# 3.8 AIR QUALITY

## SYNOPSIS

This section describes the regulatory framework, provides an overview of current air quality conditions, and evaluates potential impacts to air quality from the Donlin Gold Project proposed action and alternatives. The emissions and pollutants subject to regulation are detailed, including criteria pollutants, greenhouse gases and hazardous air pollutants, among which mercury (Hg) is of particular concern. Air quality effects are then analyzed by project phase for each alternative. Particular attention is given to estimated impacts on ambient air quality, which is an indicator for health effects. The analysis is organized project component (Mine Site, Transportation Corridor, and Pipeline).

## EXISTING CONDITION SUMMARY

**Types of pollutants:** *Criteria pollutants* are air constituents which are harmful in concentrations above a certain threshold; for instance, dust. *Hazardous air pollutants* (HAPs) are toxic substances not ordinarily present in the atmosphere in most places (or only in trace amounts); such as mercury. *Greenhouse gases* (GHGs) are not necessarily toxic in and of themselves, but may contribute to global warming; carbon dioxide ($CO_2$) is the most prevalent GHG, and the gas by which other GHGs are frequently measured.

**Regulations:** The Clean Air Act (CAA) governs air pollution in the U.S., and under this act, the U.S. Environmental Protection Agency (EPA) regulates and sets standards for ambient air quality and for emissions of pollutants. The State of Alaska implements many CAA regulations within Alaska, and also sets its own standards for air quality.

The EPA also imposes control standards for emissions sources through New Source Performance Standards, National Emission Standards for Hazardous Air Pollutants (NESHAPs) and Maximum Achievable Control Technology (MACT) requirements.

**Representative Air Pollutants:** The section covers relevant air pollutants in detail; three representative pollutants are presented here for purposes of illustration.

*Mercury* is a naturally occurring, highly toxic metal often found in gold-containing rock, as is the case in the proposed Project Area. Mercury abatement and containment methods have been a subject of study and improvement in gold processing in recent decades. In the air, the most common form of gaseous mercury can travel long distances before depositing.

*Oxides of nitrogen* consist of nitrogen dioxide ($NO_2$), nitric oxide (NO), and nitrous oxide ($N_2O$) and are produced by the reaction of gaseous nitrogen and oxygen during combustion. Nitrogen dioxide can be harmful to human health. $NO_2$ and NO also contribute to acid rain, and to the formation of ozone ($O_3$) in the troposphere (lower atmosphere), which can be harmful to human and animal health. Nitrous oxide is a greenhouse gas.

*Greenhouse gases* contribute to global warming; and climate disruption. A number of substances potentially released by project components act as GHGs, including $CO_2$,

$N_2O$, and methane ($CH_4$). GHGs are frequently expressed in terms of equivalence to $CO_2$, noted $CO_2$-e, or $CO_2$ equivalents. For example, '3 tons $CO_2$-e' indicates the same atmospheric global-warming potential as 3 tons of $CO_2$.

While some analysis of HAPs concentrations in air is presented in this section, the analysis of HAPs deposition and concentrations on the ground is presented in Section 3.2, Soils. This section's analysis discusses HAPs in total, rather than by individual compounds that make up the total value. In some cases, constituents of concern such as mercury (Hg), lead (Pb), arsenic and hydrogen cyanide are presented alongside the total HAPs results. HAPs emissions at the mine include 11 metals in fugitive dust and 40-60 organic and inorganic compounds in other sources. Implications for human health are discussed in Section 3.22, Human Health, and an analysis of HAPs metals impacts to ecological receptors is presented in Section 3.12, Wildlife; and 3.13, Fish and Aquatic Resources.

## EXPECTED EFFECTS SUMMARY

### Alternative 1 - No Action

There would be no new impacts under Alternative 1.

### Alternative 2 - Donlin Gold's Proposed Action

Table 3.8-1 summarizes projected emissions of selected pollutants to compare quality effects of components and phases of the project. No emissions are expected to cause an exceedance of any air quality standard.

**Mine Site:** Air quality modeling for the Mine Site was performed assuming that the dual-fired generators would be fired exclusively with diesel fuel, which is a conservative scenario. For the Mine Site, the Operations Phase would trigger air-quality permits and GHG reporting. The modeling included mobile, fugitive and stationary source emissions. The Mine Site would be subject to Prevention of Significant Deterioration (PSD) review for carbon monoxide (CO), $NO_x$, $PM_{2.5}$, $PM_{10}$, and volatile organic compounds (VOCs). Dispersion modeling results for PSD increments and ambient air quality standards are shown in Tables 3.8-22 and 3.8-23, respectively. All impacts subject to PSD review remain below 100 percent of allowable increment (the highest being 24-hr high of PM10, at 86 percent). Similarly, impacts remain below 100 percent of the AAQS (the highest being 1-hour high of NO2, at 62 percent, with the next-highest being 8-hour high for CO, at 36 percent. Ambient Hg modeling (Table 3.8-24), shows expected exposure at the Mine Site of less than one percent of the most stringent standard for annual exposure with no observable adverse effect (0.2 $\mu g/m^3$).

Mitigation measures and required best management practices (BMPs) include use of Hg abatement measures resulting in capture of 99.6 percent of Hg from the processing facility[1] and dust suppression quelling approximately 90 percent of dust generated from unpaved roads, as well as additional best practical methods to suppress dust from other dust generating sources within the Mine Site. BMPs and monitoring practices (i.e., via visual observations) are captured in a fugitive dust control plan (FDCP), provided in

[1] The removal efficiency cited applies only to the process facility. Mercury emissions from point sources at the process facility are controlled to the extent that 99.6 percent of the mercury is captured (Hatch 2014). The resulting amount released to the air from the stacks at the process facility is estimated at 128 pounds per year. Note that mercury may also be releases to the air or water from the open pit, waste rock facility, or tailings storage facility (SRK 2014a).

Appendix I. Operations would be required to meet air quality requirements for criteria pollutants and toxins as outlined in their air quality permits.

Construction would be limited to less than four years. Total estimated annual emissions from the Construction Phase are less than total estimated annual emissions from the Mine Site Operations Phase which were shown to have modeled impacts below required thresholds. Thus, impacts are expected to meet regulatory standards.

Closure would be limited to five years and total estimated annual emissions from closure are less than total estimated annual emissions from Mine Site operation which were shown to have modeled impacts below required thresholds. Thus, impacts are expected to meet regulatory standards.

**Table 3.8-1: Summary of Selected Emissions by Phase and Component[1]**

| Component/Phase | $PM_{2.5}$ | $PM_{10}$ | Total HAPs | Total GHGs[2] |
|---|---|---|---|---|
| **Mine Site** | | | | |
| Construction[3] | 121 tons | 765 tons | 5 tons | 203,300 tons |
| Operations | 557 tpy | 1,736 tpy | 27 tpy[4] | 1,761,000 tpy |
| Closure | 49 tpy | 273 tpy | 2 tpy | 194,300 tpy |
| **Transportation Corridor[5]** | | | | |
| Land, Air Transportation – Construction[3] | 161 tons | 1,404 tons | 8 tons | 301,600 tons |
| River Transportation – Construction | 9 tpy | 9 tpy | nc | 10,600 tpy |
| Land, Air Transportation – Operations | 5 tpy | 40 tpy | 1 tpy | 59,100 tpy |
| River Transportation – Operations | 12 tpy | 12 tpy | nc | 14,000 tpy |
| **Pipeline[5]** | | | | |
| Construction | 71 tpy | 518 tpy | 11 tpy | 259,700 tpy |
| Operations | 0.6 tpy | 0.6 tpy | 0.01 tpy | 18,800 tpy |

**Notes:**
1 Emissions shown in this table consist of fugitive, mobile, and stationary source emissions.
2 GHGs are expressed in short tons of $CO_2$ equivalents in this table and throughout the report.
3 For the Mine Site and Transportation Corridor, this table shows total emissions for the duration of the Construction Phase (3 to 4 years), not an annual rate as shown for Operations and closure. The emissions vary per year so not appropriate to divide by number of years.
4 Stationary source HAP emissions are less than 25 tpy.
5 No values are provided to the Closure Phase for the Transportation Corridor and Pipeline components, because emissions would be negligible for this phase.
nc = not calculated (negligible because HAPs are a subset of Volatile Organic Compounds (VOC) and VOC emissions negligible)
$PM_{2.5}$ and $PM_{10}$ = Particulate matter with an aerodynamic diameter less than or equal to 2.5 and 10 micrometers, respectively
HAPs = Hazardous air pollutants
GHGs = Greenhouse gases
tpy = tons per year

**Transportation Corridor and Pipeline:** No permit or reporting threshold for air quality would be exceeded in any project phase for these components.

**OTHER ALTERNATIVES** – This section discusses differences of note between Alternative 2 and the following alternatives, but does not include a comprehensive discussion of each alternative's impacts if they are the same as or similar to Alternative 2 impacts.

**Alternative 3A - LNG Powered Trucks**

This alternative would reduce the use of diesel fuel and increase consumption of natural gas, creating minor reductions in emissions of CO, $NO_x$, particulate matter (PM), $SO_2$, VOCs, and GHGs at the Mine Site, and reduced mobile source emissions from barging compared to Alternative 2. The overall impact would be similar to Alternative 2.

**Alternative 3B - Diesel Pipeline**

This alternative would result in dual-fuel equipment at the Mine Site being run on diesel, the basis for the conservative numbers modeled for Alternative 2. In practice, Alternative 2 emissions would be less than those modeled, while Alternative 3B emissions would be at modeled levels, meaning there would be increased CO, $NO_x$, $SO_2$, VOCs, PM, and GHGs at the Mine Site compared to anticipated execution of Alternative 2. There would be reduced mobile source emissions from barging compared to Alternative 2. The overall impact would be similar to Alternative 2. The *Collocated Natural Gas Pipeline Option* would be expected to have similar impacts as Alternative 2 given the availability of natural gas to fire dual-fired units.

**Alternative 5A - Dry Stack Tailings**

This alternative would require a filter plant to dewater tailings and produce filter cake during Operations. The tailings would be transported by truck to the Anaconda Creek valley for dry stacking. This alternative would call for increased power generation, resulting in an increase in emissions of criteria pollutants and GHGs from the power plant. It would require a six percent increase in barge traffic (and related emissions), and would create about three to eight percent more fugitive dust (PM) at the Mine Site than Alternative 2. The dust would be minimized through concurrent reclamation, silt fencing, snow management, and dust suppressants. At closure, the storage facility would be covered and vegetated to control fugitive dust. None of these changes affect the overall intensity of air quality impacts in comparison to Alternative 2. More detailed analyses of the applicability and appropriateness of this alternative based upon prior process research is provided in Section 2.3.6 on project alternatives and Section 3.2.3.6.4 on soil quality and effects.

## 3.8.1 APPLICABLE REGULATIONS

### 3.8.1.1 REGULATORY FRAMEWORK

The basic federal statute governing air pollution in the U.S. is the 1970 Clean Air Act (CAA),[2] as amended in 1977 and 1990. The CAA amendments of 1977 created New Source Review (NSR), a preconstruction review program for new or modified stationary sources. The NSR program includes the PSD program for protecting “clean” air, and the Nonattainment NSR (NNSR) program for cleaning up “dirty” air (an area that does not meet the national ambient air quality standards [NAAQS] is known as a “nonattainment area”). The PSD provisions of the 1977 CAA amendments include provisions for protecting air quality in national parks and wilderness

[2] The CAA is codified in 42 United States Code 7401, et seq.

areas, and set a specific goal of preventing manmade visibility impairment in certain national parks and wilderness areas. These provisions required states to update their State Implementation Plans (SIPs) to address these PSD-related items through progress plans and other measures.

In 1990, the CAA was again amended to require states to develop and implement an operating permit program for stationary sources, and to require EPA to: take action on visibility impairment from multiple sources of regional haze; develop Maximum Achievable Control Technology (MACT) standards for area sources of HAPs; and develop requirements for preventing catastrophic releases of HAPs. The 1990 amendments also included transportation and general conformity requirements aimed at ensuring that new federal transportation projects or other projects involving federal monies, approval, or permitting conform to air quality plans of nonattainment and/or maintenance areas.

#### 3.8.1.1.1 AMBIENT AIR QUALITY STANDARDS

Ambient air quality standards are set by federal regulations, which here are implemented by the State of Alaska. The EPA, in 40 Code of Federal Regulations (CFR) Part 50, establishes NAAQS for six principal pollutants, which are called "criteria" pollutants: PM, $SO_2$, CO, $NO_2$[3], $O_3$, and Pb. Under these regulations, PM with an aerodynamic diameter less than or equal to 10 micrometers is $PM_{10}$, and less than or equal to 2.5 micrometers is $PM_{2.5}$. The NAAQS were developed to protect public health (primary standards) and public welfare (secondary standards).

While the EPA sets the NAAQS, states are responsible for attaining and maintaining the standards per their SIPs. The Alaska Department of Environmental Conservation (ADEC) is the implementing agency for air pollution control regulations for the State of Alaska. ADEC has adopted Alaska Ambient Air Quality Standards (AAAQS) that are generally the same as the primary NAAQS for all six criteria pollutants; legally, AAAQS cannot be less stringent. ADEC also established AAAQS for ammonia ($NH_3$) and reduced sulfur compounds, for which there is no NAAQS. In addition, the AAAQS include additional averaging times for some criteria pollutants (e.g., $SO_2$). Table 3.8-2 lists the primary and secondary NAAQS, alongside the AAAQS.

PM emissions can be directly emitted into the air or can be created in the atmosphere through chemical or physical reactions between gases. This is known as secondary PM.

In addition to the criteria pollutants described above, non-criteria pollutants can be detrimental to the environment. Reduced sulfur compounds and $NH_3$ are non-criteria pollutants, as well as air toxics, including mercury.

[3] $NO_2$ is a component of nitrogen oxide gases formed during the combustion of coal and fuels, collectively referred to as $NO_x$. $NO_x$ is initially composed predominantly of nitric oxide (NO) (90-95 percent) and a lesser amount (5-10 percent) of $NO_2$, but NO oxidizes to $NO_2$ in the atmosphere. $NO_2$ causes detrimental effects to the bronchial system, and along with particulate matter, is the main cause of smog in urban areas.

**Table 3.8-2: National and Alaska Ambient Air Quality Standards**

| Pollutant | Averaging Time | Primary NAAQS | Secondary NAAQS | AAAQS | Form |
|---|---|---|---|---|---|
| $PM_{10}$ | 24-hour | 150 µg/m$^3$ | 150 µg/m$^3$ | 150 µg/m$^3$ | NAAQS: Not to be exceeded more than once per year on average over 3 years<br>AAAQS: Not to be exceeded by the 24-hour average concentration more than one day per calendar year |
| $PM_{2.5}$ | Annual | 12 µg/m$^3$ | 15 µg/m$^3$ | 12 µg/m$^3$ | NAAQS: Annual mean, averaged over 3 years<br>AAAQS: Annual arithmetic mean, averaged over 3 years, rounded to the nearest 0.1 µg/m$^3$ |
| | 24-hour | 35 µg/m$^3$ | 35 µg/m$^3$ | 35 µg/m$^3$ | NAAQS: 98th percentile, averaged over 3 years<br>AAAQS: 98$^{th}$ percentile, averaged over 3 years, rounded to the nearest 1 µg/m$^3$ |
| $SO_2$ | Annual | NA | NA | 80 µg/m$^3$ (0.030 ppm) | Annual arithmetic mean |
| | 24-hour | NA | NA | 365 µg/m$^3$ (0.14 ppm) | Not to be exceeded more than once per year |
| | 3-hour | NA | 0.5 ppm | 1,300 µg/m$^3$ (0.50 ppm) | Not to be exceeded more than once per year |
| | 1-hour | 75 ppb | NA | 196 µg/m$^3$ (75 ppb) | 99$^{th}$ percentile of 1-hour daily maximum concentration, averaged over 3 years |
| CO | 8-hour | 9 ppm | NA | 10,000 µg/m$^3$ (9 ppm) | Not to be exceeded more than once per year |
| | 1-hour | 35 ppm | NA | 40,000 µg/m$^3$ (35 ppm) | |
| $NO_2$ | Annual | 53 ppb (0.053 ppm) | 53 ppb (0.053 ppm) | 100 µg/m$^3$ (0.053 ppm) | NAAQS: Annual mean<br>AAAQS: Not to be exceeded by the average of the 1-hour concentration in a calendar year |
| | 1-hour | 100 ppb (0.100 ppm) | NA | 188 µg/m$^3$ (0.100 ppm) | 98$^{th}$ percentile of daily maximum 1-hour average concentrations, averaged over 3 years |
| $O_3$ | 8-hour | 0.070 ppm (137 µg/m$^3$) | 0.070 ppm (137 µg/m$^3$) | 0.070 ppm (137 µg/m$^3$) | Annual 4$^{th}$ highest daily maximum 8-hour concentration, averaged over 3 years |
| Pb | 3-month rolling | 0.15 µg/m$^3$ | 0.15 µg/m$^3$ | 0.15 µg/m$^3$ | NAAQS: Not to be exceeded<br>AAAQS: Not to be exceeded by the maximum 3-month arithmetic mean for a 3-year period |

**Table 3.8-2: National and Alaska Ambient Air Quality Standards**

| Pollutant | Averaging Time | Primary NAAQS | Secondary NAAQS | AAAQS | Form |
|---|---|---|---|---|---|
| Reduced Sulfur, expressed as $SO_2$ | 30-minute Average | NA | NA | 50 µg/$m^3$ | Not to be exceeded more than once per year |
| $NH_3$ | 8-hour Rolling Average | NA | NA | 2,100 µg/$m^3$ | Not to be exceeded more than once per year |

**Notes:**
NAAQS = National Ambient Air Quality Standard
AAAQS = Alaska Ambient Air Quality Standard
CO = Carbon monoxide
NA = Not applicable
NAAQS = National Ambient Air Quality Standard
$NH_3$ = Ammonia
$NO_2$ = Nitrogen dioxide
$O_3$ = Ozone
Pb = Lead
ppm = Parts per million
ppb = Parts per billion
$SO_2$ = Sulfur dioxide
µg/$m^3$ = Micrograms per cubic meter
$PM_{2.5}$ and $PM_{10}$ = Particulate matter with an aerodynamic diameter less than or equal to 2.5 and 10 micrometers, respectively
Source: EPA 2016; ADEC 2016.

### 3.8.1.2 AIR QUALITY ATTAINMENT STATUS

The EPA determines air quality attainment status based on whether the air quality in the area meets (attains) the NAAQS. Table 3.8-3 summarizes terms used to describe the air quality attainment status of an area.

**Table 3.8-3: Air Quality Attainment Status Terminology**

| Term | Meaning |
|---|---|
| **Nonattainment Area** | Air quality measurements in the area violate primary NAAQS or AAAQS for one or more criteria pollutants (status is pollutant-specific). |
| **Attainment Area** | Air quality measurements in the area comply with primary NAAQS or AAAQS for one or more criteria pollutants (status is pollutant-specific). |
| **Unclassified/Attainment** | If there is insufficient data on the air quality in the area to designate as attainment or nonattainment, area is considered “unclassified” and is treated as attainment area under the CAA. |
| **Maintenance Area** | Areas that were previously designated nonattainment and have since demonstrated compliance with a NAAQS are designated “maintenance” for 20 years after the effective date of attainment; this time period assumes that the area remains in compliance with the standard. |

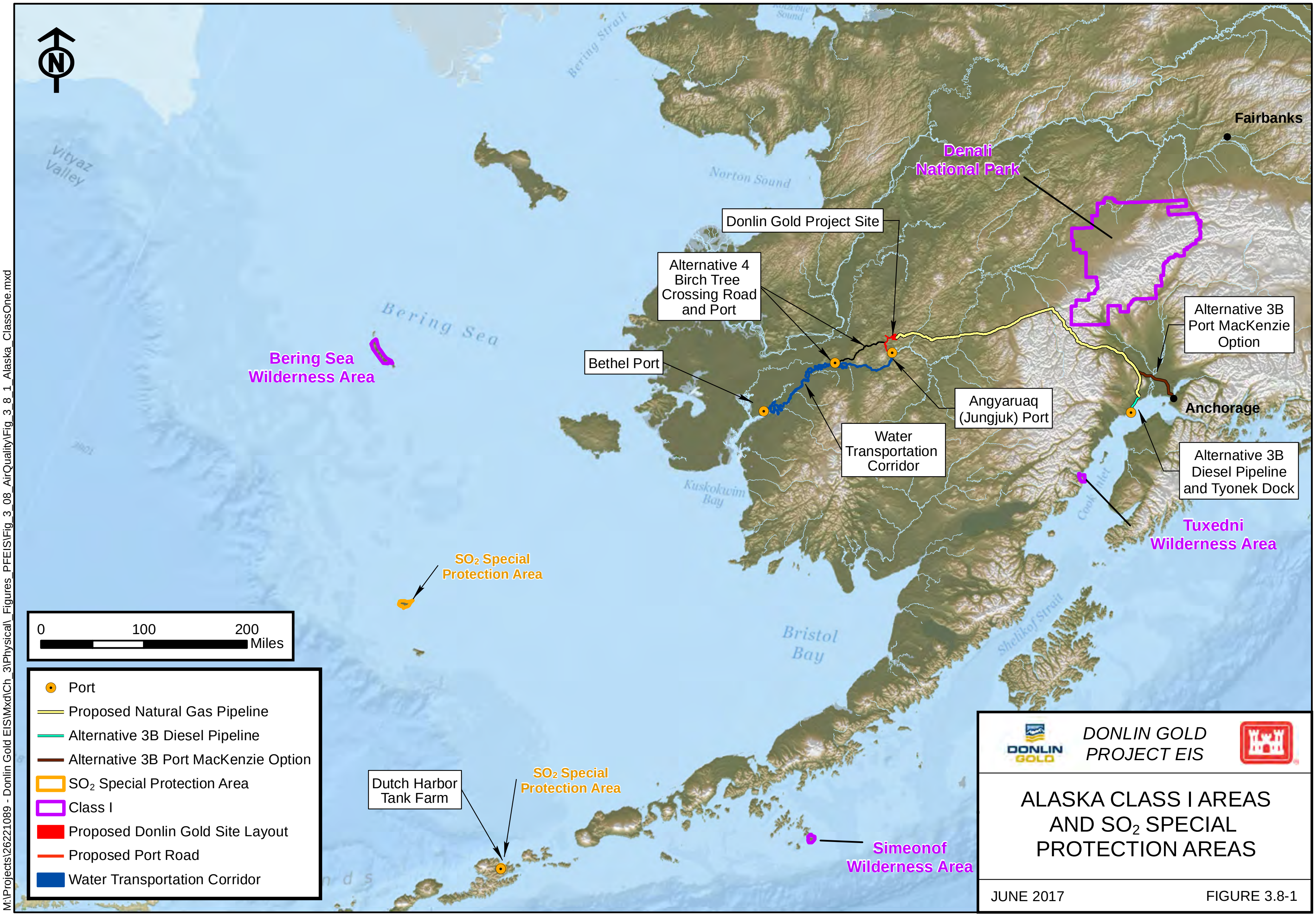
Attainment areas are classified as Class I (generally, national parks and wilderness areas above a certain size), Class II (areas not classified as Class I or III), or Class III (areas that states may designate for development) depending on the amount of air pollution. For each classification, the CAA specifies a maximum level (the "increment" in terms of micrograms per cubic meter [$\mu g/m^3$]) of $SO_2$, $NO_2$ and PM by which air quality can be degraded after a certain date. The levels, shown in Table 3.8-4 for Class II, are more stringent for Class I areas and less stringent for Class III areas. Regardless of Class I/II/III status, all areas must attain the NAAQS (shown in Table 3.8-2), or the delegated agency must develop a plan to attain the NAAQS.

**Table 3.8-4: Maximum Allowable Increments for Class II Areas**

| Pollutant | Averaging Time | Maximum Allowable Increase ($\mu g/m^3$) |
|---|---|---|
| $PM_{10}$ | Annual Arithmetic Mean | 17 |
| | 24-hour Maximum | 30 |
| $PM_{2.5}$ | Annual Arithmetic Mean | 4 |
| | 24-hour Maximum | 9 |
| $SO_2$ | Annual Arithmetic Mean | 20 |
| | 24-hour Maximum | 91 |
| | 3-hour Maximum | 512 |
| $NO_2$ | Annual Arithmetic Mean | 25 |

**Notes:**
$\mu g/m^3$ = Micrograms per cubic meter $NO_2$ = Nitrogen dioxide $SO_2$ = Sulfur dioxide
$PM_{2.5}$ and $PM_{10}$ = Particulate matter with an aerodynamic diameter less than or equal to 2.5 and 10 micrometers, respectively
Source: ADEC 2016.

Designation of Class I areas are codified in 40 CFR Part 81, Subpart D. There are 156 Class I areas in the U.S. for which federal land managers have identified visibility as an important value. Four of these are in Alaska: Denali National Park, Tuxedni Wilderness Area, Simeonof Wilderness Area, and Bering Sea Wilderness Area. These Class I areas are shown on Figure 3.8-1. The remainder of Alaska is designated as Class II. There are no Class III areas in Alaska. The distance of the Class I areas from the project components is provided in Section 3.8.3.3.1, along with discussion of correspondence with the federal land manager.



N
Bering Strait
Norton Sound
Vityaz Valley
Bering Sea
Fairbanks
Denali National Park
Donlin Gold Project Site
Alternative 4 Birch Tree Crossing Road and Port
Bethel Port
Bering Sea Wilderness Area
Alternative 3B Port MacKenzie Option
Anchorage
Angyaruaq (Jungjuk) Port
Water Transportation Corridor
Alternative 3B Diesel Pipeline and Tyonek Dock
Kuskokwim Bay
Cook Inlet
Tuxedni Wilderness Area
$SO_2$ Special Protection Area
Bristol Bay
Shelikof Strait
Dutch Harbor Tank Farm
$SO_2$ Special Protection Area
Simeonof Wilderness Area
0 100 200 Miles
Port
Proposed Natural Gas Pipeline
Alternative 3B Diesel Pipeline
Alternative 3B Port MacKenzie Option
$SO_2$ Special Protection Area
Class I
Proposed Donlin Gold Site Layout
Proposed Port Road
Water Transportation Corridor
DONLIN GOLD
DONLIN GOLD PROJECT EIS
ALASKA CLASS I AREAS AND $SO_2$ SPECIAL PROTECTION AREAS
JUNE 2017
FIGURE 3.8-1
M:\Projects\26221089 - Donlin Gold EIS\Mxd\Ch_3\Physical_Figures_PFEIS\Fig_3_08_AirQuality\Fig_3_8_1_Alaska_ClassOne.mxd

Alaska has one nonattainment area and four maintenance areas. The Fairbanks and North Pole urban area is designated as nonattainment for $PM_{2.5}$. The Eagle River area in the Municipality of Anchorage is designated as a maintenance area for $PM_{10}$, the Municipality of Anchorage and Fairbanks and North Pole urban areas are designated as maintenance areas for CO, and the Mendenhall Valley in the City and Borough of Juneau is designated as a maintenance area for $PM_{10}$. ADEC's SIP describes how the State of Alaska will comply with the CAA and achieve attainment with the NAAQS and/or AAAQS.

The air quality attainment status for the proposed Donlin Gold Project Area is either "attainment" or "unclassifiable/attainment" for each of the six criteria pollutants. The proposed Project Area is classified as Class II. Maximum allowable increments for three of the six criteria pollutants (PM, $SO_2$, and $NO_2$) are presented in Table 3.8-4. Maximum allowable increases for Class II areas are not specified for criteria pollutants CO, $O_3$, or Pb (ADEC 2016).

### 3.8.1.3 REGULATORY REQUIREMENTS

The following air quality control provisions implemented under the CAA would be applicable to the proposed Donlin Gold Project.

- Greenhouse gas reporting rule
- NSR permits (Title I)
  - Major PSD permits
  - Minor NSR permits
- Visibility protection
  - Regional Haze Rule
- Operating permits (Title V)
- NSPS (New Source Performance Standards)
- NESHAPs (National Emission Standards for Hazardous Air Pollutants)/MACT
- Compliance Assurance Monitoring (CAM)
- Mobile source regulations

The following air quality control provisions implemented under the CAA were reviewed and would not be applicable to the proposed Donlin Gold Project. Refer to Appendix I under "List of Regulations found to be Inapplicable to Project" for more information.

- Major NNSR permits
- Visibility and other special protection areas
- Best Available Retrofit Technology (BART)
- Conformity
- Chemical accident prevention provisions
- Open burning

#### 3.8.1.3.1 GREENHOUSE GAS REPORTING RULE

Greenhouse gases (GHGs) are gases that trap heat in the atmosphere. EPA found that emissions of GHGs (i.e., $CO_2$, $CH_4$, $N_2O$, hydrofluorocarbons [HFCs], perfluorocarbons [PFCs], and sulfur hexafluoride [$SF_6$]), pose a threat to public health and welfare (EPA 2009a). Subsequent to this finding, EPA issued the Mandatory Reporting of Greenhouse Gas Rule. This rule, codified in 40 CFR Part 98, is the first comprehensive national system for reporting emissions of $CO_2$ and other GHGs produced by major sources in the U.S. The purpose of the rule is to collect comprehensive and accurate data about the production of GHGs in order to confront global warming.

The gases covered by the rule are $CO_2$, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride) and other fluorinated gases. Because $CO_2$ is the reference gas for climate change, measures of non-$CO_2$ GHGs are converted into $CO_2$-equivalent ($CO_2$-e)[4] based on their global warming potential (GWP) (potential to absorb heat in the atmosphere). GWPs for these covered gases are listed in Table 3.8-5.

**Table 3.8-5: Global Warming Potentials**

| GHG | Global Warming Potential (100-Year Horizon) |
|---|---|
| $CO_2$ | 1 |
| $CH_4$ | 25 |
| $N_2O$ | 298 |
| HFCs | From 12 to 14,800 |
| PFCs | From 7,500 to 12,200 |
| $SF_6$ | 22,800 |

Source: EPA 2013f.

