5.15 PUBLIC HEALTH

5.15.1 Proposed Project Background

This public health section identifies the potential human health impacts (both positive and negative) associated with the proposed construction and operation of a pipeline to transport natural gas and natural gas liquids (NGLs) from the North Slope of Alaska near Prudhoe Bay to Fairbanks, Anchorage, and the Cook Inlet area, as proposed by the AGDC. The U.S. Army Corps of Engineers (USACE) has not yet authorized this proposed Project, which is currently in the National Environmental Policy Act (NEPA) Review/Environmental Impact Statement (EIS) process. A brief description of the proposed Project, schedule, site access, materials site, and workforce is provided below; a more detailed discussion is provided in Section 2.0.

5.15.1.1 Overview

The proposed pipeline would transport natural gas and NGLs from existing reserves within Prudhoe Bay gas fields on the North Slope of Alaska for delivery to in-state markets in Fairbanks and Southcentral Alaska (Anchorage and the Cook Inlet area). Discovered technically recoverable natural gas resources on the Alaska North Slope are estimated to be about 35 trillion cubic feet (TCF) (USDOE 2009). The proposed Project would be the first pipeline system available to transport natural gas from the North Slope. The gas and NGLs would be used to: heat homes, business, and institutions; generate electrical power; and for potential industrial uses. NGLs in excess of in-state demand could be transported to export markets via marine transport from Nikiski. However, the export of NGLs is not proposed by the AGDC as a component of the proposed action.

The Preliminary Final Environmental Impact Statement (EIS) also assesses the environmental effects of the Denali National Park Route Variation. The 15.3-mile-long Denali National Park Route Variation would replace a 15.5-mile-long segment of the proposed Project between approximately MP 540 to MP 555 and would follow the Parks Highway corridor through Denali National Park and Preserve (Denali NPP). South of the Denali NPP, the route variation would cross the Nenana River at McKinley Village and continue south within the Parks Highway rights-of-way (ROW). Section 2.0 describes the proposed action in detail, while the Denali National Park Route Variation is described in Section 4.0.

5.15.1.2 Schedule

As currently proposed by the AGDC, construction of the major aboveground facilities would commence in the summer of 2016 and would extend to the summer of 2019. Pipeline construction would be initiated in the winter of 2017 and completed to accommodate an in-service in the fall of 2019. The AGDC primarily proposes winter and summer construction and intends to use five construction spreads to construct the proposed Project. As described by the AGDC, the approximate mileposts for each spread are:
- Spread 1: MP 0.0 to MP 183.0;
- Spread 2: MP 183.0 to MP 360.0;
- Spread 3: MP 360.0 to MP 529.0;
- Spread 4: MP 529.0 to MP 737.1; and
- Fairbanks Lateral Spread: MP FL 0.0 to MP FL 34.4.

According to the AGDC, the length of time the trench would remain open (i.e., trenching to backfill) during construction at any one location would range from one to three days. Construction at any single point along the proposed pipeline, from ROW clearing to backfill and final grading, would typically last about 90 to 120 days (three to four months). Due to weather and trench settling, final grading could occur up to one year after trench backfilling.

The AGDC has indicated that the proposed Project could be operated up to 50 years, contingent on natural gas availability. The AGDC currently has no plans for future expansion of the facilities proposed. Upon reaching the end of the proposed Project’s functional life, the pipeline would be shut down and decommissioned (see Section 2.4).

5.15.1.3 Site Access

The AGDC would use existing public roads, ports, and railroads to facilitate equipment and material distribution along the proposed Project route. Approximately 3,800 rail cars would be required to transport the pipe from Seward to Fairbanks for double jointing, and approximately 9,000 truckloads would be required to distribute the pipe to laydown yards. Several temporary and permanent access roads would be required to transport equipment, materials, and workers to the proposed Project areas. Furthermore, access roads would be used to access water sources, material sites, and various aboveground facilities.

