3.10 HEALTH AND SAFETY

The evaluation of impacts on human health and safety is a required component of the National Environmental Policy Act (NEPA) as it pertains to negative and beneficial consequences of the project on potentially affected communities. There are federal and state laws and regulations, such as the Clean Air Act, Clean Water Act, and various Alaska statutes that have been enacted to ensure protection of human health. Compliance with these laws and regulations is taken into consideration in the evaluation of health and safety impacts in an integrated manner in this evaluation; and in a more singular, medium-specific manner in individual sections such as Section 3.20, Air Quality, and Section 3.18, Water and Sediment Quality.

The Environmental Impact Statement (EIS) analysis area for this evaluation corresponds to an area that could be affected by the mine site, transportation corridor, and natural gas pipeline for each alternative through changes in economic, subsistence, and health resources and activities; or through releases and discharges to the environment. Overall, as listed in Table 3.10-1, the EIS analysis area includes eight communities in the Lake and Peninsula Borough (LPB), seven communities in the Dillingham Census Area, two communities in the Kenai Peninsula Borough (KPB), and three communities in Bristol Bay, as well as surrounding regions and the Municipality of Anchorage (it is likely that some project workers would come from this urban population). Not all communities are assessed for all health effects, because some effects may be more relevant to some communities than others. Although it is possible that additional communities may occasionally use the EIS analysis area, these communities capture those most likely to use the areas with the greatest magnitude of potential impacts from the project (e.g., potential impacts to air quality, water and sediment quality, soils, wildlife and fish, and transportation), and are adequate to assess potential project impacts in this EIS with respect to health-related impacts.

This evaluation is intended to document baseline health and safety status in the EIS analysis area so that project-related positive and negative health and safety consequences for the project and alternatives may be identified and evaluated in Section 4.10, Health and Safety, as to their likelihood and degree; and mitigation measures may be recommended to minimize potential negative impacts that could occur as a result of the project. Human health data for the EIS analysis area are generally available at broad regional scales, but some data are available at the community level. Differences between the two scales are distinguished, where possible, to the extent relevant for this evaluation.

Health and safety are related and complementary concepts. In the context of evaluating the impacts of a project, “health” is broadly considered to represent a state of physical and mental well-being of communities; while “safety” is more narrowly interpreted as engineering design, operation, and handling of project infrastructure, equipment, and materials in a manner that seeks to reduce hazards and prevent the occurrence of incidents and accidents (IFC 2007). It is also important to note that regulatory programs, agencies, and compliance procedures may be overlapping or very different for the health versus the safety aspects of a project. For example, the Occupational Safety and Health Administration (OSHA) regulations cover health and safety only for workers, and do not cover untrained workers or the general public.

In this section, health is described in a manner that is consistent with the State of Alaska’s guidelines for Health Impact Assessment (HIA) (ADHSS 2015); safety is discussed in the context of relevant regulatory requirements under OSHA, the Mine Safety and Health Act (MSHA), and other types of hazard assessment and prevention.

Table 3.10-1: Potentially Affected Communities

Potentially Affected Communities	HECs Evaluated	Level of Evaluation	
		Community[5] and Regional	Regional
Lake and Peninsula Borough			
Lake and Peninsula Borough	All, as needed[1]		X
Iliamna Lake/Lake Clark Region	All, as needed[1]		X
Nondalton	All	X	
Iliamna	All	X	
Newhalen	All	X	
Port Alsworth	All	X	
Pedro Bay	All	X	
Kokhanok	All	X	
Igiugig	All	X	
Levelock	All	X	
Dillingham Census Area			
Dillingham Census Area	All, as needed[1]		X
Nushagak/Bristol Bay Region	All, as needed[1]		X
Ekwok	All	X	
Koliganek	All	X	
New Stuyahok	All	X	
Dillingham	All, particularly HECs 1, 3 & 4 [2]	X	
Clark's Point	HECs 3 & 4 for Subsistence [3]	X	
Manokotak	HECs 3 & 4 for Subsistence [3]	X	
Aleknagik	HECs 3 & 4 for Subsistence [3]	X	
Bristol Bay Borough			
Bristol Bay Borough	All		X
King Salmon	HECs 3 & 4 for Subsistence [3]	X	
Naknek	HECs 3 & 4 for Subsistence [3]	X	
South Naknek	HECs 3 & 4 for Subsistence [3]	X	
Kenai Peninsula Borough			
Kenai Peninsula Borough	All		X
Ninilchik	HECs 3 & 4 for Subsistence [3]	X	
Seldovia	HECs 3 & 4 for Subsistence [3]	X	
City of Anchorage and Matanuska-Susitna Borough			
Anchorage Mat-Su Region	All, particularly HEC 1 [4]		X

Notes:
[1] Regions and boroughs are evaluated, as needed, based on the lack of or uncertainty with the community-level data.
[2] Dillingham is farther from the project than the other 11 potentially affected communities, but it is likely that some project workers would come from this population, and it is possible that subsistence users from this population could use the EIS analysis area. Therefore, the primary impacts would be expected to be socioeconomic in HEC 1, and subsistence impacts in HECs 3 and 4. Dillingham is represented in the information provided for the Dillingham Census Area.
[3] Potential subsistence impacts for these communities are evaluated in HECs 3 and 4, and are represented in the information provided for the larger boroughs in which they reside (Dillingham Census Area, Bristol Bay Borough, and Kenai Peninsula Borough).
[4] Anchorage is outside the Bristol Bay drainages and farther from the project, but it is likely that some project workers would come from this urban population, and the primary impact would be expected to be socioeconomic (HEC 1).
[5] Community-level evaluations were performed as data permitted.
HEC = Health Effect Category

3.10.1 Health

For the purposes of this document, and consistent with Alaska Department of Health and Social Services (ADHSS), health is defined not merely as the absence of disease, but as "the reduction in mortality, morbidity, and disability due to detectable disease or disorder, and an increase in the perceived level of health" (ADHSS 2015). Therefore, it represents an integrated state of physical, social, and mental well-being. Health is affected by environmental, social, cultural, and genetic factors often called "determinants of health." Community health in Alaska, with its environmental and social setting and complex blend of health determinants, is in many ways different from national health trends in the US (ADHSS 2015). Resource development projects, such as mining activities, can often affect the health of nearby communities in complex ways; impacts may be both positive and negative.

