.20 - 0.53
NSPS III	17	0.20 - 0.54
No Control Specified	152	0.027 - 0.40

**Step 1 – Identification of Particulate Control Technologies for Small Diesel Engines**

From research, the Department identified the following technologies as available for particulate control of engines rated at 500 hp or less:

- (a) Good Combustion Practices  
See description in Section 3.1.

### **Step 2 – Elimination of Technically Infeasible Particulate Control Options for Small Diesel Engines**

Good combustion practices is a technically feasible particulate emission control method for EU IDs 13 and 14.

### **Step 3 – Ranking of Remaining Particulate Control Options for Small Diesel Engines**

Donlin has accepted the only feasible control option. Therefore, ranking is not required.

### **Step 4 – Evaluate the Most Effective Controls**

Good combustion practices will reduce particulate emissions from EU IDs 13 and 14 while having minimal environmental impacts.

### **RBLC Review**

A review of similar units in the RBLC indicates that good combustion practices is the principle particulate control technology for small diesel engines.

### **Applicant Proposal**

Donlin proposed to use clean fuel, good combustion practices, and install engines certified to meet NSPS Subpart III as BACT for particulates. For EU IDs 13 and 14 the BACT particulate emission rate will be 0.03 g/kW-hr.

## **8.4 VOC**

Possible VOC emission control technologies for small diesel engines were obtained from the RBLC. The RBLC was searched for all determinations in the last 10 years under the process code 17.21, Small Internal Combustion Engines (<500 hp), subcategory Fuel Oil. The search results for small diesel engines are summarized in Table 8-4.

**Table 8-4. VOC Control for Small Diesel Engines**

<b>Control Technology</b>	<b>Number of Determinations</b>	<b>Emission Limits (g/kW-hr)</b>
Good Combustion Practices	134	0.19 - 4.02
NSPS III	17	4.02
No Control Specified	152	0.0034 - 4.02

### **Step 1 – Identification of VOC Control Technologies for Small Diesel Engines**

From research, the Department identified the following technologies as available for VOC control of engines rated at 500 hp or less:

- (a) Good Combustion Practices  
See description in Section 3.1.

### **Step 2 – Elimination of Technically Infeasible VOC Control Options for Small Diesel Engines**

Good combustion practices is a technically feasible VOC emission control method for EU IDs 13 and 14.

### **Step 3 – Ranking of Remaining VOC Control Options for Small Diesel Engines**

Donlin has accepted the only feasible control option. Therefore, ranking is not required.

### **Step 4 – Evaluate the Most Effective Controls**

Good combustion practices will reduce VOC emissions from EU IDs 13 and 14 while having minimal environmental impacts.

### **RBLC Review**

A review of similar units in the RBLC indicates that good combustion practices is the principle VOC control technology for small diesel engines.

### **Applicant Proposal**

Donlin proposed to use good combustion practices and install engines certified to meet NSPS Subpart III as BACT for VOC. For EU IDs 13 and 14 the BACT VOC emission rate will be 0.24 g/kW-hr.

### **8.5 GHG**

Possible GHG emission control technologies for small diesel engines were obtained from the RBLC. The RBLC was searched for all determinations in the last 10 years under the process code 17.21, Small Internal Combustion Engines (<500 hp), subcategory Fuel Oil. The search results for small diesel engines are summarized in Table 8-5.

**Table 8-5. GHG Control for Small Diesel Engines**

<b>Control Technology</b>	<b>Number of Determinations</b>	<b>Emission Limits (tpy)</b>
Good Combustion Practices	15	0.29 - 3083
NSPS IIII	1	15.6
No Control Specified	9	19 - 892

### **Step 1 – Identification of GHG Control Technologies for Small Diesel Engines**

From research, the Department identified the following technologies as available for GHG control of engines rated at 500 hp or less:

- (c) CCS  
See description in Section 3.5.
- (d) Good Combustion Practices  
See description in Section 3.1.

### **Step 2 – Elimination of Technically Infeasible GHG Control Options for Small Diesel Engines**



CCS is technically infeasible as there are no CCS systems commercially available in the United States.

### **Step 3 – Ranking of Remaining GHG Control Options for Small Diesel Engines**

Donlin has accepted the only feasible control option. Therefore, ranking is not required.

### **Step 4 – Evaluate the Most Effective Controls**

Good combustion practices will reduce GHG emissions from EU IDs 13 and 14 while having minimal energy and environmental impacts.

### **RBLC Review**

A review of similar units in the RBLC indicates that good combustion practices is the principle control method for GHG emissions from small diesel engines.

### **Applicant Proposal**

Donlin proposed to use good combustion practices for EU IDs 13 and 14 as BACT for reducing GHG emissions from small diesel engines. The BACT GHG emission limit will be 2,700 tons per year of CO<sub>2</sub> emissions combined for EU IDs 13 and 14.

## **9.0 Carbon Regeneration Kiln**

The carbon regeneration kiln (EU ID 88) heats (with electricity) used activated carbon to reactivate the carbon for reuse in the process. The carbon regeneration kiln has a design process rate of 1.65 tons per hour of carbon. The power plant will emit CO, NO<sub>x</sub>, particulates, and VOC. The following sections provide a BACT review for each of these pollutants.

The RBLC currently does not have determinations for carbon regeneration kilns. Table 9-1 below lists existing gold mining operations in Alaska with minor or Title V permits with carbon regeneration emission sources.

**Table 9-1. Existing Sources with a Carbon Regeneration Kiln**

<b>Facility</b>	<b>Control Technology for Carbon Regeneration Kiln</b>
Fort Knox Mine	No emission controls are listed in their Title V permit
Pogo Mine	Wet scrubber for particulate emissions control

## **9.1 CO**

Possible CO emission control technologies for carbon regeneration kilns were determined based on research for similar units. Alaska currently has two mines using similar units.

### **Step 1 – Identification of CO Control Technologies for the Carbon Regeneration Kiln**

From research, the Department identified the following technologies as available for CO control of carbon regeneration kilns:

- (a) Oxidation Catalyst  
See description in Section 3.1.
- (b) Good Combustion Practices

See description in Section 3.1

### **Step 2 – Elimination of Technically Infeasible CO Control Options for the Carbon Regeneration Kiln**

Both control technologies listed above are technically feasible.

### **Step 3 – Ranking of Remaining CO Control Options for the Carbon Regeneration Kiln**

The following control technologies have been identified and ranked for control of CO from the emergency engines:

- (a) Oxidation Catalyst (90% Control)
- (b) Good Combustion Practices (Less than 90% Control)

### **Step 4 – Evaluate the Most Effective Controls**

Catalytic oxidation will reduce CO emissions from EU ID 88 while having minimal energy and environmental impacts. This system requires no consumables and does not produce waste effluents or by-products aside from catalyst replacement and recycling as necessary.

### **Facility Review**

A review of similar sources in Alaska indicates add-on control technology is not practical for carbon regeneration kilns. Based on the small potential to emit associated with these units (less than 4 tpy), catalytic oxidation is not a cost effective control technology for the carbon regeneration kiln.

### **Applicant Proposal**

Donlin proposed to use good operating practices as CO BACT. The CO BACT emission rate will be 0.88 lb/hr for EU ID 88.

## **9.2 NO<sub>x</sub>**

Possible NO<sub>x</sub> emission control technologies for carbon regeneration kilns were determined based on research for similar units. Alaska currently has two mines using similar units.

### **Step 1 – Identification of NO<sub>x</sub> Control Technologies for the Carbon Regeneration Kiln**

From research, the Department identified the following technologies as available for NO<sub>x</sub> control of carbon regeneration kilns:

- (a) Selective Catalytic Reduction (SCR)  
See description in Section 3.2
- (b) Good Combustion Practices  
See description in Section 3.1.