The reporting requirements apply to suppliers of fossil fuel and industrial chemicals, manufacturers of certain motor vehicles and engines (not including light and medium duty on-road vehicles), and sources with emissions greater than 25,000 metric tons (MT) per year, in terms of $CO_2$-e GHGs (about the amount of GHG emissions emitted from 5,200 passenger vehicles over the course of a year).

Sources must report under the GHG rule if they are in a source category listed in 40 CFR 98.2(a)(1) or (a)(2) (including certain electricity generation units, cement production, or iron and steel production); or if the source:

- Is not a source category listed in 40 CFR 98.2(a)(1) or (a)(2);
- Has an aggregate maximum rated heat input capacity greater than 30 million British thermal units per hour (MMBtu/hr); and
- Emits at least 25,000 MT per year of $CO_2$-e from all stationary fuel combustion sources.

[4] As defined in 40 CFR Part 98, $CO_2$-e means the number of metric tons of $CO_2$ emission with the same theoretical global warming potential as one metric ton of a non-$CO_2$ GHG; and global warming potential (GWP) means the ratio of the time-integrated radiative forcing from the instantaneous release of one kilogram of a trace substance relative to that one kilogram of a reference gas, i.e. $CO_2$ (EPA 2009b).

### 3.8.1.3.2 NEW SOURCE REVIEW PERMITTING

NSR is a preconstruction permitting program that ensures air quality is not significantly degraded when a new source of air pollution is constructed, or an existing source is modified, such that air pollutant emissions are increased. In areas with poor air quality (nonattainment areas), NSR ensures that the new emissions do not inhibit progress toward cleaner air. In areas with good air quality, NSR ensures that the new emissions do not degrade the air quality to a degree considered unacceptable (major PSD or minor NSR). In addition, the NSR program ensures that any large, new, or modified industrial source would be as clean as possible, by incorporating advances in air pollution controls.

NSR permits are legal documents that authorize a permittee to construct a source of emissions. The permits also specify how the permittee may operate the emissions source, including limitations on emissions and / or operating hours.

#### Major Prevention of Significant Deterioration Permits

Prevention of Significant Deterioration permits are required for PSD major stationary sources that are either new or are being significantly modified[5] in an attainment area.

The emissions thresholds triggering a PSD review and permitting are listed below.[6]

- For GHG emissions, a new source is subject to PSD review if it is otherwise subject to PSD (for another regulated pollutant) and has a potential to emit (PTE) greater than or equal to 75,000 tons per year (tpy) $CO_2$-e.
- For regulated air pollutants other than GHGs, a source is subject to PSD review if it emits more than 100 tpy (if classified in one of the 28 named source categories listed in Section 169 of the CAA) of the regulated air pollutant, or 250 tpy of the regulated air pollutant for any other type of source.
- For a source subject to PSD review for one regulated pollutant, the source is also subject to PSD review for all other pollutants causing a significant increase in emissions level.

Activities at the Donlin Gold Project are not listed in Section 169 of the CAA, so the PSD major threshold for $NO_x$, CO, $SO_2$, VOC, $PM_{2.5}$ and $PM_{10}$ is 250 tpy. Issuance of PSD permits requires a control technology review, an air quality analysis to evaluate the project impact on ambient air quality standards and increments, and an additional impacts analysis to evaluate the impact of the project on soils, vegetation, and visibility. The control technology review requires determination of the Best Available Control Technology (BACT), which refers to an emission limit based on the best available controls. The determination considers cost, environmental impacts, and energy needs. The air quality analysis ensures the project does not cause or contribute to a violation of ambient air quality standards or increments.

---

[5] A significant (major) increase for a PSD major modification is defined in 40 CFR 52.21. The most common pollutants that trigger PSD are: $NO_x$ threshold 40 tpy, CO threshold 100 tpy, $SO_2$ threshold 40 tpy, $PM_{10}$ threshold 15 tpy, $PM_{2.5}$ threshold 10 tpy, and $O_3$ precursor VOC threshold 40 tpy.

[6] This summary reflects July 24, 2014 EPA Guidance indicating that EPA will no longer treat GHGs as air pollutants for purposes of determining whether a source is a major source required to obtain a PSD or Title V permit (EPA 2014e). ADEC incorporates federal PSD rules into Alaska regulations in 18 AAC 50.306.

An additional impact analysis is an assessment of the project impacts on air, soil, vegetation, and visibility resources (also referred to as Air Quality Related Values or AQRVs) that are sensitive to air quality. These analyses, as required, will be reviewed by ADEC as part of the PSD permit application. In addition, ADEC must notify the appropriate federal land manager (in this case, the National Park Service [NPS]) of a proposed PSD-major project that has the potential to impact a Class I area (generally within 62 miles [100 kilometers (km)] of the Class I area); such notification must include an analysis of the project's impact on visibility in the Class I area. If the federal land manager determines (and ADEC agrees) that a project would have an adverse impact on the air, soil, vegetation, or visibility resources, then the permit application would be denied, regardless of whether the ambient air quality analysis shows compliance with ambient air quality standards and allowable increases.

Minor New Source Review Permits

ADEC developed a minor NSR permit program (codified in 18 AAC 50, Article 5) to protect ambient air quality standards from emissions from sources that do not require a major PSD NSR or major NNSR permit. ADEC requires minor permits for certain new or relocated minor sources, for certain changes at existing sources, and for specific source categories as described below.

- New Sources: A minor permit is required under 18 AAC 50.502(c)(1) for new sources if the PTE exceeds 15 tpy of $PM_{10}$, 40 tpy of $NO_x$, 40 tpy of $SO_2$, 0.6 tpy of Pb, 100 tpy of CO within 10 km of a nonattainment area, or 10 tpy of direct $PM_{2.5}$.
- Modifications to Existing Sources: A minor permit is required under 18 AAC 50.502(c)(3) for a modification increasing the PTE by 10 tpy of $PM_{10}$, 10 tpy of $NO_x$, 10 tpy of $SO_2$, 100 tpy of CO within 10 kilometers of a nonattainment area, or 10 tpy of direct $PM_{2.5}$, for sources with emissions greater than thresholds listed in 18 AAC 50.502(c)(1).
- Specific Source Categories: A minor permit is required under 18 AAC 50.502(b) for asphalt plants over 5 tons per hour of product, thermal soil remediation units over 5 tons per hour of untreated material, rock crushers with rated capacity over 5 tons per hour, one or more incinerators with cumulative capacity over 1,000 pounds per hour, coal preparation plants, and Port of Anchorage sources.

The Pipeline compressor station is anticipated to require a minor air quality permit to construct and may require a Title V operating permit.

### 3.8.1.3.3 VISIBILITY PROTECTION REQUIREMENTS

Visibility describes visual quality, such as clarity of a vista or the distance one can see (ADEC 2011b). Visibility impairment is "any humanly perceptible change in visibility (light extinction, visual range, contrast, coloration) from that which would have existed under natural conditions" (EPA 1999a). Visibility impairment is measured in deciviews (dvs).[7] Visibility

[7] As defined in 40 CFR 51.301, deciview means a measurement of visibility impairment. A deciview is a haze index derived from calculated light extinction, such that uniform changes in haziness correspond to uniform incremental changes in perception across the entire range of conditions, from pristine to highly impaired.

impairment is caused by aerosols and pollutant emissions (primarily $SO_2$, $NO_x$, and PM) that scatter and absorb light.

The EPA, in 1980, adopted regulations forcing states to update their SIPs for protection of visibility in Class I areas from one or several distinct sources in 40 CFR Part 51, Subpart P (40 CFR 51.300 through 307). These regulations called for determination of Best Available Retrofit Technology and for identification of integral vistas. In 1999, the EPA revised the visibility regulations to incorporate regional haze (the "Regional Haze Rule"), which addresses visibility impairment from multiple sources.

## Regional Haze Rule

In 1999, the EPA revised the visibility regulations to incorporate regional haze ("Regional Haze Rule), which addresses visibility impairment from multiple sources. The Regional Haze Rule (promulgated in 18 AAC 50.300 to 309) requires states to develop long-term plans for reducing pollutant emissions that contribute to visibility degradation, and within the plans, to establish goals aimed at improving visibility in Class I areas. The SIPs must address haze caused by all sources of pollutants that impair visibility, including haze resulting from smoke, vehicles, electric utility and industrial fuel burning, and other activities that generate pollution. In Alaska, two primary sources of these compounds are manmade pollution from northern Europe and Russia (Arctic Haze) and pollutants from Asian deserts and cities (Asian dust). Other sources are biogenic emissions from living organisms, sea salt, and geogenic emissions from volcanoes in Alaska (ADEC 2011b). On December 14, 2016, the EPA finalized revisions to the Regional Haze Rule (Published in the Federal Register – January 10, 2017), which describes actions that states must take when submitting regional haze SIPs and progress reports. This revised rule addresses requirements for the second planning period (post 2018). At the current time, ADEC is in the very early stages of understanding the rule revisions and how to implement them in the SIP. However, ADEC does not expect the revisions to the rule to change their long-term strategy to continue to meet goals.

ADEC's long-term strategies to meet the visibility goal include:

- Ongoing air pollution control programs (including PSD NSR, BART);
- Measures to mitigate impact of construction activities (including measures for handling bulk materials in 18 AAC 50.045(d));
- Emission limitations and schedules for compliance (including BART);
- Source retirement and replacement schedules;
- Smoke management techniques for agricultural and forestry burning (including open burning in 18 AAC 50.065); and
- Enforceability of emission limitations and control measures.

ADEC would implement additional strategies and controls should existing strategies prove to be inadequate to show reasonable progress.

The Mine Site infrastructure and processes component of the Donlin Gold Project would be subject to regional haze requirements as implemented through the PSD NSR permitting process – and accompanying additional impact analysis on visibility, soils, and vegetation - as well as other state and federal regulations. However, the NPS was notified about the project, and indicated that no Class I area analysis would be required (Air Sciences Inc. 2014a, 2015b); therefore, it is unlikely that the Donlin Gold Project will be subject to Regional Haze Rule-specific requirements.

#### 3.8.1.3.4 OPERATING PERMITS (TITLE V)

The required elements of operating permit programs are outlined in 40 CFR Part 70 and Part 71. Operating permits may be referred to as Title V permits. A Title V permit should list all air pollution requirements that apply to the source, including emissions limits and monitoring, record keeping, and reporting requirements. Regulations also require that the permittee annually report the compliance status of its source with respect to permit conditions to the ADEC. The definition of a major source under Title V varies according to which pollutants are emitted from the source, and the attainment designation of the area where the source is located. In general, a source is considered major for Title V if its PTE exceeds one or more of the following: 100 tpy or more of any regulated pollutant; 10 tpy or more of any single HAP; or 25 tpy or more total HAPs.

#### 3.8.1.3.5 NEW SOURCE PERFORMANCE STANDARDS

The NSPS, codified in 40 CFR Part 60, establish requirements for new, modified, or reconstructed units in specific source categories. NSPS requirements include emission limits, control standards, and monitoring, reporting, and record keeping.

Applicable NSPS for the project may include the following NSPS listed below. The emission units subject to an NSPS or NESHAPs are listed in Appendix I (Air Sciences Inc. 2016).

- 40 CFR Part 60, Subpart A – General Provisions. Subpart A contains the general requirements applicable to all emission units subject to 40 CFR Part 60.
- 40 CFR Part 60, Subpart Dc – Standards of Performance for Small Industrial-Commercial-Institutional Steam Generating Units. Subpart Dc applies to each steam generating unit for which construction, modification, or reconstruction is commenced after June 9, 1989 and has a maximum design heat input capacity of 29 megawatts (MW) (100 MMBtu/hr) or less, but greater than or equal to 2.9 MW (10 MMBtu/hr). This subpart sets standards for PM and sulfur dioxide ($SO_2$) emissions. The project would have an oxygen plant boiler (33-BLR-001), a carbon elution heater (56-BLR-200), and power plant auxiliary heaters (PP-HEU-100 and 200) subject to Subpart Dc.
- 40 CFR Part 60, Subpart LL – Standards of Performance for Metallic Mineral Processing Plants. The provisions of this subpart are applicable to the following affected facilities in metallic mineral processing plants that commence construction or modification after August 24, 1982: each crusher and screen in open pit mines; other crushers and screens; bucket elevators; conveyor belt transfer points; thermal dryers; product packaging stations; storage bins; enclosed storage areas; truck loading stations; truck unloading stations. This subpart sets standards for PM emissions. The project would have a gyratory crusher dump pocket and rock breaker (11-BIN-100), gyratory crusher (11-CRU-100), surge pocket (11-BIN-150), apron feeder (11-FEE-150), gyratory crusher discharge conveyor (11-CVB-100), stockpile feed conveyor (14-CVB-200), coarse ore reclaim apron feeders (14-FEE-200, 210, 220,

and 230), pebble crushers (16-CRU-200 and 300), semi-autogenous grinding (SAG) mill feed conveyor (16-CVB-300), and pebble discharge conveyor (16-CVB-480).

- 40 CFR Part 60, Subpart CCCC – Standards of Performance for Commercial and Industrial Solid Waste Incineration (CISWI) Units for Which Construction Is Commenced After June 4, 2010, or for which Modification or Reconstruction Is Commenced After August 7, 2013. This subpart sets operating limits and emission limits for cadmium, CO, dioxins/furans, hydrogen chloride, Pb, Hg, opacity, PM, $NO_x$, and $SO_2$. The effective date for this subpart is August 7, 2013. Subpart CCCC applies to each incineration unit that is:
  - A new incineration unit as defined in 40 CFR 60.2015;
  - A CISWI unit as defined in 40 CFR 60.2265; and is
  - Not exempt under 40 CFR 60.2020.

The project would have a camp waste incinerator (Emission Unit ID CWI) subject to Subpart CCCC.

- 40 CFR Part 60, Subpart IIII – Standards of Performance for Stationary Compression Ignition Internal Combustion Engines (CI ICE). Donlin Gold, LLC plans to use electrical power supplied by onsite generation. Subpart IIII applies to owners and operators of stationary CI ICE that commence construction after July 11, 2005, where the stationary CI ICE are manufactured after April 1, 2006, and are not fire pump engines. Subpart IIII applies to fire pumps that commenced construction after July 11, 2005, and were manufactured after July 1, 2006. This subpart sets emission standards for $NO_x$ + non methane hydrocarbons, hydrocarbons, $NO_x$, CO, and PM. The project would have generators and fire pumps (Emission Unit IDs W-1 to W-12, ADG1-2, BEDG1 & 2, CEDG1 to 4, and FP1 to 3) subject to Subpart IIII.
- 40 CFR Part 60, Subpart JJJJ – Standards of Performance for Stationary Spark Ignition Internal Combustion Engines (SI ICE). Donlin Gold plans to use electrical power supplied by onsite generation. Subpart JJJJ applies to owners and operators of stationary SI ICE that commence construction after June 12, 2006, where the stationary SI ICE are manufactured on or after July 1, 2007. This subpart sets emission standards for $NO_x$, CO, and VOCs. The project would have generators (Emission Unit IDs W1 to W12) at the power plant subject to Subpart JJJJ.
- 40 CFR 60, Part Subpart LLLL – Standard of Performance for New Sewage Sludge Incineration (SSI) Units. This subpart sets operating limits and emission limits for PM, hydrogen chloride, CO, dioxins/furans, Hg, $NO_x$, $SO_2$, cadmium, Pb, and fugitive emissions from ash handling. The effective date for this subpart was September 21, 2011. This subpart applies to the sewage sludge incinerator (Emission Unit ID SS1) that meets the following criteria:
  - construction commenced after October 14, 2010 or for which modification commenced after September 21, 2011;
  - is an SSI unit as defined in 40 CFR 60.4930; and
  - is not exempt under 40 CFR 60.4780.

#### 3.8.1.3.6 NATIONAL EMISSION STANDARDS FOR HAZARDOUS AIR POLLUTANTS / MAXIMUM ACHIEVABLE CONTROL TECHNOLOGY

Hazardous Air Pollutants emissions are regulated under NESHAPs, codified in 40 CFR Part 61 and 40 CFR Part 63. 40 CFR Part 61, promulgated in 1985, regulates eight types of hazardous substances (asbestos, benzene, beryllium, coke oven emissions, inorganic arsenic (As), Hg, radionuclides, and vinyl chloride).

The EPA subsequently promulgated 40 CFR Part 63, which added 189 additional compounds to the list of HAPs. Also known as the MACT standards, 40 CFR Part 63 regulates HAP emissions from major sources of HAPs and specific source categories that emit HAPs, as well as certain minor or "area" sources of HAPs. 40 CFR Part 63 considers any source with the PTE 10 tpy or more of any single HAP, or 25 tpy or more of HAPs in aggregate, as a major source of HAPs.

Applicable NESHAPs for the project, based on the types of emission units and the expected date of installation, may include the following NESHAPs listed below. The emission units subject to an NSPS or NESHAPs are listed in Appendix I (Air Sciences Inc. 2016):

- 40 CFR Part 63, Subpart A – General Provisions. Subpart A contains the general requirements applicable to all emission units subject to 40 CFR Part 63.
- 40 CFR Part 63, Subpart ZZZZ – National Emissions Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines (RICE). Subpart ZZZZ applies to any existing, new, or reconstructed stationary RICE located at a major or area source of HAP emissions. For stationary RICE located at an area source of HAP emissions, a stationary RICE "exists" if construction or reconstruction of the stationary RICE commenced before June 12, 2006. A stationary RICE located at an area source of HAP emissions is "new" if construction of the stationary RICE commenced on or after June 12, 2006. For area sources, this subpart sets operating limitations and emission limitations for CO and formaldehyde, as well as management practices and work practice standards. The project would have generators (S1 to W2, ADG1-2, BED1-2, CEDG1-4, and FP1-3) that would be subject to Subpart ZZZZ.
- 40 CFR Part 63, Subpart JJJJJJ – National Emission Standards for Hazardous Air Pollutants for Area Sources: Industrial, Commercial, and Institutional Boilers. Subpart JJJJJJ applies to each new, reconstructed, or existing industrial, commercial, and institutional boilers within a subcategory (coal, biomass, and oil) located at an area source. A source is considered new if construction or reconstruction of the affected source commenced after June 4, 2010 and meets the criteria at the time construction commenced. This subpart sets operating limits and emission limits for PM, CO, and Hg, as well as emission reduction measures, management practices, and work practice standards. The project's auxiliary boilers (Emission Unit IDs PP-HEU-100 & 200), pressure oxidation (POX) boilers (Emission Unit IDs 17-BLR-301 & 302), and oxygen plant boiler (Emission Unit ID 33-BLR-001) would be exempt from the requirements of Subpart JJJJJJ, per 40 CFR 63.11195(e), as these boilers would be natural gas-fired boilers that burn liquid fuel only during periods of gas curtailment, gas supply interruption, startups, or periodic testing on liquid fuel. The portable heaters would also be exempt, per 40 CFR 63.11195, as these boilers would be temporary.

- 40 CFR 63.11640 Subpart EEEEEEE – National Emission Standards for Hazardous Air Pollutants for Gold Mine Ore Processing and Production Area Source Category. Subpart EEEEEEE applies to each collection of "ore pretreatment processes" at a gold mine ore processing and production facility, each collection of "carbon processes with mercury retorts" at a gold mine ore processing and production facility, each collection of "carbon processes without mercury retorts" at a gold mine ore processing and production facility, and each collection of "non-carbon concentrate processes" at a gold mine ore processing and production facility, as defined in 40 CFR 63.11651. This subpart sets gaseous emission standards for Hg; there are no regulations for the amount of Hg in dust. For a new ore pretreatment process, Hg emissions to the atmosphere cannot exceed 84 pounds of Hg per million tons of ore processed; and for a new carbon process with Hg retorts, Hg emissions cannot exceed 0.8 pounds of Hg per ton of concentrate processed. The project would have autoclaves, kiln, pregnant solution tank, electrowinning cells, retort, and furnace (Emission Unit IDs 17-AUT-101 & 102, 56-KLN-100, 56-TNK-518, 37-EWN-100 to 400, 19-VEZ-100, 19-FUR-100) subject to Subpart EEEEEEE.
- 40 CFR Part 63, Subpart CCCCCC – National Emission Standards for Hazardous Air Pollutants for Gasoline-Dispensing Facilities. This subpart applies to gasoline dispensing facilities located at an area source. However, the proposed Aviation Gasoline Tank at the airport would be exempt from the requirements of Subpart CCCCCC per 40 CFR 63.111(g) (Rieser 2015a).

#### 3.8.1.3.7 COMPLIANCE ASSURANCE MONITORING

The EPA developed CAM requirements, codified in 40 CFR Part 64, in order to provide reasonable assurance that facilities comply with emissions limitations by monitoring the operation and maintenance of their control devices. CAM requirements apply to emission units that are equipped with post-process pollutant control devices, have pre-control device emissions equal to or greater than 100 percent of the major source threshold for a pollutant as defined in 40 CFR Part 70 and Part 71, and are subject to the Title V permit program. To comply with these requirements, a CAM Plan must be developed for each affected pollutant emitted from each affected emission unit. The focus of each CAM Plan is to assure compliance with the applicable emission limit. Per 40 CFR 64.5(d), the CAM plan for the project's affected emission units must be submitted as part of the application for a renewal of the Title V permit.

#### 3.8.1.3.8 MOBILE SOURCE REGULATIONS

Mobile source air pollution control requirements for gasoline and diesel on-road engines are codified in 40 CFR Part 80, Part 85, and Part 86. Under these provisions, the EPA initially established "Tier 1," and later "Tier 2" and "Tier 3", emissions standards for the purpose of minimizing emissions from these sources. EPA's Tier 2 and Tier 3 emission standards and gasoline sulfur control program are designed to reduce emissions from passenger cars, light trucks, and large passenger vehicles (including sport utility vehicles, minivans, vans, and pickup trucks) and to reduce the sulfur content of gasoline. These more stringent emission standards have applied to the aforementioned types of motor vehicles operating on any fuel, since 2004. These reductions are intended to provide for cleaner air and greater public health protection, primarily by reducing $O_3$ and PM pollution.

Provisions for non-road diesel engines are codified in 40 CFR Part 89 and Part 90. Starting in 1996, non-road engines became subject to EPA's increasingly stringent Tier 1 through Tier 4 emissions standards, depending on model year and engine size. These requirements are imposed on the manufacturers of these mobile sources rather than on owners or operators.

The EPA's mobile source regulations in 40 CFR Part 80, Subpart I (Motor Vehicle Diesel Fuel; Non-road, Locomotive, and Marine Diesel Fuel; and U.S. Emissions Control Area Marine Fuel) contain provisions restricting diesel fuel sulfur content for fuel used in mobile sources, in order to prevent damage to the emission control systems. These restrictions were phased in for highway diesel fuel starting in 2006 and for non-road diesel fuel in 2007. Alaska had a slightly different implementation schedule than the rest of the country, but as of December 1, 2010, all parts of Alaska (urban and rural) are required to use ultra-low sulfur diesel (ULSD) with a maximum sulfur content of 15 parts per million (ppm) (0.0015 percent sulfur) in on-road vehicles and non-road equipment, as is required in the other states.

In collaboration with the National Highway Traffic Safety Administration, the EPA implemented regulations for GHG emission standards for light-duty and heavy-duty vehicles, and for heavy-duty engines, for the purpose of reducing GHG emission from these sources. These regulations are codified in 40 CFR Parts 85, 86, 600, 1033, 1036, 1037, 1039, 1065, 1066, and 1068.

In 40 CFR Part 80, the EPA implemented the Renewable Fuel Standards (RFS) requiring transportation fuel sold in the U.S. to contain a minimum volume of renewable fuel. The purpose of the RFS is to reduce GHG emissions, as well as to support the nation's renewable fuel industry and reduce the nation's dependence on imported petroleum.

The project would include use of both on-road and non-road engines subject to mobile source regulations and associated emissions standards. Although Donlin Gold, LLC would have no direct compliance responsibility with regard to vehicles and engine emissions standards, the equipment selected would impact the total air emissions from the Donlin Gold Project.

Donlin Gold would be subject to ULSD fuel requirements for all proposed project components.

## 3.8.2 AFFECTED ENVIRONMENT

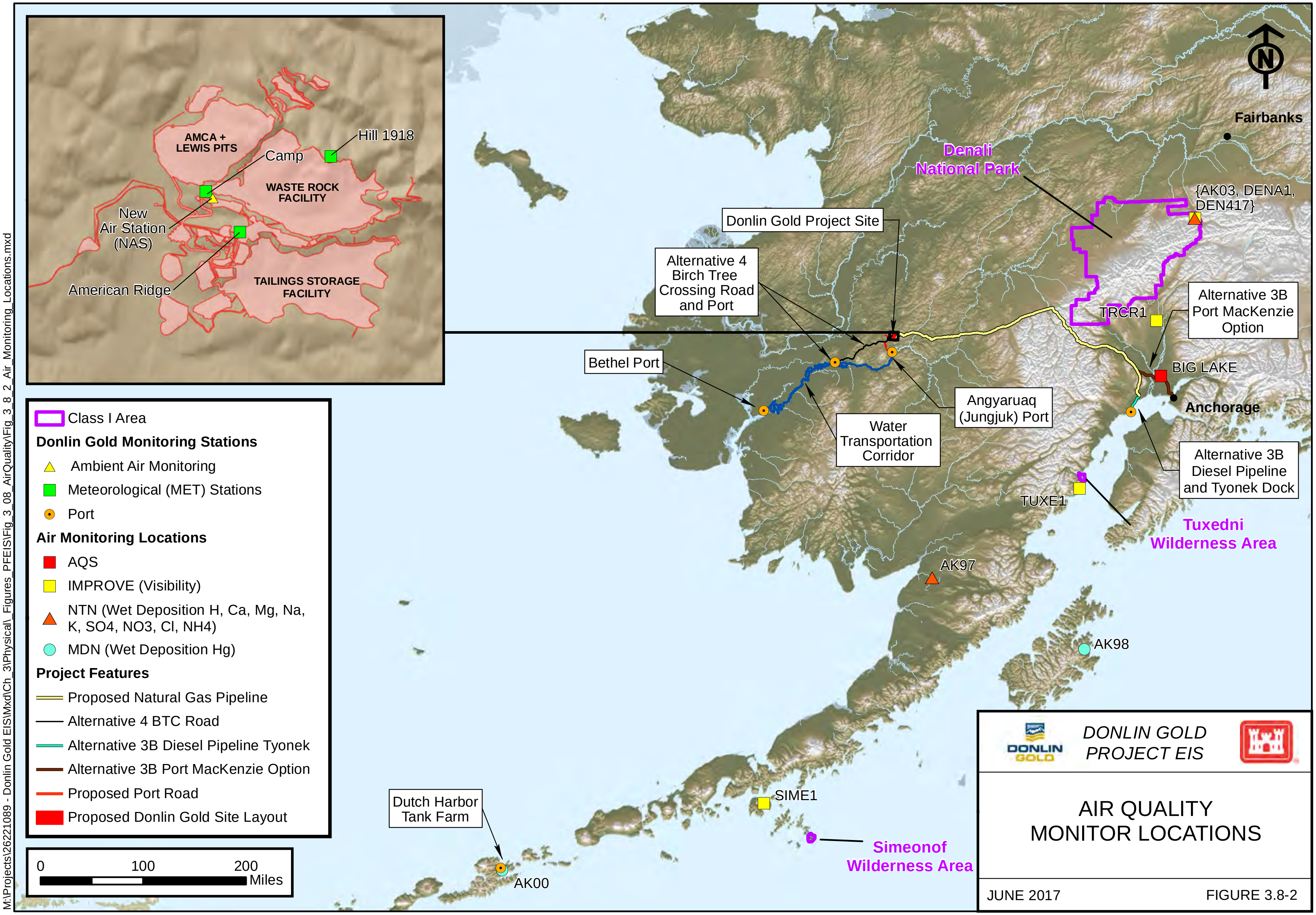
This section presents baseline ambient air quality data for each proposed project component. According to the most recent available information and studies conducted in the EIS Analysis Area, the baseline ambient air in the region are well within the national and Alaska State ambient air quality standards (as discussed in the sections below).

### 3.8.2.1 MINE SITE

Donlin Gold conducted an ambient air quality field monitoring program to collect baseline data in support of the PSD permit application for the Mine Site component of the project. This monitoring was conducted in accordance with Quality Assurance Project Plans (QAPPs) effective March 3, 2006 through July of 2009 (when the program was discontinued), and a new QAPP effective October 1, 2010 (MMA 2010c [as revised through November 15, 2010]; MMA 2011d). The QAPPs describe the methods and requirements for ambient air quality data collection. ADEC approved both QAPPs, indicating agreement that Donlin Gold's methodology is appropriate for PSD modeling. Criteria pollutant data were collected at two monitoring stations: the New Air Station and the Camp Station[8] as shown on Figure 3.8-2. PM monitoring data were collected at the Camp Station from July to late September 2006 (MMA 2008a), and at the New Air Station between July 2006 and December 2008 (MMA 2008b, c, 2009c). Gaseous pollutant ($SO_2$, $NO_x$, CO, $O_3$) data were collected at the New Air Station starting November of 2006 through December 2008 (MMA 2008d, 2009b). Donlin Gold restarted the ambient gaseous monitoring program for $O_3$ and oxides of nitrogen ($NO_x$) at New Air Station in October of 2010 (MMA 2011d). Additional air monitoring data are available on EPA's Air Data website (EPA 2013b).

During data collection, onsite activities included the daily operations of the exploration program and associated mining camp and airstrip, and an offsite placer mining operation about two miles north of the Donlin Gold Project (MMA 2005).

[8] The "Camp Station" at which PM data was collected from July to September 2006, is located at the current exploration camp. The monitor was moved to the New Air Station (NAS) in September of 2006. This "Camp Station" is not the same as the proposed mine camp location to be used during mine operations.




DONLIN GOLD

DONLIN GOLD
PROJECT EIS

AIR QUALITY
MONITOR LOCATIONS

JUNE 2017

FIGURE 3.8-2

M:\Projects\26221089 - Donlin Gold EIS\Mxd\Ch_3\Physical_Figures_PFEIS\Fig_3_08_AirQuality\Fig_3_8_2_Air_Monitoring_Locations.mxd

#### 3.8.2.1.1 CRITERIA POLLUTANT DATA

The air sampling methods used at the New Air Station and Camp Station are listed in Table 3.8-6.