Funding and completion of an HIA following Alaska guidelines is strictly voluntary in Alaska, and is not required by either Alaska State law or federal law (ADHSS 2015). Although voluntary, Alaska's HIA toolkit guidance helps project applicants and policy-makers understand both the negative and positive health impacts of a proposed project, and create plans to enhance the positive and reduce the negative impacts. The toolkit provides a broad-based but tiered process that allows the scope of the HIA to be focused on a sub-set of finite, plausible health impacts (clearly defined causal connection between the project and the anticipated health impact) identified through a screening and scoping process. Therefore, although this health evaluation describes the broad health effects categories (HECs) and several typical health metrics for each category included in the ADHSS guidelines, emphasis is focused on assessing key issues and potential impacts identified during scoping (as required by NEPA), and those expressed by stakeholders.

There is generally overlap between the affected communities in relation to the project components and phases for all alternatives and variants (see Chapter 2, Alternatives, for a description of alternatives and variants); therefore, the functional classification of baseline information for the affected communities was at the scale of the EIS analysis area and through the end of the closure phase. Specific affected community distinctions by component, area, or phase are only denoted when relevant.

3.10.1.1 Assumptions and Limitations

Focus on Most Relevant Human Health Effects Categories and Diseases—Important goals of developing an HIA are that it should be useful in understanding project consequences, and should help to inform project decisions. It should consider those health-related issues that are relevant to the project, or of concern to the stakeholders and affected communities. The HIA toolkit outlines a broad set of eight types of HECs to be considered for an HIA in Alaska. However, not all effects categories are relevant or likely for every project. This health evaluation has been streamlined to focus on the HECs that could be directly impacted by the project or may be expressed as a primary stakeholder concern, based on the project description and review of concerns expressed by stakeholders and community members as summarized in the Pebble Project EIS Scoping Report (Appendix A). Among the range of concerns expressed by the communities and stakeholders during the scoping process, the highest health-related concerns included anxiety about possible social, psychological, and behavioral health impacts; concerns about short-term economic gains versus potential long-term environmental devastation; fear of increased traffic-related accidents and injuries; potential exposure to toxic chemicals in air, water, and other environmental media; chemical impacts on availability and quality of subsistence foods, particularly fishing resources; and potential overloading of existing infrastructure and services. The key issues for the health evaluation were then identified by considering the stakeholder concerns in the context of the project description, including the design and operation features and the impact avoidance, mitigation, and monitoring measures already proposed by Pebble Limited Partnership (PLP).

Therefore, the primary focus of this health evaluation includes HEC 1: Social Determinants of Health; HEC 2: Accidents and Injuries; HEC 3: Exposure to Hazardous Materials; and HEC 4: Food,

Nutrition, and Subsistence Activity. Baseline information for these HECs is discussed in this section and Appendix K3.10. These HECs are considered relevant because they assess social, financial, and health impacts that may arise directly from project-related employment and economic activities (HEC 1); accidents and injuries related to a variety of new construction and transportation facilities required for the project (HEC 2); possible health effects related to chemicals that the public may be exposed to during project activities (HEC 3); and impacts on food availability and harvesting activities that may occur in the project footprint or affected areas (HEC 4).

The remaining health effects categories are less likely to have plausible, causal connections with or easily measurable impacts from the project. The baseline status of these HECs is briefly summarized in this section, but is discussed in more detail in Appendix K3.10 for purposes of completeness.

Identifying Potentially Affected Communities—The communities included in this health evaluation are consistent with the recommendations in the HIA guidance that potentially affected communities should be identified on the basis of multiple factors, including geographic proximity to the project, potential for economic impact (e.g., work force recruitment areas, population influx areas), potential use areas in relation to project footprint (e.g., subsistence activity areas), and areas of health disparities. The project would cover a relatively large geographical distance. The transportation corridor would extend approximately 72 miles, and the natural gas pipeline would extend approximately 210 miles. The potentially affected communities, including children and adults, that were identified for the health evaluation correspond to the EIS analysis areas, which are the basis of Section 3.3, Needs and Welfare of the People—Socioeconomics, and Section 3.9, Subsistence. The populations of the communities in the EIS analysis area for the health section range from very small, rural communities closer to the mine site to larger, more urban communities farther away. The locations of the selected areas are illustrated in figures for Section 3.4, Environmental Justice. These potentially affected communities, regional areas, and the HECs for which they are evaluated in this section are listed in Table 3.10-1.

The majority of the health evaluation is focused on 11 individual communities that represent the five larger boroughs/census area of the EIS analysis area. This section focuses on the 11 potentially affected communities geographically closest to the project in the Bristol Bay drainage basins: those most likely to be potentially impacted by the project. These communities include eight Iliamna Lake/Lake Clark communities in the LPB, and three Nushagak/Bristol Bay communities in the Dillingham Census Area. The eight LPB communities are closest to the project, and include Nondalton, Newhalen, Kokhanok, Port Alsworth, Iliamna, Pedro Bay, Levelock, and Igiugig. In 2018, the LPB had a population of 1,663, while these small rural communities had approximate population ranges of 33 to 227 people. These eight communities may be more directly impacted, both positively and negatively, compared to communities farther away, due to their relative proximity to the project components, and were evaluated for all HECs at the community level when data permitted. Three Nushagak/Bristol Bay communities (i.e., New Stuyahok, Koliganek, and Ekwok) in the Dillingham Census Area (census area population 5,021 in 2018) were also identified as geographically close to the project, and were evaluated at the community level when data permitted. These three communities had populations ranging from 106 to 496 in 2018. This section also evaluates impacts to the nearby community of Dillingham (at a regional level for health effects) and nearby boroughs and municipalities, because it is likely that some project workers would come from these populations. The 2018 populations for these communities were 2,382 in Dillingham, 58,471 in the KPB, 879 in the Bristol Bay Borough, and 295,365 in the Municipality of Anchorage (ADOL 2018; USCB 2018).