### **Step 2 – Elimination of Technically Infeasible NO<sub>x</sub> Control Options for the Carbon Regeneration Kiln**

SCR will reduce NO<sub>x</sub> emissions from EU ID 88 while having minimal energy and environmental impacts. Engine efficiency will be minimally impacted by SCR.

### **Step 3 – Ranking of Remaining NOx Control Options for the Carbon Regeneration Kiln**

The following control technologies have been identified and ranked for control of NOx from the carbon regeneration kilns:

- (a) SCR (70% - 95% Control)
- (b) Good Combustion Practices (Less than 40% Control)

### **Step 4 – Evaluate the Most Effective Controls**

A review of similar units in the RBLC indicates add-on control technology is not practical for carbon regeneration kilns. Based on the small potential to emit associated with this unit (0.08 tpy), SCR is not a cost effective control technology for carbon regeneration kilns.

### **Applicant Proposal**

Donlin proposed to use good operating practices as NOx BACT. The resulting NOx BACT emission rate is 0.02 lb/hr for EU ID 88.

## **9.3 Particulates**

Possible particulate emissions control technologies for carbon regeneration kilns were determined based on research for similar units. Alaska currently has two mines using similar units.

### **Step 1 – Identification of Particulate Control Technologies for the Carbon Regeneration Kiln**

From research, the Department identified the following technologies as available for particulate control of carbon regeneration kilns:

- (a) Good Operating Practices  
See description in Section 3.1.
- (b) Wet Scrubber  
See description in Section 4.1
- (c) Wet Off-Gas Cooler  
Wet Off-Gas Coolers, similar to wet scrubbers, use a solution to remove particulate matter from exhaust streams. The mechanism for particulate collection is impaction and interception by water droplets. The wet off-gas cooler will control particulate emissions and is necessary to reduce the exhaust gas temperature prior to entering the carbon bed for mercury control.

### **Step 2 – Elimination of Technically Infeasible Particulate Control Options for the Carbon Regeneration Kiln**

All listed control methods for EU ID 88 are technically feasible.

### **Step 3 – Ranking of Remaining Particulate Control Options for the Carbon Regeneration Kiln**

The following control technologies have been identified and ranked for control of particulates from the carbon regeneration kiln:

- (a) Wet Scrubber (50% - 90% Control)
- (b) Wet Off-Gas Cooler (50% Control)
- (c) Good Operating Practices (Less than 40% Control)

#### **Step 4 – Evaluate the Most Effective Controls**

The most effective control for particulates is to use a wet scrubber. However, due to the small amount of uncontrolled particulate emissions, a wet scrubber would not be cost effective. A wet off-gas cooler will provide particulate control while reducing the exhaust gas temperature as required before entering the carbon bed. This control method will have minimal impacts on the environment.

#### **Applicant Proposal**

Donlin proposed to use a wet off-gas cooler as particulate BACT. The particulate BACT emission rate will be 0.44 lb/hr for EU ID 88.

#### **9.4 VOC**

Possible VOC emission control technologies for carbon regeneration kilns were determined based on research for similar units. Alaska currently has two mines using similar units.

#### **Step 1 – Identification of VOC Control Technologies for the Carbon Regeneration Kiln**

From research, the Department identified the following technologies as available for VOC control of carbon regeneration kilns:

- (a) Thermal Oxidation  
See description in Section 5.1
- (b) Catalytic Oxidation  
See description in Section 5.1
- (c) Good Operating Practices  
See description in Section 3.1.

#### **Step 2 – Elimination of Technically Infeasible VOC Control Options for the Carbon Regeneration Kiln**

All control technologies listed above are technically feasible. However, thermal and catalytic oxidation controls are not commercially installed carbon regeneration kilns and are not considered a viable option of VOC control.

#### **Step 3 – Ranking of Remaining VOC Control Options for the Carbon Regeneration Kiln**

Donlin has accepted the only feasible control option. Therefore, ranking is not required.

#### **Step 4 – Evaluate the Most Effective Controls**

The most effective control for VOC is to use good operating practices. This control method will have minimal impacts on the environment.

### **Applicant Proposal**

Donlin proposed to use good operating practices as VOC BACT. The VOC BACT emission rate will be 0.44 lb/hr for EU ID 88.

### **10.0 Induction Smelting Furnace**

An induction smelting furnace (EU ID 100) will be operated at DGP for gold refining. The induction smelting furnace will emit particulates. The following sections provide a particulate BACT review.

### **10.1 Particulates**

Possible particulate emission control technologies for the induction smelting furnace were obtained from the RBLC. The RBLC was searched for all determinations in the last 10 years under the process name containing “furnace” and the primary fuel as electricity under process codes 80, Metallurgical Industry, and 90, Mineral Products. The search results are summarized in Table 10-1.

**Table 10-1. Particulate Control for the Induction Smelting Furnace**

<b>Control Technology</b>	<b>Number of Determinations</b>	<b>Emission Limits (gr/dscf)</b>
Dust Collector	36	0.0003 - 0.0052
Enclosure	2	No Data
No Control Specified	3	No Data

### **Step 1 – Identification of Particulate Control Technologies for the Induction Smelting Furnace**

From research, the Department identified the following technologies as available for particulate control of an induction smelting furnace:

- (a) Dust Collector  
See description in Section 4.1.
- (b) ESP  
See description in Section 4.1.
- (c) Wet Scrubber  
See description in Section 4.1.
- (d) Enclosure  
See description in Section 4.1.

### **Step 2 – Elimination of Technically Infeasible Particulate Control Options for the Induction Smelting Furnace**

A dust collector, ESP, wet scrubber, and enclosure are technically feasible particulate control options.

### **Step 3 – Ranking of Remaining Particulate Control Options for the Induction Smelting Furnace**

The following control technologies have been identified and ranked for control of NO<sub>x</sub> from the induction smelting furnace:

- |                    |                     |
|--------------------|---------------------|
| (a) Dust Collector | (>99% Control)      |
| (b) Enclosure      | (>99% Control)      |
| (c) ESP            | (>90% Control)      |
| (d) Wet Scrubber   | (50% - 90% Control) |

### **Step 4 – Evaluate the Most Effective Controls**

A dust collector will reduce particulate emissions from EU ID 100 while having minimal environmental impacts.

#### **RBLC Review**

A review of similar units in the RBLC indicates that dust collectors are the principle particulate control technologies installed on induction smelting furnaces.

#### **Applicant Proposal**

Donlin proposed to install a dust collector for EU ID 100 as BACT for reducing particulate emissions. The particulate BACT emission rate will be 0.005 gr/scf for EU ID 100.

### **11.0 Pressure Oxidation Hot Cure**

The oxidized ore concentrate slurry from the autoclaves will enter three POX hot cure tanks (85 - 87). The POX hot cure tanks will emit particulates. The following section provides a BACT review for particulates.

#### **11.1 Particulates**

The RBLC was searched, but there were no determinations for ore hot curing found.

### **Step 1 – Identification of Particulate Control Technologies for Pressure Oxidation Hot Cure**

From research, the Department identified the following technologies as available for particulate control of ore hot curing:

- (a) Dust Collector  
See description in Section 4.1.
- (b) ESP  
See description in Section 4.1.
- (c) Wet Scrubber  
See description in Section 4.1.
- (d) Good Operating Practices

See description in Section 3.1.

### **Step 2 – Elimination of Technically Infeasible Particulate Control Options for Pressure Oxidation Hot Cure**

Dust collectors are technically infeasible because of the high moisture content of the hot cure exhaust.