**Table 3.8-6: New Air Station and Camp Station Measurement Methods**

| Measured Parameter | Measurement Method effective March 2006 | Measurement Method effective October 2010 |
|---|---|---|
| $PM_{10}$ | Gravimetric Analysis<br>EPA Reference Method Designation<br>RFPS-0202-141 | N/A |
| $PM_{2.5}$ | Gravimetric Analysis<br>EPA Reference Method Designation<br>EPQM-0202-142 & RFPS-0498-116 | N/A |
| CO | Gas Filter Correlation NDIR<br>EPA Federal Equivalent Method Designation<br>RFCA-1093-093 | N/A |
| $NO_x$ | Chemiluminescence<br>EPA Federal Reference Method Designation<br>RFNA-1194-099 | Chemiluminescence<br>EPA Federal Reference Method Designation<br>RFNA-1194-099 |
| $O_3$ | N/A | UV Photometric Absorption<br>EPA Federal Equivalent Method Designation<br>EQOA-0992-087 |
| $SO_2$ | Pulsed Fluorescence<br>EPA Federal Equivalent Method Designation<br>EQSA-0495-100 | N/A |

**Notes:**
CO = Carbon monoxide
N/A = Not applicable
$NO_x$ = Oxides of nitrogen
$O_3$ = Ozone
$PM_{2.5}$ and $PM_{10}$ = Particulate matter with an aerodynamic diameter less than or equal to 2.5 and 10 micrometers, respectively
$SO_2$ = Sulfur dioxide

Source: Air Sciences Inc. 2016; MMA 2005, 2010c, 2011d.

A summary of the baseline ambient air quality concentrations in the area of the Mine Site is presented in Table 3.8-7. The available data in this area confirm that ambient pollutant concentrations comply with the respective NAAQS and AAAQS.

The data presented in the table is the best available data for characterizing the existing air quality at the Mine Site for purposes of the EIS. ADEC will review Donlin Gold, LLC's monitoring data to ensure accuracy and representativeness as part of the PSD permitting process under 18 AAC 50 and 40 CFR 52.21.

Little research has been done to quantify the long-term trends in air quality in the Donlin Creek area or to determine how local and regional air masses interact. Due to the low population and source density, the southwest region of Alaska has no long-term air quality measurements nor has it historically been a monitoring priority of ADEC's Air Monitoring and Quality Assurance Group. However, based on public health concerns related to anthropogenic fugitive dust generated within rural communities, the recent State of Alaska 2015 Ambient Air Quality Network Assessment is recommending a Special Purpose Monitoring (SPM) site for PM2.5 and PM10 in Bethel (ADEC 2016); the project area is approximately 145 miles northeast of Bethel. Therefore, not enough information is available to provide a quantitative baseline of spatial and temporal trends in air quality over long periods across southwest Alaska.

Long-term air quality monitoring nearest to the Donlin Creek area is conducted on the east side of Denali National Park and in the Fairbanks and Anchorage areas. With the possible exception of Denali under some meteorological conditions, none of these measurements are likely to be representative of the project area. Therefore, the best sense for air quality trends in the project area can be gleaned by examining trends observed at Denali. Denali's air quality is usually among the best in the country as measured by an air quality monitoring program dating back to 1980. This exceptional record is related to the remote location in interior Alaska, which is far from large-scale industrial activities and densely populated urban areas. Trends measured in Denali show an annual pattern of a summertime low and a peak in the late winter and early spring. These seasonal trends are consistent with known patterns of international contaminant transport directly across the Pacific Ocean, or up and over the Arctic Ocean related to arctic haze (NPS 2017). Local and regional sources also contribute but total contributions are relatively low. With global pollution projected to increase over time, future trends in Denali's clean air is dependent on international as well as national efforts to limit emission increases (NPS 2011).

## Table 3.8-7: Baseline Ambient Air Quality Data Collected at New Air Station and Camp Monitoring Stations

| | Averaging Time | Monitored Value and Description (Monitoring Station/Year) | | Monitoring Station and Data Collection Dates | Primary NAAQS (% of Primary NAAQS) | AAAQS (% of AAAQS) |
|---|---|---|---|---|---|---|
| $PM_{10}$ | 24-hour | 14.1 μg/m$^3$ (NAS/2007) | Maximum 2$^{nd}$ high value for data collection period | Camp and NAS - July 1, 2006 to June 30, 2007 (MMA 2008b);[a] and<br>NAS - July 1, 2007 to June 30, 2008 (MMA 2008c) | 150 μg/m$^3$ (9%) | 150 μg/m$^3$ (9%) |
| $PM_{2.5}$ | Annual | 2.3 μg/m$^3$ (NAS/2008) | Highest 12-month rolling annual mean for data collection period | NAS - January 1, 2008 to December 31, 2008 (MMA 2009c) | 12 μg/m$^3$ (19%) | 12 μg/m$^3$ (19%) |
| | 24-hour | 6.8 μg/m$^3$ (NAS/2008) | Annual 98th percentile 24-hour value averaged over all annual data collection periods | NAS - January 1, 2008 to December 31, 2008 (MMA 2009c) | 35 μg/m$^3$ (19%) | 35 μg/m$^3$ (19%) |
| $SO_2$ | Annual | <0.0005 ppm (NAS/2007 and 2008) | Highest 12-month rolling annual mean for data collection period | NAS - November 18, 2006 to November 17, 2007 (MMA 2008d); and<br>NAS - January 1, 2008 to December 31, 2008 (MMA 2009a) | N/A | 0.030 ppm (2%) |
| | 24-hour | 0.002 ppm (NAS/2007 and 2008) | Maximum 2$^{nd}$ High for data collection period | NAS - November 18, 2006 to November 17, 2007 (MMA 2008d); and<br>NAS - January 1, 2008 to December 31, 2008 (MMA 2009a) | N/A | 0.14 ppm (1%) |
| | 3-hour | 0.002 ppm (NAS/2007 and 2008) | Maximum 2$^{nd}$ High Value for data collection period | NAS - November 18, 2006 to November 17, 2007 (MMA 2008d); and<br>NAS - January 1, 2008 to December 31, 2008 (MMA 2009a) | N/A | 0.50 ppm (<1%) |
| | 1-hour | 0.003 ppm (NAS/2007 and 2008)---na | Annual 99$^{th}$ percentile daily maximum 1-hour value averaged over all annual data collection periods. | NAS - November 18, 2006 to November 17, 2007 (MMA 2008d); and<br>NAS - January 1, 2008 to December 31, 2008 (MMA 2009a) | 75 ppb (4%) | 75 ppb (4%) |

**Table 3.8-7: Baseline Ambient Air Quality Data Collected at New Air Station and Camp Monitoring Stations**

| | Averaging Time | Monitored Value and Description (Monitoring Station/Year) | | Monitoring Station and Data Collection Dates | Primary NAAQS (% of Primary NAAQS) | AAAQS (% of AAAQS) |
|---|---|---|---|---|---|---|
| CO | 8-hour | 0.4 ppm (NAS/2007) | Maximum 2nd High Value for data collection period | NAS - November 18, 2006 to November 17, 2007 (MMA 2008d); and<br>NAS - January 1, 2008 to December 31, 2008 (MMA 2009a) | 9 ppm (4%) | 9 ppm (4%) |
| | 1-hour | 0.6 ppm (NAS/2007) | Maximum 2nd High Value for data collection period | NAS - November 18, 2006 to November 17, 2007 (MMA 2008d); and<br>NAS - January 1, 2008 to December 31, 2008 (MMA 2009a) | 35 ppm (2%) | 35 ppm (2%) |
| $NO_2$ | Annual | 0.001 ppm | Average of annual means for all annual data collection periods | NAS - November 18, 2006 to November 17, 2007 (MMA 2008d);<br>NAS - January 1, 2008 to December 31, 2008 (MMA 2009a);<br>NAS - December 1, 2010 to November 30, 2011 (MMA 2012d); and<br>NAS - April 17, 2012 to April 16, 2013 (MMA 2013) | 0.053 ppm (2%) | 0.053 ppm (2%) |
| | 1-hour | 0.011 ppm | 98th percentile of the annual distribution of daily maximum 1-hour concentrations averaged over all annual data collection periods | NAS - November 18, 2006 to November 17, 2007 (MMA 2008d);<br>NAS - January 1, 2008 to December 31, 2008 (MMA 2009a);<br>NAS - December 1, 2010 to November 30, 2011 (MMA 2012d); and<br>NAS - April 17, 2012 to April 16, 2013 (MMA 2013) | 0.100 ppm (11%) | 0.100 ppm (11%) |

**Table 3.8-7: Baseline Ambient Air Quality Data Collected at New Air Station and Camp Monitoring Stations**

| | Averaging Time | Monitored Value and Description (Monitoring Station/Year) | | Monitoring Station and Data Collection Dates | Primary NAAQS (% of Primary NAAQS) | AAAQS (% of AAAQS) |
|---|---|---|---|---|---|---|
| $O_3$ | 8-hour | 0.051 ppm (NAS/2011) | Annual fourth highest 8-hour running value averaged over all annual data collection periods | NAS - December 1, 2010 to November 30, 2011 (MMA 2012d); and NAS - April 17, 2012 to April 16, 2013 (MMA 2013) | 0.070 ppm (73%) | 0.070 ppm (73%) |

**Notes:**
a Monitor relocated from the Camp monitoring station to New Air Station in September 2006.
AAAQS = Alaska Ambient Air Quality Standard
CO = Carbon monoxide
na = Not available
N/A = Not applicable
NAAQS = National Ambient Air Quality Standard
$NO_2$ = Nitrogen dioxide
$O_3$ = Ozone
NAS = New Air Station
ppm = Parts per million
ppb = Parts per billion
$SO_2$ = Sulfur dioxide
$PM_{2.5}$ and $PM_{10}$ = Particulate matter with an aerodynamic diameter less than or equal to 2.5 and 10 micrometers, respectively
Sources: Air Sciences Inc. 2016; ADEC 2016; EPA 2016; MMA 2008b, c, d, 2009a, c, 2012d, 2013.

### 3.8.2.1.2 MERCURY

Atmospheric mercury may come from natural (vegetation, biomass burning, volcanoes, and surface waters) or anthropogenic sources (coal combustion, waste incineration, and mining activities) from sources within the state or beyond. Natural sources of emissions of mercury into the air can include mercury previously deposited on land and water surfaces (Environ 2014b).

Environ (2014b) states that mercury air concentrations (and deposition) in Alaska are largely due to global transport of anthropogenic emissions from Asia, natural mercury emissions, and legacy (previously deposited anthropogenic) mercury emissions. At the Donlin Gold Mine Site, it is estimated that the contribution of North American anthropogenic Hg emissions are less than five percent of total Hg deposition.

Donlin Gold collected ambient data on Hg at the New Air Station (ARCADIS 2013a), and at the Camp Station (Environ 2013) as shown in Table 3.8-8.

**Table 3.8-8: Measured Baseline Ambient Air Mercury Concentrations**

| Monitoring Station | Distance from Project Area (mi) | Data Collection Period | Monitoring Methodology | Total Hg ($ng/m^3$) | $Hg^0$ ($ng/m^3$) | $Hg^{II}$ ($pg/m^3$) | $Hg_P$ ($pg/m^3$) |
|---|---|---|---|---|---|---|---|
| New Air Station | 0 | May 12, 2007 to September 10, 2008 | 40 CFR Part 75, Appendix K | 0.815[a] | NA | NA | NA |
| Camp | 0 | September 1, 2011 through September 6, 2012 | MDN Monitoring Protocols[b] | 1.45 | 1.4 | 3.9 | 8.4 |

**Notes:**

a Average of 75 samples collected during the sampling period of May 12, 2007 to September 10, 2008. The highest and lowest mercury concentrations were 2.201 and 0.313 $ng/m^3$, respectively (ARCADIS 2013a).

b Measured continuously using Tekran® 2537 automated Mercury Monitor coupled with Tekran® 1130 and 1135 Speciation. $Hg^{II}$ and $Hg_p$ measured every two to three hours. $Hg^0$ measured continuously and reported every two to three hours to coincide with $Hg^{II}$ and $Hg_p$ (Environ 2013).

Hg = Mercury
$Hg^0$ = Elemental mercury vapor
$Hg^{II}$ = Gaseous divalent mercury
N/A = Not applicable
$Hg_P$ = Particle bound mercury
$ng/m^3$ = Nanogram per cubic meter
$pg/m^3$ = Picogram per cubic meter

Sources: ARCADIS 2013a; Environ 2013.

### 3.8.2.1.3 WET AND DRY DEPOSITION OF MERCURY

Deposition of Hg to the ground from the air can be wet (occurring as rain, sleet, sleet, or snow), or dry (occurring as particulate). The Mercury Deposition Network (MDN) tracks wet deposition of Hg (NADP 2013). MDN sites are located at Dutch Harbor (AK00) operated by ADEC since 2009, Gates of the Arctic National Park – Bettles (AK06) operated by NPS since 2008, Glacier Bay National Park – Bartlett Cove (AK05) operated by NPS since 2008, Kodiak (AK98) operated by ADEC since 2007, and Ambler (AK99) (NADP 2013). The Ambler site is currently inactive (Environ 2014b). The sites closest to the project (AK00, AK98) are shown on Figure 3.8-2.

Donlin Gold collected wet (total Hg) and dry ($Hg^{II}$) deposition monitoring at the Camp Station (Table 3.8-9). This site is shown on Figure 3.8-2.

**Table 3.8-9: Measured Mercury Deposition**

| Monitoring Station | Distance from Project Area (mi) | Data Collection Period | Annual[a] Wet Deposition of Total Hg ($Hg^0$, $Hg^{II}$, $Hg_P$) (µg/m²) | Annual Dry Deposition of $Hg^{II}$ (µg/m²) |
|---|---|---|---|---|
| **Methodology** | | | **MDN Protocol** | **Surrogate surface method** |
| Camp | 0 | October 25, 2011 to October 24,2012 (except February 29, 2012 to April 9, 2012) | 2.6 | 1.5 |

**Notes:**
a Based on average weekly value and 52 weeks.
b The resulting total ($Hg^0$, $Hg^{II}$, $Hg_P$) dry deposition is 5.8 µg/m², calculated by adding measured annual dry deposition of $Hg^{II}$ of 1.5 µg/m² (Environ 2013) plus annual modeled $Hg^0$ and $Hg_p$ of 3.8 µg/m² and 0.5 µg/m², respectively (Environ 2014c).
Hg = Mercury
µg/m² = Microgram per square meter
$Hg^0$ = Elemental mercury vapor
$Hg^{II}$ = Gaseous divalent mercury
$Hg_P$ = Particle bound mercury
Sources: Environ 2013, 2014c.

### 3.8.2.1.4 VISIBILITY DATA

As required by EPA's (1999) Regional Haze Rule, ADEC determined visibility conditions in all Class I areas for 2000 through 2004 (the "baseline" years for showing reasonable further progress). Baseline conditions represent visibility for the best and worst days during the time period of 2000 to 2004. ADEC determines visibility using actual pollutant concentrations measured at Interagency Monitoring of Protected Visual Environments (IMPROVE) stations (ADEC 2011b). Figure 3.8-2 shows locations of IMPROVE monitoring station locations for Denali National Park (DENA1 and TRCR1), Tuxedni (TUXE1), and Simeonof (SIME1) (EPA 2013d).

Due to distance and geography, visibility data collected at these stations would not likely be characteristic of the proposed Mine Site. However, ADEC has characterized the Yukon-Kuskokwim Delta region as "…quite windy, experiencing winds between 15-25 miles per hour throughout the year. These winds, coupled with fine delta silt, help to create dust problems for some southwestern communities" (ADEC 2011b).

In addition, ADEC has indicated that Alaska overall is affected by international long-range transport of aerosols: "International transport of pollutants into Alaska has been documented through a variety of research studies. In particular, the research has focused on Arctic haze and Asian dust" (ADEC 2011b).

### 3.8.2.2 TRANSPORTATION CORRIDOR

#### 3.8.2.2.1 POLLUTANT DATA

The Transportation Corridor component of the project (including the Bethel Port, a connected action; river traffic; Angyaruaq [Jungjuk] Port; Birch Tree Crossing [BTC] Port; the Angyaruaq [Jungjuk] and BTC mine access roads; airstrip; and Dutch Harbor tank farm) would not trigger any ambient air quality monitoring requirements for PSD or minor air quality permitting. Thus, no site-specific monitoring for criteria pollutants or ambient Hg concentrations was conducted. Donlin Gold collected wet and dry Hg data at Aniak and Crooked Creek as described below, and the proposed Mine Site would be relatively close to some parts of the Transportation Corridor component. Any actions that would occur at Dutch Harbor or the Port of Bethel at the Bethel Yard Dock are not part of the proposed action, and are considered connected actions (see Section 1.2.1, Connected Actions, in Chapter 1, Project Introduction and Purpose and Need).

Additional pollutant data are available from the EPA's Air Quality System (AQS) on EPA's Air Data website (EPA 2013b). None of the stations listed on the website would provide potentially representative[9] data. Thus, the New Air Station pollutant data shown in Table 3.8-7 are the best available data for the area where the airstrip, the mine access road, and Angyaruaq (Jungjuk) Port would be located, as well as the portion of the river traffic and BTC mine access road within 50 miles of the New Air Station. There are no representative pollutant monitoring data available for the remaining components of the transportation facility category because of distance and/or surrounding area land use.

#### 3.8.2.2.2 MERCURY

The Project Area contains Hg due to existing natural and anthropogenic sources (ARCADIS 2014). As noted previously, the Transportation Corridor component of the project would not trigger any ambient air quality permitting requirements or requirements to collect ambient Hg data; thus, site specific ambient air quality monitoring was not conducted. However, the Mine Site is relatively close to some parts of the Transportation Corridor component. Therefore, the ambient Hg data discussed in Section 3.8.2.1.2 are the best available data for the area where the airstrip, Angyaruaq (Jungjuk) Port, river traffic, and mine access roads lie within 50 miles of the New Air Station.

There are no additional ambient Hg data for the rest of the Transportation Corridor component, so the data collected at the Camp Station is considered most representative.

#### 3.8.2.2.3 WET AND DRY DEPOSITION OF MERCURY

Wet and dry Hg deposition data availability in Alaska is discussed in Section 3.8.2.1.3, and site locations are shown on Figure 3.8-2. The AK00 MDN site is located near Dutch Harbor, and provides wet Hg deposition data representative of the area where the Dutch Harbor tank farm would be located. This data is shown in Table 3.8-10.

---

[9] For purposes of this report, a pollutant monitoring station is considered to have potentially representative pollutant data if it (1) lies within about 50 miles of a project component, (2) is located in a similar land use category, and (3) has criteria pollutant data since 2000.

**Table 3.8-10: Annual Hg Wet Deposition at AK00**

| Site | Distance from Project Area | Deposition (µg/m²) | |
|---|---|---|---|
| | | 2011 | 2012 |
| AK00 | 3 mi. SE | 5.554 | 3.481 |

**Notes:**
Hg = Mercury
mi = Miles
µg/m² = Microgram per square meter
SE = Southeast

Sources: NADP 2013.

Wet and dry Hg deposition representative of the Kuskokwim River portion of the Transportation Corridor component are shown below in Table 3.8-11.

**Table 3.8-11: Measured Mercury Deposition**

| Monitoring Station | Distance from Project Area | Data Collection Period | Annual[a] Wet Deposition of Total Hg ($Hg^0$, $Hg^{II}$, $Hg_P$) (µg/m²) | Annual Dry Deposition of $Hg^{II}$ (µg/m²) |
|---|---|---|---|---|
| Methodology | | | MDN Protocol | Surrogate surface method |
| Aniak | 53 mi SW | October 25, 2011 to October 24,2012 (except March 1, 2012 to April 8, 2012) | 2.8 | 1.2[b] |
| Crooked Creek | 13 mi SW | July 9, 2011 to July 10, 2013 (except no dry deposition measurements from July 9, 2012 to July 16, 2012) | 2.4 | 1.1[c] |

**Notes:**
a Based on average weekly value and 52 weeks.
b The resulting total ($Hg^0$, $Hg^{II}$, $Hg_P$) dry deposition at Aniak is 5.5 µg/m², calculated by adding measured annual dry deposition of $Hg^{II}$ of 1.2 µg/m² (Environ 2013) plus annual modeled $Hg^0$ and $Hg_p$ of 3.8 µg/m² and 0.5 µg/m², respectively (Environ 2014c).
c The resulting total ($Hg^0$, $Hg^{II}$, $Hg_P$) dry deposition at Crooked Creek is 5.4 µg/m², calculated by adding measured annual dry deposition of $Hg^{II}$ of 1.1 µg/m² (Environ 2013) plus annual modeled $Hg^0$ and $Hg_p$ of 3.8 µg/m² and 0.5 µg/m², respectively (Environ 2014c).

Hg = Mercury
$Hg^0$ = Elemental mercury vapor
$Hg^{II}$ = Gaseous divalent mercury
$Hg_P$ = Particle bound mercury
µg/m² = Microgram per square meter
mi = Miles
SW = Southwest

Sources: Environ 2013, 2014c.

#### 3.8.2.2.4 VISIBILITY DATA

ADEC determines visibility using pollutant concentrations measured at IMPROVE stations (ADEC 2011b). Figure 3.8-2 shows locations of IMPROVE monitoring station locations for Denali National Park (DENA1 and TRCR1), Tuxedni Wilderness Area (TUXE1), and Simeonof Wilderness Area (SIME1) (EPA 2013d).

Due to distance and geography[10], visibility data collected at these stations is not likely to be representative of the area of the Bethel Port, river traffic, the Angyaruaq (Jungjuk) and BTC ports and roads, or airstrip. However, SIME1 (in Simeonof Wilderness Area) is located within 300 miles of the Dutch Harbor tank farm; both sites are rural or semi-rural; and both are coastal locations on the Alaska Peninsula. Therefore SIME1 data are presented in Table 3.8-12 as the best available data for the Transportation Corridor.

**Table 3.8-12: Historical Visibility Conditions at SIME1**

| Monitoring Station | Distance from Project Area | Worst Days (2000-2004) | | Best Days (2000-2004) | |
|---|---|---|---|---|---|
| | | Dvs | Miles | Dvs | Miles |
| SIME1 | 264 mi ENE | 18.6 | 47[a] | 7.6 | 248[a] |

**Notes:**
a Estimated based on 53.4 inverse megameters ($Mm^{-1}$) for worst days, and 9.6 $Mm^{-1}$ for best days.
dvs = deciviews (A measurement of visibility. One deciview represents the minimal perceptible change in visibility to the human eye.)
ENE = East North East
mi = Miles
Source: ADEC 2011b.

In addition, ADEC (2011b) has indicated that visibility in Alaska overall is affected by international long range transport of aerosols such as manmade pollutants from Europe and Asian dust.

### 3.8.2.3 PIPELINE

#### 3.8.2.3.1 CRITERIA POLLUTANT DATA

The pipeline component of the project (including right-of-way [ROW], compressor station, pig launcher and receiver station, main line valves, temporary work areas, Tyonek Port, and diesel pipeline) would not trigger any ambient air quality monitoring requirements for PSD or minor air quality permitting. Thus, no site-specific monitoring for criteria pollutants, Hg, or deposition was conducted. However, the Mine Site is relatively close to parts of the pipeline component. Therefore, the data shown in Table 3.8-7 are characteristic of the portions of the pipeline located on the west side of the airshed divide, at about pipeline Milepost (MP) 120.

[10] Due to the larger scale regional impacts of regional haze compared to pollutant data, an IMPROVE monitoring station is considered to have potentially representative visibility data if it (1) lies within 300 miles of a project component, (2) is located in a similar land use category, and (3) is not separated from the Project Area by a mountain range.

Additional air monitoring data from the AQS is available on EPA's Air Data website (EPA 2013b). The Big Lake monitoring station (AQS 02-170-0004) shown on Figure 3.8-2, located 20 miles from the closest part of the pipeline, is the only station on the EPA website with data[11] that is characteristic of the pipeline component area. Data from this station are potentially representative of the eastern portion of the proposed pipeline. The only criteria pollutant data available from the Big Lake monitoring station are for 24-hour $PM_{2.5}$, collected from 2000 to 2002. The Big Lake station 24-hour $PM_{2.5}$ data are shown in Table 3.8-13.

**Table 3.8-13: Big Lake 24-hour $PM_{2.5}$ Baseline Ambient Air Quality Data**

| Monitored Value and Description | | Data Collection Dates | NAAQS (% of NAAQS)[a] | AAAQS (% of AAAQS)[a] |
|---|---|---|---|---|
| **31.2 μg/m$^3$** | Highest 24-hour value for data collection period | 2000 to 2002 | 35 μg/m$^3$ (89%) | 35 μg/m$^3$ (89%) |

**Notes:**
a The percentages are based on description of the monitored value. They do not indicate attainment status, as some standards allow for exceedances.

AAAQS = Alaska Ambient Air Quality Standard
μg/m$^3$ = Microgram per cubic meter
NAAQS = National Ambient Air Quality Standard
μg = Micrograms
$PM_{2.5}$ = Particulate matter with an aerodynamic diameter less than or equal to 2.5 micrometers

Source: EPA 2013b.

### 3.8.2.3.2 MERCURY

The Project Area contains Hg due to existing natural and anthropogenic sources (ARCADIS 2014). As noted previously, the pipeline component of the project would not trigger any ambient air quality permitting requirements or requirement to collect ambient Hg data; thus site-specific ambient air quality monitoring was not conducted. However, the Mine Site is relatively close to some of the pipeline component of the project. Therefore, the ambient Hg data discussed in Section 3.8.2.1.2 are considered characteristic of portions of the pipeline located within the west side of the airshed divide, at about pipeline MP 120.

There are no additional ambient Hg data for the rest of the pipeline component.

### 3.8.2.3.3 WET AND DRY DEPOSITION OF MERCURY

Wet and dry deposition data availability in Alaska is discussed in Section 3.8.2.1.3, and site locations are shown on Figure 3.8-2. However, the Mine Site is relatively close to some of the pipeline component of the project. Therefore, the Hg deposition data shown in Table 3.8-9 are considered characteristic of portions of the pipeline located within the west side of the airshed divide, at about pipeline MP 120.

[11] For purposes of this report, monitoring stations are considered to have potentially representative pollutant data if they (1) are within about 50 miles of any part of the transportation facilities or the natural gas pipeline components of the project, (2) are in a rural or semi-rural area, and (3) have criteria pollutant data since 2000.

### 3.8.2.3.4 VISIBILITY DATA

ADEC determines visibility using pollutant concentrations measured at IMPROVE stations (ADEC 2011b). Figure 3.8-2 shows locations of IMPROVE monitoring station locations for Denali National Park (DENA1 and TRCR1), Tuxedni Wilderness Area (TUXE1), and Simeonof (SIME1) (EPA 2013d).

Due to distance and geography[12], visibility data collected at these stations would not likely be characteristic of the western portion of the pipeline component. However, stations TRCR1 (located at Trapper Creek) and TUXE1 (located at Tuxedni Wilderness Area) are on the same side of the Alaska Range as the proposed eastern portion of the pipeline (including the compressor station, Tyonek Port, and diesel pipeline), are rural or semi-rural, and are within 300 miles of the project. Therefore, the data from TUXE1 and TRCR1 are presented in Table 3.8-14 as the best available data.

**Table 3.8-14: Historical Visibility Conditions at TRCR1 and TUXE1**

| Monitoring Station | Distance from Project Area | Worst Days (2000-2004) | | Best Days (2000-2004) | |
|---|---|---|---|---|---|
| | | dvs | Miles | dvs | Miles |
| TUXE1 | 45 mi SSE | 14.1 | 56 | 4.0 | 163 |
| TRCR1 | 107 mi NNE | 11.6 | 73 | 3.5 | 172 |

**Notes:**
dvs = deciviews
mi = miles
NNE = North North East
SSE = South South East
Source: ADEC 2011b.

Although both TUXE1 and TRCR1 are influenced by sea salt, the TUXE1 monitoring site is influenced by sea salt to a greater extent (ADEC 2011b). The proposed compressor station would be three miles from Cook Inlet, so the data from TUXE1 is likely more characteristic of the area where the compressor station would be located than that from TRCR1.

In addition, ADEC (2011b) has indicated that visibility in Alaska overall is affected by international long-range transport of aerosols, such as manmade pollutants from Europe and Asian dust.

As part of the PSD application, a visibility analysis was performed by Air Sciences using the most recent version of EPA's visibility impairment screening model VISCREEN (version 13190). VISCREEN was selected and is appropriate for this analysis because it is an EPA screening method to conservatively predict impacts at a source-to-observer distance of up to 50 km. Following ADEC guidance, the results of this analysis showed that the particulate plumes from process and auxiliary point sources at the Mine Site would not likely be visible to an observer at

[12] Due to the more regional impacts of regional haze compared to pollutant data, an IMPROVE monitoring station is considered to have potentially representative visibility data if it (1) lies within 300 miles of a project component, (2) is located in a similar land use category, and (3) is not separated from the Project Area by a mountain range.

the Denali National Park (i.e., inside Class I area), a distance of approximately 196 miles. Only point sources were modeled, because mobile source and mining activities are primarily fugitive and occur over a large area; they would not likely be coherent or co-located. Furthermore, ADEC recommended that because no integral vista exists at the project site, an "outside Class I area" scenario was not required. The passing evaluation required the use of a more refined Level 2 analysis, as the more conservative wind speed and stability assumptions incorporated in the Level 1 analysis did not pass. Further details and results of the analysis can be found in the Air Sciences Inc. report provided in Appendix I (Air Sciences Inc. 2016).

#### 3.8.2.4 CLIMATE CHANGE

Climate change is affecting resources in the EIS Analysis Area and trends associated with climate change are projected to continue into the future. Section 3.26.3 discusses climate change trends and impacts to key resources in the physical environment including atmosphere, water resources, and permafrost. Current and future effects on air quality are tied to atmospheric changes (discussed in Section 3.26.3.1).