The AGDC would construct gravel roads, ice roads, and snow roads as well as improve some existing roads for proposed Project construction and/or operation. As proposed, mainline Project construction would require the temporary use of 28 gravel and ice roads (12 of which are existing roads) to access the proposed Project ROW. Further, 107 permanent gravel roads (of which 60 would be new) would be required for proposed Project mainline construction and operation. Five existing roads have been proposed for permanent use to support construction and operation of the Fairbanks Lateral. See Section 2.0 for more information.

Proposed Project-related use of highways, maintained borough roads, and other types of public roadways would typically not require improvements. Additional information on access roads and the associated land requirements is provided in Section 5.9 (Land Use).

5.15.1.4 Material Sites

Material sites (sand and gravel pits) located along the proposed Project would be used to provide gravel for workpads, access roads, pipeline bedding and padding, and the construction
of aboveground facilities. The AGDC has estimated that approximately 13.1 million cubic yards of material might be required for proposed Project construction. The AGDC has identified 546 existing material sites using Alaska Department of Transportation and Public Facilities (DOT&PF) material site information sources. The AGDC expects that the use of existing material sites would be sufficient to meet the proposed Project’s needs. A majority of these sites would be located within 10 miles of the proposed Project, thereby reducing the material hauling distance. Every effort will be expended to ensure that these material sites are not located in close proximity to areas of human activity.

The AGDC will develop a Material Site Mining Plan and Reclamation Plan for each proposed site prior to development. The AGDC would also develop a Storm Water Pollution Prevention Plan (SWPPP) for each proposed site prior to development and maintain best management practices (BMPs) during construction and operation of the material source.

5.15.1.5 Workforce

As provided in Table 5.15-1, the AGDC has proposed 15 work (construction) camps to house workers during proposed Project construction (see Sections 2.1.3 and 5.9 of the EIS). All of these camps would be located at existing construction camps or previously cleared and disturbed areas. As illustrated below, 6 of the 15 work camps are anticipated to be within the boundaries of nearby communities, including Coldfoot, Livengood, Nenana, Healy, Cantwell, and Talkeetna Junction, also known as Y (Y). Workers would also be housed in local accommodations when available.

<table>
<thead>
<tr>
<th>Borough</th>
<th>Location</th>
<th>Mile Post</th>
<th>Nearest Community</th>
<th>Distance from Nearest Community (miles)</th>
<th>Camp Capacity</th>
<th>Camp Staff</th>
</tr>
</thead>
<tbody>
<tr>
<td>North Slope</td>
<td>Prudhoe Bay</td>
<td>4</td>
<td>Deadhorse&lt;sup&gt;a&lt;/sup&gt;</td>
<td>4.8</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td></td>
<td>Franklin Bluffs</td>
<td>45</td>
<td>Deadhorse&lt;sup&gt;a&lt;/sup&gt;</td>
<td>31.1</td>
<td>500</td>
<td>44</td>
</tr>
<tr>
<td></td>
<td>Happy Valley</td>
<td>88</td>
<td>Deadhorse&lt;sup&gt;a&lt;/sup&gt;</td>
<td>73.6</td>
<td>500</td>
<td>44</td>
</tr>
<tr>
<td></td>
<td>Galbraith Lake</td>
<td>146.5</td>
<td>Anaktuvuk Pass&lt;sup&gt;b&lt;/sup&gt;</td>
<td>62.1</td>
<td>500</td>
<td>44</td>
</tr>
<tr>
<td></td>
<td>Atigun</td>
<td>171</td>
<td>Wiseman</td>
<td>51.9</td>
<td>250</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td>Chandler</td>
<td>179.8</td>
<td>Wiseman</td>
<td>43.2</td>
<td>500</td>
<td>44</td>
</tr>
<tr>
<td>Yukon-Koyukuk</td>
<td>Coldfoot</td>
<td>246.5</td>
<td>Coldfoot</td>
<td>NA</td>
<td>500</td>
<td>44</td>
</tr>
<tr>
<td></td>
<td>Old Man</td>
<td>313</td>
<td>Bettles&lt;sup&gt;b&lt;/sup&gt;</td>
<td>41.9</td>
<td>500</td>
<td>44</td>
</tr>
<tr>
<td></td>
<td>Seven Mile</td>
<td>356</td>
<td>Stevens Village&lt;sup&gt;b&lt;/sup&gt;</td>
<td>21.9</td>
<td>500</td>
<td>44</td>
</tr>
<tr>
<td></td>
<td>Livengood</td>
<td>406</td>
<td>Livengood</td>
<td>NA</td>
<td>500</td>
<td>44</td>
</tr>
<tr>
<td></td>
<td>Nenana</td>
<td>476</td>
<td>Nenana</td>
<td>NA</td>
<td>500</td>
<td>44</td>
</tr>
</tbody>
</table>
TABLE 5.15-1  Proposed Action Work Camp Housing and Nearest Communities