### **Step 3 – Ranking of Remaining Particulate Control Options for Pressure Oxidation Hot Cure**

The following control technologies have been identified and ranked for control of particulates from the hot cure:

- (a) ESP (>90% Control)
- (b) Wet Scrubber (50% - 90% Control)
- (c) Good Operating Practices (Less than 40% Control)

### **Step 4 – Evaluate the Most Effective Controls**

Uncontrolled particulate emissions from EU IDs 85 - 87 will be 1.75 tons per year. Installing an ESP or wet scrubber would not be cost effective because of the low uncontrolled emissions. Therefore, the most effective controls is good operating practices.

### **Applicant Proposal**

Donlin proposed to use good operating practices for EU IDs 85 - 87 as BACT for reducing particulate emissions. The particulate BACT emission rate will be 0.40 lb/hr for EU IDs 85 - 87.

## **12.0 Electrowinning Cells**

The electrowinning cells (EU IDs 91 - 94) are where precious metals are precipitated out of a precious metal bearing solution through electrolysis. The electrowinning cells will emit particulates. The following section provides a BACT review for particulates.

### **12.1 Particulates**

The RBLC was searched for any process name containing “electrowinning” and no determinations were found.

### **Step 1 – Identification of Particulate Control Technologies for Electrowinning Cells**

From research, the Department identified the following technologies as available for particulate control of electrowinning cells:

- (a) Dust Collector  
See description in Section 4.1.
- (b) ESP  
See description in Section 4.1.
- (c) Wet Scrubber  
See description in Section 4.1.

- (d) Good Operating Practices  
See description in Section 3.1.

### **Step 2 – Elimination of Technically Infeasible Particulate Control Options for Electrowinning Cells**

A dust collector would be technically infeasible for particulate control because of the high moisture content of the exhaust from EU IDs 91 - 94.

### **Step 3 – Ranking of Remaining Particulate Control Options for Electrowinning Cells**

The following control technologies have been identified and ranked for control of particulates from the electrowinning cells:

- (a) ESP (>90% Control)
- (b) Wet Scrubber (50% - 90% Control)
- (c) Good Operating Practices (<40% Control)

### **Step 4 – Evaluate the Most Effective Controls**

Uncontrolled particulate emissions from EU IDs 91 - 94 will be 0.82 tons per year. Installing an ESP or wet scrubber would not be cost effective because of the low uncontrolled emissions. Therefore, the most effective control is good operating practices.

### **Applicant Proposal**

Donlin proposed to use good operating practices for EU IDs 91 - 94 as BACT for reducing particulate emissions. The particulate BACT emission rate will be 0.19 lb/hr for EU IDs 91 - 94.

## **13.0 Mercury Retort**

The mercury retort (EU ID 97) is where the precious metal bearing sludge recovered from EU IDs 91 - 94 will be heated to recover mercury before being smelted in EU ID 100. The retort will emit particulates. The following section provides a particulate BACT review for particulates.

### **13.1 Particulates**

The RBLC was searched for any process name containing “retort” and no determinations were found.

### **Step 1 – Identification of Particulate Control Technologies for the Mercury Retort**

From research, the Department identified the following technologies as available for particulate control of retort:

- (a) Dust Collector  
See description in Section 4.1.
- (b) ESP  
See description in Section 4.1.
- (c) Wet Scrubber



See description in Section 4.1.

- (d) Good Operating Practices  
See description in Section 3.1.

### **Step 2 – Elimination of Technically Infeasible Particulate Control Options for the Mercury Retort**

None of the particulate control technologies listed above are technically infeasible.

### **Step 3 – Ranking of Remaining Particulate Control Options for the Mercury Retort**

The following control technologies have been identified and ranked for control of particulates from the retort:

- (a) Dust Collector (>99% Control)
- (b) ESP (>90% Control)
- (c) Wet Scrubber (50% - 90% Control)
- (d) Good Operating Practices (<40% Control)

### **Step 4 – Evaluate the Most Effective Controls**

Uncontrolled particulate emissions from EU ID 97 will be 0.13 tons per year. Installing a dust collector, ESP, or wet scrubber would not be cost effective because of the low uncontrolled emissions. Therefore, the most effective control is good operating practices.

### **Applicant Proposal**

Donlin proposed to use good operating practices for EU ID 97 as BACT for reducing particulate emissions. The particulate BACT emission rate will be 0.03 lb/hr for EU ID 97.

## **14.0 Laboratories**

Three laboratory facilities will be included at DGP, the sample receiving and preparation laboratory (EU IDs 103 and 104), the assay laboratory (EU ID 106), and the metallurgical laboratory (EU IDs 108 and 109). The laboratories will emit particulates. The following section provides a BACT review for particulates.

### **14.1 Particulates**

The particulate emissions created by the laboratory processes will be collected by fume hoods. Research was done to determine the appropriate particulate control devices for the fume hood exhaust.

### **Step 1 – Identification of Particulate Control Technologies for Laboratories**

From research, the Department identified the following technologies as available for particulate control of fume hoods:

- (a) Dust Collector  
See description in Section 4.1.
- (b) ESP

See description in Section 4.1.

- (c) Wet Scrubber  
 See description in Section 4.1.

**Step 2 – Elimination of Technically Infeasible Particulate Control Options for Laboratories**

All of the controls technologies listed above are technically feasible.

**Step 3 – Ranking of Remaining Particulate Control Options for Laboratories**

The following control technologies have been identified and ranked for control of particulates from the laboratories:

- (a) Dust Collector (>99% Control)
- (b) ESP (>90% Control)
- (c) Wet Scrubber (50% - 90% Control)

**Step 4 – Evaluate the Most Effective Controls**

The most effective control technology is a dust collector. The dust collector will have a minimal impact on the environment.

**Applicant Proposal**

Donlin proposed to install dust collectors for EU IDs 103, 104, 106, 108, and 109 as BACT for reducing particulate emissions. The particulate BACT emission rate will be 0.009 gr/scf for EU IDs 103 and 104, 0.004 gr/scf for EU ID 106, and 0.009 gr/scf for EU IDs 108 and 109.

**15.0 Reagent Handling for Water Treatment**

DGP will include a water conditioning circuit (EU ID 111) with the water treatment plant. The transfer of the water conditioning reagents will generate particulate emissions. The following section provides a BACT review for particulates.

**15.1 Particulates**

Possible particulate emission control technologies for reagent transfers were obtained from the RBLC. The RBLC was searched for all determinations in the last 10 years under the process codes 90.019, Lime/Limestone Handling/Kiln/Storage/Manufacturing. Determinations for crushers, silos, fuel tanks, and fuel-fired sources were removed for this analysis. The search results are summarized in Table 15-1.

**Table 15-1. Particulate Control for Reagent Handling for Water Treatment**

Control Technology	Number of Determinations	Emission Limits (gr/dscf)
Dust Collector	25	0.002 to 0.022
Enclosure	7	No Data
Water Spray	2	No Data
No Control Specified	24	0.005

**Step 1 – Identification of Particulate Control Technologies for Reagent Handling for Water Treatment**

From research, the Department identified the following technologies as available for particulate emission control of reagent handling:

- (a) Dust Collector  
See description in Section 4.1.
- (b) Enclosure  
See description in Section 4.1.
- (c) Water Spray  
See description in Section 4.1.
- (d) ESP  
See description in Section 4.1.
- (e) Wet Scrubber  
See description in Section 4.1.

### **Step 2 – Elimination of Technically Infeasible Particulate Control Options for Reagent Handling for Water Treatment**

All of the controls listed above are technically feasible.

### **Step 3 – Ranking of Remaining Particulate Control Options for Reagent Handling for Water Treatment**

The following control technologies have been identified and ranked for control of particulate emissions from reagent handling:

- (a) Dust Collector (>99% Control)
- (b) Enclosure (>99% Control)
- (c) ESP (>90% Control)
- (d) Wet Scrubber (50% - 90% Control)
- (e) Water Sprays (up to 90% Control)

### **Step 4 – Evaluate the Most Effective Controls**

The most effective particulate emissions control for the reagent handling for the water treatment plant is a dust collector. A dust collector will have minimal impact on the environment.