### 3.8.3 ENVIRONMENTAL CONSEQUENCES

This section addresses the air quality impacts during Construction, Operations and Closure Phases of the Donlin Gold Project. Direct and indirect impacts are evaluated for each phase. Air emissions associated with the project consist of emissions from fugitive, mobile, and stationary air pollution sources as described below.

- Fugitive sources of emissions are those which could not reasonably pass through a stack, chimney, vent, or other functionally equivalent opening (40 CFR 52.21(b)(20)). Fugitive emissions can be particulate or gaseous. Examples of particulate fugitive emissions associated with the project are fugitive dust from construction activities or other activities that disturb the soil, vehicle traffic, wind erosion of exposed surfaces, and material handling. An example of gaseous fugitive emissions associated with the project would be GHG emissions due to leaks from natural gas pipeline and compressor station valves and fittings.
- Mobile sources are highway and off-highway vehicles. Examples of mobile sources associated with the project are trucks, buses, earth-moving equipment, ships, and airplanes.
- Point sources of air pollution are those that pass through a stack, chimney, vent, or other functionally equivalent opening (40 CFR 52.21(b)(20)). Examples of stationary sources associated with the project are mining process activities (for which emissions pass through a stack or vent), power plant generators, and incinerators.

Fugitive, mobile, and point sources of emissions all contribute to air quality impacts, but the emissions from each category are handled differently under air quality control regulations. When assessing stationary source air quality permitting requirements, mobile emissions are not included and neither are the fugitive emissions for the gold mine ore processing and production area source category. However, these emissions may be considered when determining a project's impact on the AAAQS. Criteria pollutants and HAPs from mobile sources of air pollution are regulated through the manufacturer and are also subject to federal fuel sulfur standards. Stationary source emissions are subject to state and federal emissions standards and permitting requirements.

In addition to criteria pollutant emissions, the project would generate ammonia, hydrogen sulfide, and HAP emissions (including As, Hg, Pb, and hydrogen cyanide [HCN]). Mercury emissions are of special concern for the Donlin Gold Project. Mercury is highly toxic, and the methylated form affects the environment through bioaccumulation. Mercury from natural and anthropogenic sources is already present in the Project Area, and it is associated with the gold ore found at the project (SRK 2014a). The following summarizes the various forms of Hg found in the atmosphere, and their fate in the environment (SRK 2014a; Environ 2015).

- Elemental Hg vapor ($Hg^0$) is a gaseous form of Hg. It is the most common form of atmospheric Hg, on a global basis, total atmospheric Hg is comprised of approximately 90 percent $Hg^0$ (Environ 2015). It deposits relatively slowly and may travel long distances.
- Gaseous divalent Hg ($Hg^{II}$) may exist as a solid or gas in the atmosphere. It deposits to the surface relatively quickly through wet or dry deposition, thus tends to settle close to its source.
- Particulate-bound Hg ($Hg_p$) is emitted either directly as PM from the source or first emitted in gaseous form and then collects on atmospheric particles. Wet and dry deposition rates are slower than $Hg^{II}$ and quicker than $Hg^0$.

Mercury emissions have the potential to occur from stationary and fugitive sources at the Mine Site. The stationary source emissions from the electrowinning cell, regeneration kiln, induction furnace, autoclaves and retort; and fugitive gaseous Hg emissions from the tailings storage facility (TSF), waste rock facility, open pit, and ore stockpile would only occur at the Mine Site. Fugitive dust particulate Hg emissions would occur at the Mine Site from wind erosion of exposed surfaces, traffic on unpaved roads, and ore transportation and processing (Environ 2015).

In addition to mercury deposition, information on the impacts from deposition of other HAPs is provided in Section 3.2, Soils, and Section 3.7, Water Quality. Implications to human health are discussed in Section 3.22, and an analysis of HAPS metals impacts to ecological receptors is presented in Section 3.12, Wildlife, and Section 3.13, Fish.

### 3.8.3.1 AIR QUALITY IMPACTS ANALYSIS METHODOLOGY

The Project Area is the footprint of the Mine Site, Transportation Corridor, and Pipeline. The emissions from the Project Area are described as direct emissions. The EIS Analysis Area is the larger geographical area that would experience indirect impacts, and is described in the impact analysis for each component. Indirect emissions are not quantified in this EIS.

Expected air quality impacts due to the Donlin Gold Project are evaluated based on the results of dispersion modeling and emissions estimates. Table 3.8-15 provides the impact methodology framework applied to assessing direct or indirect impacts to air quality based on four factors of intensity or magnitude, duration, extent or scope, and context (40 CFR 1508.27, described in Section 3.0, Approach and Methodology).

**Table 3.8-15: Impact Methodology for Effects on Air Quality**

| Impact Factor | Assessment Criteria | | |
|---|---|---|---|
| **Magnitude or Intensity** | Emissions are below air quality thresholds[a], or impacts meet regulatory standards. | NA | Regulatory standards; mitigation measures are not effective. |
| **Duration** | Air quality would be reduced infrequently, but not longer than the span of the project Construction and would be expected to return to pre-activity levels at the completion of the activity. | Air quality would be reduced from the end of project construction through the life of the mine, and up to 100 years. | Air quality would be reduced and would not be anticipated to return to previous levels. |
| **Extent or Scope** | Affects air quality only locally; discrete portions of the Project Area affected. | Affects air quality beyond a local area, potentially throughout the EIS Analysis Area or outside the Project Area. | Affects air quality beyond the regional scale. |
| **Context** | Affects attainment/unclassified[b] areas. | Affects maintenance[b] areas or areas with local air quality standards. | Affects Class I areas or poor air quality (EPA non-attainment[b] areas). |

**Notes:**
a Air thresholds are shown in Table 3.8-15.
b Refer to Section 3.8.1.2 and Table 3.8-2 for descriptions of air quality attainment and maintenance areas.

Emissions were quantified for Alternative 2; impacts to air quality from other action alternatives are discussed qualitatively in relation to Alternative 2 in Sections 3.8.3.4 through 3.8.3.8.

Air quality thresholds for PSD permits, Title V permits, and minor permits are shown in Table 3.8-16. For the Donlin Gold Project, only emissions from stationary sources count toward permit applicability.

**Table 3.8-16: Air Quality Thresholds**

| Permit Type | CO (tpy) | $NO_x$ (tpy) | $PM_{2.5}$ (tpy) | $PM_{10}$ (tpy) | PM (tpy) | $SO_2$ (tpy) | VOC (tpy) | HAPs (tpy) |
|---|---|---|---|---|---|---|---|---|
| **PSD** | | | | | | | | |
| Major Source Threshold | 250 | 250 | 250 | 250 | 250 | 250 | 250 | NA |
| Significant Emission Rate | 100 | 40 | 10 | 15 | 25 | 40 | 40 | NA |
| **Title V** | | | | | | | | |
| New Major Source Threshold | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 10/25[a] |
| **Minor Permit** | | | | | | | | |
| New Minor Source Threshold | NA[b] | 40 | 10 | 15 | NA | 40 | NA | NA |

**Notes:**
a A source is major for Title V if it emits 10 tpy of any individual HAP or 25 tpy or more of any combination of HAPs, including fugitive emissions.
b Alaska new minor source threshold for CO is 100 tpy for a stationary source within 10 kilometers of a CO nonattainment area. None of the project alternatives are within 10 kilometers of a CO nonattainment area. Therefore, this threshold is not applicable.
CO = Carbon monoxide
HAPs = Hazardous air pollutants
NA = Not applicable
$NO_x$ = Oxides of nitrogen
PM = Total suspended particulate matter
$PM_{2.5}$ and $PM_{10}$ = Particulate matter with an aerodynamic diameter less than or equal to 2.5 and 10 micrometers, respectively
$SO_2$ = Sulfur dioxide
VOC = Volatile organic compound

Source: ADEC 2016.

Except for a small portion of the pipeline (which would primarily emit GHGs) located near Denali National Park, the project is not located near a Class I area. No components of the project would be located within or near a non-attainment, maintenance, or area with local regulations. Therefore, the context would be common for all components and phases.

The following common assumptions and approaches were used to estimate emissions for the air quality impact analyses:

- Natural gas fuel sulfur content same as that for pipeline quality natural gas, 6.0E-4 pounds per million Btu (lb/MMBtu) (per Appendix D of 40 CFR Part 75);
- Diesel-fired equipment uses ULSD;
- For the Construction Phase of all components, mobile construction equipment emissions are based on expected equipment types and usage factors provided by Donlin Gold (Fernandez 2014f); and
- Fugitive dust generated from wind erosion of exposed surfaces is based on maximum acreage of disturbed area in a year for a given phase.

Note that, although neither mobile source nor fugitive emissions are counted for permit applicability, their impacts are included in the ambient impact analysis.

### 3.8.3.2 ALTERNATIVE 1 – NO ACTION

Under the No Action Alternative, the proposed Donlin Gold Project would not be undertaken. Existing ambient air quality, as it reflects current activities and conditions described in the Affected Environment section, would remain the same. Consequently, no new direct or indirect effects on air quality would occur from the implementation of the No Action Alternative.

### 3.8.3.3 ALTERNATIVE 2 – DONLIN GOLD'S PROPOSED ACTION

Based on comments on the Draft EIS from agencies and the public, one route option has been included in Alternative 2 to address concerns due to pipeline crossings of the Iditarod National Historic Trail (INHT):

- North Option: The MP 84.8 to 112 North Option would realign this segment of the natural gas pipeline crossing to the north of the INHT before the Happy River crossing and remain on the north side of the Happy River Valley before rejoining the alignment near MP-112 where it enters the Three Mile Valley. The North Alignment would be 26.5 miles long, with one crossing of the INHT and only 0.1 mile physically located in the INHT right-of-way (ROW). The average separation distance from the INHT would be 1 mile.

#### 3.8.3.3.1 MINE SITE

For analysis purposes, the Project Area and the EIS Analysis Area for the Mine Site are both the core operating area boundary.

<u>Construction</u>

The Construction Phase of the Mine Site would last three to four years (SRK 2016a). Activities consist of initial pioneering and development of pits to be mined, including the construction of mining facilities, milling facilities, TSF, waste rock facilities, overburden storage facilities, haul roads, and support infrastructure. There will be an incinerator or open pit burning at the Mine Site during Construction (Enos 2015b). All activities occur within the footprint of the Mine Site and impacts are anticipated to occur primarily within those limits.

Direct impacts to air quality during this phase would be caused by air emissions from fugitive and mobile sources; the estimated emissions are summarized in Table 3.8-17.

**Table 3.8-17: Mine Site Construction Phase Emissions[d]**

| Emissions Source | CO (tons) | $NO_x$ (tons) | $PM_{2.5}$ (tons) | $PM_{10}$ (tons) | PM (tons) | $SO_2$ (tons) | VOC (tons) | HAPsf (tons) | Hg[d,f] (tons) | Pb[d,f] (tons) | As[d,f] (tons) | HCN[d,f] (tons) | Sb[d,f] (tons) | $CO_2$-e[f] (tons) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Fugitive[a,b]** | 152 | 4 | 105 | 749 | 3,011 | 0.0 | 0.0 | 3 | 0.002 | 0.03 | 0.4 | nc | 0.02 | 6,5000 |
| **Mobile[b]** | 2,055 | 861 | 16 | 16 | 16 | 4 | 152 | 2 | 0 | nc | nc | nc | nc | 196,700 |
| **Total** | **2,207** | **865** | **121** | **765** | **3,027** | **4** | **152** | **5** | **0.002** | 0.03 | 0.4 | nc | 0.02 | **203,300** |

**Notes:**

a Fugitive sources of PM consist of disturbed areas subject to wind erosion, material handling, drilling, roads, dozing and grading, blasting, and crushing (SRK 2015g; Air Sciences Inc. 2016). Fugitive GHGs result from permafrost degradation and removal (AECOM 2017e). Estimates assume 90 percent control efficiency applied to dust generated from unpaved roads due to vehicle miles traveled (VMT). No controls applied to dust generated by material handling, crushing, dozing and grading, or wind erosion of the tailings beach (Cardno 2015a, b; AECOM 2017a).

b All emissions from blasting were categorized under the fugitive emissions category. The combustion emissions from the mobile equipment that contribute to fugitive dust were categorized under mobile emissions.

c Mobile sources consist of tailpipe emissions from construction equipment and personnel transport equipment (Fernandez 2014f, Air Sciences Inc. 2016; Cardno 2015a,b; AECOM, 2017a).

d Hg, Pb, As, HCN, and Sb are also a subset of HAPs emissions. Additional information on the impacts from deposition of these pollutants is provided in Section 3.2, Soils, and Section 3.7, Water Quality.

e The emissions in this table cover the entire Construction Phase.

f Cardno (2015a; b) and AECOM (2017a) emissions estimates may not reflect all updates incorporated in Air Sciences Inc. (2016).

As - Arsenic
CO = Carbon monoxide
$CO_2$-e = Carbon dioxide equivalent HAPs = Hazardous air pollutants
HCN = Hydrogen cyanide
Hg = Mercury
nc = not calculated (negligible)
$NO_x$ = Oxides of nitrogen
Pb = Lead
PM = Total suspended particulate matter
$PM_{2.5}$ and $PM_{10}$ = Particulate matter with an aerodynamic diameter less than or equal to 2.5 and 10 micrometers, respectively
Sb = Antimony
$SO_2$ = Sulfur dioxide
VOC = Volatile organic compounds
Source: AECOM 2017a, e; Air Sciences Inc. 2016; Cardno 2015a, b; Fernandez 2014f; SRK 2015g.

At the Mine Site, during the Construction Phase, emissions would primarily be from non-road diesel engines. Regulations of these engines are outlined in Section 3.8.1.3.8. As there would be no emitting units classified as stationary sources during the Construction Phase, air permitting would not be required. Total estimated annual emissions from Mine Site Construction (Table 3.8-17) are less than total estimated annual emissions from Mine Site Operations (Table 3.8-19) which were shown to have modeled impacts below required thresholds (Table 3.8-23). Thus, impacts are expected to meet regulatory standards.

Indirect air quality impacts associated with the Construction Phase of the Mine Site would result from emissions associated with transporting supplies and construction materials to the Mine Site and from the oil and gas production and refining required to generate the fuel used to power project sources. There are currently no defined methodologies for estimating indirect emissions from oil and gas production and refining. Estimating emissions from oil and gas production and refining is highly dependent on the design, operation, and product composition; for fuel purchased on an open market the supplier will likely vary over time based on availability and economics. The impacts from transporting supplies are discussed under the Transportation Corridor section.

## Operations

The Operations Phase of the Mine Site would last 25 to 30 years. Activities include extracting the ore from the ground and processing it to produce gold doré bars. The processing steps include crushing, grinding, flotation, pressure oxidation, cyanide leaching, gold refining, cyanide detoxification, and discharging tailings to the TSF. Under Alternative 2, Donlin Gold would use a conventional slurry disposal method within a lined TSF in the Anaconda Valley (SRK 2016a). Maintenance activities would include routine and preventive maintenance of support facilities and infrastructure (such as mine roads, landfill trenches, and other associated mining facilities) in the area of the Mine Site. Some reclamation activities would occur during the mine Operations Phase, in areas that are no longer required for active mining. These activities occur within the footprint of the Mine Site and modeled impacts have shown compliance with AAQS at its core operating area boundary.

Table 3.8-18 shows a list of stationary fuel combustion emission units at the Mine Site during operations, with their respective typical fuel.

**Table 3.8-18: Mine Site Stationary Fuel Combustion Emission Units during Operations Phase**

| ID | Description | Fuel | Typical Fuel |
|---|---|---|---|
| W1 to 12 | Power plant generators (12) | Natural Gas/ULSD[a] | 99% natural gas and 1% diesel |
| BEDG1 & 2 | Black start generators (2) | ULSD | ULSD |
| CEDG1 to 4 | Emergency generators (2) | ULSD | ULSD |
| FP1 to 3 | Fire pumps (3) | ULSD | ULSD |
| 17-BLR-301 & 302 | POX boilers (2) | Natural Gas/ULSD[b] | Natural Gas |
| 33-BLR-001 | Oxygen plant boiler | Natural Gas/ULSD[b] | Natural Gas |
| 56-BLR-200 | Carbon elution heater | Natural Gas/ULSD[b] | Natural Gas |
| PP-HEU-100 & 200 | Power plant auxiliary boilers (2) | Natural Gas/ULSD[b] | Natural Gas |
| 15-BRN-100 | $SO_2$ burner | Natural Gas | Natural Gas |
| 1-15-BRN-100 | Auxiliary $SO_2$ boiler | ULSD | ULSD |
| 81-HEU-1 to 138 | Building heaters (138) | Natural Gas | Natural Gas |
| 81-HVA-104 to 109, 111 to 113, 119, 126, 127, 201 to 207, 220, 230, 231, 233, 234, 253, 257 | Air handlers (26) | Natural Gas | Natural Gas |
| PBH1 to 20 | Portable heaters (20) | ULSD | ULSD |

**Notes:**
a Worst case fuel for power plant generators is ULSD for CO, $NO_x$, PM, $PM_{10}$, $PM_{2.5}$, $SO_2$, VOC, and $CO_2$-e.
b Worst case fuel for dual-fuel boilers is ULSD for $NO_x$, PM, $PM_{10}$, and SO2, and natural gas for CO, $PM_{2.5}$, VOC, and $CO_2$-e.
ULSD = Ultra low sulfur diesel
Source: Air Sciences Inc. 2016.

Mercury emissions would be released into the atmosphere at the Mine Site during the Operations Phase. Sources include the following (SRK 2014a):

- Open Pit Mine, Ore, and Waste Rock – Gaseous mercury emissions may be released to the air due to volatilization of weathered sulfide minerals when exposed to the environment. Mercury has a low volatilization temperature, so will form a gas at ambient temperatures, as well as at the higher temperatures that occur during gold processing. These sources may also generate particle bound Hg as wind-blown dust.
- Ore Processing – Mercury may be released into atmosphere during crushing and grinding as fugitive dust. Gaseous Hg would be produced during the pressure oxidation, carbon reactivation, electrowinning, retort, and refining stages. The gaseous Hg from the point sources would be collected and treated prior to release to the atmosphere, such that only 0.4 percent of the Hg passing through the mill would be released into the atmosphere (Hatch 2014).
- TSF – Mercury would be present in the TSF in an inorganic solid form. However, releases to air from TSF could occur as fugitive gaseous emissions through volatilization and as fugitive particle bound emissions in wind-blown dust.

- Fugitive Dust – Mercury emissions would occur as fugitive dust due to mining operations such as drilling, blasting, loading, ore crushing, wind erosion of exposed surfaces, and road use.

Emissions of Hg from the natural gas power plant are expected to be negligible (EPA 2014a).

Direct impacts to air quality during this phase would be caused by air emissions from fugitive, mobile, and stationary sources; the estimated emissions are summarized in Table 3.8-17.

The Operations emissions are based on AP-42 emission factors, performance data from similar sources, manufacturer specifications, new source performance standards (NSPS), and technical literature (Air Sciences Inc. 2016; Cardno 2015a,b; AECOM 2017a). In addition:

- Mill operations, power generation, and ancillary equipment (including incinerators) emissions are based on maximum design rates.
- Combustion source emissions assume typical fuel as shown in Table 3.8-18.
- The main power plant generators operate with selective catalytic reduction to control $NO_x$ and an oxidation catalyst to control CO; and emissions limitations in 40 CFR Part 60, Subpart IIII.
- The autoclaves and carbon process with retort are subject to mercury emission limit 40 CFR Part 63, Subpart EEEEEEE. The controls would be expected to outperform these standards (Hatch 2014). Mercury abatement would occur at each major thermal source, including the autoclave, carbon kiln, gold furnaces, and retort (SRK 2016a).

As shown in Table 3.8-19, $CO_2$-e emissions from Mine Site operations are 1,761,000 tpy. This converts to 1,598,000 MT per year; therefore, the project would be subject to the GHG reporting rule described in Section 3.8.1.3.1.

## Table 3.8-19: Annual Mine Site Operations Phase Emissions

| Emissions Source | CO (tpy) | $NO_x$ (tpy) | $PM_{2.5}$ (tpy) | $PM_{10}$ (tpy) | PM (tpy) | $SO_2$ (tpy) | VOC (tpy) | HAPs[f] (tpy) | Hg[e,f] (tpy) | Pb[e,f] (tpy) | As[e,f] (tpy) | HCN[e,f] (tpy) | Sb[e,f] (tpy) | $CO_2$-e (tpy) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fugitive[a,b] | 1,923 | 53 | 170 | 1,341 | 4,719 | 0.2 | 0.2 | 4 | 0.04 | 0.05 | 0.7 | nc | 0.03 | 328,200 |
| Mobile[c] | 2,042 | 1,978 | 23 | 23 | 23 | 4 | 111 | 4 | 0 | nc | nc | nc | nc | 408,800 |
| Stationary[d] | 1,256 | 1,230 | 367 | 660 | 693 | 23 | 1,168 | 23 | 0.3 | 0.007 | 0.1 | 2 | 0.002 | 1,024,100 |
| **Total** | **5,222** | **3,260** | **836** | **2,024** | **5,434** | **27** | **1,279** | **31** | **0.4** | **0.06** | **0.8** | **2** | **0.03** | **1,761,000** |

**Notes:**

a Fugitive sources consist of drilling, blasting, ore loading (in-pit), ore unloading (short term stockpile), ore unloading (long-term stockpile), waste loading, waste unloading, ore hauling, waste hauling, dozer use, grader use, water truck use, tailings beach (dry), haul roads, waste dump, short-term ore stockpile, long-term ore stockpile, long-term ore stockpile west, long-term ore stock pile east (Air Sciences Inc. 2016; Cardno 2015a,b; AECOM 2017a) and GHGs from dewatered wetlands (Cardno 2015b) and permafrost degradation and removal (AECOM 2017e). During operations, 90 percent control efficiency was applied to fugitive dust generated from unpaved roads (haul roads and access roads), and maintenance equipment (water trucks). No controls applied to the fugitive emissions resulting from drilling, blasting, material handling (ore and waste), maintenance equipment (dozers, graders) or wind erosion of the tailings beach.

b All emissions from blasting were categorizes under the fugitive emissions category. The combustion emissions from the mobile equipment that contribute to fugitive dust were categorized under mobile emissions.

c Mobile sources consist of hydraulic shovels, front-end loaders, haul trucks, drills, track dozers, wheel dozers, graders, water trucks, hydraulic excavators, fuel trucks, service trucks, mobile cranes, low boy trucks, tire handlers, and light plants (Air Sciences Inc. 2016; Cardno 2015a,b; AECOM, 2017a).

d Stationary sources consist of power plant generators (12), black start generators (2), emergency generators (4), fire pumps (2), POX boilers (2), oxygen plant boiler, carbon elution heater, power plant auxiliary boilers (2), $SO_2$ burner, auxiliary $SO_2$ burner, building heaters (138), air handlers (26), portable heaters (20), ROM ore discharge and crushing, coarse ore transfer, pebble crushers and stockpile, reagents handling, and mixing, refinery sources, laboratories, water treatment plant, camp waste incinerator, sewage sludge incinerator, Mine Site tanks, and power plant tanks (Air Sciences Inc. 2016; Cardno 2015a,b; AECOM, 2017a).

e Hg, Pb, As, HCN, and Sb are also a subset of HAPs emissions. Additional information on the impacts from deposition of these pollutants is provided in Section 3.2, Soils, and Section 3.7, Water Quality.

f Cardno (2015a, b) emissions estimates may not reflect all updates incorporated in Air Sciences Inc. (2016).

CO = Carbon monoxide
$CO_2$-e = Carbon dioxide equivalent
Hg = Mercury
HAPs = Hazardous air pollutants
HCN = Hydrogen cyanide
Sb = Antimony
As = Arsenic
nc = not calculated (negligible)
PM = Total suspended particulate matter
$NO_x$ = Oxides of nitrogen
$PM_{2.5}$ and $PM_{10}$ = Particulate matter with an aerodynamic diameter less than or equal to 2.5 and 10 micrometers, respectively
Pb = Lead
POX = Pressure oxidation
$SO_2$ = Sulfur dioxide
ROM = Run of mine
tpy = tons per year
VOC = Volatile organic compounds

Sources: Air Sciences Inc. 2016; Cardno 2015a, b; AECOM, 2017a, e.

### *Air Quality Control Permit*

Donlin Gold is required to obtain air quality control permits from the ADEC for Mine Site operations. Fugitive and mobile source emissions do not count for permit applicability. For the purpose of this EIS, the emission calculations for all combustion emission units at the Mine Site in Table 3.8-18 are based on natural gas usage to the extent possible, as that is the fuel expected to be used for Alternative 2. However, for PSD NSR, minor NSR and Title V permit applicability, PTE is estimated using the fuel that yields the highest emissions (i.e., worst-case) allowed by the permit. As Alternative 2 includes the option of using diesel fuel in the dual fuel-fired equipment as a contingency measure, it should be accounted for in determining permit applicability. Table 3.8-20 shows Mine Site stationary source emissions assuming the highest emitting fuel is used in dual-fuel fired equipment. For criteria pollutants the highest emitting fuel is usually, but not always, ULSD.[13]

**Table 3.8-20: Annual Mine Site Stationary Operations Phase Emissions for Permit Applicability**

| Emissions Source | CO (tpy) | $NO_x$ (tpy) | $PM_{2.5}$ (tpy) | $PM_{10}$ (tpy) | PM (tpy) | $SO_2$ (tpy) | VOC (tpy) | HAPs (tpy) |
|---|---|---|---|---|---|---|---|---|
| **Stationary[a]** | 1,256 | 1,230 | 643 | 660 | 693 | 23 | 1,168 | 23.4 |
| PSD Major Source Threshold | 250 | 250 | 250 | 250 | 250 | 250 | 250 | NA |
| Significant Emission Rate | 100 | 40 | 10 | 15 | 25 | 40 | 40 | NA |
| **PSD Permit Triggered?** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **No** | **Yes** | **No** |
| Title V Major Source Threshold | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 10/25[b] |
| **Title V Permit Triggered?** | **Yes** | **Yes** | **Yes** | **Yes** | **Yes** | **No** | **Yes** | **No** |
| Minor Source Threshold | NA | 40 | 10 | 15 | NA | 40 | NA | NA |
| **Minor Permit Triggered?[c]** | **NA** | **No** | **No** | **No** | **No** | **No** | **NA** | **NA** |

**Notes:**

a Stationary sources consist of power plant generators (12), airport generators (2), black start generators (2), emergency generators (4), fire pumps (3), ROM ore discharge and crushing, coarse ore transfer, pebble crushers and recycle, reagents handling and mixing, refinery sources, laboratories, water treatment plant, POX boilers (2), oxygen plant boiler, carbon elution heater, power plant auxiliary boilers, $SO_2$ burner, auxiliary $SO_2$ burner, building heaters (138), air handlers (26), portable heaters (20), camp waste incinerator, sewage sludge incinerator, Mine Site tanks, power plant tanks, airport tanks, and camp site tanks. The HAP emission rate also includes fugitive sources (Air Sciences Inc. 2016).

b A source is major for Title V if it emits 10 tpy of any individual HAP or 25 tpy or more of any combination of HAPs, including fugitive emissions.

c No minor source permit is required because the project will obtain a PSD major source permit.

HAPs = Hazardous air pollutants
CO = Carbon monoxide
NA = Not applicable
$NO_x$ = Oxides of nitrogen
PM = Total suspended particulate matter
$PM_{2.5}$ and $PM_{10}$ = Particulate matter with an aerodynamic diameter less than or equal to 2.5 and 10 micrometers, respectively
POX = Pressure oxidation
PSD = Prevention of significant deterioration
ROM = Run-of-mine
$SO_2$ = Sulfur dioxide
tpy = Tons per year
VOC = Volatile organic compounds

Sources: Air Sciences Inc. 2016; ADEC 2016.

[13] The highest emitting fuel varies depending on pollutant and combustion unit type.

Emissions of CO, $NO_x$, $PM_{2.5}$, $PM_{10}$, and VOCs exceed PSD thresholds, making this a PSD major source for these pollutants. The project is also major for $O_3$, because it is major for both $NO_x$ and VOC. The PSD permit process would require Donlin Gold to perform an air quality impact analysis to ensure compliance with air quality standards and increments in 18 AAC 50.010 and 18 AAC 50.020. The permit would also require BACT on emission units to minimize air pollution.

This Mine Site would be located 220 miles (350 km) from the Tuxedni Wilderness Class I area,[14] and 188 miles (300 km) from the nearest border of Denali National Park Class I area, therefore no notification to the NPS would be required by regulation. The closest distance of any Class I area to any part of the project is 4.4 miles [Denali National Park to the natural gas pipeline], but the pipeline would not have operating emissions. NPS was notified about the project, and indicated that no Class I area analysis would be required (Air Sciences Inc. 2016). However, NPS requested an evaluation of project effects on the Lake Clark National Park and the Katmai National Park and Preserve (both Class II areas) (Air Sciences Inc. 2014a).

Air Sciences Inc. (2015b) includes additional impact analyses of project impacts on soil, vegetation, and visibility in the EIS Analysis Area, which is designated as Class II. Donlin Gold's assessment of project impacts on soils and vegetation is based on the results that demonstrate compliance with the primary AAQS for CO, $NO_2$, $PM_{2.5}$ and $PM_{10}$. Because the project complies with primary standards, it would also comply with secondary standards. Secondary standards were designed to protect public welfare, including prevention of damage to vegetation (Air Sciences Inc. 2015b).

As part of the PSD application, a visibility analysis was performed by Air Sciences using the most recent version of EPA's visibility impairment screening model VISCREEN (version 13190). Following ADEC guidance, the results of this analysis showed that the particulate plumes from process and auxiliary point sources at the Mine Site would not likely be visible to an observer at the Denali National Park (i.e. inside Class I area), a distance of approximately 196 miles. Only point sources were modeled, because mobile source and mining activities are primarily fugitive and occur over a large area; they would not likely be coherent or co-located. Furthermore, ADEC recommended that because no integral vista exists at the project site, an "outside Class I area" scenario was not required. The passing evaluation required the use of a more refined Level 2 analysis, as the more conservative wind speed and stability assumptions incorporated in the Level 1 analysis did not pass. Further details and results of the analysis can be found in the Air Sciences Inc. report provided in Appendix I (Air Sciences Inc. 2016).