<table>
<thead>
<tr>
<th>Borough</th>
<th>Location</th>
<th>Mile Post</th>
<th>Nearest Community</th>
<th>Distance from Nearest Community (miles)</th>
<th>Camp Capacity</th>
<th>Camp Staff</th>
</tr>
</thead>
<tbody>
<tr>
<td>Denali</td>
<td>Healy</td>
<td>530</td>
<td>Healy</td>
<td>NA</td>
<td>500</td>
<td>44</td>
</tr>
<tr>
<td></td>
<td>Cantwell</td>
<td>569</td>
<td>Cantwell</td>
<td>NA</td>
<td>500</td>
<td>44</td>
</tr>
<tr>
<td>Mat-Su</td>
<td>Chulitna Butte</td>
<td>607</td>
<td>Cantwell</td>
<td>33.6</td>
<td>500</td>
<td>44</td>
</tr>
<tr>
<td></td>
<td>Sunshine</td>
<td>677</td>
<td>Y</td>
<td>NA</td>
<td>500</td>
<td>44</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td></td>
<td><strong>6,750</strong></td>
<td></td>
<td><strong>593</strong></td>
</tr>
</tbody>
</table>

a Deadhorse is primarily a service center for provision of support services to the petroleum industry in the Prudhoe Bay operating area. All residents are employees of oil-drilling or oil-production and support companies.

b The communities of Anaktuvuk Pass, Bettles and Stevens Village are all off the road system and will not be easily accessible to pipeline construction workers.

It is anticipated that construction of the proposed Project will at most require 6,400 construction employees at any given time (see Table 2.3-1). Of this amount, the majority (5,500 employees) would be required for the construction of the mainline (see Table 5.12-15). (More information is provided below.) It is anticipated that the operations and maintenance of the facilities and infrastructure planned for development under the proposed action would require between 50 to 75 workers, with most workers concentrated at the facilities near Prudhoe Bay, Fairbanks, and Cook Inlet.

5.15.2  Methodology

Although a formal Health Impact Assessment (HIA) was not conducted (nor was it required to be conducted) for the proposed Project, this Public Health section uses a methodology similar to the HIA process to evaluate the potential human health effects (both positive and negative) of the proposed Project. HIA is a “combination of procedures, methods, and tools by which a proposed Project may be judged as to its potential effects on the health of a population and the distribution of those effects on the population” (World Health Organization 1999). A HIA can be used to objectively evaluate the potential health effects of a proposed Project before it is built and can provide recommendations to increase positive health outcomes and minimize adverse health outcomes (Centers for Disease Control [CDC] 2009a). As defined by the World Health Organization (WHO) Constitution, “health” is a state of complete physical, mental, and social well-being and not simply the absence of disease or infirmity (WHO 1999). An evaluation of health impacts should consider effects to social and personal resources as well as physical capabilities.