### **RBLC Review**

A review of similar units in the RBLC indicates that dust collectors, enclosures, and water sprays are the principle particulate control technologies used to control particulate emissions for reagent transfers.

### **Applicant Proposal**

Donlin proposed to install a dust collector for EU ID 111 as BACT for particulate emissions. The particulate BACT emissions rate will be 0.02 gr/scf for EU ID 111.

## 16.0 Mill Reagents Handling

The mill reagents handling will include lime handling and slaking (EU IDs 59, 61, and 63), flocculant handling and mixing (EU ID 65), caustic soda handling and mixing (EU ID 67), copper sulfate handling and mixing (EU ID 69), xanthate (PAX) handling and mixing (EU ID 71), and soda ash handling and mixing (EU IDs 73 and 75).

The mill reagents handling will emit particulates. The following section provides a BACT review for particulates.

### 16.1 Particulates

Possible particulate emission control technologies for reagent transfers were obtained from the RBLC. The RBLC was searched for all determinations in the last 10 years under the process codes 90.019, Lime/Limestone Handling/Kiln/Storage/Manufacturing. Determinations for crushers, silos, fuel tanks, and fuel-fired sources were removed for this analysis. The search results are summarized in Table 16-1.

**Table 16-1. Particulate Control for Reagent Handling for Mill Reagents Handling**

Control Technology	Number of Determinations	Emission Limits (gr/dscf)
Dust Collector	25	0.002 to 0.022
Enclosure	7	No Data
Water Spray	2	No Data
No Control Specified	24	0.005

#### Step 1 – Identification of Particulate Control Technologies for Mill Reagents Handling

From research, the Department identified the following technologies as available for particulate emissions control of mill reagents handling:

- (a) Dust Collector  
See description in Section 4.1.
- (b) Enclosure  
See description in Section 4.1.
- (c) Water Spray  
See description in Section 4.1.
- (d) ESP  
See description in Section 4.1.
- (e) Wet Scrubber  
See description in Section 4.1.

#### Step 2 – Elimination of Technically Infeasible Particulate Control Options for Mill Reagent Handling

All of the controls listed above are technically feasible for EU IDs 59, 61, 63, 65, 67, 69, 71, 73, and 75. For EU ID 63 a dust collector is not considered technically feasible due to the moisture from slaking.

### **Step 3 – Ranking of Remaining Particulate Control Options for Mill Reagent Handling**

The following control technologies have been identified and ranked for control of particulate from the mill reagent handling:

- |                    |                     |
|--------------------|---------------------|
| (a) Dust Collector | (>99% Control)      |
| (b) Enclosure      | (>99% Control)      |
| (c) ESP            | (>90% Control)      |
| (d) Wet Scrubber   | (50% - 90% Control) |
| (e) Water Sprays   | (up to 90% Control) |

For EU ID 63 the following control technologies have been identified and ranked for control of particulates:

- |                  |                     |
|------------------|---------------------|
| (a) Enclosure    | (>99% Control)      |
| (b) ESP          | (>90% Control)      |
| (c) Wet Scrubber | (50% - 90% Control) |
| (d) Water Sprays | (up to 90% Control) |

### **Step 4 – Evaluate the Most Effective Controls**

The most effective particulate emissions control for the mill reagent handling is a dust collector. For EU ID 63 the most effective control technology for particulate emissions is a wet scrubber. A dust collector and a wet scrubber will have a minimal impact on the environment.

### **RBLC Review**

A review of similar units in the RBLC indicates that dust collectors, enclosures, and water sprays are the principle particulate control technologies used to control particulate emissions for reagent transfers.

### **Applicant Proposal**

Donlin proposed to install a dust collector for EU IDs 59, 61, 65, 67, 69, 71, 73, and 75 as BACT for particulate emissions. Donlin proposed a wet scrubber for EU ID 63 as BACT for particulate emissions. The particulate BACT emissions rate will be 0.02 gr/scf for EU IDs 59, 61, 63, 65, 67, 69, 71, 73, and 75.

### **17.0 Fuel Tanks**

DGP will have a total of 21 fuel tanks that are significant<sup>3</sup> under Title V (EU IDs 126 - 142, 150 - 152, and 156). The fuel tanks will emit VOCs. The following section provides the BACT review for VOC.

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<sup>3</sup> Insignificant Emission Units include operation, loading, and unloading of volatile liquid storage with 10,000-gallon capacity or less, with lids or other closure and storing liquid with a vapor pressure not greater than 80 mm of mercury at 21°C. [18 AAC 50.326(g)(3)]

### 17.1 VOC

Possible VOC emission control technologies for fuel tanks were obtained from the RBLC. The RBLC was searched for all determinations in the last 10 years under the process codes 42.005 Petroleum Liquid Storage in Fixed Roof Tanks and 42.006 Petroleum Liquid Storage in Floating Roof Tanks. The search results are summarized in Table 17-1.

**Table 17-1. VOC Control for Fuel Tanks**

<b>Control Technology</b>	<b>Number of Determinations</b>	<b>Emission Limits (tpy)</b>
Floating Roof	30	0.88 - 18.57
Submerged Fill	7	0.8 - 72.5
Fixed Roof	5	0.8 - 72.5
Capture and Recover/Control	4	3.95 - 7.33
NSPS	3	114.1
Leak Detection and Repair	1	28.3
No Control Specified	15	0.05 - 81.57

#### **Step 1 – Identification of VOC Control Technologies for Fuel Tanks**

From research, the Department identified the following technologies as available for VOC control of fuel tanks:

- (a) Floating Roof  
 A roof that floats on the surface of the store liquid that will rise and fall with the liquid level in the level in the tank creating no vapor space except for when tanks have low liquid levels.
- (b) Submerged Fill  
 The tank is filled through an opening underneath the liquid surface level.
- (c) Fixed Roof  
 A cone or dome shaped roof that is permanently affixed to a liquid storage tank.
- (d) Capture and Recover/Control  
 A vapor recovery unit draws hydrocarbon vapors out of the storage tank under low-pressure and then separates out any liquid collected to be recycled to the storage tank.
- (e) Leak Detection and Repair  
 A system of detecting tank leaks for repairs. This can range from a visual inspection to a computerized system with in-tank probes.

#### **Step 2 – Elimination of Technically Infeasible VOC Control Options for Fuel Tanks**

None of the controls listed above are technically infeasible.

#### **Step 3 – Ranking of Remaining VOC Control Options for Fuel Tanks**

The following control technologies have been identified and ranked for control of VOC from the tanks:

- (a) Floating Roof
- (b) Submerged Fill
- (c) Fixed Roof
- (d) Capture and Recover/Control
- (e) Leak Detection and Repair

**Step 4 – Evaluate the Most Effective Controls**

A floating roof is the most effective control. The 32 fuel tanks at DGP have a combined PTE of 1.9 tons per year of uncontrolled VOC emissions making add-on control not cost effective. Submerged fill has the best VOC emissions control without requiring an add-on control.

**RBLC Review**

A review of similar units in the RBLC indicates that submerged fill can be used as VOC control for fuel tanks.

**Applicant Proposal**

Donlin proposed to use submerged fill for EU IDs 126 - 142, 150 - 152, and 156 as BACT for reducing particulate emissions from fuel tanks. The VOC BACT emission limit will be 1.8 tpy EU IDs 126 - 142, 150 - 152, and 156.

**18.0 Incinerators**

DGP will have two incinerators, the camp waste incinerator (EU ID 27) and the sewage sludge incinerator (EU ID 28). The incinerators will emit CO, NO<sub>x</sub>, SO<sub>2</sub>, particulates, lead, and GHG.<sup>4</sup> The following sections provide a BACT review for each of these pollutants (except SO<sub>2</sub>, and lead).