For subsistence-related health impacts, a total of 19 individual communities distributed throughout the larger boroughs and census areas are evaluated. The communities evaluated for subsistence impacts in this section (in HECs 3 and 4) were slightly different from the communities evaluated for socioeconomic impacts. The local communities evaluated for subsistence effects include the eight affected communities in the LPB, and two of the three affected communities in the Nushagak/Bristol Bay area (the data are insufficient to evaluate subsistence for Ekwok), as well

as nine additional communities that are farther from the project, but are known to use the area for subsistence (see Section 3.9, Subsistence). The nine additional subsistence-related communities include four communities in the Dillingham Census Area (Dillingham, Clark's Point, Manokotak, and Aleknagik), three communities in the Bristol Bay Borough (Naknek, South Naknek, and King Salmon), and two communities in the KPB (Ninilchik and Seldovia). Section 3.9, Subsistence, and Appendix K3.9 focus on six of the Iliamna Lake communities geographically closest to the project that show a particularly high level of subsistence activities in the EIS analysis area (Iliamna, Newhalen, Pedro Bay, Nondalton, Igiugig, and Kokhanok), but also present baseline details on traditional ecological knowledge (TEK), seasonal rounds, and subsistence harvest patterns for all 19 communities. Although it is possible that additional communities may occasionally use the EIS analysis area, these 19 communities, particularly the six Iliamna Lake communities, capture those most likely to use the area and are adequate to assess potential project impacts in this EIS with respect to subsistence-related health impacts.

The limitation of evaluating health impacts to communities based on proximity to the project components is that some effects may not be directly related to the distance between the community and the project component, such as employment opportunities. The rural location of the mine and the planned on-site housing camps make traditional commute times irrelevant; therefore, the communities that would contribute to the workforce may include more than those closest to the site. Also not directly related to distance would be changes in a community from project features, such as communities that might want to use project components like the Amakdedori port during the operations phase. These factors that are not dependent on distance also warrant consideration.

Age and Scope of Available Information—This EIS relies on previously compiled baseline information for most of the HECs, which date from about 2002 to 2017, with the majority from 2008 to 2017. More current data were accessed, when available, with a focus on the effects categories and diseases most relevant to human health effects.

For five categories (i.e., Social Determinants of Health; Accidents and Injuries; Food, Nutrition, and Subsistence Activity; Water and Sanitation; and Health Services Infrastructure), this health evaluation primarily relies on the data and conclusions from Section 4.3, Needs and Welfare of the People–Socioeconomics; Section 4.12, Transportation and Navigation; and Section 4.9, Subsistence, and supplements those sections as appropriate. For infectious diseases and non-communicable and chronic diseases, the baseline description focuses on the top several diseases in each category based on their public health significance and occurrence frequency. The sources of data cited also provide information on less prevalent diseases and conditions.

Health data are not always available at the community level for these potentially affected communities, due to privacy concerns and very small community sizes. To address these limitations, regional data sources in and near the EIS analysis area, including the LPB, Bristol Bay Borough, Dillingham Census Area, KPB, and Municipality of Anchorage, were included in the evaluation. Of these, only Anchorage is considered an urbanized area, and although it is neither geographically close to the project nor in the Bristol Bay drainages, it is likely that some project workers would come from this population. The other boroughs are considered remote, rural areas and are in or close to the EIS analysis area.

3.10.1.2 Demographic Summary of Potentially Affected Communities

The eight Iliamna Lake/Lake Clark communities and three Nushagak/Bristol Bay communities in or geographically closest to the project are generally comparable in median age and high school-level education rates to state averages, but lower in rates of college-level education and median income levels. With the exception of Port Alsworth, the individual communities in LPB and the Dillingham Census Area are majority Alaska Native populations. Bristol Bay Borough, Kenai Peninsula, and Anchorage have closer correspondences with state-level trends; particularly Anchorage, with its much larger population. To provide context for the health evaluation, a brief summary of the

demographic data is presented in Table 3.10-2 for the 11 communities geographically closest to the project, as well as regional data. More detailed demographic information for these 11 communities, including seasonal impact on employment, top employment sectors, population changes, age range percentages, gender percentages, and housing, is presented in Section 3.3, Needs and Welfare of the People–Socioeconomics. The nine additional communities that were evaluated only for subsistence impacts are represented in the information provided for the larger areas in which they reside (Dillingham Census Area, Bristol Bay Borough, and KPB).

Table 3.10-2: Demographic Summary

Subject	Alaska Native[1] Population (2017)	White[2] Population (2017)	Median Age (2018)	High School Graduate or Higher (2018)	Earned College Degrees (2018)	Median Household Income (2018)	Unemploy-ment Rate (2018)
Lake and Peninsula Borough	67.6%	22.4%	32.3	88%	16%	$45,208	13.2%
Nondalton	73.6%	13.6%	31.8	85%	11%	$38,750	25.0%
Iliamna	75.4%	16.9%	34.8	97%	19%	$93,750	6.1%
Newhalen	82.5%	9.6%	25.3	90%	17%	$36,250	8.0%
Port Alsworth	10.2%	68.8%	18.9	99%	49%	$86,667	1.3%
Pedro Bay	50.0%	16.7%	57.3	100%	11%	$53,750	18.2%
Kokhanok	91.9%	8.1%	28.1	81%	8%	$41,250	30.8%
Igiugig	89.1%	10.9%	29.0	86%	21%	$48,750	0.0%
Levelock	97.9%	2.1%	24.5	83%	2%	$25,000	16.3%
Dillingham Census Area	72.9%	17.5%	30.1	86%	17%	$58,708	11.4%
Ekwok	100.0%	0.0%	28.3	69%	0%	$28,750	39.5%
Koliganek	82.9%	9.4%	26.6	83%	20%	$53,750	11.1%
New Stuyahok	97.3%	0.4%	24.8	78%	3%	$43,750	23.8%
Dillingham	56.5%	28.0%	31.6	91%	22%	$75,764	5.1%
Bristol Bay Borough	34.6%	52.0%	41.8	93%	20%	$79,500	6.8%
Kenai Peninsula Borough	7.3%	83.6%	40.6	93%	24%	$65,279	8.6%
Anchorage	7.3%	63.7%	33.1	93%	35%	$82,271	5.8%
State of Alaska	14.2%	65.3%	33.9	92%	29%	$76,114	7.7%