As noted above, the State of Alaska does not require a formal HIA; however, it has developed Technical Guidance for Health Impact Assessment in Alaska, also known as the Alaska HIA Toolkit (Alaska Department of Health and Social Services [ADHSS] 2011a). This public health analysis, along with the description of the methodology prescribed by the State of Alaska for conducting a HIA, was informed by both the Toolkit as well as the Human Health section of the Point Thomson Project Draft EIS (USACE 2011).
The Alaska HIA Toolkit notes that reasonable limits need to be placed on the scope of the assessment:

A limited scope means that the HIA team will not address every conceivable health effect or effects that are primarily nuisance impacts and rarely observed. Instead, scoping highlights health effects that produce intense impacts—with persistent duration and broad geographical scope—that are highly likely to occur. There must also be a clearly-defined causal link between the Project and the anticipated health effect.

HIAs typically do not address so-called “inside the fence” impacts, which are impacts on the proposed Project workforce. (These would be addressed in a separate Health Risk Assessment according to the Toolkit.) However, this analysis does include some analyses of worker impacts. This is done for two reasons:

- For some impacts, such as traffic accidents, available data do not distinguish between injuries for workers and non-workers. Both are included in this analysis.
- Some impacts on workers, such as injuries on the job, might have the potential to impact available community health resources.

Data Sets and Limitations

As noted below, this is a “desktop-level” HIA (requiring no new data collection) using relevant and existing data. One commenter on an earlier draft of this document raised the issue of the quality and coverage of the datasets used in this analysis. Where available, data used in this analysis were taken from federal, state, and local governments and agencies. Where such data were unavailable, data were taken from (in preference order) the peer-reviewed literature, reports from various agencies, other sections of this EIS, and popular accounts. The sources of all data are provided in this section either in the text or at the bottom of the various tables. Readers interested in quality, coverage, and possible precision of the data are advised to consult the references for each data source. Comments on data limitations are provided in particularly noteworthy cases, as for example, in certain rate data on a census area (CA) or borough basis. All data identified as ‘anecdotal’ must be viewed with caution.

Input from Public and Agency Comments

From the scoping process onward this section has benefited greatly from public and agency review and comment. In most cases the substance of these comments has been incorporated directly in the organization or content of the text. In a few cases specific comments have been acknowledged and responses singled out for mention.
5.15.2.1 Framework

The general approach to HIAs typically involves a five-step process consisting of Screening, Scoping, Assessment, Reporting, and Monitoring (ANGDA 2010):

- Screening is the process by which a determination is made as to whether an HIA is necessary for the proposed Project at hand and whether it is likely to be beneficial;
- Scoping is the process of identifying concerns to be analyzed in the HIA. The scoping should identify proposed Project alternatives that will be evaluated, the boundaries of the study, the available data, and gaps in the data;
- Assessment has three components: it should include a profile of baseline health conditions for the affected communities, a qualitative or quantitative evaluation of potential health impacts, and management strategies for any identified adverse health impacts;
- Reporting includes the documentation of the methodology, findings, and recommendations of the scoping and assessment phases; and
- Monitoring is a more long-term step where the mitigation recommendations developed in the report (if needed) may be incorporated into longer-term strategies for monitoring and management of health impacts.

These steps are described in more detail below.

**Screening**

For the proposed Project, the screening step was conducted by the lead agency; the USACE initiated a Public Health analysis to be developed as a section of the EIS. This Public Health section was developed in a manner similar to a desktop-level HIA. Desktop HIAs require no new data collection and instead present existing and accessible data. At the desktop level, a broad overview of possible health impacts is considered.

The description of baseline health status in this Public Health section is based on readily available public health data.