**18.1 CO**

Possible CO emission control technologies for the incinerators were obtained from the RBLC. The RBLC was searched for all determinations in the last 10 years under the process codes 24.4 and 24.5, Waste Disposal, subcategories Municipal Waste Combustion and Wastewater Treatment Sludge Incineration. The search results are summarized in Table 18-1.

**Table 18-1. CO Control for Incinerators**

Control Technology	Number of Determinations	Emission Limits (ppmvd at 7% O <sub>2</sub> )
Good Combustion Practices	2	80 - 100
No Control Specified	1	100

**Step 1 – Identification of CO Control Technologies for Incinerators**

From research, the Department identified the following technologies as available for CO control of incinerators:

- (a) Good Combustion Practices  
 See description in Section 3.1.

<sup>4</sup> Incinerators emit trace amounts of organics, which are hazardous air pollutants regulated under NSPS per Section 129 of the Clean Air Act.

**Step 2 – Elimination of Technically Infeasible CO Control Options for Incinerators**

The control technology listed above is technically feasible.

**Step 3 – Ranking of Remaining CO Control Options for Incinerators**

Donlin has accepted the only feasible control option. Therefore, ranking is not required.

**Step 4 – Evaluate the Most Effective Controls**

Good combustion practices are the most effective CO controls for incinerators.

**RBLC Review**

A review of similar units in the RBLC indicates that good combustion practices is the principle CO control technology for incinerators.

**Applicant Proposal**

Donlin proposed to install incinerators that will comply with NSPS Subpart CCCC (EU ID 27) and NSPS Subpart LLLL (EU ID 28). The CO BACT emission limits will be 13 ppmvd at 7% O<sub>2</sub> for EU ID 27 and 52 ppmvd at 7% O<sub>2</sub> for EU ID 28.

**18.2 NO<sub>x</sub>**

Possible NO<sub>x</sub> emission control technologies for the incinerators were obtained from the RBLC. The RBLC was searched for all determinations in the last 10 years under the process codes 24.4 and 24.5, Waste Disposal, subcategories Municipal Waste Combustion and Wastewater Treatment Sludge Incineration. The search results are summarized in Table 18-2.

**Table 18-2. NO<sub>x</sub> Control for Incinerators**

<b>Control Technology</b>	<b>Number of Determinations</b>	<b>Emission Limits (ppmvd at 7% O<sub>2</sub>)</b>
Selective Catalytic Reduction	1	50
Selective Non-Catalytic Reduction	2	90 to 150
Low-NO <sub>x</sub> burner and flue gas recirculation	1	250
No Control Specified	2	102*

\* Listed as 2.71 lb/ton in the RBLC and converted to ppmvd assuming 8,760 hours of operation per year, 7,700 Btu/lb dry sludge, and 9,570 scf/MMBtu.

**Step 1 – Identification of NO<sub>x</sub> Control Technologies for Incinerators**

From research, the Department identified the following technologies as available for NO<sub>x</sub> control of incinerators:

- (a) SCR  
 See description in Section 3.2.



(b) Selective Non-Catalytic Reduction (SNCR)

SNCR involves the non-catalytic decomposition of NO<sub>x</sub> in the flue gas to N<sub>2</sub> and water using reducing agents such as urea or NH<sub>3</sub>. The process utilizes a gas phase homogeneous reaction between NO<sub>x</sub> and the reducing agent within a specific temperature window. The reducing agent must be injected into the flue gas at a location in the unit that provides the optimum reaction temperature and residence time. The NH<sub>3</sub> process (trade name-Thermal DeNO<sub>x</sub>) requires a reaction temperature window of 1,600°F to 2,200°F. In the urea process (trade name–NO<sub>x</sub>OUT), the optimum temperature ranges between 1,600 °F and 2,100 °F.

(c) Low-NO<sub>x</sub> Burner and Flue Gas Recirculation

Using LNBs can reduce formation of NO<sub>x</sub> through careful control of the fuel-air mixture during combustion. Control techniques used in LNBs includes staged air, and staged fuel, as well as other methods that effectively lower the flame temperature. Experience suggests that significant reduction in NO<sub>x</sub> emissions can be realized using LNBs. The U.S. EPA reports that LNBs have achieved reduction up to 80%, but actual reduction depends on the type of fuel and varies considerably from one installation to another. Typical reductions range from 40% - 60% but under certain conditions, higher reductions are possible.

Flue gas recirculation lowers the peak combustion temperature and drops the percentage of oxygen in the combustion air/flue gas mixture, delaying the formation of NO<sub>x</sub> caused by high flame temperatures.

(d) Good Combustion Practices

See description in Section 3.1.

**Step 2 – Elimination of Technically Infeasible NO<sub>x</sub> Control Options for Incinerators**

All control options listed above are technically feasible.

**Step 3 – Ranking of Remaining NO<sub>x</sub> Control Options for Incinerators**

The following control technologies have been identified and ranked for control of NO<sub>x</sub> from the incinerators:

- |                                |                     |
|--------------------------------|---------------------|
| (a) SCR                        | (70% - 90% Control) |
| (b) Low-NO <sub>x</sub> Burner | (60% Control)       |
| (c) SNCR                       | (30% - 50% Control) |
| (d) Good Combustion Practices  | (<40% Control)      |

**Step 4 – Evaluate the Most Effective Controls**

Due to the low amount of maximum NO<sub>x</sub> emissions from EU IDs 27 and 28, 0.7 tpy and 0.06 tpy, respectively, any add-on control would not be cost effective.

**RBLC Review**

A review of similar units in the RBLC indicates that good combustion practices are used as NO<sub>x</sub> control for incinerators.

**Applicant Proposal**

Donlin proposed to use good combustion practices for EU IDs 27 and 28 as BACT for reducing NOx emissions. Using good combustion practices will reduce NOx emissions to below the applicable NOx emission limit in NSPS Subpart CCCC for EU ID 27 and NSPS Subpart LLLL for EU ID 28. The BACT emission rates for NOx will be 170 ppmvd at 7% O<sub>2</sub> for EU ID 27 and 210 ppmvd at 7% O<sub>2</sub> for EU ID 28.

**18.3 Particulates**

Possible particulate emission control technologies for the incinerators were obtained from the RBLC. The RBLC was searched for all determinations in the last 10 years under the process codes 24.4 and 24.5, Waste Disposal, subcategories Municipal Waste Combustion and Wastewater Treatment Sludge Incineration. The search results are summarized in Table 18-3.

**Table 18-3. Particulate Control for Incinerators**

<b>Control Technology</b>	<b>Number of Determinations</b>	<b>Emission Limits (mg/dscm at 7% O<sub>2</sub>)</b>
Dust Collector	3	12 to 24

**Step 1 – Identification of Particulate Control Technologies for Incinerators**

From research, the Department identified the following technologies as available for particulate control of incinerators:

- (a) Dust Collector  
See description in Section 4.1.
- (b) Wet Scrubber  
See description in Section 4.1.
- (c) ESP  
See description in Section 4.1.
- (d) Good Combustion Practices  
See description in Section 3.1.

**Step 2 – Elimination of Technically Infeasible Particulate Control Options for Incinerators**

All control options listed above are technically feasible.

**Step 3 – Ranking of Remaining Particulate Control Options for Incinerators**

The following control technologies have been identified and ranked for control of particulates from the incinerators:

- (a) Dust Collector (>99% Control)
- (b) ESP (>90% Control)
- (c) Wet Scrubber (50% - 90% Control)
- (d) Good Combustion Practices (<40% Control)

#### **Step 4 – Evaluate the Most Effective Controls**

Add-on controls options were eliminated because at the maximum emissions rate allowed by NSPS Subpart CCCC for EU ID 27 and NSPS Subpart LLLL for EU ID 28, the PTE for each incinerator is below 1 ton per year. Good combustion practices will reduce particulate emissions while having minimal environmental impacts.