To show that there would not be adverse impacts at Lake Clark or Katmai National Parks, Donlin Gold conducted an ambient analysis for CO, $NO_2$, $PM_{2.5}$, $PM_{10}$, and $SO_2$ using AERMOD. The analysis showed compliance with the primary AAQS at both locations, indicating compliance with the secondary standards (Air Sciences Inc. 2015b). Again, because the project complies with primary standards, it would also comply with secondary standards.

The Mine Site would also trigger Title V permitting. A complete Title V permit application would be required no later than 12 months after the date on which the Mine Site becomes subject to AS 46.14.120(b) (i.e., within 12 months after commencement of operation of a major

[14] Class I areas, as they pertain to air quality, are described in Section 3.8.1.2

source). The Compliance Assurance Monitoring Rule would be applicable to the project approximately 5 years after startup.

No minor permits are triggered (a minor permit is not required for a new facility that requires a PSD permit per 18 AAC 50.502(a)(1)) (ADEC 2016).

### *Ambient Impacts*

Donlin Gold prepared an air quality impact analysis to show compliance with air quality standards and increments for PSD permitting as part of its air emissions permit application, and also to support the EIS. The analysis was conducted using the most recent version of the AMS/EPA Regulatory Model (AERMOD) version 16216r, which is recommended by EPA. AERMOD was selected for this analysis because it is preferred and recommended by EPA for near-field applications that do not involve complex (including inhomogeneous local) winds. The consultant, Air Sciences Inc., has carefully examined the terrain within the modeling domain and determined that complex winds are not likely. AERMOD therefore has been selected as the most suitable dispersion model for this application. For this analysis, Donlin Gold incorporated data from AERMAP (version 11103), the terrain preprocessor; AERMET (version 16216), the meteorological preprocessor; and surface characteristics from a tool based on AERSURFACE developed by Air Sciences Inc. specifically for Alaska (Air Sciences Inc. 2016, 2017). The analysis covers all PSD pollutants. The ambient analysis uses the highest emitting fuel (worst-case) assumptions described under Air Quality Control Permit above. In addition, the modeling analysis accounts for mining activities and mobile machinery. Donlin Gold used five years of ADEC-approved site specific meteorological data as input to the ambient analysis to show compliance with PSD increments and the AAAQS. This surface meteorological data was collected at the American Ridge station from July 1, 2005 to June 30, 2010 (Air Sciences Inc. 2016). Upper air data was from the McGrath NWS COOP Site. The modeling accounts for depletion of PM into the ambient air due to settling; however, the deposition to the ground was not estimated.

Modeled emissions are shown in Table 3.8-21. PSD Increment dispersion modeling results are shown in Table 3.8-22 and AAQS dispersion modeling results are shown in Table 3.8-23. Input and output files associated with met processing (via AERMET), building downwash (via BPIP), dispersion modeling (via AERMOD), and visibility (via VISCREEN) are available via Air Sciences report contained in the Administrative Record (Air Sciences Inc. 2016, 2017 also provided in Appendix I). Further modeling output depicting Hg-related modeling using CALPUFF, CMAQ and other related models are available via Environ reports contained in the Administrative Record (Environ 2015).

The ambient analysis, including meteorological data used in support of the analysis, would be reviewed in detail by ADEC during the air quality application review process. ADEC would present its findings on data adequacy in the permit technical analysis report.

As shown on Figure 3.8-3, the maximum PSD increment impacts are located either right on or very close to Donlin Gold's plant boundary. These impacts are consistent with the predominant wind from the southeast indicated in the Wind Frequency Distribution of the 2016 Air Science report provided in Appendix I.

As shown on Figure 3.8-4, the maximum total ambient impacts are located either right on or very close to Donlin Gold's ambient air boundary. The location of the impacts is consistent with the predominant wind from the southeast indicated in the Wind Frequency Distribution of the appended 2016 Air Science report.

**Table 3.8-21: Annual Mine Site Operations Phase Modeled Emissions**

| Emissions Source | CO (tpy) | $NO_x$ (tpy) | $PM_{2.5}$ (tpy) | $PM_{10}$ (tpy) | $SO_2$ (tpy) | |
|---|---|---|---|---|---|---|
| Stationary[a] | 1,256 | 1,230 | 643 | 660 | 23 | |
| Fugitive[b] | 1,923 | 53 | 169 | 1,350 | 0 | |
| Mobile[c] | 2,046 | 1,979 | 23 | 23 | 4 | |
| **Total** | **5,225** | **3,262** | **836** | **2,033** | **27** | |

**Notes:**

a Stationary sources consist of power plant generators (12), airport generators (2), black start generators (2), emergency generators (4), fire pumps (3), ROM ore discharge and crushing, coarse ore transfer, pebble crushers and recycle, reagents handling and mixing, refinery sources, laboratories, water treatment plant, POX boilers (2), oxygen plant boiler, carbon elution heater, power plant auxiliary boilers, $SO_2$ burner, auxiliary $SO_2$ burner, building heaters (138), air handlers (26), portable heaters (20), camp waste incinerator, sewage sludge incinerator, Mine Site tanks, power plant tanks, airport tanks, and camp site tanks.

b Fugitive emissions are a result of mining activities consisting of drilling, blasting, material handling (ore handling (in-pit), ore loading and unloading, waste loading and unloading, ore and waste hauling), maintenance equipment (dozers, graders, water trucks), wind erosion of exposed surfaces (tailings beach, haul roads, access roads, waste dump, and stockpiles). During operations, 90 percent control efficiency was applied to fugitive dust generated from unpaved roads (haul roads and access roads), and maintenance equipment (water trucks). No controls applied to the fugitive emissions resulting from drilling, blasting, material handling (ore and waste), maintenance equipment (dozers, graders) or wind erosion of the tailings beach. c Mobile machinery consists of hydraulic shovels, front-end loaders, haul trucks, drills, track dozers, wheel dozers, graders, water trucks, hydraulic excavators, fuel trucks, service trucks, mobile cranes, low boy trucks, tire handlers and light plants.

CO = Carbon monoxide
$NO_x$ = Oxides of nitrogen
$PM_{2.5}$ and $PM_{10}$ = Particulate matter with an aerodynamic diameter less than or equal to 2.5 and 10 micrrometers, respectively.
POX = Pressure oxidation
ROM = Run of mine
$SO_2$ = Sulfur dioxide
tpy =Tons per year

Source: Air Sciences Inc. 2016, 2017

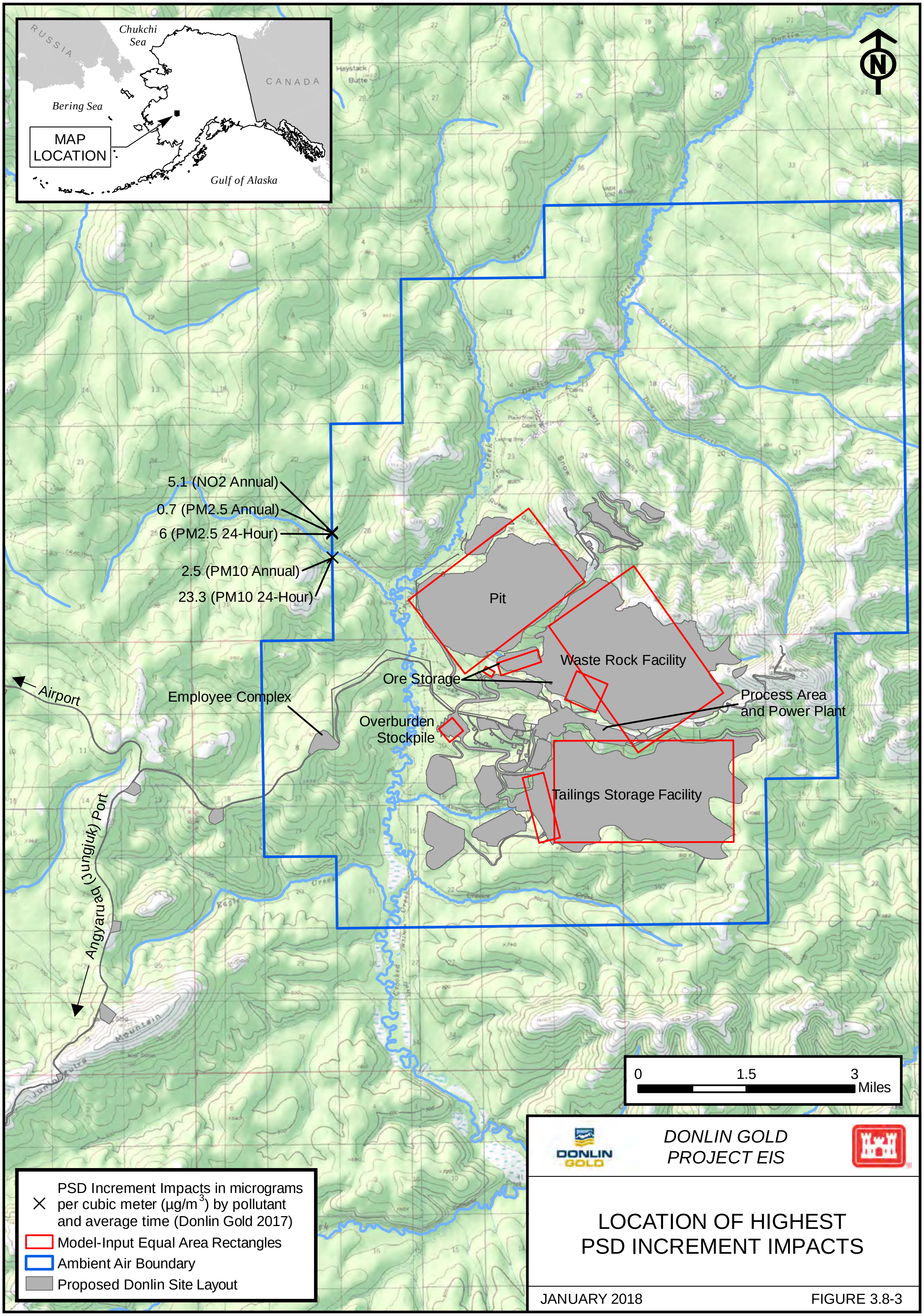
**Table 3.8-22: PSD Increment Dispersion Modeling Results**

| Pollutant | Averaging Period | Maximum Impact ($\mu g/m^3$) | PSD Increment ($\mu g/m^3$) | Percent of Increment (%) |
|---|---|---|---|---|
| **$NO_2$** | Annual | 5.4 | 25 | 22 |
| **$PM_{2.5}$** | Annual | 0.8 | 4 | 20 |
| | 24-Hour (2nd high) | 6.9 | 9 | 77 |
| **$PM_{10}$** | Annual | 2.7 | 17 | 16 |
| | 24-Hour (2nd high) | 25.7 | 30 | 86 |

**Notes:**

% = Percent
$NO_2$ = Nitrogen dioxide
$PM_{2.5}$ and $PM_{10}$ = Particulate matter with an aerodynamic diameter less than or equal to 2.5 and 10 micrometers, respectively.
PSD = Prevention of significant deterioration
$\mu g/m^3$ = micrograms per cubic meter

Source: Air Sciences Inc. 2016. Donlin Revised EIS Modeling Summary (2017)




DONLIN GOLD
PROJECT EIS

LOCATION OF HIGHEST PSD INCREMENT IMPACTS

JANUARY 2018

FIGURE 3.8-3

**Table 3.8-23: AAAQS Dispersion Modeling Results**

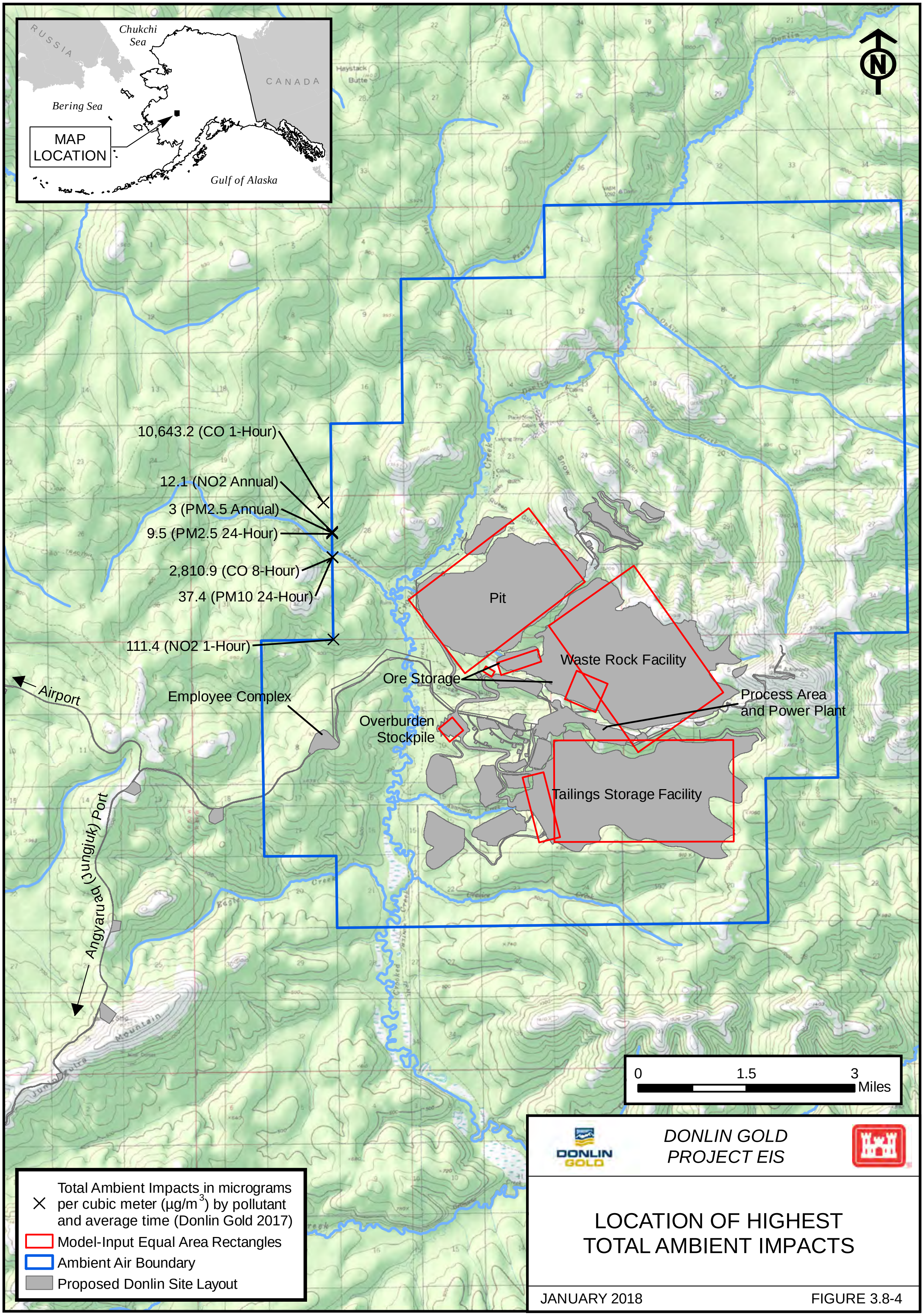
| Pollutant | Averaging Period | Maximum Impact (µg/m$^3$) | Background (µg/m$^3$) | Total Concentration (µg/m$^3$) | NAAS and AAAQS (µg/m$^3$) | Total Concentration Percent of Standard (%) |
|---|---|---|---|---|---|---|
| CO | 8-Hour (2$^{nd}$ high) | 3,151.5 | 457.9 | 3,609.4 | 10,000 | 36 |
| | 1-Hour (2$^{nd}$ high) | 12,725.5 | 686.9 | 13,412.4 | 40,000 | 34 |
| $NO_2$ | Annual | 12.4 | (included) | 12.4 | 100 | 12 |
| | 1-Hour (8$^{th}$ high) | 116.4 | (included) | 116.4 | 188 | 62 |
| $PM_{2.5}$ | Annual | 0.8 | 2.3 | 3.1 | 12 | 26 |
| | 24-Hour (8$^{th}$ high) | 3.1 | 6.8 | 9.9 | 35 | 28 |
| $PM_{10}$ | 24-Hour (2$^{nd}$ high) | 25.7 | 14.1 | 39.8 | 150 | 27 |

**Notes:**
% = Percent
CO = Carbon monoxide
na = Not available
NAAQS/AAAQS = National/Alaska Ambient Air Quality Standards
$NO_2$ = Nitrogen dioxide
$PM_{2.5}$ and $PM_{10}$ = Particulate matter with an aerodynamic diameter less than or equal to 2.5 and 10 micrometers, respectively
VOC = Volatile Organic Compounds
µg/m$^3$ = micrograms per cubic meter
Source: Air Sciences Inc. 2016. Donlin Revised EIS Modeling Summary (2017).

The tables show that the project would comply with AAAQS and PSD increments for the highest emitting fuel. (As described in Section 3.8.1.1.1, the AAAQS are generally the same as the NAAQS, as they cannot be less stringent. Thus, compliance with the AAAQS ensures compliance with the NAAQS.) Because all dual fuel-fired equipment would be primarily fired on natural gas for Alternative 2, the modeling is conservative. Emissions are above air quality thresholds; however, the impacts are shown to comply with AAAQS and NAAQS.

Following recent EPA guidance (EPA 2014g) on assessing the ambient impacts of secondary $PM_{2.5}$, Air Sciences Inc. (2015b) determined that no additional evaluation of secondary $PM_{2.5}$ is necessary to conclude that secondary $PM_{2.5}$ from the project will not cause or contribute to a violation of the $PM_{2.5}$ standard or increment.

To estimate $O_3$ impacts, Air Sciences Inc. (2016) conducted a qualitative analysis of $O_3$ concentrations. Air Sciences Inc. compared total NOx and VOC emissions in the Anchorage area to the total emissions from the project. Project maximum NOx emissions are 3,241 tpy and maximum total VOC emissions are 1,279 tpy, for a total of approximately 4,500 tpy. As indicated in Air Sciences Inc. (2016), this is only 17 percent of the combined Anchorage-area $NO_x$ and VOC emissions of approximately 27,000 tpy for 2002. Anchorage monitoring data from 2010 to 2012 indicates that ambient $O_3$ is 45 ppb, well below the 70 ppb 8-hour $O_3$ standard. Because the project $NO_x$ plus VOC emissions are less than Anchorage-area $NO_x$ plus VOC emissions and the Anchorage area is in compliance with the $O_3$ standard, it is expected that the project would also not cause or contribute to a violation of the $O_3$ standard.




DONLIN GOLD PROJECT EIS

LOCATION OF HIGHEST TOTAL AMBIENT IMPACTS

JANUARY 2018

FIGURE 3.8-4

As described earlier, there are three types of mercury air emissions produced by gold mining: elemental mercury vapor ($Hg^0$), gaseous divalent mercury ($Hg^{II}$), and particulate-bound mercury ($Hg_P$). The most common type is $Hg^0$, which is also the longest lived in the atmosphere, and is considered a global pollutant (Environ 2014b). $Hg^{II}$ and $Hg_P$ are more soluble and reactive and settle out of the atmosphere more quickly through wet and dry deposition (discussed below). The mercury source in the Project Area is a stable sulphide mineral called cinnabar (HgS), which has less risk of release to the atmosphere than the elemental form of Hg. However, some fraction of the mercury present in the ore as cinnabar would be liberated during processing; because extreme heat and pressure would be applied to the ore, Hg would be liberated from the ore as a gas. The gas, if not captured, would have the potential to oxidize and methylate. The ore from the project would be from the Kuskokwim gold belt, which contains naturally occurring Hg at an estimated concentration of 1.62 ppm (Environ 2014b).

The three forms of atmospheric inorganic mercury—elemental mercury vapor (Hg0), gaseous divalent mercury (HgII), and particulate-bound mercury—are capable of being modeled by existing air quality models. Emissions, atmospheric transport, chemical transformation, and wet and dry deposition of the three forms of atmospheric inorganic mercury can be simulated, and their air concentrations and depositions can be predicted by the models.

The overall mercury concentrations and depositions in Alaska can be affected by a number of factors. The following factors were considered and applied in respective air quality modeling efforts for the Donlin Gold Project:

- Intercontinental transport of anthropogenic, natural and legacy Hg emissions from around the globe. (Global and regional modeling)
- Local anthropogenic, natural and legacy Hg emissions (Global, regional and local modeling)
- Precipitation patterns and other meteorology (Global, regional and local modeling)
- Forms and physical properties of the atmospheric inorganic mercury (Global, regional and local modeling); and
- Chemical transformation of Hg between Hg(0) to Hg(II) (Global and regional modeling).

In establishing "baseline" mercury (Hg) concentration level in the Donlin Gold Project Area, and assessing impacts due to project operations, Donlin Gold conducted a sequence of air quality modeling to simulate Hg air and deposition concentration. This sequence included:

1. Global-scale modeling using GEOS-Chem model,
2. Regional-scale air quality modeling using CMAQ model, and
3. Local-scale air quality modeling using CALPUFF model.

In areas of uncertainty, conservative assumptions were typically made such that Donlin source contributions were more likely to be over-estimated than under-estimated. AERMOD is the EPA preferred model for distances up to 50 km; however, Lagrangian models, such as CALPUFF, are recommended by EPA for distances greater than 50 km.

Donlin Gold conducted global-scale modeling using the GEOS-Chem model to simulate mercury air (and deposition) concentrations in the Donlin Gold Project Area, and determine the sources contributing to existing Hg levels in the Project Area. Global scale modeling is considered in the Donlin project because it is known that global transport of Hg can be one of dominant sources of Hg in Alaska as well as in Project Area. The GEOS-Chem model is a state-of-the-art global circulation model based on assimilated meteorological observations from one of NASA's satellite systems and has routinely been used for applications in a wide range of atmospheric compositions. The model setup including the specifics of the meteorological simulation are detailed in the modeling reports (Environ 2014c and references therein). Modeling results indicate baseline annual $Hg^0$, $Hg^{II}$, and $Hg_P$ air concentrations of 1.6 ng/m³, 8.6 pg/m³, and 0.43 pg/m³, respectively, in the Donlin Gold Project grid cell for calendar year 2008 (Environ 2014b). The values were refined with regional scale modeling using a complex photochemical grid model (PGM), EPA's Community Modeling Air Quality (CMAQ) system. CMAQ was selected because it is a state-of-the-science air quality model that is extensively applied in conjunction with GEOS-Chem in the U.S. and around the world for regulatory issues, such as ozone and fine particulate matter (PM2.5), as well as for toxic air pollutants, including mercury. CMAQ accounts for the emissions, chemistry, transport and deposition of mercury and other compounds. Donlin Gold used CMAQ system Version 5.0. Regional modeling, also for calendar year 2008, results show baseline $Hg^0$ concentration of 1.45 ng/m³, which is comparable to the measured value of 1.4 ng/m³ shown in Table 3.8-8 (Environ 2013, 2014c).

The previously mentioned Environ 2014b global-scale study simulated total ($Hg^0$, $Hg^{II}$, and $Hg_p$) wet and dry Hg deposition of 11.6 µg/m² for 2008 near the Donlin Gold Project. Environ (2014b) indicates that the largest contribution to deposition is natural (pre-industrial) at 34 percent, followed by legacy (previously deposited human-caused emissions) at 27 percent, anthropogenic from Asia at 23 percent, and North American anthropogenic at less than 5 percent.

These global-scale modeling results were refined in a subsequent regional-scale Hg modeling study (Environ 2014c). Donlin Gold refined the background values from GEOS-Chem modeling results with regional-scale modeling. Two regional-scale simulations were conducted using CMAQ – one that incorporated an algorithm accounting for bidirectional Hg emission and re-emissions of mercury, and one that did not. The purpose of the first simulation was for model evaluation. The purpose of the second simulation (with no algorithm) was to estimate representative baseline levels of $Hg^0$ and $Hg_P$ dry deposition.

These baseline values developed via the CMAQ modeling are used for assessing project impacts of Donlin <u>process stack</u> and <u>fugitive sources</u> of Hg on atmospheric <u>concentrations</u> and <u>depositions (dry and wet)</u> using the non-steady state Lagrangian puff transport and dispersion model, CALPUFF. Although there is no regulatory-default Hg model, CALPUFF is appropriate for this analysis because it is an EPA screening technique for long-range transport and has been applied to previous Hg studies. CALPUFF required these inputs as it does not consider bidirectional Hg deposition and re-emissions. The estimated stack and fugitive emissions constitute 63 percent and 37 percent, respectively, of the total Donlin Hg emissions inventory of 91 kg/yr. Fugitive gaseous and dust Hg emissions constitute 35 percent and 2 percent (Environ, 2015). Gaseous Hg air emissions from four fugitive source categories: 1) tailings storage facility, 2)waste rock facility, 3) ore stockpile, and 4) open pit – were estimated using data and methods from the Eckley studies in Nevada (Eckley et al. 2011a, 2011b) in addition to Donlin-specific solar radiation, air temperature and geochemistry/Hg content data. Tailings emissions constitute approximately 90 percent of the total fugitive emissions.

The three forms of inorganic atmospheric Hg—Hg(0), Hg(II) and Hg(p)—were simulated in CALPUFF including their emissions from Donlin sources, atmospheric dispersion and wet and dry deposition. Neither chemical transformations of Hg nor re-emissions from land/water surface were considered, so the overall results could be conservative (i.e., over-estimated). The resulting total baseline Hg deposition is 8.4 µg/m$^2$ at Camp (obtained by "adding measured baseline annual wet deposition of total Hg [2.6 µg/m$^2$ at Camp] and dry deposition of $Hg^{II}$ [1.5 µg/m$^2$ at Camp] to the CMAQ-modeled dry deposition of other species [3.78 µg/m$^2$ plus 0.50 µg/m$^2$]" (Environ 2014c), and 7.8 µg/m$^2$ at Crooked Creek Village (Environ 2014c).

For mercury deposition impacts from the project, Donlin Gold used meteorological data for 2008 from the Weather Research and Forecast model, with a grid resolution of 4 km (Environ 2012). Mercury concentrations were estimated at discrete and gridded receptors in the Project Area (Crooked Creek and Aniak).

Table 3.8-24 shows the ambient air modeling results for $Hg^0$ for comparison to EPA and World Health Organization (WHO) guidelines. The maximum modeled impact is less than one percent of the guidelines shown.

**Table 3.8-24: Mercury Ambient Modeling Results Estimated Using CALPUFF**

| Guideline Authority | Guideline Type | Time Period | Guideline Limit | Observed Baseline at Camp ($Hg^0$) | Maximum Modeled Concentration due to Stack and Fugitive Sources ($Hg^0$) | Total ($Hg^0$) | Percent of Guideline (%) |
|---|---|---|---|---|---|---|---|
| **EPA**[a] | Chronic Inhalation Exposure | Annual Average | 0.3 µg/m$^3$ | 0.0014 µg/m$^3$ | 0.00027 µg/m$^3$ | 0.00167 µg/m$^3$ | 0.56 |
| **WHO**[b] | No observed adverse effect | Annual Average | 0.2 µg/m$^3$ | 0.0014 µg/m$^3$ | 0.000075 µg/m$^3$ | 0.00167 µg/m$^3$ | 0.84 |
| **EPA**[c] | Acute Inhalation Exposure | Max 1-hr | 1.7 mg/m$^3$ | 0.000002 mg/m$^3$ | 0.000075 mg/m$^3$ | 0.000077 mg/m$^3$ | 0.0045 |

**Notes:**
a EPA Integrated Risk Information System (IRIS) (EPA 2014b).
b World Health Organization (WHO 2003).
c EPA Acute exposure guideline levels for mercury vapor (EPA 2010b).

$Hg^0$ = Elemental Hg vapor, also known as gaseous elemental Hg
µg/m$^3$ = microgram per cubic meter
mg/m$^3$ = milligram per cubic meter

Source: EPA 2010b, 2014b; WHO 2003; Environ 2015.

The geographic distribution of predicted ambient air concentrations of annual average $Hg^0$ and 1-hour peak $Hg^0$ from the stack and fugitive sources at the Mine Site are shown on Figures 3.6-5 and 3.8-6, respectively. Note that the units representing the ambient Hg concentrations are different for the two figures.

Table 3.8-25 shows the project's predicted stationary source (due to stacks) and fugitive Hg deposition based on CALPUFF modeling results. The maximum annual predicted contribution from the project's stack and fugitive sources is 4.7 µg/m². Baseline deposition is 8.4 µg/m²; the project's sources could increase deposition by up to 56 percent in some areas (Environ 2013, 2015). There are no standards or guidelines for Hg deposition.