**Scoping**

The *Alaska HIA Toolkit* (Alaska Department of Health and Social Services [ADHSS] 2011a) provides a table of various potentially relevant Health Effects Categories (HECs). The broad HECs identified in the *Alaska HIA Toolkit* include social determinants of health (SDH); accidents and injuries; exposure to potentially hazardous materials; food, nutrition, and subsistence activity; infectious disease; water and sanitation; non-communicable and chronic diseases; and health services infrastructure and capacity (see Table 5.15-2). Each of these broad HECs includes several elements. For example, the broad HEC of social determinants of health includes psychological issues related to drugs and alcohol, teenage pregnancy, family stress,
domestic violence, depression and anxiety, isolation, work rotations and hiring practices, cultural change, and economy, employment, and education.

To supplement HECs identified in the toolkit, the scoping process relied on comments received from the public and the stakeholders during EIS scoping meetings to identify public health concerns. In its March 8, 2010 letter to the USACE, the EPA raised concerns directly or indirectly applicable to human health, which may be grouped under the following categories of impacts: air quality, hazardous materials, seismically-induced pipeline rupture, climate change, socio-cultural, subsistence, water quality, and cumulative effects. Comments submitted by individual members of the public, Copper Country Alliance, Tanana Chiefs Conference, and the Trustees for Alaska also raised concerns related to public health. In particular, commenters requested that the EIS assess the potential effects of the proposed Project on the following:

- Water resources, including water uses and potential water pollution;
- Air quality effects to communities near the proposed pipeline ROW or aboveground facilities;
- Impacts to the way of life of remote residents and access to their properties;
- Effects to subsistence, especially during the construction phase;
- Noise from compressor stations;
- Socioeconomic benefits, including the benefits of lowering energy costs and increased employment, training, and business opportunities;
- Socioeconomic costs, including effects to tourism and to businesses during the construction period and the need for just compensation for the taking of lands;
- Changes in infectious and chronic diseases rates related to a large transient workforce;
- Increased demand on rural medical clinics;
- Waste production from the construction camps;
- Environmental justice; and
- Cumulative effects.

Most of these categories are evaluated in greater detail in other sections of the EIS; however, these issues are considered within this Public Health section as they relate to the health effects categories (HECs) identified above and described below.

1 Copies of agency comment submissions are included in Appendix D of the Scoping Report (Appendix B of this Draft EIS).
2 Copies of public comment submissions are included in Appendix E of the Scoping Report (Appendix B of this Draft EIS).
“Noise from compressor stations” identified by commenters in the above list is not addressed in the detailed assessment below. This is because (see Section 5.17) the noise impacts are not expected to be material. The distances from the compressor stations to various sensitive noise receptors (see Table 5.17-2) range from 7.5 miles (Wiseman) to 212.3 miles (Willow). Specifically, Section 5.17 contains the following assessment for both construction and operations and maintenance of the compressor stations as follows:

“Construction

According to Table 5.17-2, the nearest sensitive receptor to compressor stations construction would be the city of Wiseman, approximately 7.5 miles (39,511 feet) from the station. The estimated noise levels from construction activities at this receptor would be approximately 55 dBA (L_Eq) using a nominal existing ambient level of 55 dBA (adapted from Table 5.17-4). The calculation assumes a terrain coefficient of 0.007 for brush, an integration loss of 3 for berm or rough terrain, and typical usage factors. The exact value would depend on the number of sources operating at this distance. This noise level would be perceived as insignificant, thus creating no noise impact (i.e., increase of 0 dBA over estimated ambient levels).

The estimated vibration level at this receptor from construction equipment would be less than 16 VdB, which would be well below the FTA damage threshold for buildings of 100 VdB (adapted from Table 5.17-5). This level is also below the human perceptibility threshold of about 65 VdB and, thus, would not constitute an impact.

Operations and Maintenance

Compressor stations are used to increase the pressure and keep the flow of natural gas moving through the pipeline at an appropriate rate and typically contain gas turbine-driven centrifugal compressors. Additional facilities would include gas and utility piping, a filter separator/scrubber, refrigerant condensers, a helicopter port, communication tower, tank farm, power generators, and various control and compressor buildings. Noise and vibration levels from operations would be perceived as insignificant…”

Based on this analysis, no significant health related impacts are expected from either construction or operation and maintenance of the compressor facilities. However, Section 5.14 addresses subsistence and concludes:

Potential compressor station sites, particularly the one located near the Minto Flats Game Refuge, could introduce additional noise, emissions, and activity in an area of the Project and disrupt subsistence users and resources.