#### **RBLC Review**

A review of similar units in the RBLC indicates that good combustion practices are used as particulate control for incinerators.

#### **Applicant Proposal**

Donlin proposed to use good combustion practices for EU IDs 27 and 28 as BACT for reducing particulate emissions to comply with NSPS Subpart CCCC (EU ID 27) and NSPS Subpart LLLL (EU ID 28). Particulate BACT emission rates will be 270 mg/dscm at 7% O<sub>2</sub> for EU ID 27 and 60 mg/dscm at 7% O<sub>2</sub> for EU ID 28.

#### **18.4 GHG**

Possible GHG emission control technologies for the incinerators were obtained from the RBLC. The RBLC was searched for all determinations in the last 10 years under the process codes 24.4 and 24.5, Waste Disposal, subcategories Municipal Waste Combustion and Wastewater Treatment Sludge Incineration. No results were found for GHG emissions.

#### **Step 1 – Identification of GHG Control Technologies for Incinerators**

From research, the Department identified the following technologies as available for GHG control of incinerators:

- (a) CCS  
See description in Section 3.5.
- (b) Good Combustion Practices  
See description in Section 3.1.

#### **Step 2 – Elimination of Technically Infeasible GHG Control Options for Incinerators**

CCS is technically infeasible as there are no CCS systems commercially available in the United States.

#### **Step 3 – Ranking of Remaining GHG Control Options for Incinerators**

Donlin has accepted the only feasible control option. Therefore, ranking is not required.

#### **Step 4 – Evaluate the Most Effective Controls**

Good combustion practices are the most effective GHG controls for incinerators.

#### **RBLC Review**

A review of similar units in the RBLC indicates that good combustion practices is the principle GHG control technology for incinerators.

### **Applicant Proposal**

Donlin proposed to install incinerators that will comply with NSPS Subpart CCCC (EU ID 27) and NSPS Subpart LLLL (EU ID 28). The GHG BACT emission limit will be 525 tons per year of CO<sub>2</sub> emissions combined for EU IDs 27 and 28.

### **19.0 Acidulation and Neutralization Tanks**

DGP will have GHG emissions from the acidulation tanks (EU ID 124) and the neutralization tanks (EU ID 125). The following sections provide the GHG BACT review.

### **19.1 GHG**

Possible GHG emission control technologies for the acidulation and naturalization tanks were determined based on research for similar tanks.

### **Step 1 – Identification of GHG Control Technologies for Acidulation and Neutralization Tanks**

From research, the Department identified the following technologies as available for GHG control of the acidulation and neutralization tanks:

- (a) CCS  
See description in Section 3.5.
- (b) Good Operating Practices  
See description in Section 3.1.

### **Step 2 – Elimination of Technically Infeasible GHG Control Options for Acidulation and Neutralization Tanks**

CCS is technically infeasible as there are no CCS systems commercially available in the United States.

### **Step 3 – Ranking of Remaining GHG Control Options for Acidulation and Neutralization Tanks**

Donlin has accepted the only feasible control option. Therefore, ranking is not required.

### **Step 4 – Evaluate the Most Effective Controls**

Good operating practices are the most effective GHG controls for the acidulation and neutralization tanks.

### **RBLC Review**

A review of similar units in the RBLC indicates that good operating practices is the principle GHG control technology for acidulation and neutralization tanks.

### **Applicant Proposal**

Donlin proposed to use good operating practices. The GHG BACT emission limit will be 273,175 tons per year of CO<sub>2</sub> emissions combined for EU IDs 124 and 125.

**20.0 Fugitive Dust from Unpaved Roads**

DGP will have fugitive emissions from unpaved roads (EU IDs 158 - 160) while hauling ore and waste, road graders, maintenance vehicles, and other haul road travel. The unpaved roads will emit particulates. The following sections provide the particulate BACT review.

**20.1 Particulates**

Possible particulate emission control technologies for fugitives from unpaved roads were obtained from the RBLC. The RBLC was searched for all determinations in the last 10 years under the process code 99.150, Unpaved Roads. The search results are summarized in Table 20-1.

**Table 20-1. Particulate Control for Fugitive Dust from Unpaved Roads**

<b>Control Technology</b>	<b>Number of Determinations</b>	<b>Control Efficiency (%)</b>
Chemical and Water	13	90
Water	12	50 - 95.5
Chemical	11	75 - 98
Speed Reduction	3	90
Crushed Stone	1	No Data
No Control Specified	3	No Data

**Step 1 – Identification of Particulate Control Technologies for Fugitive Dust from Unpaved Roads**

From research, the Department identified the following technologies as available for particulate control of fugitive dust from unpaved roads:

- (a) Chemical and Water  
 A spray consisting of a mixture of water and chemical suppressants are used to wet the material to minimize the amount of fugitive dust.
- (b) Water  
 See description in Section 4.1.
- (c) Chemical  
 A spray of chemical suppressants are used to wet the material to minimize the amount of fugitive dust.
- (d) Speed Reduction  
 Limiting vehicle speed on unpaved roads to decrease the amount of fugitive dust.
- (e) Crushed Stone  
 Applying a layer of crushed stone on top of an unpaved road to decrease fugitive dust from vehicles driving on the road.

**Step 2 – Elimination of Technically Infeasible Particulate Control Options for Fugitive Dust from Unpaved Roads**

All control options listed above are technically feasible.

### Step 3 – Ranking of Remaining Particulate Control Options for Fugitive Dust from Unpaved Roads

The following control technologies have been identified and ranked for control of particulates from unpaved roads:

- |                        |                       |
|------------------------|-----------------------|
| (a) Chemical and Water | 90% control           |
| (b) Water              | 50 - 95.5% control    |
| (c) Chemical           | 75 - 98% control      |
| (d) Speed Reduction    | 90% control           |
| (e) Crushed Stone      | No data for % control |

### Step 4 – Evaluate the Most Effective Controls

The most effective control method for fugitive dust from haul roads is the use of a chemical suppressant and water. Environmental impacts from this control method is the effect of the chemicals on the surrounding vegetation.

#### RBLC Review

A review of similar units in the RBLC indicates that the use of chemical suppressant and water are the principle particulate control methods used for fugitive emissions from unpaved roads.

#### Applicant Proposal

Donlin proposed to apply both water and a chemical suppressant with the expectation to achieve 90 percent or greater control efficiency. The PM BACT limit for unpaved roads will be 3,500 tons per year for EU IDs 158 - 160.

### 21.0 Fugitive Dust from Material Loading and Unloading

DGP will have fugitive emissions from material loading and unloading (EU IDs 115 - 120). The material loading and unloading will emit particulates. The following sections provide the particulate BACT review.

#### 21.1 Particulates

Possible particulate emission control technologies for fugitive emissions from material loading and unloading were obtained from the RBLC. The RBLC was searched for all determinations in the last 10 years under the process code 19.190, Other Fugitive Dust Sources and filtered to only include material transfer emission sources. The search results are summarized in Table 20-1.

**Table 21-1. Particulate Control for Fugitive Dust from Material Loading and Unloading**

Control Technology	Number of Determinations	Control Efficiency (%)
Enclosure	65	50 - 95
Baghouse	41	98.8 - 99.7
Water Spray	7	90 - 98.3
Moisture Content	5	90 - 99
No Control Specified	12	No Data

### **Step 1 – Identification of Particulate Control Technologies for Fugitive Dust from Material Loading and Unloading**

From research, the Department identified the following technologies as available for particulates control of material loading and unloading:

- (a) Enclosure  
See description in Section 4.1.
- (b) Dust Collector  
See description in Section 4.1.
- (c) Water Spray  
See description in Section 4.1.
- (d) Moisture Content  
See description in Section 4.1.