Notes:
[1]Alone, or in combination with one or more other races.
[2]Alone, non-Hispanic.
See Section 3.3, Needs and Welfare of the People—Socioeconomics, for additional discussion and details.
Demographic and socioeconomic profiles of the potentially affected communities are presented in McDowell et al. 2011a; McDowell 2018a; in Section 3.3, Needs and Welfare of the People—Socioeconomics; and Section 3.4, Environmental Justice. The Alaska Native Health Status Report (ANTHC 2017a) presents recent state and regional overviews of sociodemographic highlights demographics, education attainment, unemployment, poverty, and household income), as well as mortality highlights, morbidity highlights, and maternal, infant, and child health highlights.
Sources: USCB 2018

3.10.1.3 Baseline Community Health Conditions

Baseline conditions are defined as the current health status of the potentially affected communities, in the absence of or prior to the project. Information for the 11 potentially affected communities geographically closest to the project and evaluated for all HECs is presented, and

compared to other local and regional data as warranted, and compared to state or US data. Primary data sources include government, regional, community, and academic sources.[1] As noted earlier, the individual communities in the Dillingham Census Area, KPB, and Bristol Bay Borough that were evaluated only for subsistence impacts are not included here, but are included in the respective borough-level data.

Although statewide data offer some context, the HEC discussions in this section are limited to health endpoints that have relevant and recent regional and local data available (older data are presented as warranted or if current data were not available). When available, local community data are representative of very small populations. Comparisons of statewide rates with local small population community rates should be interpreted with caution due to the statistical uncertainty associated with small populations, and because the statewide rates represent a mix of large and small population data. For regional rates based on fewer than 20 cases, they should also be viewed with caution because they may not be statistically reliable.

It is important to recognize that communities and populations are composed of many sub-groups with different levels of health status, access to healthcare, and susceptibility to health impacts leading to disparities in health status. Age, gender, ethnicity, income level, education, and other factors greatly affect the health status of individuals and households.

3.10.1.4 Health Effects Categories

HEC 1: Social Determinants of Health

It is widely recognized that social and economic factors and access to healthcare have a strong causal relationship with health status (WHO 2018; ODPHP 2018). Factors such as income, education, isolation, and early access to healthcare are termed social determinants of health (SDH) because any changes in these factors, positive or negative, can lead to corresponding changes in the physical, mental, and social health of the population. Outcomes of SDH such as infant mortality, suicide rates, or dental health serve as indicators of overall community health status and health needs. Any project-related impacts to the SDH of the affected communities, especially small communities, may result in immediate and substantial impacts on key aspects of community health (e.g., increased income levels as a project benefit may make preventive healthcare more affordable and result in a drop in avoidable serious health issues). Oral health is an important and commonly used health indicator by public health agencies such as the Centers for Disease Control and the ADHSS, because it represents both behavioral and structural risk factors.

The ADHSS Technical Guide (ADHSS 2015) suggests a broad list of SDH for consideration. For the purposes of this evaluation, a limited subset of SDH representing a range of physical, mental, and social factors was selected that covers a range of population sectors from infants to adults, and has the most value as overall indicators of community health status. Physical metrics of SDH include life expectancy, adequate prenatal care, infant mortality, and oral health. Psychosocial metrics of SDH include teen pregnancy rates, adult mental health, suicide (overlaps with HEC 2), alcohol use, binge drinking, and crime (e.g., assault and rape). Many of these SDH for the affected

[1] Primary data sources include the Alaska Department of Commerce, Community, and Economic Development, Alaska Department of Environmental Conservation, Alaska Department of Fish and Game, ADHSS, Alaska Department of Labor and Workforce Department, Alaska Native Tribal Health Consortium, Alaska State Troopers, Bristol Bay Area Health Corporation, Bristol Bay Native Association, Cook Inlet Region, Inc. Foundation, Commercial Fisheries Entry Commission, US Department of Commerce, Bureau of Economic Analysis, US Census Bureau, US Centers for Disease Control and Prevention, US Department of Health and Human Services, World Health Organization, and other government, regional, community, and academic sources.

communities are evaluated in Section 3.3, Needs and Welfare of the People—Socioeconomics. SDHs, such as isolation and cultural change, lack meaningful available data at the community level of health, but are addressed in a larger context in Section 3.7, Cultural Resources, and Section 3.9, Subsistence.

For those SDH not covered in Section 3.3, Needs and Welfare of the People–Socioeconomics, Table K3.10-1 in Appendix K3.10 summarizes the additional relevant SDH and important indicators for this HEC, because they may potentially be impacted by the project. The Bristol Bay, Kenai Peninsula, and Anchorage regions have similar Alaska Native life expectancies to the state, but these rates are approximately 7 to 8 years lower than state and national life expectancies for whites (ANTHC 2017b). The Iliamna Lake/Lake Clark communities had rates of adequate prenatal care comparable to the urban Anchorage region. In comparison to these rates, the Nushagak/ Bristol Bay communities, LPB, Dillingham Census Area, and Bristol Bay Borough all had higher rates of inadequate prenatal care, particularly the Nushagak/Bristol Bay communities (ANTHC 2016a; McDowell 2018b). The Nushagak/Bristol Bay communities and the Bristol Bay region had higher teen pregnancy rates than the Dillingham Census Area, the Kenai Peninsula, and Anchorage (ANTHC 2016c). With regard to oral health, the Bristol Bay, Kenai Peninsula, Anchorage, and state rates were all fairly similar for Alaska Natives, but they all had higher rates of tooth loss compared to Alaska Whites (ANTHC 2017c, d).