**Table 3.8-25: Annual Maximum Mercury Deposition Modeling Results estimated using CALPUFF**

| Location | $Hg^0$, $Hg^{II}$, and $Hg_p$ Deposition due to Stacks (µg/m²) | $Hg^0$ and $Hg_p$ Deposition due to Fugitives (µg/m²) | Maximum Total Hg Deposition due to All Sources (µg/m²) |
|---|---|---|---|
| Eta – Crooked Creek HUC12 Watershed | 0.5 | 4.2 | 4.7 |

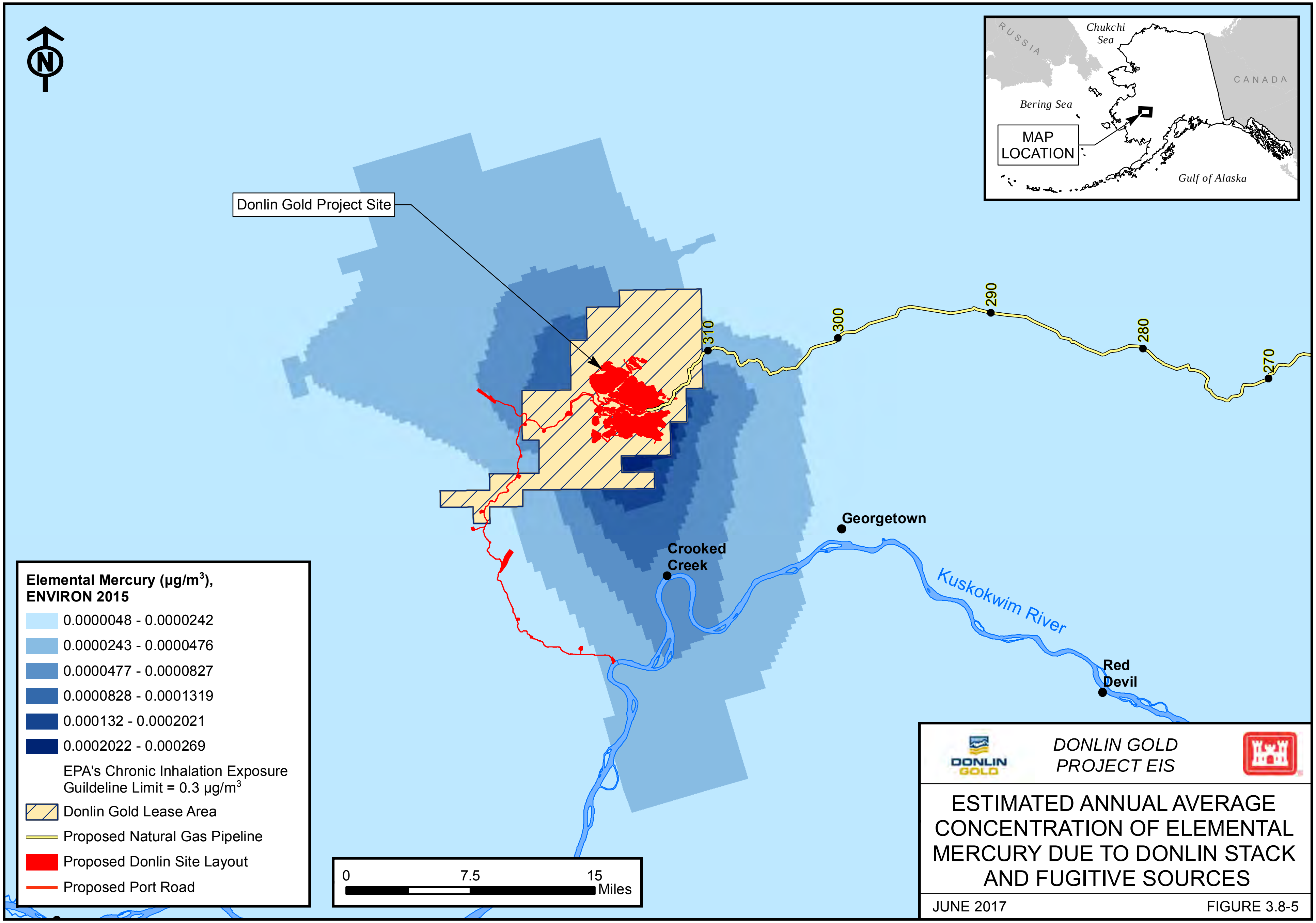
**Notes:**
$Hg^0$ = Elemental Hg vapor, also known as gaseous elemental Hg
$Hg^{II}$ = Gaseous divalent Hg, also known as gaseous oxidized mercury or reactive gaseous Hg
$Hg_p$ = Particle bound Hg
µg/m² = microgram per square meter
Source: Environ 2015.

The geographic distribution of predicted concentrations of annual total Hg deposition flux from the stack and fugitive sources at the Mine Site are shown on Figure 3.8-7.

The different forms of Hg ($Hg^0$, $Hg^{II}$, and $Hg_p$) have different chemical and physical characteristics, which affect their deposition rates (Environ 2015).

EPA (2014a) indicates that natural gas power plants have negligible Hg emissions; therefore, the project's incremental Hg emissions would largely be a result of mining activities.

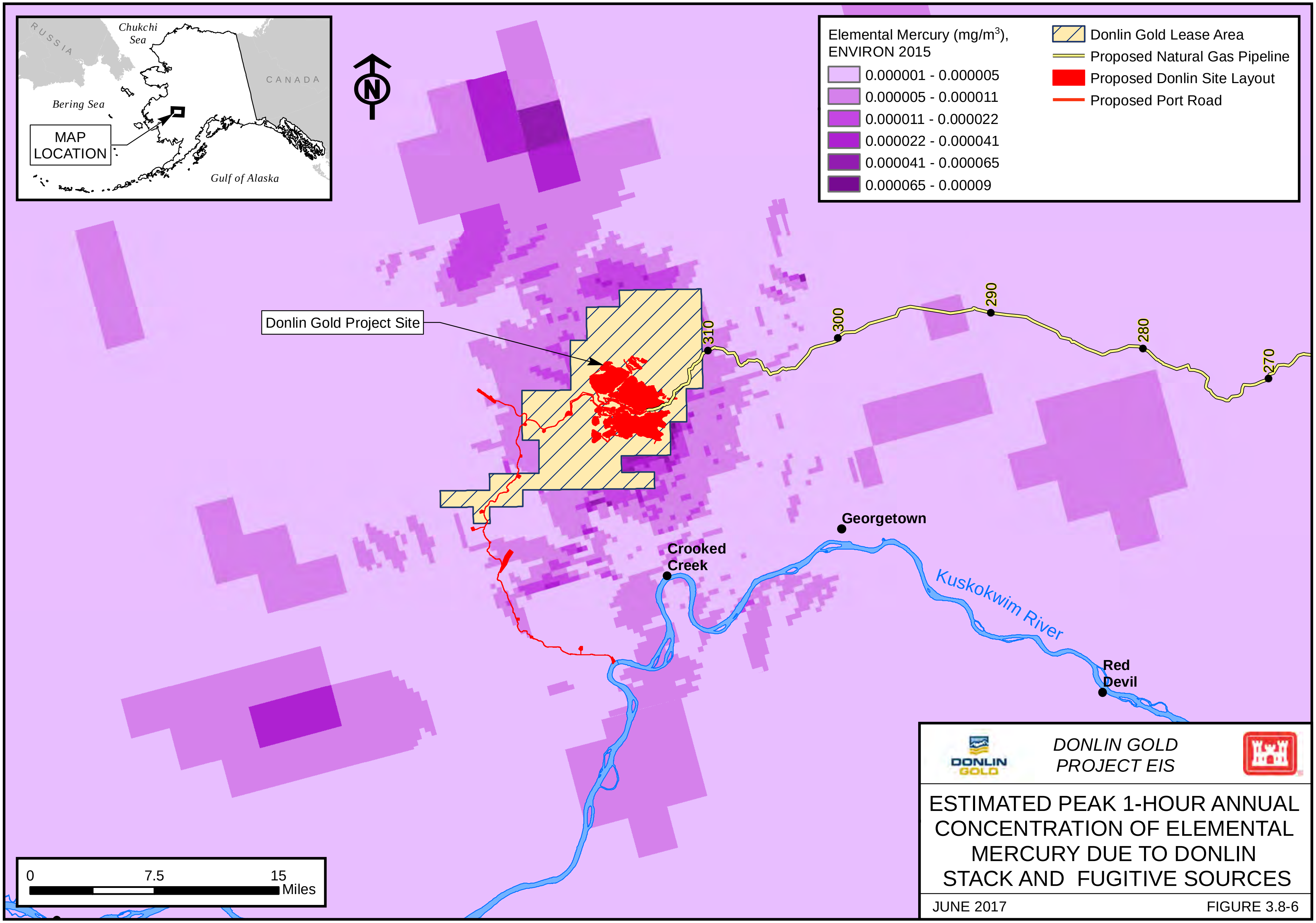
As with the Construction Phase, indirect air quality impacts associated with the Operations Phase of the Mine Site would result from emissions associated with transporting supplies and construction materials to the Mine Site and from the oil and gas production and refining required to generate the fuel used to power project sources. There are currently no defined methodologies for estimating indirect emissions from oil and gas production and refining. Estimating emissions from oil and gas production and refining is highly dependent on the design, operation, and product composition; for fuel purchased on an open market the supplier will likely vary over time based on availability and economics. The impacts from transporting supplies would be associated with the Transportation Corridor and are discussed in that section.




ESTIMATED ANNUAL AVERAGE CONCENTRATION OF ELEMENTAL MERCURY DUE TO DONLIN STACK AND FUGITIVE SOURCES

JUNE 2017

FIGURE 3.8-5




DONLIN GOLD
PROJECT EIS

ESTIMATED PEAK 1-HOUR ANNUAL CONCENTRATION OF ELEMENTAL MERCURY DUE TO DONLIN STACK AND FUGITIVE SOURCES

JUNE 2017

FIGURE 3.8-6

## Closure

Donlin Gold's goals for reclamation of the Mine Site during and after operations include shaping, vegetating, and stabilizing the land for post-reclamation land use (SRK 2015g). Some reclamation activities would occur concurrently with project activities during the Operations Phase, thus mitigating impacts during that phase.

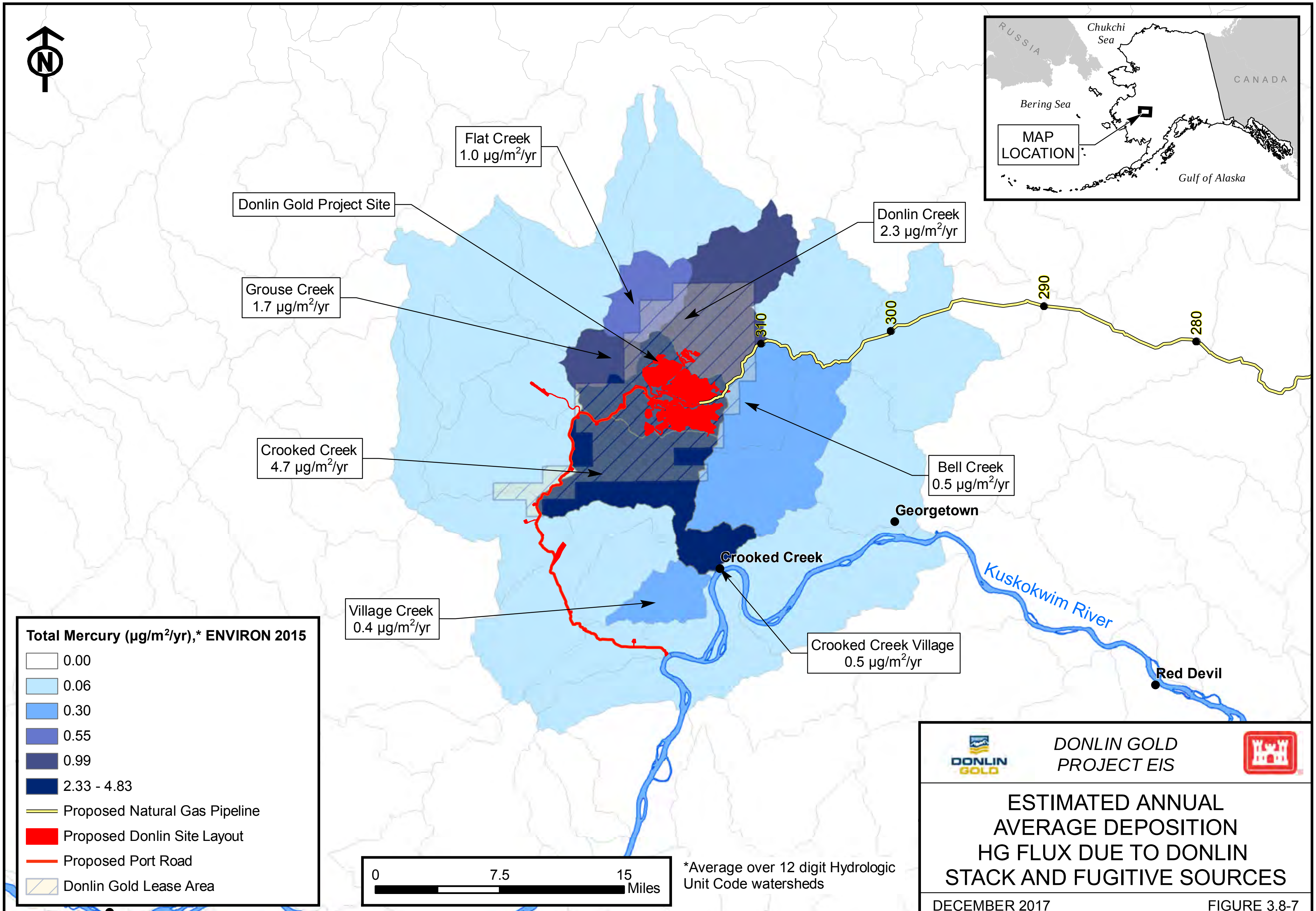
Closure and reclamation activities such as reclaiming roads (although some roads would remain for post-reclamation monitoring); backfilling the pit and stabilizing pit highwalls; grading, contouring and restoring the WRF; covering the tailings impoundment; and removing material, equipment, and buildings would require considerable grading including soil amendments and revegetation as necessary. These activities would continue for a period of five years after operations cease (SRK 2015g).

Post-reclamation monitoring activities would continue beyond this timeframe. For example, one small generator would remain at the Mine Site to operate the post-reclamation water treatment plant until such time as the discharge meets water quality standards, and the airstrip would remain as a long term facility. Additional post-reclamation phase emissions would result from vehicle traffic on unpaved roads due to monitoring activities at the open pit, TSF, and WRF (SRK 2016d). These impacts would last longer than four years and would occur within the footprint of the Mine Site and impacts are anticipated to occur primarily within those limits.

Direct impacts to air quality would be caused by air emissions from fugitive, mobile, and stationary sources; the estimated emissions are summarized in Table 3.8-26 during the Closure Phase.

As there are only minimal emissions from stationary sources during the Closure Phase, air permitting would not be required. Total estimated annual emissions from Mine Site Closure are less than total estimated annual emissions from Mine Site Operations which were shown to have modeled impacts below required thresholds. Thus, impacts are expected to meet regulatory standards.

There would also be indirect air quality impacts associated with the Closure Phase of the Mine Site because transportation of supplies and employees would still occur. These impacts would be associated with the Transportation Corridor component through occasional barge, aircraft, or vehicle use during closure.




DONLIN GOLD
PROJECT EIS

ESTIMATED ANNUAL AVERAGE DEPOSITION HG FLUX DUE TO DONLIN STACK AND FUGITIVE SOURCES

DECEMBER 2017

FIGURE 3.8-7

**Table 3.8-26: Maximum Annual Mine Site Closure Phase Emissions**

| Emissions Source | CO (tpy) | $NO_x$ (tpy) | $PM_{2.5}$ (tpy) | $PM_{10}$ (tpy) | PM (tpy) | $SO_2$ (tpy) | VOC (tpy) | HAPs (tpy) | Hg[d] (tpy) | Pb[d] (tpy) | As[d] (tpy) | HCN[d] (tpy) | Sb[d] (tpy) | $CO_2$-e (tpy) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Fugitive[a]** | 0.0 | 0.0 | 40 | 264 | 527 | 0.0 | 0.0 | 0.5 | 0.0003 | 0.006 | 0.08 | nc | 0.003 | 0[e] |
| **Mobile[b]** | 967 | 759 | 10 | 10 | 20 | 0.3 | 52 | 2 | 0.0 | nc | nc | nc | nc | 192,400 |
| **Stationary[c]** | 9 | 1 | 0.1 | 0.1 | 0.1 | 0.0 | 0.5 | 0.1 | 0.0 | nc | nc | nc | nc | 1,800 |
| **Total** | **976** | **760** | **49** | **273** | **537** | **0** | **53** | **2** | **0.0003** | 0.006 | 0.08 | nc | 0.003 | **194,300** |

**Notes:**

a Fugitive sources consist of disturbed areas subject to wind erosion, assuming exposed surface derived from waste material composite sample and 80 percent control efficiency. Fugitive dust from vehicle traffic on unpaved roads is not included (Rieser 2014d).

b Mobile sources consist of front-end loaders (8), water truck (2), hydraulic excavators (4), drill rigs (1), track dozers (8), graders (2), mobile cranes (5), low boy truck (4), and backhoes (4), assuming 8,760 hours per year usage (Fernandez 2014f). Tailpipe emissions from vehicle traffic are not included (Rieser 2014d).

c Stationary sources consist of one 275 kW generator (Rieser 2014e).

d Hg, Pb, As, HCN, and Sb are also a subset of HAPs emissions. Additional information on the impacts from deposition of these pollutants is provided in Section 3.2, Soils, and Section 3.7, Water Quality.

e There are no additional fugitive GHG emissions expected from dewatered wetlands or permafrost degradation or removal during closure or post-closure of the mine (AECOM 2017e).

CO = Carbon monoxide
$CO_2$-e = Carbon dioxide equivalent
HAPs = Hazardous air pollutants
Hg = Mercury
nc = not calculated (negligible)
Pb = Lead
As = Arsenic
HCN = Hydrogen cyanide
Sb = Antimony
PM = Total suspended particulate matter
$NO_x$ = Oxides of nitrogen
$PM_{2.5}$ and $PM_{10}$ = Particulate matter with an aerodynamic diameter less than or equal to 2.5 and 10 micrometers, respectively
$SO_2$ = Sulfur dioxide
tpy = tons per year
VOC = Volatile organic compounds

Source: Fernandez 2014f; Rieser 2014d, e; Cardno 2015b; AECOM 2017e.

## Summary of Mine Site Impacts

In terms of intensity, impacts to air quality would be below thresholds, with impacts meeting regulatory standards for the Construction and Closure Phases. During operations, impacts would be above thresholds but meeting regulatory standards. During the Construction and Closure Phases, air quality would be reduced infrequently and would be expected to return to pre-activity levels at the completion of the activity. However, impacts would persist through life of project during Mine Site Operations and for Mine Site post-reclamation activities. The extent or scope of impacts would be limited to discrete portions of the Project Area. In terms of context, the location is in an attainment / unclassified area.

### 3.8.3.3.2 TRANSPORTATION CORRIDOR

The Project Area for the Transportation Corridor is the ROW width of the roads, the property boundary of the Angyaruaq (Jungjuk) Port, the area of the Bethel Port expansion (connected action), the airstrip property boundary (and up to 3,000 feet in altitude), and the bank width of the river. Impacts occurring within the Project Area are considered direct impacts. The EIS Analysis Area includes the airport of origin and flight path for air traffic; for water transportation the EIS Analysis Area includes the existing Bethel Port, the Dutch Harbor Port and the ocean traffic lane from the Aleutian chain to Bethel. Impacts in the EIS Analysis Area are considered indirect impacts. Any actions that would occur at Dutch Harbor or the Port of Bethel at the Bethel Yard Dock are not part of the proposed action, and are considered connected actions (see Section 1.2.1, Connected Actions, in Chapter 1, Project Introduction and Purpose and Need).

Construction of Transportation Corridor subcomponents is estimated to occur in the first year of the project. The Transportation Corridor would be operational through the life of the project.

Emissions of Hg are not expected to be of concern for the Transportation Corridor, as no ore would be handled. However, lead would likely be emitted from the use of aviation gasoline (avgas) in aircraft.

## Land and Air Transportation

Fuel and general cargo would be transported by road from the Angyaruaq (Jungjuk) Port site to the Mine Site on the Angyaruaq (Jungjuk) mine access road. As shown on Figure 2.3-12 (Chapter 2, Alternatives), the mine access road would be a 30-mile, two-lane, 30-foot wide, all-season gravel road starting at the mine and ending at the Angyaruaq (Jungjuk) Port site near the mouth of Jungjuk Creek. There would be a three-mile-long spur road that connects the proposed airstrip to the mine access road. The mine camp facilities would be located on the mine access road. Use of these roads would be limited to mine support traffic; public use would not be allowed (SRK 2013a). Fuel would be transported using a fleet of 13,500-gallon capacity B-train tanker trucks, and general cargo using a fleet of B-train tractor-trailer units (SRK 2013a).

The Transportation Corridor would also include a 5,000-foot by 150-foot gravel airstrip located approximately nine miles west of the Mine Site. Two 200-kW diesel generators would be located at the airstrip, along with three 9,900-gallon storage tanks (one containing ULSD for the generators, and the others containing Jet "A" fuel and avgas), and a 5,000-gallon diesel storage tank). The airstrip would be used for transportation of personnel, perishable goods, and emergency re-supply of cargo goods (SRK 2013a).

The proposed 21-acre Angyaruaq (Jungjuk) Port site, located near the mouth of Jungjuk Creek would serve as a main terminal for river barges from the Bethel Port and a transfer point for cargo going to the mine site. Facilities would include barge berths; barge ramp; container handling equipment; seasonal storage for containers, break bulk cargo and fuel; and barge-season office/lunchroom facilities. Electricity would be provided by two 1,200-kW diesel generators (one primary and one standby). The site would include a 252 horsepower emergency firepump, 2.8 Mgal storage tank for diesel fuel, a 25,000-gallon diesel fuel dispenser tank, a 25,000-gallon port equipment tank, and a 270-gallon fire pump tank (SRK 2013a; Fernandez 2013c).

The existing Bethel Port site would be used for fuel and material transport and storage, as a connected action. A new 16-acre cargo terminal; 3.5-acre infrastructure for buildings, access roads, and other support facilities; and additional 4 Mgal fuel storage site are proposed at the Bethel Port. During shipping season, the cargo and fuel terminals would operate full time (SRK 2013a). Any actions that would occur at Dutch Harbor or the Port of Bethel at the Bethel Yard Dock are not part of the proposed action, and are considered connected actions (see Section 1.2.1, Connected Actions, in Chapter 1, Project Introduction and Purpose and Need).

The existing Dutch Harbor Port site is a forward deployment location used for cargo transport and fuel storage. About 8 Mgal of fuel storage would be constructed for the project. No other additional facilities would be constructed at the Dutch Harbor Port (SRK 2013a; AMEC 2013).

### *Construction*

Construction activities would include clearing, grubbing, and earthwork for installation of the access roads, airstrip, and ports. Disturbed areas consist of the permanent camp, airstrip, material sites, mine access road, and the airport spur road. Emissions from open burning are not included in emissions estimates for facility construction because it is not expected to occur (Rieser 2014c). Reclamation of borrow pits is anticipated to occur concurrently with these activities, reducing the exposed area. The use of heavy equipment would be expected to result in fugitive dust and tailpipe emissions in the local vicinity of the activity. Air transportation during construction includes operation of fixed wing aircraft and rotary wing aircraft (helicopters) (Fernandez 2014f). Impacts from aircraft would result from combustion of fuel in the aircraft.

Direct impacts to air quality would be caused by fugitive and mobile sources; the estimated emissions are summarized in Table 3.8-26. Note that this table covers the entire Construction Phase. Direct impacts from aircraft consist of the emissions generated from landings and take-offs (LTOs) at the Donlin Gold airstrip only. An LTO cycle includes all normal operations performed by an aircraft between the time it descends through an altitude of 3,000 feet on its approach and the time it subsequently reaches the 3,000-foot altitude after takeoff (EMEP 2013). Note that direct impacts would also occur from expanding the Bethel Port; however, specific information on construction equipment is not available for the Bethel Port (Fernandez 2014f). The emissions that would be caused by expanding the existing Bethel Port by 3.5 acres were estimated by prorating the diesel machinery and windblown dust emissions that would be caused by construction of the new 21-acre Angyaruaq (Jungjuk) Port. The direct emissions expected from expanding the Bethel Port are included in Table 3.8-27.

**Table 3.8-27: Land and Air Transportation Construction Phase Emissions[e]**

| Emissions Source | CO (tons) | $NO_x$ (tons) | $PM_{2.5}$ (tons) | $PM_{10}$ (tons) | PM (tons) | $SO_2$ (tons) | VOC (tons) | HAPs (tons) | Hg[c] (tons) | Pb[c] (tons) | As[c] (tons) | HCN[c] (tons) | Sb[c] (tons) | $CO_2$-e[d] (tons) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fugitive[a] | 20 | 0.5 | 152 | 1,396 | 4,940 | 0.0 | 0.0 | 5 | 0.003 | 0.05 | 0.7 | nc | 0.03 | 100 |
| Mobile[b] | 1,314 | 226 | 8 | 8 | 8 | 5 | 83 | 3 | nc | 0.02 | nc | nc | nc | 301,500 |
| **Total** | **1,334** | **227** | **161** | **1,404** | **4,948** | **5** | **83** | **8** | 0.003 | **0.07** | 0.7 | nc | 0.03 | **301,600** |

**Notes:**

a Fugitive sources consist of disturbed areas subject to wind erosion, material handling, drilling, vehicles traveling on roads, dozing and grading, and blasting (Cardno 2015a, c; AECOM, 2017a). Estimates assume 90 percent control efficiency applied to dust generated from unpaved roads due to vehicle miles traveled (VMT). Fugitive GHGs result from permafrost degradation (AECOM 2017e).

b Mobile sources consist of tailpipe emissions from construction equipment, (Cardno 2015a, c; AECOM 2017a; Fernandez 2014f).

c Hg, Pb, As, HCN, and Sb are also a subset of HAPs emissions. Additional information on the impacts from deposition of these pollutants is provided in Section 3.2, Soils, and Section 3.7, Water Quality.

d $CO_2$-e emissions calculated assuming 3 years of construction.

e The emissions in this table cover the entire Construction Phase.

CO = Carbon monoxide
$CO_2$-e = Carbon dioxide equivalent
HAPs = Hazardous air pollutants
$NO_x$ = Oxides of nitrogen
Pb = Lead
$PM_{2.5}$ and $PM_{10}$ = Particulate matter with an aerodynamic diameter less than or equal to 2.5 and 10 micrometers, respectively.
$SO_2$ = Sulfur dioxide
tpy = tons per year
VOC = Volatile organic compounds
nc = not calculated
Hg = Mercury
As = Arsenic
HCN = Hydrogen cyanide
Sb = Antimony

Source: SRK 2015g; Fernandez 2014f; Tripod 2014; FAA 2009, 2012; Airlines Inform 2012; EPA 2009c, 2010c; EMEP 2013; CR 2014; Cardno 2015a, c; AECOM, 2017a, e.

Transportation Corridor Land and Air Construction Phase emissions are primarily due to non-road diesel engines and/or aircraft which are regulated as outlined in Section 3.8.1.3.8. The land and air Transportation Corridor impacts would occur along the access road, airstrip and air traffic. As there would be no emitting units classified as stationary sources during the Construction Phase, air permitting would not be required. Total estimated annual emissions from Land and Air Transportation Construction are less than total estimated annual emissions from Mine Site Operations which were shown to have modeled impacts below required thresholds. Thus, impacts are expected to meet regulatory standards.

Indirect air quality impacts associated with the Construction Phase would result from LTO and cruise operations for air traffic between Anchorage (or other point of origin) and the airstrip. Cruise operations are defined as all activities that take place above 3,000 feet, including climb from the end of climb-out in the LTO cycle to the cruise altitude, cruise and the descent from the cruise altitude to the start of the LTO operations of landing (EMEP 2013). There would be additional indirect air quality impacts associated with the Construction Phase of the Angyaruaq (Jungjuk) and Bethel ports, due to transportation of supplies and employees. There would also be indirect impacts associated with construction activities at Dutch Harbor Port. Any actions that would occur at Dutch Harbor or the Port of Bethel at the Bethel Yard Dock are not part of the proposed action, and are considered connected actions (see Section 1.2.1, Connected Actions, in Chapter 1, Project Introduction and Purpose and Need).

### *Operations*

During the Operations Phase, the mine access road and airstrip access roads would be used as follows:

- Mine Access Road – transporting cargo, maintenance equipment, fuel, and personnel from Angyaruaq (Jungjuk) Port to the Mine Site using container trucks, tanker trucks, and light vehicles. Graders and water trucks will be used for maintenance;
- Camp to Mine Site – transporting personnel and goods from the camp to Mine Site using the mine access road; vehicles would include buses and light vehicles. Graders and water trucks will be used for maintenance; and
- Airport to Camp – transporting personnel and goods from the camp to the airport using the mine access road and the airstrip road; vehicles would include buses and light vehicles. Graders and water trucks will be used for maintenance (Air Sciences Inc. 2016).

Air transportation during operations includes operation of fixed wing aircraft and helicopters (Fernandez 2014f). Impacts would result from fugitive dust due to wind erosion of the airstrip, combustion of fuel in the generators, and combustion of fuel in the aircraft

The Angyaruaq (Jungjuk) and Bethel ports would be used for cargo transportation during the 110-day, ice-free barging season. During the winter, activities would be limited to facilities maintenance via road to the mine site (SRK 2013a).

Direct impacts to air quality during this phase would be caused by air emissions from fugitive, mobile, and stationary sources; the estimated emissions are summarized in Table 3.8-28 does not include Bethel Port direct emissions because data is not available.

Land and Air Transportation Corridor Operations Phase emissions are primarily due to non-road diesel engines and/or aircraft which are regulated as outlined in Section 3.8.1.3.8. As there are minimal emissions from emitting units classified as stationary sources during the Construction Phase, air permitting would not be required. Total estimated annual emissions from Land and Air Transportation Operations are less than total estimated annual emissions from Mine Site Operations which were shown to have modeled impacts below required thresholds. Thus, impacts are expected to meet regulatory standards.

Indirect air quality impacts associated with the Operations Phase would result from LTO and cruise operations for air traffic between Anchorage (or other point of origin) and the airstrip and cargo activities/fuel storage at the Dutch Harbor Port. There would be additional indirect air quality impacts associated with the Operations Phase of the Angyaruaq (Jungjuk) and Bethel ports, due to transportation of supplies and employees.

There are no direct impacts to air quality at the Dutch Harbor Port. Indirect impacts to air quality during this phase would be caused by air emissions from mobile and stationary sources.

The land and air Transportation Corridor impacts would occur along the access road, airstrip and air traffic.