Because of this potential impact on subsistence resources, noise, emissions, and activity in the vicinity of the compressor station will be included in this analysis.
Assessment

The impact assessment evaluates the public health impacts by drawing on:

- Available health baseline data from the literature review (see the Affected Environment section);
- Review of the proposed Project context, alternatives and developments; and
- Review of pertinent resource sections of this Draft EIS, particularly Section 5.2, Water Resources, Section 5.13, Socioeconomics, Section 5.14, Subsistence – developed by Stephen R. Braund & Associates, and Section 5.16, Air Quality. Where appropriate, the analysis may refer to these sections to note that there may be some overlap among the resource evaluations.

This Public Health section does not address classic occupational health concerns. However, “cross-over” issues (e.g., health issues that arise as workers interact with local communities) are analyzed within the section.

Health Effects Categories

The impacts were analyzed according to the eight Alaska-specific HECs noted above and specific health issues relevant to the proposed Project (see Table 5.15-2). These HECs were developed for the Alaska HIA Toolkit, specifically the Health Effects Category table contained on pages 29-30. The Alaska HIA Toolkit introduces this table as follows:

The table shown presents a list of health effects relevant for Alaskan resource development Projects. The HECs can be used for desktop, rapid appraisal and comprehensive HIAs.

The toolkit also notes that not every aspect associated with the HECs listed in Table 5.15-2 is relevant for a given Project, but at least initial consideration should be given to all of the standard HEC categories during scoping exercises. For this reason, the analysis developed in the Environmental Consequences section (5.15.4) focuses on the relevant aspects of each of the HECs listed in Table 5.1.5-2.

Impact Evaluation Criteria

The level of the human health impacts from the proposed Project were determined and ranked based on the impact assessment criteria for human health presented in Table 5.15-3. This table is derived from the Impact Assessment methodology described in the Alaska HIA Toolkit. The scoring system includes consequences (health effect, duration, magnitude, and geographic extent), which collectively determine the severity rating. Together the severity rating and the estimated likelihood determine the impact rating. Potential public health impacts from the proposed Project were ranked and rated by using the following four-step semi-quantitative risk assessment procedure:
• Step 1. Score the level of each consequence (health effect, duration, magnitude, and geographic extent,) on a four-point scale: low (0), medium (1), high (2), and very high (3), as described in Table 5.15-3;

• Step 2. Rate the severity of the health impact (low, medium, high, or very high) based on the sum of the scores of the consequences;

• Step 3. Rate the potential (or likelihood) of the impact to occur based on professional judgment on the percent probability of the impact occurring; and

• Step 4. Rate the identified health impacts (low, medium, high, or very high) based on the intersection of the level of severity and potential (or likelihood) as shown in Table 5.15-4. Health issues anticipated to have negligible or zero impacts were identified as having no impacts.

The ranking of consequences assessed in Step 1 is presented in Table 5.15-3 and the severity, likelihood, and impact ratings assessed in Steps 2, 3, and 4 are presented in Table 5.15-4.