Mental health is measured as self-reported stress, depression, and problems with emotions in the past 30 days (ANTHC 2017e; McDowell 2018b). Although the average statewide number of poor mental health days was 20 percent higher for Alaska Natives than Alaska Whites (ANTHC 2017e), the LPB, Dillingham Census Area, and Bristol Bay Borough all self-reported lower rates of poor mental health (all races) than state rates reported for all races, whites, and Alaska Natives (McDowell 2018b). Binge drinking is measured as self-reported adults aged 18 years of older who have had five or more drinks (men) or four or more drinks (women) on one or more occasions in the past 30 days (ANTHC 2017g) or in one sitting (McDowell 2018b). The LPB and Dillingham Census Area self-reported lower rates of binge drinking (all races) compared to state rates, while Bristol Bay Borough reported rates higher than the state (McDowell 2018b). The overall violent crime rate in the Dillingham Census Area is nearly double the rate in the urban Anchorage region and the state, and more than four times the rate in the Kenai Peninsula region and nationally (FBI 2017). Specifically, aggravated assault and rape were much higher in the Dillingham Census Area compared to other regional, state, and national rates. There were no violent crime rates reported for the Bristol Bay Borough (FBI 2017), but these results appear erroneous (perhaps the 2017 data were not yet tabulated into the FBI database), because reported crimes in 2016 in Bristol Bay include assault, burglary, forcible entry, larceny-theft, and motor vehicle theft (McDowell 2018a). Although not exhaustive, these metrics indicate that some areas of health status where the rural communities are comparable to or better off than urban areas, and some health needs where rural areas fare worse, project-related activities may lead to improvement or further worsening, as discussed in Section 4.10, Health and Safety.

Overall, the affected communities whose health may be most impacted by the project in the EIS analysis area (or may use the area for residence, subsistence, or recreation) are the remote, rural communities in the Bristol Bay Region (which includes the LPB, Bristol Bay Borough, and Dillingham Census Area) and Kenai Peninsula Region. The remote communities generally have lower levels of employment, income, formal educational attainment, and access to amenities than urban communities. Although they are comparable to the larger urban areas in some areas of health, there are other areas such as alcohol consumption where the rural areas may have higher health needs.

HEC 2: Accidents and Injuries

Accidents and injuries include both fatal and non-fatal incidents that are primarily unintentional and affect the mortality and morbidity rates of a community. Unintentional injury (e.g., falls, poisoning, drowning, and motor vehicle crashes) is the third leading cause of death in the state, and a leading cause of death in most regions (ADHSS 2017a; ANTHC 2017i), including the Iliamna Lake/Lake Clark Communities, Dillingham Census Area, and Bristol Bay Borough (McDowell 2018b). Intentional incidents include homicide and suicide (note: suicide overlaps with HEC 1, psychosocial stress). An understanding of baseline rates of accidents and injuries is important to understand whether any aspects of the project could lead to changes in these parameters. For example, surface transportation elements of the project could alter the rates of motor vehicle and other land transport accidents.

Information regarding unintentional deaths and injuries, leading causes of hospitalization, and suicide rates was available for most of the regions in the EIS analysis area (see Table K3.10-2). In comparison to national and state rates, the levels of unintentional deaths and injuries in the potentially affected communities were higher. Overall, falls were the number one cause of hospitalizations in Alaska, as well as the EIS analysis area, with the exception of Bristol Bay.

Vehicle incidents and causes related to land transport were ranked as the number one cause of hospitalization in Bristol Bay (other land transport), as number two (other land transport) in the LPB, and number two (other land transport) and number three (motor vehicle) in Dillingham Census Area. These rankings are similar to one another and to the state of Alaska overall, where vehicle accident hospitalizations are ranked as the number two (motor vehicle) and number four (other land transport) causes of hospitalization for the state of Alaska overall (ANTHC 2015, 2017c, j; McDowell 2018b). Baseline data for other transportation accident types (e.g., ferry, barge, air) were not readily available, which may be due to low number of occurrences, because none are listed as leading causes of hospitalizations. Numeric data on rates or numbers of accidents by cause or type of transportation were not readily available.

Suicide mortality rates varied by region, but it was the fourth leading cause of death among Alaska Native people during the period from 2012 to 2015 (ANTHC 2017f). Suicide mortality rates for the Dillingham Census area, Anchorage, and state are similar. In comparison to the Dillingham Census Area, Anchorage, and the state, Bristol Bay regional rates are higher, and Kenai Peninsula regional rates are lower (ANTHC 2017f; McDowell 2018b). However, due to the low number of documented suicide mortality cases in the Dillingham Census Area, Bristol Bay region, and Kenai Peninsula region, these rates may not be statistically reliable, and should be viewed with caution.

HEC 3: Exposure to Potentially Hazardous Materials

Environmental exposure to hazardous chemicals through the air, land, or water is considered a health determinant. Baseline data may be qualitative in terms of proximity to known contamination sources, or quantitative through analytical data collection (e.g., water quality data, soil analytical data). Overall, baseline conditions of exposure to potentially hazardous chemicals may include the occurrence of localized poor air quality in some areas due to outdoor dust or indoor air pollution, as well as elevated levels of a few naturally occurring metals in soils, surface waters, groundwater, and some food sources. Dust from unpaved roads may circulate contaminants that can be deposited onto surface water and further redistributed to sediments.

Air Quality—The role of poor air quality on community health, particularly with regard to respiratory disorders, has been well-documented (WHO 2016). Air pollutant concentrations that are lower than the Alaska Ambient Air Quality Standards (AAAQS) provide public health protection, including protecting the health of sensitive populations such as asthmatics, children,

and the elderly. Section 3.20, Air Quality, presents background concentrations for criteria pollutants for each project component that are representative of the ambient environment, and include the contributions from nearby and other background sources. These background air quality data are sufficient for establishing baseline EIS analysis area conditions for NEPA purposes. All measured criteria air pollutants in the region containing the project are below AAAQS. The project is far from any potential sources of lead (e.g., airfields); and absent large regional anthropogenic sources, there is no reason to expect measurable concentrations of hazardous air pollutants in the project area except for what is biogenic in nature (see Section 3.20, Air Quality).

Burning trash, generating power using diesel generators, and heating homes using wood stoves are possible practices in the potentially affected communities in the EIS analysis area that could contribute to localized poor air quality indoors and outdoors. Unpaved roads are a major source of dust and may circulate pollutants in dust, which affects air quality and may also settle on food sources. There are also indoor air quality issues with the use of old wood and fuel oil burning stoves, which may be made worse by spending a lot of time indoors in winter.