**Table 3.8-28: Annual Land and Air Transportation Operations Phase Emissions**

| Emissions Source | CO (tpy) | $NO_x$ (tpy) | $PM_{2.5}$ (tpy) | $PM_{10}$ (tpy) | PM (tpy) | $SO_2$ (tpy) | VOC (tpy) | HAPs (tpy) | Hg (tpy) | Pb[d] (tpy) | As (tpy) | HCN (tpy) | Sb (tpy) | $CO_2$-e (tpy) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fugitive[a] | 0.0 | 0.0 | 4 | 36 | 142 | 0.0 | 0.0 | 0.0 | nc | 0.0 | nc | nc | nc | 30 |
| Mobile[b] | 204 | 42 | 1 | 1 | 1 | 0.8 | 0.6 | 0.5 | nc | 0.002 | nc | nc | nc | 40,100 |
| Stationary[c] | 98 | 10 | 0.5 | 0.5 | 0.5 | 0.2 | 5 | 0.4 | nc | 0.0 | nc | nc | nc | 18,900 |
| **Total** | **303** | **52** | **5** | **40** | **144** | **1** | **6** | **1.0** | **nc** | **0.002** | **nc** | **nc** | **nc** | **59,100** |

**Notes:**

a Fugitive sources consist of disturbed areas subject to wind erosion, and vehicle traffic on unpaved roads (Cardno 2015c). During operations, 90 percent control efficiency was applied to fugitive dust generated from unpaved roads (access roads) (SRK 2015g). Fugitive GHGs result from permafrost degradation (AECOM 2017e).

b Mobile sources consist of tailpipe emissions from buses, light weight vehicles, water trucks, graders, tanker trucks, and container trucks -and mobile harbor cranes (2), wheel-loader, forklift (5 ton), forklift (30 ton container handling) (4), pick-up (4x4) (6), container trailers (20), semi-trailer tractor (14), terminal tractors (4), highboy trailer, fuel truck (Cardno 2015c; Fernandez 2014f).

c Stationary sources consist of airport generators (2 @ 200 kilowatt-electric) and fuel storage tanks; Angyaruaq (Jungjuk) Port generators (2 @ 1,200 kilowatt-electric), firepump (500 hours per year), and fuel storage tanks (Cardno 2015c; Fernandez 2013c).

d Hg, Pb, As, HCN, and Sb are also a subset of HAPs emissions. Additional information on the impacts from deposition of these pollutants is provided in Section 3.2, Soils, and Section 3.7, Water Quality.

As = Arsenic
CO = Carbon monoxide
$CO_2$-e = Carbon dioxide equivalent
HAPs = Hazardous air pollutants
Hg = Mercury
nc = not calculated (negligible)
Pb = Lead
$NO_x$ = Oxides of nitrogen
PM = Total suspended particulate matter
$PM_{2.5}$ and $PM_{10}$ = Particulate matter with an aerodynamic diameter less than or equal to 2.5 and 10 micrometers, respectively
Sb = Antimony
$SO_2$ = Sulfur dioxide
tpy – Tons per year
VOC = Volatile organic compounds

Sources: Cardno 2015c; SRK 2015g; Tripod 2014; FAA 2009, 2012; Airlines Inform 2012; EPA 2009d, 2010c; EMEP 2013; AECOM 2017e.

### *Closure*

The proposed access roads would be used for long-term monitoring at the Mine Site. The road traffic associated with monitoring activities is anticipated to be significantly less than either Construction or Operations phases. The roads would not be reclaimed after mine operations cease, so there would be no impacts to air quality due to reclamation activities. The impacts due to monitoring activities would last for at least 50 years.

The Angyaruaq (Jungjuk) Port and proposed airstrip would be used for long-term monitoring at the Mine Site. The air traffic associated with monitoring activities is anticipated to be significantly less than either Construction or Operations phases. The Angyaruaq (Jungjuk) Port would be partially reclaimed by removing sheet piles and fill and recontouring the area (SRK 2015g). This could result in short term emissions during these reclamation activities. The airstrip would not be reclaimed after mine operations cease, so there would be no impacts to air quality due to reclamation activities. The impacts due to monitoring activities[15] post-closure would last for at least 50 years.

It is unlikely that the Bethel and Dutch Harbor port sites would be reclaimed upon project closure. Therefore, it is anticipated that no air quality impacts would occur due to project closure and reclamation activities for either site.

## Water Transportation

The following sections describe direct impacts from river traffic as well as indirect impacts from ocean barge traffic. There would be an increase in ocean and river barge traffic from transporting cargo and fuel supplies during the Mine Site Construction and Operations Phases.

Ocean barges would transport general cargo from Seattle, Washington, Vancouver, British Columbia, or Dutch Harbor to Bethel, and fuel from refineries in the Pacific Northwest to Dutch Harbor for storage and then to Bethel. Ocean barging could occur all year. For purposes of this EIS, ocean barging impacts are considered indirect impacts.

River barges transport the general cargo and fuel on the Kuskokwim River from Bethel to Angyaruaq (Jungjuk) Port. River barging could only occur during the ice-free season, assumed to be about 110 days (AMEC 2013). Impacts of river barges are considered to be direct impacts.

### *Construction*

Construction Phase activities would require river fuel barges (19 round trips annually for two sets of barges), river general cargo barges (50 round trips annually for two sets of barges), ocean fuel barges (10 round trips annually), and ocean general cargo barges (16 round trips annually) (Rieser 2014b, assuming Construction Phase river barging same as operations barging). Impacts would vary from local (Kuskokwim River) to regional in extent (ocean barging).

Direct impacts on air quality would be caused by air emissions from mobile sources; the estimated emissions are summarized in Table 3.8-29.

---

[15] Mine site monitoring of groundwater is described in Section 3.6.

### Table 3.8-29: Annual River Traffic Construction Phase Emissions

| Emissions Source | CO (tpy) | $NO_x$ (tpy) | $PM_{2.5}$[c] (tpy) | $PM_{10}$ (tpy) | PM (tpy) | $SO_2$[d] (tpy) | VOC (tpy) | HAPs[e] (tpy) | Hg[e] (tpy) | Pb[e] (tpy) | As[e] (tpy) | HCN[e] (tpy) | Sb[e] (tpy) | $CO_2$-e (tpy) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Fugitive**[a] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | nc | nc | nc | nc | nc | nc | 100 |
| **Mobile**[b] | 76 | 148 | 9 | 9 | nc | 0.1 | 8 | nc | nc | nc | nc | nc | nc | 10,600 |
| **Total** | 76 | 148 | 9 | 9 | 0 | 0 | 8 | nc | nc | nc | nc | nc | nc | 10,700 |

**Notes:**
a Fugitive GHGs result from permafrost degradation near port facilities (AECOM 2017e).
b Mobile sources consist of river barges (Cardno 2015c; AMEC 2013; Rieser 2014b).
c $PM_{2.5}$ EF is assumed 97 percent of $PM_{10}$.
d $SO_2$ EF is based on 1.5 percent diesel fuel sulfur content.
e HAPs, including Hg, Pb, As, HCN, and Sb, emissions from barges not calculated, assumed impacts to be negligible due to low VOC emissions. Additional information on the impacts from deposition of these pollutants is provided in Section 3.2, Soils, and Section 3.7, Water Quality.

As = Arsenic
CO = Carbon monoxide
$CO_2$-e = Carbon dioxide equivalent
HAPs = Hazardous air pollutants
HCN = Hydrogen cyanide
$NO_x$ = Oxides of nitrogen
nc = not calculated
PM = Total suspended particulate matter
$PM_{2.5}$ and $PM_{10}$ = Particulate matter with an aerodynamic diameter less than or equal to 2.5 and 10 micrometers, respectively
Sb = Antimony
$SO_2$ = Sulfur dioxide
tpy = tons per year
VOC = Volatile organic compounds

Sources: Cardno 2015c; AMEC 2013; Rieser 2014b; EPA 2009c; AECOM 2017e.

There would be no emitting units classified as stationary sources during the Construction Phase so no air quality permit would be required. Air emissions would be primarily mobile in nature and subject to federal regulations that govern mobile sources. Total estimated annual emissions from River Traffic Transportation Construction are less than total estimated annual emissions from Mine Site Operations which were shown to have modeled impacts below required thresholds. Thus, impacts are expected to meet regulatory standards.

Indirect impacts would occur from ocean barging between Pacific Northwest to Dutch Harbor and Bethel. The indirect $CO_2$-e emissions associated with annual Construction Phase are summarized in Table 3.8-30.

### Table 3.8-30: Annual Ocean Traffic Construction Phase Indirect Emissions

| Emissions Source | $CO_2$-e (tpy) |
|---|---|
| Mobile[a] | 23,600 |
| **Total** | 23,600 |

**Notes:**
a Mobile sources consist of ocean going vessels, including general cargo and fuel barges and associated tugboats (Cardno 2015c; AMEC 2013; Rieser 2014b). All emissions are indirect; hence, only $CO_2$-e emissions are provided.
$CO_2$-e = Carbon dioxide equivalent

Source: Cardno 2015c; AMEC 2013; Rieser 2014b; EPA 2009c.

Water Transportation Corridor subcomponent impacts would occur in proximity to the ports and vessel traffic.

### *Operations*

Operations Phase activities would require river fuel barges (58 round trips annually), river general cargo barges (64 round trips annually), ocean fuel barges (14 round trips annually), and ocean general cargo barges (12 round trips annually) (SRK 2013a; Rieser 2014b). Impacts would occur due to river barging on Kuskokwim River and / or ocean barging.

Direct impacts on air quality would be caused by air emissions from mobile sources as shown in Table 3.8-31.

**Table 3.8-31: Annual River Traffic Operations Phase Emissions**

| Emissions Source | CO (tpy) | $NO_x$ (tpy) | $PM_{2.5}$[c] (tpy) | $PM_{10}$ (tpy) | PM (tpy) | $SO_2$[d] (tpy) | VOC (tpy) | HAPs[e] (tpy) | Hg[e] (tpy) | Pb[e] (tpy) | As[e] (tpy) | HCN[e] (tpy) | Sb[e] (tpy) | $CO_2$-e (tpy) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fugitive[a] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | nc | nc | nc | nc | nc | nc | 30 |
| Mobile[b] | 100 | 196 | 12 | 12 | nc | 0.1 | 10 | nc | nc | nc | nc | nc | nc | 14,000 |
| **Total** | 100 | 196 | 12 | 12 | 0 | 0 | 10 | nc | nc | nc | nc | nc | nc | 14,000 |

**Notes:**
a Fugitive GHGs result from permafrost degradation near port facilities (AECOM 2017e).
b Mobile sources consist of river barges (Cardno 2015c; AMEC 2013; Rieser 2014b).
c $PM_{2.5}$ EF is assumed 97 percent of $PM_{10}$.
d $SO_2$ EF is based on 1.5 percent diesel fuel sulfur content.
e HAPs, including Hg, Pb, As, HCN, and Sb, emissions from barges not calculated, assumed negligible due to low VOC emissions. Additional information on the impacts from deposition of these pollutants is provided in Section 3.2, Soils, and Section 3.7, Water Quality.

CO = Carbon monoxide
HAPs = Hazardous air pollutants
nc = not calculated
$NO_x$ = Oxides of nitrogen
$CO_2$-e = Carbon dioxide equivalent
$SO_2$ = Sulfur dioxide
tpy = tons per year
VOC = Volatile organic compounds
$PM_{2.5}$ and $PM_{10}$ = Particulate matter with an aerodynamic diameter less than or equal to 2.5 and 10 micrometers, respectively
As = Arsenic
HCN = Hydrogen cyanide
Sb = Antimony
Pb = Lead
Hg = Mercury
PM = Total suspended particulate matter

Source: Cardno 2015c; AMEC 2013; Rieser 2014b; EPA 2009c; AECOM 2017e.

There would be no emitting units classified as stationary sources during the Operations Phase so no air quality permit would be required. Air emissions would be entirely mobile in nature and subject to federal regulations that govern mobile sources. Total estimated annual emissions from River Traffic Transportation Operations are less than total estimated annual emissions from Mine Site Operations which were shown to have modeled impacts below required thresholds. Thus, impacts are expected to meet regulatory standards.

Indirect air quality impacts would result from the increased ocean traffic from various ports in the Pacific Northwest to Dutch Harbor and Bethel. The indirect $CO_2$-e emissions associated with annual Construction Phase are summarized in Table 3.8-32.

**Table 3.8-32: Annual Ocean Traffic Operations Phase Indirect Emissions**

| Emissions Source | $CO_2$-e (tpy) |
|---|---|
| Mobile[a] | 21,200 |
| **Total** | 21,200 |

**Notes:**
a Mobile sources consist of ocean going vessels, including general cargo and fuel barges and associated tugboats (Cardno 2015c; AMEC 2013; Rieser 2014b). All such emissions are indirect; hence, only $CO_2$-e emissions are provided.

Source: Cardno 2015c; AMEC 2013; Rieser 2014b; EPA 2009c.

### *Closure*

There would continue to be air quality impacts associated with ocean and river traffic as long as barging is used to provide supplies and fuel during closure and reclamation activities, for a duration of approximately 5 years (SRK 2015g). Less than 20 tpy of fugitive GHG emissions are estimated to occur as a result of permafrost degradation with continued use of the facilities at Bethel Port. Any actions that would occur at Dutch Harbor or the Port of Bethel at the Bethel Yard Dock are not part of the proposed action, and are considered connected actions (see Section 1.2.1, Connected Actions, in Chapter 1, Project Introduction and Purpose and Need).

### Summary of Transportation Corridor Impacts

In terms of intensity, impacts to air quality for all phases associated with the Transportation Corridor would be below permit thresholds, with impacts meeting regulatory standards. During the Construction Phase, air quality would be reduced infrequently and is expected to return to pre-activity levels at the completion of the activity. During Operations and Closure Phases, impacts would persist through life of project. The extent or scope of impacts to air quality would range from discrete portions of the Project Area to areas potentially throughout the EIS Analysis Area or outside the Project Area. In terms of context, the location is in an attainment / unclassified area.

## 3.8.3.3.3 PIPELINE

The Project Area is the Pipeline ROW width, the property boundary of the proposed compressor station, the proposed airstrip property boundary (and up to 3,000 feet in altitude), proposed barge landings on east and west sides of the Kuskokwim River, and boundary of improvements to the Beluga barge landing. The EIS Analysis Area includes the airport of origin and flight path for air traffic, and the ocean traffic lane from Anchorage to Beluga.

For the Pipeline, no specific HAPs are expected to be of concern for the air quality resource, as mercury would be for the Mine Site and lead would be for the Transportation Corridor. Criteria air pollutant, HAPs, and GHG emissions in tpy during the Construction and Operations Phases are shown in Table 3.8-33 and Table 3.8-34.

**Table 3.8-33: Annual Pipeline Construction Phase Emissions**

| Emissions Source | CO (tpy) | $NO_x$ (tpy) | $PM_{2.5}$ (tpy) | $PM_{10}$ (tpy) | PM (tpy) | $SO_2$ (tpy) | VOC (tpy) | HAPs (tpy) | Hg[d] (tpy) | Pb[d] (tpy) | As[d] (tpy) | HCN[d] (tpy) | Sb[d] (tpy) | $CO_2$-e (tpy) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fugitive[a] | 0.0 | 0.0 | 60 | 507 | 2,085 | 0.0 | 0.0 | 2 | 0.001 | 0.02 | 0.03 | nc | 0.01 | 900 |
| Mobile[b] | 1,612 | 306 | 10 | 10 | 10 | 5 | 100 | 8 | nc | 0.02 | nc | nc | nc | 258,300 |
| Stationary[c] | 0.0 | 0.7 | 0.6 | 0.6 | 0.6 | 0.0 | 0.0 | 1 | 0.00002 | 0.009 | 0.001 | nc | nc | 400 |
| **Total** | **1,612** | **307** | **71** | **518** | **2,095** | **5** | **100** | **11** | **0.001** | **0.05** | **0.3** | **nc** | **0.01** | **259,700** |

**Notes:**

a Fugitive sources of PM consist of road, dozing, grading, material handling, and wind erosion (Cardno 2015d). Fugitive GHGs result from permafrost degradation (AECOM 2017e). Open burning is not included, because it is assumed emissions would be negligible (Rieser 2014c). No data are available for blasting at this time; the need for blasting during project construction would be determined during final design (Cardno 2015d, e). Blasting emissions during Construction are expected to be minimal. Assumes exposed surface derived from waste material composite sample and zero percent control efficiency except for unpaved roads. Unpaved roads assumed to have 90 percent control efficiency from water/chemical application (Air Sciences Inc. 2016).

b Mobile sources consist of equipment used during ROW and civil construction (i.e., civil construction equipment, power generators, land and air transportation during ROW and ground preparation for both spreads [assumed to occur during 1st through 3rd year] and pipelaying, ground restoration and clean up (i.e., equipment used for construction and concurrent reclamation or restoration activities during pipelaying stage. (Fernandez 2014f; Rieser 2014b; Cardno 2015d, e). Mobile sources also include emissions from drilling activities and one 1,500 kWe camp generator (Donlin Gold 2015d; Fernandez 2014f).

c Stationary sources consist of 2 camp incinerators (one for each spread -300 people each, 5 pounds of waste per person, and 8 hours operation per day) (Rieser 2014b; Cardno 2015d, e).

d Hg, Pb, As, HCN, and Sb are also a subset of HAPs emissions. Additional information on the impacts from deposition of these pollutants is provided in Section 3.2, Soils, and Section 3.7, Water Quality.

As = Arsenic
CO = Carbon monoxide
$CO_2$-e = Carbon dioxide equivalent
HAPs = Hazardous air pollutants
HCN = Hydrogen cyanide
Hg = Mercury
nc = not calculated (negligible)
$NO_x$ = Oxides of nitrogen
Pb = Lead
PM = Total suspended particulate matter
$PM_{2.5}$ and $PM_{10}$ = Particulate matter with an aerodynamic diameter less than or equal to 2.5 and 10 micrometers, respectively
Sb = Antimony
$SO_2$ = Sulfur dioxide
tpy = tons per year
VOC = Volatile organic compounds

Sources: SRK 2015g; Fernandez 2014f; Rieser 2014b, c; Cardno 2015d, e; AECOM 2017e.

**Table 3.8-34: Annual Pipeline Operations Phase Emissions**

| Emissions Source | CO (tpy) | $NO_x$ (tpy) | $PM_{2.5}$ (tpy) | $PM_{10}$ (tpy) | PM (tpy) | $SO_2$ (tpy) | VOC (tpy) | HAPs (tpy) | Hg[d] (tpy) | Pb[d] (tpy) | As[d] (tpy) | HCN[d] (tpy) | Sb[d] (tpy) | $CO_2$-e (tpy) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fugitive[a] | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | nc | nc | nc | nc | nc | 9,800 |
| Mobile[b] | 0.7 | 0.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.01 | nc | 0.0004 | nc | nc | nc | 200 |
| Stationary[c] | 20 | 254 | 0.6 | 0.6 | 0.6 | 0.04 | 7 | nc | nc | nc | nc | nc | nc | 8,800 |
| **Total** | 20 | 255 | 0.6 | 0.6 | 0.6 | 0.04 | 7 | 0.01 | nc | 0.0004 | nc | nc | nc | 18,800 |

**Notes:**

a Fugitive sources consist of GHG emissions due to unintended leaks from valves and fittings of the pipeline and compressor station, and due to permafrost degradation (AECOM 2017e).

b Mobile sources consist of Wheeled Hydro Ax (2), Tracked Feller/Buncher (1) (Fernandez 2014f); single engine week month(Cardno 2015e; Fernandez 2014f).

c Stationary source is the natural gas compressor station which consists of three 1,000 horsepower natural gas-fired compressor engines (emissions estimated using 1,035 brake-horsepower 4-Stroke Lean Burn); it is assumed that two of these units are assumed to run 8,760 hours per year (AECOM 2017b).

d Hg, Pb, As, HCN, and Sb are also a subset of HAPs emissions. Additional information on the impacts from deposition of these pollutants is provided in Section 3.2, Soils, and Section 3.7, Water Quality.

CO = Carbon monoxide
$CO_2$-e = Carbon dioxide equivalent
HAPs = Hazardous air pollutants
$NO_x$ = Oxides of nitrogen
$PM_{2.5}$ and $PM_{10}$ = Particulate matter with an aerodynamic diameter less than or equal to 2.5 and 10 micrometers, respectively.
$SO_2$ = Sulfur dioxide
tpy = tons per year
VOC = Volatile organic compounds
nc = not calculated
PM = Total suspended particulate matter
Hg = Mercury
Pb = Lead
As = Arsenic
HCN = Hydrogen cyanide
Sb = Antimony

Source: AECOM 2017b, e; Cardno 2015e; Fernandez 2014f; Tripod 2014; FAA 2009, 2012; Airlines Inform 2012; EMEP 2013; CR 2014; INGAA 2005; IPCC 2000.

## Construction

Construction of the Pipeline would take place over a period of three to four years. During the first year, activities include ROW clearing; grading of access roads and shoofly roads; preparation of the compressor station site and campsites; camp construction; pipeline storage yard construction; airstrip development or upgrade; development of barge landings on the east and west sides of the Kuskokwim River at the pipeline crossing and material sites; and improvement of the Beluga barge landing (SRK 2013b). The barge landing at the Bethel Port and Angyaruaq [Jungjuk] Port sites would be used during Pipeline component construction as well. Impacts from these activities are discussed above under Transportation Corridor. During Year 2 through Year 3 or 4, the primary activity would be pipeline installation. Stabilization and reclamation of areas disturbed during Construction (pipeline trench, material sites, campsites, temporary access roads, pipe storage yards and other temporary uses areas) would be addressed concurrently with pipeline installation in accordance with a Stabilization, Rehabilitation, and Reclamation Plan (SRK 2013b). Pipeline construction moves through an area relatively quickly; therefore, air emissions would be localized to a working area.

Concurrent reclamation would occur as soon as practicable for access roads (including the Kuskokwim east and west barge landings and access roads), temporary pipeline storage yards, campsites, and airstrips in accordance with an approved Stabilization, Rehabilitation, and Reclamation Plan (SRK 2013b). A portion of the Beluga Port would be maintained for storing material and equipment needed during Operations.

Direct impacts to air quality during this phase would be caused by air emissions from stationary, fugitive, and mobile sources; the estimated emissions are summarized in Table 3.8-33. Note that these emissions would occur along entire Pipeline length.

Although some open burning may occur in remote areas, air pollutant emissions from such open burning is expected to be minimal and would be conducted in accordance with an open burn approval as required by the ADEC (SRK 2013b; Rieser 2014c).

The Construction Phase emissions presented in Table 3.8-24 are based on the premise that work on the two pipeline construction spreads are estimated to last two winter seasons, and two or three summer construction seasons. The air emissions from permittable sources during construction of the pipeline would not exceed permit thresholds The Pipeline impacts would occur along the pipeline length and its varying construction limits. Total estimated annual emissions from the Pipeline component during the Construction Phase are less than total estimated annual emissions from the Mine Site component during the Operations Phase which were shown to have modeled impacts below required thresholds. Thus, impacts are expected to meet regulatory standards. Indirect impacts would result from ocean barge emissions between Anchorage and Beluga.

## Operations

The compressor station would have combustion emissions due to the use of natural gas-fired compressors. The other Pipeline components (metering stations, mainline block valves, pipeline) would emit neither criteria pollutants nor substantial quantities of HAPs. However, there would be minor fugitive GHG emissions due to leaks from the compressor station, pipeline segments, valves and fittings. In addition, there would be some project-related maintenance activity along the pipeline such as vehicle and helicopter traffic (SRK 2013b). There would be no vented GHG emissions due to pipeline blowdown for planned maintenance (Rieser 2014a). There would be direct GHG emissions due to permafrost degradation and removal and indirect emissions due to pipeline leakage between an assumed wellhead in Cook Inlet to Beluga.

Direct impacts to air quality during this phase would be caused by air emissions from stationary, fugitive and mobile sources; the estimated direct emissions are summarized in Table 3.8-34.

Emissions from the Operations Phase would be primarily mobile in nature and subject to regulations that govern mobile sources. Total estimated annual emissions from Pipeline Operations are less than total estimated annual emissions from Mine Site Operations which were shown to have modeled impacts below required thresholds. Thus, impacts are expected to meet regulatory standards.

Increases in emissions due to the natural gas-fired compressor station would be subject to ADEC permitting review process, unless they are already accounted for in the existing permit.

ADEC would not permit changes in emissions that would cause or contribute to a violation of the NAAQS or AAAQS.

## Closure

Reclamation at Pipeline closure would be conducted in accordance with a Stabilization, Rehabilitation and Reclamation Plan (SRK 2013b). Activities would include removing all above-ground pipeline structures, signs and markers, and abandoning in place pipe buried below grade and in borings that were completed using horizontal directional drilling. Fiber optic cable would be abandoned in place. Roads and airstrips used for Operations (if any) would be reclaimed. These activities would only require small hand tools used to cut aboveground sections of the pipeline (Fernandez 2014f). There would be continued fugitive GHG emissions from melting permafrost across the pipeline ROW of about 20 tpy. Impacts to air quality due to pipeline reclamation activities are expected to be negligible.

### 3.8.3.3.4 DESIGN FEATURES

Under Alternative 2, the following design features proposed by Donlin Gold were considered when assessing air quality impacts:

- Comply with ambient air quality standards and applicable state air quality regulations in 18 AAC 50, including open burning, fugitive dust, state emissions standards, construction and operating permit requirements.
- Comply with applicable federal requirements, including fuel sulfur, NSPS (40 CFR Part 60, Subparts A, Dc, LL, CCCC, IIII, JJJJ, and LLLL), and NESHAP (40 CFR Part 63, Subparts A, ZZZZ, and EEEEEE) requirements.
- As detailed in the Fugitive Dust Control Plan (provided in Appendix I), use best management practices to minimize fugitive dust during Construction and Operations as necessary: limit traffic and disturbance of soil, where possible; stabilize and maintain stability of disturbed soil by spraying water, spreading snow, or applying another approved dust suppressant. Implementation of these measures combined with visual observations would provide 90 percent control, or greater (Air Sciences Inc. 2016).
- Use the following additional best practical methods to minimize fugitive dust: minimize disturbance of soil by phasing activities, refrain from blasting or drilling during meteorological conditions that would exacerbate dust production (Donlin Gold 2015f).
- Minimize area affected by project operations, and perform concurrent reclamation in areas not required for active mining (SRK 2015g; ARCADIS 2013a).
- Use selective catalytic reduction to minimize $NO_x$ emissions and an oxidation catalyst to minimize CO and organic compound emissions at the power plant (Air Sciences Inc. 2016).
- Use natural gas to fuel the power plant at the mine, rather than diesel.

- Use state of the art mercury abatement systems at the kiln feed and discharge, POX vent gas, and electrowinning cell fume hoods and gold refinery area, to comply with MACT regulations (SRK 2016a).
- Follow the post-closure reclamation plan (SRK 2015g).

### 3.8.3.3.5 CLIMATE CHANGE

Predicted overall increases in temperatures and precipitation and changes in the patterns of their distribution have the potential to influence the chemical formation pathways that can transform primary pollutants into secondary pollutants and the removal rate of the pollutants from the atmosphere via wet and dry deposition. Therefore climate change has the potential to alter the projected effects of the Donlin Gold Project on air quality. These effects are tied to changes in atmospheric conditions as discussed in Section 3.26.4.2.1, Climate Change.

### 3.8.3.3.6 SUMMARY OF IMPACTS FOR ALTERNATIVE 2

Applying the methodology defined in Table 3.8-14 to the information and data presented in this section, Alternative 2 has potential direct and indirect impacts to air quality. Table 3.8-35 provides a summary of impacts by the four assessment factors. In terms of intensity, impacts to air quality would be below thresholds and meeting regulatory standards for the Construction and Closure Phases. During Operations air quality would be above thresholds but meeting regulatory standards (Table 3.8-35). During the Construction Phase, air quality would be reduced infrequently and is expected to return to pre-activity levels at the completion of the activity. During Operations and Closure Phases, impacts would persist through life of project. The extent or scope of impacts to air quality would range from discrete portions of the Project Area to areas potentially throughout the EIS Analysis Area or outside the Project Area. In terms of context, the location is in an attainment / unclassified area.

Direct impacts to air quality from the Construction Phase would result primarily from mobile and fugitive emissions. Non-road diesel engines, aircraft and vessels must comply with federal emissions standards. Additionally, best practical methods to suppress dust generating sources within the Mine Site are assembled in a fugitive dust control plan (FDCP), along with intended measures to monitor effectiveness (i.e., via visual observations). The FDCP is provided in Appendix I and would apply to all Mine Site related phases.

Direct impacts to air quality during the Mine Site Operations Phase would result from fugitive, stationary, and mobile sources. Mercury emissions would be released from the open pit, ore, and waste rock (volitization of weathered sulfide minerals); ore processing and other mining operations (emitted as fugitive dust); and from the TSF. The gaseous mercury from the point sources would be collected and treated, such that only 0.4 percent of the mercury passing through the mine would be released into the atmosphere. Emissions during Mine Site Operations would be above air quality thresholds; however, impacts comply with AAAQS and NAAQS, and PSD increments for the highest emitting fuel (i.e., diesel).

Direct impacts to air quality during Mine Site Closure Phase would result from fugitive, stationary, and mobile sources. Air emissions would not exceed thresholds, and impacts would meet regulatory standards during this phase.