<table>
<thead>
<tr>
<th>Health Effects Category</th>
<th>Description</th>
</tr>
</thead>
</table>
| Water and Sanitation    | This category includes the changes to access, quantity and quality of water supplies. The pathways include:  
  • Lack of adequate water service is linked to the high rates of lower respiratory infections observed in some regions, and to invasive skin infections.  
  • Revenue from the Project that supports construction and maintenance of water & sanitation facilities.  
  • Increased demand on water and sanitation infrastructure secondary to influx of non-resident workers. |
| Accidents and Injuries  | This category includes impacts related to both fatal and non-fatal injury patterns for individuals and communities. Changed patterns of accidents and injuries may arise due to:  
  • Influx of non-resident personnel (increased traffic on roadways, rivers, air corridors).  
  • Distance of travel required for successful subsistence.  
  • Project-related income and revenue used for improved infrastructure (e.g., roadways) and improved subsistence equipment/technology. |
| Exposure to Hazardous Materials | This category includes Project emissions and discharges that lead to potential exposure. Exposure pathways include:  
  • Food. Quality changes in subsistence foods (risk based on analysis of foods or modeled environmental concentrations).  
  • Drinking water.  
  • Air. Respiratory exposures to fugitive dusts, criteria pollutants, VOCs, mercury, and other substances.  
  • Work. Secondary occupational exposure such as a family member’s exposure to lead on a worker’s clothing.  
  • Indirect pathways, such as changing heating fuels/energy production fuels in communities |
| Food, Nutrition, and Subsistence Activity | This section depends on the subsistence analysis and nutritional surveys (if completed) and considers:  
  • Effect on Diet: This pathway considers how changes in wildlife habitat, hunting patterns, and food choices will influence the diet of and cultural practices of local communities. While nutritional surveys are the most effective way to assess dietary intake, conclusions can be drawn if certain assumptions are accepted.  
  • Effect on Food Security: This discussion considers Project-specific impacts that may limit or increase the availability of foods needed by local communities to survive in a mixed cash and subsistence economy present in rural Alaska. |
<table>
<thead>
<tr>
<th>Health Effects Category</th>
<th>Description</th>
</tr>
</thead>
</table>
| Health Services Infrastructure and Capacity | This category considers how the Project will influence health services infrastructure and capacity. The pathways include:  
- Increased revenues can be used to support or bolster local/regional services and infrastructure.  
- Increased demands on infrastructure and services by incoming nonresident employees or residents injured on the job, especially during construction phases.  |
| Infectious Disease | This category includes the Project’s influence on patterns of infectious disease: The pathways include:  
- Influx of non-resident personnel from outside the region  
- Crowded or enclosed living & working conditions and the mixing of low and high prevalence populations due to influx can create an increased risk for transmission of STIs such as syphilis, HIV, and chlamydia.  
- Changes to groundwater/wetlands can alter habitat for agents that transmit vector-borne diseases. This is not a likely scenario in Alaska, but with the cumulative effects of climate change it may become an issue of greater concern in the future. |
| Non-Communicable and Chronic Diseases | This category considers how the Project might change patterns of chronic diseases. The pathways include:  
- Nutritional changes that could eventually produce obesity, impaired glucose tolerance, diabetes, cardiovascular disease.  
- Pulmonary exposures that lead to tobacco related chronic lung disease, asthma; in-home heat sources; local community air quality; clinic visits for respiratory illness.  
- Cancer rates secondary to diet changes or environmental exposures.  
- Increased rates of other disorders, specific to the contaminant(s) of concern. |
| Social Determinants of Health (SDH) | This is a broad category that considers how living conditions and social situations influence the health of individuals and communities.  
- Psychosocial issues related to drugs and alcohol.  
- Teenage pregnancy.  
- Family stress.  
- Domestic violence.  
- Depression & anxiety.  
- Isolation.  
- Work rotations and hiring practices.  
- Cultural change.  
- Economy, employment, and education.  
Limitations: While SDH are real and important, it is extremely difficult to establish direct causality between a change in a social determinant and a particular health outcome. The language used to communicate impacts related to social determinants should reflect that SDH influence health in complex ways. |
TABLE 5.15-3  Step Risk Assessment Matrix (Step 1 of 4)