Water Quality—The baseline water quality data are provided in Section 3.18, Water and Sediment Quality. The baseline surface water data were obtained from the waterbodies in the EIS analysis area that would be most affected by project activities, including North Fork Koktuli, South Fork Koktuli, Upper Talarik Creek, Frying Pan Lake, Iliamna Lake, and surface water data along the western and eastern parts of the north access route of the transportation corridor. Baseline surface water resources in the vicinity of the mine site and Alternative 1a, Alternative 1, Alternative 2, and Alternative 3 transportation corridors had numerous detections of naturally occurring trace elements/metals, but only a few mean concentrations exceeded the selected applicable State of Alaska water quality standards (WQS) protective for all designated water uses (most stringent of human health and ecological criteria, including drinking water supply and household use): aluminum in the western portion of the north access road, and aluminum and copper in the eastern portion of the north access road. Although cyanide was only occasionally present in detectable concentrations, none of the mean concentrations were above the WQS. See Section 3.18 and Appendix K3.18, Water and Sediment Quality, for further details on water quality criteria.

The baseline groundwater data were obtained from individual wells along the watershed in each lithologic group in and outside the Pebble deposit area. Baseline groundwater had numerous detections of naturally occurring trace elements/metals, with mean concentrations of aluminum, copper, iron, lead, manganese, molybdenum, and zinc exceeding the most stringent of either drinking water standards or WQS for aquatic life criteria, because groundwater could discharge to surface waterbodies. For further details, see Section 3.18, Water and Sediment Quality. Several community drinking water wells are situated along the transportation corridors: Nondalton City Well, Newhalen Public Well #2, Iliamna Weathered Inn Well, and the Pedro Bay Tribal Council Well. Arsenic was reported as above drinking water standards in the Nondalton, Newhalen, and Pedro Bay wells, while pH was reported above drinking water standards in the Newhalen, Pedro Bay, and Iliamna wells. Arsenic is a naturally occurring element in rock and soil, and often present in trace amounts in groundwater. Concentrations of arsenic in groundwater are generally associated with volcanic deposits and gold-mining areas, and high concentrations of arsenic in groundwater are largely the result of arsenic-containing minerals (e.g., iron-sulfide and copper-sulfide minerals) dissolving naturally over time from weathered rock and soils.

Existing Potentially Hazardous Materials Sites—There are numerous known contaminated sites in the EIS analysis area that are under federal or state agency oversight. The following summarizes the number of open Alaska Department of Environmental Conservation (ADEC)-regulated contaminated sites listed for each of the boroughs in and in the vicinity of the EIS analysis area on ADEC's contaminated sites database, as of March 2018 (ADEC 2018d):

- Lake and Peninsula Borough—30 open sites
- Bristol Bay Borough—60 open sites
- Dillingham Census Area—25 open sites
- Kenai Peninsula—130 open sites

In addition, there are four US Environmental Protection Agency (EPA) Comprehensive Environmental Response, Compensation, and Liability Act sites in Anchorage (EPA 2018a), as well as US Army Corps of Engineers (USACE) formerly used defense sites in the LPB (four sites) and the KPB (10 sites). Contaminants of concern from these sites include, but are not limited to: metals, asbestos, polychlorinated biphenyls, petroleum hydrocarbons (e.g., fuel, lubricants), pesticides, and solvents. All these sites are under active oversight by government agencies, and agency directives are expected to control or prevent exposure to the general public. Additionally, no contaminated site records coincided with or were in proximity to the project footprint. Therefore, the proximity of these sites is not expected to contribute to the baseline exposure to hazardous materials.

Potentially Hazardous Materials Exposure through Subsistence—People may be exposed to chemicals in food sources through food-web transfer (chemicals accumulated by fish, wildlife, or edible plants). The accumulation of chemicals in biological tissues is called bioaccumulation; increasingly higher concentrations of chemicals at higher levels of the food-web is called biomagnification. However, not all chemicals have the propensity to bioaccumulate or biomagnify. Examples of metals that may bioaccumulate to some degree include arsenic, lead, and mercury; mercury also can biomagnify.

In the EIS analysis area, baseline trace element (metal) data were collected for soil, vegetation, and fish tissue, as well as sediment and surface water, and are provided and discussed in Section 3.14, Soils; Section 3.26, Vegetation; Section 3.24, Fish Values; and Section 3.18, Water and Sediment Quality. Exposure to these trace elements/metals from these media, resources, and from ambient air may have the potential to impact human health from direct exposure, including inhalation; or through dietary exposure, including the potential for some of these trace metals to bioaccumulate in tissue. Bioaccumulation can occur either from the direct exposure pathway (i.e., inhalation of metals in air or dust) or from the dietary pathway (e.g., metals may bioaccumulate and biomagnify in wildlife and fish, which may then be consumed by subsistence users). In addition, exposure to infants can occur through maternal transfer of dietary metals. Exposure to these trace elements through direct and dietary exposure represents baseline hazardous exposure potential for the potentially affected communities in the EIS analysis area.

HEC 4: Food, Nutrition, and Subsistence Activity

The role of adequate and high-quality food and nutrition is of paramount importance to health. In Alaska, subsistence activities greatly contribute to community nutrition to provide dietary items such as fish, game, and berries that are highly nutritious, and support cultural and social cohesion (ANHB 2004). The level of physical activity involved in harvesting subsistence foods also contributes to a more active lifestyle and confers additional health benefits (overlaps with HEC 7, because low physical activity is considered a chronic disease contributing factor). Therefore, subsistence activities and nutrition play a large role in the physical and social health of communities; changes to these dietary habits and food security may lead to changes in health. For example, if the footprint of a project has a substantial overlap with traditional hunting or fishing areas such that people's access to these resources is reduced or subsistence users avoid harvesting resources near regional extractive industrial developments due to contamination concerns (whether real or perceived), this may lead to changes in subsistence harvesting patterns and dietary composition, such as reduced fishing or hunting activity, and the purchase of lower-

quality, processed foods. The health consequences may include a more sedentary lifestyle along with lower nutritional health status. Conversely, positive impacts may also occur if increased income from increased employment allows food-insecure households to purchase more equipment for subsistence harvesting, or to purchase more nutritious food.

As discussed in Section 3.3, Needs and Welfare of the People–Socioeconomics, the cost of living in Alaska is higher than the national average, with Alaska ranked as the third most expensive state nationally, based on costs of living in the four largest Alaskan cities, including Anchorage. However, the price of food in Alaska is even higher in small rural communities that are not connected to the Alaska main road system. In some communities, staple goods, such as food and fuel, cost more than twice as much as they do in Anchorage because the items need to be transported by barge or air. For example, during an August 2018 visit to Iliamna, the price of a half-gallon of whole milk was $13.49, which is equivalent to $27 a gallon, and is nearly nine times the 2017 national average price of $3.16 (Statistica 2018). For additional discussion, see Section 3.3, Needs and Welfare of the People–Socioeconomics.