### **Step 2 – Elimination of Technically Infeasible Particulate Control Options for Fugitive Dust from Material Loading and Unloading**

Add-on controls such as a baghouse or enclosure are not technically feasible because the loading and unloading operations at DGP are mobile.

### **Step 3 – Ranking of Remaining Particulate Control Options for Fugitive Dust from Material Loading and Unloading**

The following control technologies have been identified and ranked for control of particulates from the fugitive dust from unpaved roads:

- (a) Water Spray (up to 90% control)
- (b) Moisture Content (<90% control)

### **Step 4 – Evaluate the Most Effective Controls**

The most effective control method for fugitive dust from material loading and unloading is the use of a water spray. Environmental impact from this control method is minimal.

#### **RBLC Review**

A review of similar units in the RBLC indicates that the use of a water spray is a principle particulate control methods used for fugitive emissions from material loading and unloading.

#### **Applicant Proposal**

Donlin proposed to avoid activities during adverse winds and water work areas, as outlined in the fugitive dust plan. The PM BACT limit from material loading and unloading will be 530 tons per year for EU IDs 115 - 120.

## **22.0 Fugitive Dust from Wind Erosion**

Exposed and active mining areas can be a source of fugitive emissions due to wind erosion.

The wind erosion will emit particulates. The following sections provide the particulate BACT review.

### 22.1 Particulates

Possible particulate emission control technologies for fugitives from wind erosion were obtained from the RBLC. The RBLC was searched for all determinations in the last 10 years under the process code 99.190, Other Fugitive Dust Sources and filtered to only include wind erosion emission sources. The search results are summarized in Table 22-1.

**Table 22-1. Particulate Control for Fugitive Dust from Wind Erosion**

Control Technology	Number of Determinations	Control Efficiency (%)
Water Spray	24	50 - 90
Chemical	2	85
Enclosure	7	50
Moisture Content	2	90
Wind Block	1	No Data
No Control Specified	3	No Data

#### Step 1 – Identification of Particulate Control Technologies for Fugitive Dust from Wind Erosion

From research, the Department identified the following technologies as available for control of fugitive dust from wind erosion:

- (a) Water Spray  
Water sprays are used to wet the material to minimize the amount of fugitive dust.
- (b) Chemical  
A spray of chemical suppressants are used to wet the material to minimize the amount of fugitive dust.
- (c) Enclosure  
See description in Section 4.1.
- (d) Moisture Content  
See description in Section 4.1.
- (e) Wind Block  
A wind block is used to slow wind by deflecting it. They can range from a row of trees to a fabric fence, to an artificial shelter.

#### Step 2 – Elimination of Technically Infeasible Particulate Control Options for Fugitive Dust from Wind Erosion

Add-on controls such as an enclosure or wind block are not technically feasible because of the large exposed areas that may be exposed to wind erosion.



### **Step 3 – Ranking of Remaining Particulate Control Options for Fugitive Dust from Wind Erosion**

The following control technologies have been identified and ranked for control of particulates from unpaved roads:

- |                      |                     |
|----------------------|---------------------|
| (a) Water Spray      | (up to 90% control) |
| (b) Moisture Content | (90% control)       |
| (c) Chemical         | (85% control)       |

### **Step 4 – Evaluate the Most Effective Controls**

The most effective control method for fugitive dust from wind erosion is the use of a chemical suppressant. Environmental impacts from this control method are the effects of the chemical suppressant on the surrounding vegetation.

### **RBLC Review**

A review of similar units in the RBLC indicates that the use of a water spray is a principle particulate control methods used for fugitive emissions from wind erosion.

### **Applicant Proposal**

Donlin proposed to use phased surface disturbance, dozer maintenance of waste facility surfaces, and chemical application. Donlin will also cover the coarse ore stockpile to reduce particulate emissions, and the haul road wind erosion emissions will be controlled with the fugitives from unpaved roads discussed in Section 20.1. The estimated total fugitive dust emission from wind erosion is 25 tons per year from EU ID 161.

## **23.0 Drilling and Blasting**

DGP will have fugitive emissions from drilling (EU ID 113) and blasting (EU ID 114). The drilling will emit particulates, and the blasting will emit CO, NO<sub>x</sub>, particulates, and GHG. The following sections provide the CO, NO<sub>x</sub>, and particulate BACT reviews.

### **23.1 CO**

Possible CO emission control technologies from blasting were obtained from the RBLC. The RBLC was searched for all determinations in the last 10 years under the process code 99.190, Other Fugitive Dust Sources and filtered to only include blasting activities. Only one determination was found in the RBLC with no control specified.

### **RBLC Review**

A review of similar units in the RBLC indicates that there is no CO emission control available for blasting.

### **Applicant Proposal**

Donlin proposed to use best practical methods as BACT for CO emissions from blasting. Total emissions from blasting for CO will be approximately 1,400 tons per year for EU IDs 113 and 114.

### **23.2 NO<sub>x</sub>**

Possible NO<sub>x</sub> emission control technologies from blasting were obtained from the RBLC. The RBLC was searched for all determinations in the last 10 years under the process code 99.190, Other Fugitive Dust Sources and filtered to only include blasting activities. Only one determination was found in the RBLC with no control specified.

#### **RBLC Review**

A review of similar units in the RBLC indicates that there is no NO<sub>x</sub> emission control available for blasting.

#### **Applicant Proposal**

Donlin proposed to use best practical methods as BACT for NO<sub>x</sub> emissions from blasting. Total emissions from blasting for NO<sub>x</sub> will be approximately 40 tons per year.

### **23.3 Particulates**

Possible particulate emission control technologies from drilling blasting were obtained from the RBLC. The RBLC was searched for all determinations in the last 10 years under the process code 99.190, Other Fugitive Dust Sources and filtered to only include drilling or blasting activities. Only one determination was found in the RBLC with no control specified.

#### **RBLC Review**

A review of similar units in the RBLC indicates that there is no particulate emission control available for drilling and blasting.

#### **Applicant Proposal**

Donlin proposed to avoid activities during adverse winds, and using blast-hole-stemming and wet and/or shrouded drilling when practical as set out in their fugitive dust plan as BACT for particulate emissions from drilling and blasting. Total potential particulate emissions from EU IDs 113 and 114 are approximated to be 200 tons per year.

## APPENDIX C: BACT SUMMARY

### Table C-1. CO BACT Limits

EU ID	Description	BACT Limit	BACT Control
1 - 12	17 MW Wartsilla engines (ULSD)	0.18 g/kW-hr	Oxidation Catalyst with Good Combustion Practices
1 - 12	17 MW Wartsilla engines (Natural Gas)	0.12 g/kW-hr	Oxidation Catalyst with Good Combustion Practices
13 & 14	200 kW Airport Generators	4.38 g/kW-hr	Good Combustion Practices; Clean Fuels; 40 CFR 60 Subpart IIII
15 - 26	Boilers and Heaters (ULSD)	0.0384 lb/MMBtu	Good Combustion Practices
15 - 26	Boilers and Heaters (Natural Gas)	0.0824 lb/MMBtu	Good Combustion Practices
27	Camp Waste Incinerator	13 ppmvd at 7% O <sub>2</sub>	Good Combustion Practices; 40 CFR 60 Subpart CCCC, Table 8
28	Sewage Sludge Incinerator	52 ppmvd at 7% O <sub>2</sub>	Good Combustion Practices; 40 CFR 60 Subpart LLLL, Table 2
29 - 34	Emergency Engines > 560 kW	4.38 g/kW-hr	Good Combustion Practices; Clean Fuels; 40 CFR 60 Subpart IIII
35 - 37	Fire Pump Engines 130 < kW < 225	3.30 g/hp-hr	Good Combustion Practices; Clean Fuels; 40 CFR 60 Subpart IIII
77 & 81	Autoclaves	88 lb/hr	Good Operating Practices
88	Carbon Regeneration Kiln	0.88 lb/hr	Good Operating Practices
113 & 114	Drilling and Blasting	1,400 tpy	Good Combustion Practices