**Table 3.8-35: Summary of Impacts[1] of Alternative 2 on Air Quality by Project Component**

| Impact Type | Impact Level | | | |
|---|---|---|---|---|
| | Magnitude or Intensity | Duration | Geographic Extent | Context |
| **Mine Site** | | | | |
| Project-related Air Quality Impact | Emissions are below air quality thresholds, or impacts meet regulatory standards. | During the Construction Phase, air quality would be reduced infrequently and is expected to return to pre-activity levels at the completion of the activity. During Operations and Closure Phases, impacts would persist through life of project | Affects air quality only locally; discrete portions of the Project Area affected. | Affects attainment/unclassified areas. |
| **Transportation Corridor** | | | | |
| Project-related Air Quality Impact | Emissions are below air quality thresholds, or impacts meet regulatory standards. | During the Construction Phase, air quality would be reduced infrequently and is expected to return to pre-activity levels at the completion of the activity. During Operations and Closure Phases, impacts would persist through life of project | Impacts to air quality would range from discrete portions of the Project Area to areas potentially throughout the EIS Analysis Area or outside the Project Area. | Affects attainment/unclassified areas. |
| **Pipeline** | | | | |
| Project-related Air Quality Impact | Emissions are below air quality thresholds, or impacts meet regulatory standards. | During the Construction Phase, air quality would be reduced infrequently and is expected to return to pre-activity levels at the completion of the activity. During Operations and Closure Phases, impacts would persist through life of project | Impacts to air quality would range from discrete portions of the Project Area to areas potentially throughout the EIS Analysis Area or outside the Project Area. | Affects attainment/unclassified areas. |

**Notes:**
Stationary source emission thresholds for PSD permit, Title V permit, and minor permit applicability are shown in Table 3.8-15.
1 The expected impacts account for impact reducing design features proposed by Donlin Gold and Standard Permit Conditions and BMPs that would be required. It does not account for additional mitigation measures the Corps is considering.

### 3.8.3.3.7 MITIGATION AND MONITORING FOR ALTERNATIVE 2

Effects determinations take into account impact reducing design features (Table 5.2-1 in Chapter 5, Impact Avoidance, Minimization, and Mitigation) proposed by Donlin Gold and also the Standard Permit Conditions and BMPs (Section 5.3) that would be implemented.

Design features important for reducing impacts to air quality include:

- The project design includes the use of natural gas to fuel the power plant and the other dual-fuel fired units at the Mine Site, which would result in lowering GHG emissions by 9.6 MMT $CO_2$-e during the mine life of 27.5 years compared to diesel fuel;
- The project design includes use of selective catalytic reduction to minimize oxides of nitrogen emissions at the power plant;
- The project design includes the use of state-of-the-art mercury abatement systems at the kiln feed and discharge, pressure oxidation vent gas, and electrowinning cell fume hoods and gold refinery area, to comply with maximum achievable control technology regulations;
- A Fugitive Dust Control Plan and air quality permit requirements would be followed that describe BACTs and source testing for PM emissions, BMPs for controlling dust from site activities (including roads) and wind erosion, and training and performance assessment procedures (ADEC 2017i); and
- An air blast evaporation system or sprinklers would be used to minimize fugitive dust emissions from TSF beaches during dry conditions.

Standard Permit Conditions and BMPs important for reducing impacts to air quality include:

- Use of BMPs such as watering and use of dust suppressants to control fugitive dust (see FDCP, provided in Appendix I); and
- Compliance with Alaska Ambient Air Quality Standards (AAAQS), National Ambient Air Quality Standards (NAAQS), and Prevention of Significant Deterioration (PSD) increments.

Additional measures are being considered by the Corps and Cooperating agencies and are further assessed in Chapter 5, Impact Avoidance, Minimization, and Mitigation (Section 5.5 and Section 5.7). Examples of additional measures being considered that are applicable to this resource include:

- Cover waste rock immediately to prevent formation of dust;
- Use solar power to reduce GHG emissions from power generation at the Mine Site;
- Install automatic and publicly accessible air and water quality data collection stations that are on-site and available for point sources and in the surrounding areas for diffuse emissions;
- Use carbon capture and utilization technology to capture CO2 waste emissions and use them to produce new products and economic opportunities; and

- Develop and implement a fugitive dust management, testing, and monitoring plan to evaluate fugitive dust emissions and their distribution to soils, sediment, air, water, vegetation, and the potential exposure of contaminants, such as mercury, arsenic, ARD/ML, to humans and wildlife. Collect additional baseline sediment data in Crooked Creek tributaries southeast of the Mine Site, an area of sub-dominant wind direction, to support future monitoring interpretations. Include elements of risk management and monitoring in the plan. Based on the results of the testing, determine through adaptive management if additional future sampling would be required during operations and post-closure, particularly for fugitive dust resulting from truck traffic along the access road.

#### 3.8.3.4 ALTERNATIVE 3A – REDUCED DIESEL BARGING: LNG-POWERED HAUL TRUCKS

Under Alternative 3A, Donlin Gold would use LNG instead of diesel to power the large haul trucks that would move waste rock and ore from the open pits during Operations. These large trucks would account for approximately 75 percent of the total annual diesel consumption under Alternative 2. This alternative would affect the Mine Site and the Transportation Corridor components during the Operations Phase. Impacts to air quality during the Construction and Closure Phases would be similar to those described under Alternative 2.

Under Alternative 3A, an LNG Plant, LNG storage tanks, and LNG distribution system would be located at the Mine Site in an area that would be disturbed under Alternative 2.

The associated plant would process and cool the pipeline-delivered natural gas into liquefied natural gas (LNG). The plant would also include processes such as an inlet amine sweetener and glycol dehydrator unit to remove carbon dioxide and water, respectively, from the feed gas stream. Remaining water vapor may be removed by molecular sieve dehydrators. The feed gas entering the liquefaction process is predominantly methane. A propane refrigeration system initially cools the methane. Additional cooling may be provided by a cascade refrigeration system and/or mixed refrigerant train. The feed gas is given a pressure drop where LNG is produced. The LNG would then be stored for later usage.

Emissions would primarily be the result of natural gas combustion in internal combustion engines associated with the gas compressors; once sized and specified, such emissions are more easily estimated. Otherwise, the process is primarily a closed loop process and any refrigerant or methane emissions would most likely be fugitive (e.g., associated with leaks). Permitting of the LNG plant compressors would be processed by the Air Quality Division of ADEC and its operating requirements would become part of the Title V permit framework.

During the Operations Phase, there would be a reduction in consumption of diesel, compared to Alternative 2, thus less diesel storage would be needed. The consumption of natural gas would be increased.

There would be no vented emissions from the LNG storage tanks. Fugitive emissions are assumed to be negligible (Fernandez 2013c). This would reduce HAPs (a subset of VOC) emissions by about 8 percent, but would not affect Hg (a subset of HAPs) emissions. Emissions of CO, $NO_x$, PM, $SO_2$, VOCs, and GHGs at the Mine Site would decrease compared to Alternative 2. In the case of GHGs, combustion of natural gas (while not LNG, natural gas has been used as a proxy) results in approximately 28 percent less emissions than diesel fuel combustion (based on heat content). This figure takes into account heat content of the fuels (in units of million British thermal units [mmBtu]), GHG emissions from the natural gas combustion produces 53.06 kilograms $CO_2$-e per mmBtu (kg / mmBtu), whereas diesel (Distillate fuel oil No. 2) combustion produces 73.96 kg $CO_2$-e / mmBtu (EPA 2014j). Based on this information, we anticipate that this alternative would result in approximately a 28 percent reduction in GHG emissions from haul trucks.

For the Transportation Corridor component under Alternative 3A, there would be fewer ocean and river barge trips and less tanker truck traffic compared to Alternative 2. No additional fuel storage capacity would be required at the Dutch Harbor Port and the fuel storage capacity required at Bethel and Angyaruaq (Jungjuk) ports would be reduced or eliminated. Emissions of CO, $NO_x$, PM, $SO_2$, VOCs, and GHGs at the Mine Site would decrease compared to Alternative 2. Using LNG in the trucks instead of diesel would result in lower emissions of all pollutants at the Mine Site, and at the land and water transportation subcomponents during the Operations Phase. This would not affect the intensity of emissions (emissions from mobile sources are not considered in permit applicability, but emissions would exceed thresholds, as in Alternative 2). The duration of impacts would remain through life of mine, the extent or scope would be limited to the Mine Site, and the context would not affect a Class I, non-attainment, or maintenance area, or area with local regulations. Impacts associated with climate change would be the same as those discussed for Alternative 2. The project's GHG emissions would be lower due to less reliance upon diesel fuel in mobile sources and reduced use of barges. The effects determinations take into account applicable impact reducing design features, as discussed in Alternative 2. Examples of additional measures being considered that are applicable to this resource are listed under Alternative 2.

### 3.8.3.5 ALTERNATIVE 3B – REDUCED DIESEL BARGING: DIESEL PIPELINE

Under Alternative 3B and options, Donlin Gold would use a diesel pipeline to provide fuel to the mine's power generation facilities and mobile vehicle fleet, thereby eliminating barging of diesel fuel on the Kuskokwim River. This alternative would entail:

- Construction and operations of a diesel pipeline from either Tyonek (Alternative 3B and Alternative 3B Collocated Natural Gas Pipeline Option) or Port MacKenzie (Alternative 3B Port MacKenzie Option);
- expansion of the existing Tyonek North Foreland Barge Facility;
- Construction of a new Operations Center and Pumping Facility containing meters, pumps and a pig launcher, and a tank farm to store a one month supply of diesel fuel at either Tyonek or Port MacKenzie, depending on selected option; and
- Construction of living quarters and spill containment systems (Michael Baker, Jr. Inc. 2013a).

Two options to Alternative 3B have been added based on Draft EIS comments from agencies and the public:

- Port MacKenzie Option: The Port MacKenzie Option would utilize the existing Port MacKenzie facility to receive and unload diesel tankers instead of the Tyonek facility considered under Alternative 3B. A pumping station and tank farm of similar size to the Tyonek conceptual design would be provided at Port MacKenzie. A pipeline would extend northwest from Port MacKenzie, route around the Susitna Flats State Game Refuge, cross the Little Susitna and Susitna rivers, and connect with the Alternative 3B alignment at approximately MP 28. In this option, there would be no improvements to the existing Tyonek dock; a pumping station and tank farm would not be constructed near Tyonek; and the pipeline from the Tyonek tank farm considered under Alternative 3B to MP 28 would not be constructed.

- Collocated Natural Gas and Diesel Pipeline Option: The Collocated Natural Gas and Diesel Pipeline Option (Collocated Pipeline Option) would add the 14-inch-diameter natural gas pipeline proposed under Alternative 2 to Alternative 3B. Under this option, the power plant would operate primarily on natural gas instead of diesel as proposed under Alternative 3B. The diesel pipeline would deliver the diesel that would be supplied using river barges under Alternative 2 and because it would not be supplying the power plant, could be reduced to an 8-inch-diameter pipeline. The two pipelines would be constructed in a single trench that would be slightly wider than proposed under either Alternative 2 or Alternative 3B and the work space would be five feet wider. The permanent pipeline ROW would be approximately two feet wider. This option could be configured with either the Tyonek or Port MacKenzie dock options.

Under the Alternative 3B Collocated Natural Gas Pipeline Option, two pipelines would be constructed from Tyonek, one for diesel and one for natural gas. Air quality impacts would occur during Construction from heavy equipment operation as described under Alternative 2.

Under the Alternative 3B Port MacKenzie Option, the natural gas line in Alternative 2 would be replaced with a diesel pipeline. This alternative would also relocate the eastern terminus of the diesel pipeline from Tyonek to Port MacKenzie, resulting in approximately one mile of additional piping. Air impacts from heavy equipment operation during Construction would be similar to those described in Alternative 2, and the overall air quality impact would be similar to that for Alternative 3B.

Alternative 3B would involve similar heavy equipment utilization and activities undertaken during the Construction and Closure Phases described in Alternative 2 for the Pipeline component. Under Alternative 3B and 3B Port MacKenzie Option, the only variation would be the air quality impacts generated from the construction of an additional 19 to 20 miles of diesel pipeline segment, depending on selected option, and associated above-ground facilities for the diesel pipeline. However, some of these impacts would be offset by not building the Pipeline compressor station, the LNG Plant, and other natural gas above-ground facilities, or the diesel storage capacity at the Dutch Harbor, Bethel and Angyaruaq (Jungjuk) ports. Any actions that would occur at Dutch Harbor or the Port of Bethel at the Bethel Yard Dock are not part of the proposed action, and are considered connected actions (see Section 1.2.1, Connected Actions, in Chapter 1, Project Introduction and Purpose and Need).

During the Operations Phase, Alternative 3B (including the Port MacKenzie Option and the Collocated Natural Gas Pipeline Option) would affect the Mine Site, Transportation Corridor, and Pipeline components.

At the Mine Site, except for the collocated natural gas pipeline option, dual fuel-fired equipment would be powered by diesel instead of natural gas. Emissions of NOx, CO, PM, $SO_2$, VOCs, and GHGs would be the same as those conservatively calculated for Alternative 2. As described in the discussion of Alternative 3A for GHGs, combustion of diesel fuel results in approximately 28 percent greater emissions of GHGs as compared to combustion of natural gas (EPA 2014). Therefore, this alternative would be anticipated to have a greater impact, approaching a 30 percent increase, depending upon actual operation of dual-fuel units under Alternative 2. Mercury emissions would increase compared to Alternative 2 due to use of diesel in the dual fuel-fired boilers. This would not affect the intensity of emissions as defined in Table 3.8-14 (emissions are above thresholds, and compliance with the ambient standards was demonstrated assuming highest emitting fuel). The duration would last through the life of the mine, the extent would be limited to the Mine Site, and the context would not affect a Class I, non-attainment, or maintenance area, or area with local regulations. The overall impact would result in increased emissions compared to what is expected under Alternative 2 and consistent with the conservative emissions estimates provided in Table 3.8-18 (Annual Mine Site Operations Phase Emissions). Under the collocated natural gas pipeline option, actual emissions would be anticipated to be similar to Alternative 2 with the expectation that dual-fired equipment would be fired on natural gas.

For the Transportation Corridor, there would be no barging of fuel on the Kuskokwim (although barging would still be needed for other supplies), increased barging (along with tug boats) of diesel in Cook Inlet, and new or expanded port facilities with diesel storage, as compared to Alternative 2. There would be no transportation of diesel fuel on the mine access road. Fuel deliveries would occur year round. Fuel storage at the Mine Site would be reduced from Alternative 2 levels. Impacts from the air transportation subcomponent would be similar to Alternative 2.

Emissions of all criteria pollutants and GHGs in both options from the Transportation Corridor as a whole would decrease, but could be offset by emissions from increased use of diesel fuel in other Transportation Corridor-related combustion equipment at the Mine Site. This would not affect the intensity of emissions (emissions would be below thresholds). The duration would last through the life of the mine, the extent would affect the Transportation Corridor only, and the context would not affect a Class I, non-attainment, or maintenance area, or an area with local regulations. The overall impact would be similar to Alternative 2.

For the diesel pipeline component, there would be no compressor station. However, there would be an Operations Center and Pumping Facility, and 10 million gallons of diesel storage would be added at Tyonek.

During the Construction Phase, under Alternative 3B and Alternative 3B Port MacKenzie Option, temporary emissions of criteria pollutants and GHGs are estimated to increase by about 6 percent due to construction of the additional 18 to 20-mile diesel pipeline. Under Alternative 3B Collocated Natural Gas Pipeline Option, temporary emissions of criteria pollutants and GHGs from construction of both pipelines are estimated to increase by up to approximately 170 percent as compared to Alternative 2 emissions for the gas pipeline construction, due to conservative assumption that the construction of an additional 47 miles of collocated diesel pipeline would be a separate construction project with similar levels of activity.

During the Operations Phase, fugitive GHG emissions from the diesel pipeline would be less compared to that of the Pipeline component of Alternative 2. In the case of the collocated pipeline option, you would have emissions from both pipelines. Overall emissions from the operation of pipelines are a small component of overall project operations. This would not affect the intensity of emissions (emissions would be below thresholds). The duration of impacts would last through the life of the mine and the extent would affect the pipeline only. While the diesel pipeline would come close to a Class I area, the associated emissions are negligible emissions; thus, would not affect a Class I, non-attainment, or maintenance area, or area with local regulations. GHG emission estimates would be the same as those discussed for Alternative 2.

The effects determinations take into account applicable impact reducing design features, as discussed in Alternative 2. Examples of additional measures being considered that are applicable to this resource are listed under Alternative 2.

### 3.8.3.6 ALTERNATIVE 4 – BIRCH TREE CROSSING (BTC) PORT

Under Alternative 4, the upriver port site would be located at the BTC Port site rather than Angyaruaq (Jungjuk) Port site. This alternative would reduce the barge distance for freight and diesel out of Bethel bound for the Mine Site by about 75 river miles. However, a longer 76-mile access road (BTC Road) between the BTC Port site and the Mine Site would be used for transporting fuel and cargo for the project. The stationary emissions (power generation) would not change. This alternative would affect only the Transportation Corridor component (land and water) during the Construction and Operations Phases.

Criteria air pollutants and GHG emissions, due to traffic along the 76-mile BTC Road during Construction and Operations, are expected to increase about three times compared to the Alternative 2 30-mile mine access road. However, stationary source emissions would remain similar to Alternative 2. The overall intensity, duration, extent, and context of impacts would be the same as described for Alternative 2. For both phases, the increase in overall emissions due to the longer road would be largely offset by the reduced barging emissions. Therefore, GHG emission estimates would not be substantially different from those discussed for Alternative 2.

The effects determinations take into account applicable impact reducing design features, as discussed in Alternative 2. Examples of additional measures being considered that are applicable to this resource are listed under Alternative 2.

### 3.8.3.7 ALTERNATIVE 5A – DRY STACK TAILINGS

Under Alternative 5A, Donlin Gold would dispose of tailings in a dry stack TSF located in the Anaconda Creek valley. This would involve dewatering the tailings in a filter plant to produce filter cake. The filter cake would be transported by heated bed[16] haul trucks to the TSF. Dozers, graders, and roller compactors would be used to move and spread material, and compact the tailings. At closure, a cover system would be placed over the TSF and vegetated to control fugitive dust. A water treatment plant would be used to treat pit lake water post-closure (BGC 2014a).

This alternative would affect the Mine Site during the Operations and Closure phases. The additional use of mobile machinery for transport and dewatering at the filter plant would increase mobile emissions, exposure of the dry stack surface would increase fugitive emissions, and the increase in power consumption would cause an increase in stationary emissions from

[16] Heated truck beds would prevent the tailings from freezing to the truck beds during the winter.

the power plant. The lower moisture content, increased heavy equipment use, and higher elevation of the tailings pile under Alternative 5A versus Alternative 2 would make the emissions from dry stack greater over an equivalent sized TSF tailings beach area. The increase in fugitive emissions due to the dry stack would be offset by the elimination of fugitive dust emissions from the TSF beach area under Alternative 2. The total increase in CO, $NO_X$, $PM_{2.5}$, $PM_{10}$, and $SO_2$ emissions would be 3.1 percent, 3.3 percent, 2.9 percent, 8.3 percent, and 1.0 percent, respectively (Air Sciences Inc. 2015c). The increase in HAPs over Alternative 2 would be 0.07 tpy, and the increase in mercury would be 0.0001 tpy (Cardno 2015b). The dry stack tailings would be trafficable so the closure cover would be easier to place. This alternative would also affect the Transportation Corridor component during the Operations Phase, as there would be a six percent increase in barge traffic (and related emissions) compared to Alternative 2 (BGC 2014a).

Donlin Gold would mitigate impacts from fugitive dust by installing a silt fence across the dry stack surface as a wind break, removing snow from active areas only, and using a tall oil dust suppressant (Donlin Gold 2014b).

A potential increase in stationary source emissions due to the increase in power consumption would not change permit applicability, as the emissions (except $SO_2$) are already above thresholds. The 3 percent increase in modeled emissions from the power plant is not expected to change results of the ambient analysis, which is for the entire source and had a maximum impact on an ambient standard or increment of 57.1 percent (for 24-hr $PM_{2.5}$ NAAQS). Furthermore, the modeling is based on diesel fueling of all of the dual fuel-fired units, as diesel is the highest emitting fuel for all modeled pollutants.

This alternative includes two options:

- Unlined Option: The tailings storage facility (TSF) would not be lined with a linear low-density polyethylene (LLDPE) liner. The area would be cleared and grubbed and an underdrain system placed in the major tributaries under the TSF and operating pond to intercept groundwater base flows and infiltration through the dry stack tailings (DST) and convey it to a Seepage Recovery System (SRS). Water collecting in the SRS pond would be pumped to the operating pond, lower contact water dam (CWD), or directly to the processing plant for use in process.
- Lined Option: The DST would be underlain by a pumped overdrain layer throughout the footprint, with an impermeable LLDPE liner below. The rock underdrain and foundation preparation would be completed in the same manner as the Unlined Option.

Using the dry stack instead of conventional slurry would result in increased emissions at the Mine Site and Transportation Corridor during the Operations Phase. However, the overall intensity, duration, extent, and context of impacts would be the same as or similar to those described for Alternative 2. GHG emission estimates are expected to increase over Alternative 2 similar to the criteria pollutants discussed above.

The effects determinations take into account applicable impact reducing design features, as discussed in Alternative 2. Examples of additional measures being considered that are applicable to this resource are listed under Alternative 2.

### 3.8.3.8 ALTERNATIVE 6A – MODIFIED NATURAL GAS PIPELINE ALIGNMENT: DALZELL GORGE ROUTE

Alternative 6A would realign the natural gas pipeline to the Dalzell Gorge Route (MP 106.5 to MP 152.7). This action would not cause a substantial change in air emissions, including GHG emissions, in any of the phases or project components from those identified under Alternative 2 The overall intensity, duration, extent, and context of impacts would be the same as described for Alternative 2.

The effects determinations take into account applicable impact reducing design features, as discussed in Alternative 2. Examples of additional measures being considered that are applicable to this resource are listed under Alternative 2.

### 3.8.3.9 ALTERNATIVES IMPACT COMPARISON

A comparison of the air quality impacts by component associated with each alternative is presented in Table 3.8-36.

**Table 3.8-36: Comparison by Alternative* for Air Quality**

| Impact - causing Project Component | Alternative 2 – Proposed Action | Alternative 3A – LNG-Powered Haul Trucks | Alternative 3B – Diesel Pipeline | Alternative 4 – BTC Port | Alternative 5A – Dry Stack Tailings | Alternative 6A – Dalzell Gorge Route |
|---|---|---|---|---|---|---|
| **Mine Site** | | | | | | |
| Construction | Direct impacts to air quality during this phase would result from fugitive and mobile sources.<br>Air emissions would not exceed thresholds, and impacts would meet regulatory standards during this phase. | Similar to Alternative 2. | Similar to Alternative 2. | Similar to Alternative 2. | Similar to Alternative 2. | Similar to Alternative 2. |
| Operations | Direct impacts to air quality during this phase would result from fugitive, stationary, and mobile sources.<br>Mercury emissions would be released from the open pit, ore, and waste rock (volitization of weathered sulfide minerals); ore processing and other mining operations (emitted as fugitive dust); and from the TSF. The gaseous mercury from the point sources would be collected and treated, such that only 0.4 percent of the mercury passing through the | Similar to Alternative 2, with the following differences:<br>There would be a reduction in the consumption of diesel, and less diesel storage would be required. Consumption of natural gas would be increased. There would be no vented emissions from the LNG storage tanks, which would reduce HAPs emissions by approximately 8 percent. Emissions of carbon monoxide, nitrogen oxides, | Similar to Alternative 2, with the following differences:<br>Emissions of $NO_x$, CO, PM, $SO_2$, VOCs, and GHGs would increase. Mercury emissions would increase compared to Alternative 2 due to use of diesel in the dual fuel-fired boilers, but would still be within permitting and regulatory thresholds. | Similar to Alternative 2. | Similar to Alternative 2, with the following differences:<br>The additional use of mobile machinery for transport and dewatering at the filter plant would increase mobile emissions, exposure of the dry stack surface would increase fugitive emissions, and the increase in power consumption would cause an increase in stationary emissions from the power plant. The | Similar to Alternative 2. |

**Table 3.8-36: Comparison by Alternative* for Air Quality**

| Impact - causing Project Component | Alternative 2 – Proposed Action | Alternative 3A – LNG-Powered Haul Trucks | Alternative 3B – Diesel Pipeline | Alternative 4 – BTC Port | Alternative 5A – Dry Stack Tailings | Alternative 6A – Dalzell Gorge Route |
|---|---|---|---|---|---|---|
| Operations continued | mine would be released into the atmosphere.<br>Emissions during Mine Site Operations would be above air quality thresholds; however, impacts comply with AAAQS and NAAQS, and PSD increments for the highest emitting fuel. | particulate matter, sulfur dioxide, volatile organic compounds, and $CO_2$-e at the Mine Site would decrease compared to Alternative 2. | | | increase in fugitive emissions due to the dry stack would be offset by the elimination of fugitive dust emissions from the TSF beach area under Alternative 2.<br>Permitting and regulatory thresholds would still be met. | |
| Closure | Direct impacts to air quality during this phase would result from fugitive, stationary, and mobile sources.<br>Air emissions would not exceed thresholds, and impacts would meet regulatory standards during this phase. | Similar to Alternative 2. | Similar to Alternative 2. | Similar to Alternative 2. | Similar to Alternative 2. | Similar to Alternative 2. |
| **Transportation Corridor** | | | | | | |
| Construction | Direct impacts to air | Similar to | Similar to | Similar to | Similar to | Similar to |

**Table 3.8-36: Comparison by Alternative* for Air Quality**

| Impact - causing Project Component | Alternative 2 – Proposed Action | Alternative 3A – LNG-Powered Haul Trucks | Alternative 3B – Diesel Pipeline | Alternative 4 – BTC Port | Alternative 5A – Dry Stack Tailings | Alternative 6A – Dalzell Gorge Route |
|---|---|---|---|---|---|---|
| | quality during this phase would result from fugitive and mobile sources associated with land, air, and water transportation.<br>Air emissions would not exceed thresholds, and impacts would meet regulatory standards during this phase. | Alternative 2. | Alternative 2. | Alternative 2, with the following differences:<br>Criteria air pollutants and GHG emissions along the roadway are expected to increase about 3 times compared to Alternative 2. The increase in emissions due to the longer road would be largely offset by the reduced barging emissions.<br>Permitting and regulatory thresholds would still be met. | Alternative 2. | Alternative 2. |
| Operations | Direct impacts to air quality during Operations activities would result from fugitive, stationary, and mobile sources.<br>Air emissions would not exceed thresholds, and impacts would meet regulatory standards during this phase. | Similar to Alternative 2, with the following differences:<br>Using LNG haul trucks would result in lower emissions of all pollutants during this phase. | Similar to Alternative 2, with the following differences:<br>Emissions of all criteria pollutants and GHGs from water transportation would decrease, but could be offset by emissions from increased use of | Similar to Alternative 2, with the following differences:<br>Criteria air pollutants and GHG emissions are expected to increase about 3 times compared to Alternative 2. The increase in emissions due to | Similar to Alternative 2, except there would be a six percent increase in cargo barge traffic compared to Alternative 2.<br>Permitting and regulatory thresholds would still be met. | Similar to Alternative 2. |

**Table 3.8-36: Comparison by Alternative* for Air Quality**

| Impact - causing Project Component | Alternative 2 – Proposed Action | Alternative 3A – LNG-Powered Haul Trucks | Alternative 3B – Diesel Pipeline | Alternative 4 – BTC Port | Alternative 5A – Dry Stack Tailings | Alternative 6A – Dalzell Gorge Route |
|---|---|---|---|---|---|---|
| | | | diesel fuel in other Transportation Corridor-related combustion equipment at the Mine Site. Permitting and regulatory thresholds would still be met. | the longer road would be largely offset by the reduced barging emissions.<br>Permitting and regulatory thresholds would still be met. | | |
| Closure | Direct impacts to air quality during closure activities would result from fugitive, stationary, and mobile sources. The proposed access roads, Angyaruaq (Jungjuk) Port, and airstrip would be used for long-term monitoring at the Mine Site and would not be reclaimed.<br>Air emissions would not exceed thresholds, and impacts would meet regulatory standards during this phase. | Similar to Alternative 2. | Similar to Alternative 2. | Similar to Alternative 2. | Similar to Alternative 2. | Similar to Alternative 2. |
| **Pipeline** | | | | | | |
| Construction - | Direct impacts to air quality during this phase would result from fugitive, stationary, and mobile sources.<br>Air emissions would not | Similar to Alternative 2. | Similar to Alternative 2, with the following differences:<br>Temporary emissions of | Similar to Alternative 2. | Similar to Alternative 2. | Similar to Alternative 2. |

**Table 3.8-36: Comparison by Alternative* for Air Quality**

| Impact - causing Project Component | Alternative 2 – Proposed Action | Alternative 3A – LNG-Powered Haul Trucks | Alternative 3B – Diesel Pipeline | Alternative 4 – BTC Port | Alternative 5A – Dry Stack Tailings | Alternative 6A – Dalzell Gorge Route |
|---|---|---|---|---|---|---|
| | exceed thresholds, and impacts would meet regulatory standards during this phase. | | criteria pollutants and GHGs are estimated to increase by about six percent due to construction of the additional 18-mile diesel pipeline.<br>Permitting and regulatory thresholds would still be met. | | | |
| Operations | Direct impacts to air quality during this phase would result from fugitive and mobile sources.<br>Air emissions would not exceed thresholds, and impacts would meet regulatory standards during this phase. | Similar to Alternative 2. | Same as Alternative 2, with the following differences:<br>Fugitive GHG emissions from the diesel pipeline would be less compared to that of natural gas pipeline under Alternative 2.<br>Permitting and regulatory thresholds would still be met. | Similar to Alternative 2. | Similar to Alternative 2. | Similar to Alternative 2. |
| Closure | Fugitive and mobile emissions during reclamation of the pipeline and associated above-ground facilities would occur. | Similar to Alternative 2. | Similar to Alternative 2 but would include reclamation activities for the 18-mile Tyonek | Similar to Alternative 2. | Similar to Alternative 2. | Similar to Alternative 2. |

**Table 3.8-36: Comparison by Alternative* for Air Quality**

| Impact - causing Project Component | Alternative 2 – Proposed Action | Alternative 3A – LNG-Powered Haul Trucks | Alternative 3B – Diesel Pipeline | Alternative 4 – BTC Port | Alternative 5A – Dry Stack Tailings | Alternative 6A – Dalzell Gorge Route |
|---|---|---|---|---|---|---|
| | Air emissions would not exceed thresholds, and impacts would meet regulatory standards. | | diesel pipeline segment and Operations Center and Pumping Facility at Tyonek. | | | |

**Notes:** *Alternative 1 (No Action Alternative) would have no new impacts to air quality.