Although the cost of living can be high in rural communities, it can be offset by subsistence hunting and fishing to supplement the needs of families and communities. Subsistence activities are a central feature of Alaska Native history and society, support healthy diet and nutrition, and are an important aspect of preserving cultural heritage and mental health. Subsistence foods are vital in small rural communities, and are often the basis of many local economies. These foods are important for food security due to high cost of living/food in the region, and are widely recognized as healthier than market food options (USDA 2004). Subsistence foods include salmon, shellfish, game and wildlife (e.g., moose and caribou), and plants and berries. Section 3.9 and Appendix K3.9, Subsistence provide subsistence harvest activity details for each of the potentially affected communities. As shown in Table K3.10-3 in Appendix K3.10, the LPB, Dillingham Census Area, and Bristol Bay Borough report a higher subsistence lifestyle (approximately 2.5 times) than Alaska's population overall (McDowell 2018b). These subsistence lifestyle rates correspond with LPB and Bristol Bay Borough self-reporting higher percentages of physical activity compared to Alaska overall, but do not correlate with the Dillingham Census Area, which was only slightly above Alaska overall (McDowell 2018b; see Table K3.10-5 in Appendix K3.10). However, this may be due to how the baseline data for the communities was measured, because subsistence lifestyle and physical activity were both self-reported and defined by the respondent.

Percentages of nutritional intake and weight are similar between the LPB, Dillingham Census Area, Bristol Bay Borough, and the state, with some noted differences (McDowell 2018b). Table K3.10-3 in Appendix K3.10 presents nutritional baseline data, while overweight/obese baseline data are presented in Table K3.10-5 in Appendix K3.10 (weight overlaps with HEC 7, because it is considered a chronic disease contributing factor). Bristol Bay Borough self-reports as more likely to be overweight/obese according to body mass index, and eat fewer than five daily servings of fruits and vegetables compared to Alaska overall; while Dillingham Census Area self-reports a higher percentage of adults who consume one or more sugar-sweetened beverage or soda per day (not including 100 percent juice or artificially sweetened drinks) compared to Alaska overall (McDowell 2018b).

Poverty levels and rates of malnutrition, as well as cost of living/food and access to and the quantity and quality of subsistence resources have the potential to impact food security and health. Food security is defined by the US Department of Agriculture (USDA) as, "access by all people at all times to enough food for an active, healthy life" (ADF&G 2018v). Food security data, as collected by the Alaska Department of Fish and Game (ADF&G), include subsistence foods and store-bought foods. As shown in Table K3.10-3 in Appendix K3.10, the potentially affected communities in the LPB had percentages of families with incomes below the federal poverty level

threshold[2] (2012-2016) ranging from 28.6 percent (Kokhanok) to 0 percent (Igiugig and Pedro Bay); while those in the Dillingham Census Area ranged from 28.1 percent (New Stuyahok) to 5.7 percent (Koliganek). Overall, approximately 15 percent of both LPB and Dillingham Census Area families and just 4 percent of Bristol Bay Borough families fell below the federal poverty level threshold (McDowell 2018a). These borough/census area rates are lower than those living below the poverty level threshold for Alaska Natives statewide, and fairly similar to national whites, at 6.7 percent (2011-2015) (ANTHC 2017a).

Subsistence activities remain an important food source for a large proportion of households in the EIS analysis area reporting using and harvesting (Section 3.9, Subsistence), although it is difficult to quantify how variability in subsistence activities would influence food security. Although subsistence frequently involves no monetary exchange, the contribution of food procured by hunting and fishing and sharing can be a significant contributor to household and community welfare (see Section 3.3, Needs and Welfare of the People—Socioeconomics).

HECs of Low Relevance

As noted earlier, the relevance to the project of the remaining HECs outlined in the HIA toolkit is expected to be low. These include Infectious Diseases (HEC 5), Water and Sanitation (HEC 6), Non-communicable and Chronic Diseases (HEC 7), and Healthcare and Safety Services and Infrastructure (HEC 8). These issues may be addressed by planned project programs and measures, or fall outside the project activity footprint. Therefore, they are briefly summarized here; additional details are included in Appendix K3.10.

HEC 5: Infectious Diseases

HEC 5 evaluates the role of infectious diseases in the health, mortality, and morbidity of populations. Appendix K3.10 and Table K3.10-4 provide details on leading infectious disease rates for the EIS analysis area community regions, when available, and the state of Alaska, as well as childhood immunization rates. Overall, reportable infectious diseases (influenza and pneumonia) were the tenth leading cause of death to all races in Alaska (ADHSS 2017a), but regional rates were not readily available. Regional Alaska Native rates of sexually transmitted infections (as represented by chlamydia and gonorrhea) are comparable to or lower than state Alaska Native rates, while the more urban Anchorage region has rates higher than the state average (ANTHC 2017k, l).

HEC 6: Water and Sanitation

HEC 6 evaluates water and sanitation for the potentially affected communities because the lack of safe water supply (i.e., running water) and suitable sewage disposal can represent a major public health and community development problem. Appendix K3.10 provides details on water and sanitation for the EIS analysis area community regions. In the Bristol Bay Region (which includes Bristol Bay Borough, the Dillingham Census Area, and LPB), 99 percent of households had water and sewer services; while in the Kenai Peninsula, service was 100 percent (ANTHC 2017n).