### Table C-2. NOx BACT Limits

EU ID	Description	BACT Limit	BACT Control
1 – 12	17 MW Wartsilla engines (ULSD)	0.53 g/kW-hr	Selective Catalytic Reduction; Good Combustion Practices
1 – 12	17 MW Wartsilla engines (Natural Gas)	0.08 g/kW-hr	Selective Catalytic Reduction; Good Combustion Practices
13 & 14	200 kW Airport Generators	0.5 g/kW-hr	Good Combustion Practices; Clean Fuels; 40 CFR 60 Subpart IIII
15 - 18 & 21 - 26	Boilers and Heaters (ULSD)	0.154 lb/MMBtu	Good Combustion Practices
15 - 18 & 21 - 26	Boilers and Heaters (Natural Gas)	0.098 lb/MMBtu	Good Combustion Practices
19 & 20	Power Plant Auxiliary Heaters (ULSD)	0.154 lb/MMBtu	Low-NOx Burners
19 & 20	Power Plant Auxiliary Heaters (Natural Gas)	0.049 lb/MMBtu	Low-NOx Burners
27	Camp Waste Incinerator	170 ppmvd at 7% O <sub>2</sub>	Good Combustion Practices; 40 CFR 60 Subpart CCCC, Table 8
28	Sewage Sludge Incinerator	210 ppmvd at 7% O <sub>2</sub>	Good Combustion Practices; 40 CFR 60 Subpart LLLL, Table 2
29 – 34	Emergency Engines > 560 kW	8.0 g/kW-hr <sup>1</sup>	Good Combustion Practices; Clean Fuels; 40 CFR 60 Subpart IIII
35 – 37	Fire Pump Engines 130 < kW < 225	3.7 g/hp-hr <sup>1</sup>	Good Combustion Practices; Clean Fuels; 40 CFR 60 Subpart IIII
88	Carbon Regeneration Kiln	0.02 lb/hr	Good Operating Practices
113 & 114	Drilling and Blasting	40 tpy	Best Practical Methods / Fugitive Dust Control Plan

Table Notes: <sup>1</sup> BACT Limit for NO<sub>x</sub> + VOC

**Table C-3. Particulate BACT Limits**

<b>EU ID</b>	<b>Description</b>	<b>BACT Limit</b>	<b>BACT Control</b>
1 - 12	17 MW Wartsilla engines (ULSD)	0.15 g/kW-hr	Clean Fuel with GCP
1 - 12	17 MW Wartsilla engines (Natural Gas)	0.13 g/kW-hr	Clean Fuel with GCP
13 & 14	200 kW Airport Generators	0.03 g/kW-hr	Good Combustion Practices; Clean Fuels; 40 CFR 60 Subpart IIII
15 - 26	Boilers and Heaters (ULSD)	0.0254 lb/MMBtu	Good Combustion Practices
15 - 26	Boilers and Heaters (Natural Gas)	0.0075 lb/MMBtu	Good Combustion Practices
27	Camp Waste Incinerator	270 mg/dscm at 7% O <sub>2</sub>	Good Combustion Practices; 40 CFR 60 Subpart CCCC, Table 8
28	Sewage Sludge Incinerator	60 mg/dscm at 7% O <sub>2</sub>	Good Combustion Practices; 40 CFR 60 Subpart LLLL, Table 2
29 - 34	Emergency Engines > 560 kW	0.25 g/kW-hr	Good Combustion Practices; Clean Fuels; 40 CFR 60 Subpart IIII
35 - 37	Fire Pump Engines 130 < kW < 225	0.19 g/hp-hr	Good Combustion Practices; Clean Fuels; 40 CFR 60 Subpart IIII
39, 41 - 43, 46, 48, 50, 52, 55, & 56	Crushers, Apron Feeders, Conveyors	0.01 gr/dscf	Dust Collectors
38, 44, 45, 54, & 58	Rock Breaker, Dump Pocket, Conveyors	0.00048 lb/ton	Enclosures
59, 61, 65, 67, 69, 71, 73, & 75	Mill Reagents Handling	0.02 gr/scf	Dust Collectors
63	Lime Handling Slaker	0.02 gr/scf	Wet Scrubber
77 & 81	Autoclaves	0.22 lb/hr	Venturi Scubbers
85 - 87	Pressure Oxidation Hot Cure	0.4 lb/hr	Good Operating Practices
88	Carbon Regeneration Kiln	0.44 lb/hr	Wet Off-Gas Cooler
91 - 94	Electrowinning Cells	0.19 lb/hr	Good Operating Practices
97	Mercury Retort	0.03 lb/hr	Good Operating Practices
100	Induction Smelting Furnace	0.005 gr/dscf	Dust Collector
103 & 104	Sample Receiving and Preparation Lab	0.009 gr/dscf	Dust Collectors
106	Assay Laboratory	0.004 gr/dscf	Dust Collector
108 & 109	Metallurgical Laboratory	0.009 gr/dscf	Dust Collectors
111	Reagent Handling for Water Treatment	0.02 gr/scf	Dust Collector
113 & 114	Drilling and Blasting	200 tpy	Best Practical Methods / Fugitive Dust Control Plan
115 - 120	Material Loading and Unloading	500 tpy	Water Spray
158 - 160	Unpaved Roads	3,500 tpy	Chemical and Water Dust Suppressants
161	Fugitive Dust from Wind Erosion	25 tpy	Best Practical Methods / Fugitive Dust Control Plan

**Table C-4. VOC BACT Limits**

<b>EU ID</b>	<b>Description</b>	<b>BACT Limit</b>	<b>BACT Control</b>
1 – 12	17 MW Wartsilla engines (ULSD)	0.21 g/kW-hr	Oxidation Catalyst; Good Combustion Practices
1 – 12	17 MW Wartsilla engines (Natural Gas)	0.09 g/kW-hr	Oxidation Catalyst; Good Combustion Practices
13 & 14	200 kW Airport Generators	0.24 g/kW-hr	Good Combustion Practices; Clean Fuels; 40 CFR 60
15 - 26	Boilers and Heaters (ULSD)	0.00154 lb/MMBtu	Good Combustion Practices
15 - 26	Boilers and Heaters (Natural Gas)	0.0054 lb/MMBtu	Good Combustion Practices
77 & 81	Autoclaves	0.04 lb/hr	Carbon Adsorber
88	Carbon Regeneration Kiln	0.44 lb/hr	Good Operating Practices
126 – 142, 150 – 152, & 156	Fuel Tanks	1.7 tpy	Submerged Fill

**Table C-5. GHG BACT Limits**

<b>EU ID</b>	<b>Description</b>	<b>BACT Limit</b>	<b>BACT Control</b>
1 - 12	17 MW Wartsilla engines (ULSD)	440 g/hp-hr	Good Combustion Practices
1 - 12	17 MW Wartsilla engines (Natural Gas)	305 g/hp-hr	Good Combustion Practices
13 - 14	200 kW Airport Generators	2,700 tpy	Good Combustion Practices
15 - 26	Boilers and Heaters (ULSD and Natural Gas)	140,264 tpy	Good Combustion Practices
27 & 28	Camp Waste and Sewage Sludge Incinerators	525 tpy	Good Combustion Practices
29 - 37	Emergency and Black Start Generators	3,000 tpy	Good Combustion Practices
77 & 81	Autoclaves	37,659 tpy	Good Operating Practices
113 & 114	Drilling and Blasting	8,600 tpy	Good Combustion Practices
124 & 125	Acidulation and Neutralization Tanks	273,175 tpy	Good Operating Practices

## APPENDIX D: MODELING REPORT