HEC 7: Non-Communicable and Chronic Disease

Because non-communicable and chronic diseases can consume a large part of healthcare resources and affect the overall health status of a population, HEC 7 evaluates the incidence of

[2] The federal poverty threshold is updated for inflation, but does not vary geographically and is based on pre-tax income (ANTHC 2017a).

such diseases; but in the context of evaluating an individual project, it may be difficult to attribute a single project-related cause to changes in disease incidence. Appendix K3.10 and Table K3.10-5 provide details on non-communicable and chronic diseases for the EIS analysis area communities and regions, as well as chronic disease contributing factors. Overall, Iliamna Lake/Lake Clark, Nushagak/Bristol Bay communities, Anchorage, and the state have similar leading causes of death (cancer and heart disease) and similar cancer death rates, with the exception of higher cancer rates in Iliamna Lake/Lake Clark communities and LPB (McDowell 2018b; ADHSS 2017a; ANTHC 2017a, i, o). The leading types of cancers causing deaths in the potentially affected communities are colorectal and lung/bronchus cancers. Colorectal cancer death rates are higher in the LPB and Dillingham Census Area compared to the state; conversely, lung/bronchus cancer death rates are lower in these two areas compared to the state (McDowell 2018b). Cancer incidence is variable, but generally similar between the regions, state, and national rates, with the exception of lower incidence in the Dillingham Census Area (colorectal as the leading type) and higher in the Kenai Peninsula Region (McDowell 2018b). Heart disease rates in the Iliamna Lake/Lake Clark communities, Nushagak/Bristol Bay communities, and LPB were higher than both Anchorage and state rates (McDowell 2018b; ADHSS 2017a; ANTHC 2017a, i, p).

HEC 8: Health and Safety Services Infrastructure and Capacity

An important measure of the health-related resilience and support structure of a community is the quality and quantity of healthcare and safety services that are available to the residents. HEC 8 evaluates potential impacts to the capacity of existing healthcare and safety services. Appendix K3.10 and Table K3.10-6 provide details on health services, hospitalizations, and adequacy of health services in the EIS analysis area. Overall, the LPB, Bristol Bay Borough, and the Dillingham Census Area report lower or similar access to health services (McDowell 2018b). All of these communities, with the exception of Port Alsworth, have a health clinic served by 1 to 5 health aides. Although there are some variations in the top three leading causes of hospitalizations by year and region, pregnancy/childbirth and newborn/neonate complications of pregnancy and childbirth or newborn/neonate conditions are consistently leading causes. The LPB, the Dillingham Census Area, Bristol Bay Borough, Kenai Peninsula, and Anchorage are all designated as Medically Underserved Area/Population.

Table K3.10-7 provides a summary of the available safety services for the eight Iliamna Lake/ Lake Clark communities in the LPB and the three Nushagak/Bristol Bay communities in the Dillingham Census Area, including number of village public safety officers (VPSO) or village police officers (VPO), ambulances, fire trucks, and emergency medical technicians (EMT) or emergency trauma technicians (ETT). Only two of these communities (New Stuyahok and Koliganek) are served by a VPSO and/or VPO; the communities without rely on Alaska State Trooper coverage. Three communities have an ambulance, fire truck, and EMTs (Newhalen, Nondalton, and Iliamna). Three other communities also have ambulances: one with a fire truck (Igiugig) and two with an EMT (Pedro Bay and New Stuyahok). Of the remaining communities, Kokhanok is served only by ETTs, Levelock is served only by a fire truck, Koliganek is only served by EMTs, and Port Alsworth and Ekwok are not served by any of these safety services. Overall, these communities have lower access to safety services than larger nearby communities, such as the city of Dillingham, which has a police department and a hospital (McDowell 2018a, 2018b), and Anchorage.

3.10.2 Safety

Safety, as defined by compliance with OSHA and MSHA regulations, or other types of design, structural, operational, and accident or hazard prevention programs cannot be described for the

EIS analysis area under baseline conditions, because there is no project activity. Safety is discussed with reference to the project in Section 4.10, Health and Safety.

Baseline safety for the potentially affected communities "outside the fence" were included under HECs discussed in this section (e.g., violent crime under HEC 1, accidents and injuries under HEC 2, health and safety infrastructure and capacity under HEC 8).

3.10.2.1 Pipeline Reliability and Safety

The transportation of natural gas by pipeline involves some risk to the public in the event of an accident and subsequent release of gas. The greatest hazard is a fire or explosion following a major pipeline rupture. Section 4.27, Spill Risk, discusses the risk of a natural gas release from the pipeline.

Methane, the primary component of natural gas, is colorless, odorless, and tasteless. Although there are differing opinions regarding methane's relative toxicity, for the purpose of this EIS, methane is considered toxic, in keeping with its listing on the EPA's Toxic Substances Control Act inventory, and is a simple asphyxiate. If breathed in high concentration, oxygen deficiency can result in serious injury or death. Methane has an auto-ignition temperature of 1,000 degrees Fahrenheit (°F) and is flammable at concentrations between 5 and 15 percent in air. Unconfined mixtures of methane in air are rarely explosive. However, a flammable concentration in an enclosed space in the presence of an ignition source can explode. It is buoyant at atmospheric temperatures and disperses rapidly in air.

The US Department of Transportation (USDOT) is mandated to set pipeline safety standards under Title 49, United States Code Chapter 601. The USDOT's Pipeline and Hazardous Materials Safety Administration oversees the national regulatory program to ensure the safe transportation of natural gas and other hazardous liquids by pipeline. The USDOT pipeline standards are published in 49 Code of Federal Regulations (CFR) Parts 190 to 199. Parts 190, 191, 192, and 199 apply to the pipeline. The pipeline and aboveground facilities associated with the project must be designed, constructed, operated, and maintained in accordance with the USDOT Minimum Federal Safety Standards in 49 CFR Part 192. The regulations are intended to ensure adequate protection for the public and to prevent natural gas facility incidents and failures.

Area classifications based on population density in the vicinity of the pipeline are defined by 49 CFR Part 192, which also specifies more rigorous safety requirements for populated areas. The class location unit is an area that extends 220 yards (660 feet) on either side of the centerline of any continuous 1-mile length of pipeline. The four area classifications are defined as follows:

- Class 1—Location with 10 or fewer buildings intended for human occupancy.
- Class 2—Location with more than 10 but fewer than 46 buildings intended for human occupancy.
- Class 3—Location with 46 or more buildings intended for human occupancy, or where the pipeline lies within 100 yards of any building, or small, well-defined outside area occupied by 20 or more people on at least 5 days a week for 10 weeks in any 12-month period.
- Class 4—Location where buildings with four or more stories aboveground are prevalent.

The pipeline and aboveground facilities associated with the project must be designed, constructed, operated, and maintained in accordance with Part 192 of the pipeline safety regulations, which prescribe minimum safety requirements for the transportation of natural gas.