<table>
<thead>
<tr>
<th>Impact Level (Score)</th>
<th>A – Health Effect</th>
<th>B – Duration</th>
<th>C – Magnitude</th>
<th>D – Extent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low (0)</td>
<td>Effect is not perceptible</td>
<td>Less than 1 month</td>
<td>Minor intensity</td>
<td>Individual cases</td>
</tr>
<tr>
<td>Medium (1)</td>
<td>Effect results in annoyance, minor injuries or illnesses that do not require intervention</td>
<td>Short-term: 1 - 12 months</td>
<td>Those impacted will be able to adapt to the impact with ease and maintain pre-impact level of health</td>
<td>Local: small limited impact to households</td>
</tr>
<tr>
<td>High (2)</td>
<td>Effect resulting in moderate injury or illness that may require intervention</td>
<td>Medium-term: 1 to 6 years</td>
<td>Those impacted will be able to adapt to the health impact with some difficulty and will maintain pre-impact level of health with support</td>
<td>Entire PACs; village level</td>
</tr>
<tr>
<td>Very high (3)</td>
<td>Effect resulting in loss of life, severe injuries or chronic illness that requires intervention</td>
<td>Long-term: more than 6 years/life of Project and beyond</td>
<td>Those impacted will not be able to adapt to the health impact or to maintain pre-impact level of health</td>
<td>Extends beyond PACs; regional, national, global</td>
</tr>
</tbody>
</table>

Source: ADHSS 2011a.

TABLE 5.15-4  Step Risk Assessment Matrix (Steps 2, 3, and 4 of 4)

<table>
<thead>
<tr>
<th>Step 2: Severity Rating (Magnitude + Duration + Geographic Extent + Health Effect)</th>
<th>Step 3: Likelihood Rating</th>
<th>Step 4: Impact Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extremely Unlikely &lt; 1%</td>
<td>Very Unlikely 1 - 10%</td>
<td>Unlikely 10 - 33%</td>
</tr>
<tr>
<td>Low (1 - 3)</td>
<td>♦</td>
<td>♦</td>
</tr>
<tr>
<td>Medium (4 - 6)</td>
<td>♦</td>
<td>♦</td>
</tr>
<tr>
<td>High (7 - 9)</td>
<td>♦ ♦</td>
<td>♦</td>
</tr>
<tr>
<td>Very high (10 - 12)</td>
<td>♦ ♦ ♦</td>
<td>♦ ♦</td>
</tr>
</tbody>
</table>

Sources: ADHSS 2011a.

A low impact rating would indicate that while a positive or negative effect to health could occur from the proposed activity, the impact magnitude would be small (with or without mitigation) and well within accepted levels, and/or the receptor has low sensitivity to the effect. Low impacts may be low in intensity but have long duration, as found in the operations and maintenance phase, or medium in intensity but of very short duration, as is common during the construction phase.

For each of the HEC ratings, there is either a positive (+) or negative (-) sign to indicate whether the effects of the low, medium, high, or very high ratings are anticipated to be negative or positive.
Under the HIA methodology, negative impacts classified with a medium (or higher) impact rating and above would require action so that predicted negative health effects could be mitigated to as low as reasonably practicable (Winkler et al. 2010). An impact given a high or very high rating would affect the proposed activity that, without mitigation, might present an unacceptable risk. Mitigation requirements would be determined by the USACE.

Reporting

This Public Health section documents the methodology, findings and recommendations of the scoping and assessment phases.

Monitoring

Section 5.15.5 describes the mitigation recommendations developed for impacts classified with a medium impact rating and above. Section 5.15.6 describes the longer-term strategies for monitoring and management of health impacts to determine if the mitigation measures achieve their intended outcomes. To monitor effectiveness, the monitoring and evaluation plan is anchored to a set of key performance indicators (KPIs). As described in the Alaska HIA Toolkit (p. 63), KPIs can measure:

- A health outcome (e.g., clinic visits per month for asthma exacerbation);
- An intermediate health risk indicator (Body Mass Index is a risk factor for problems such as cardiovascular disease and diabetes mellitus); and/or
- A health hazard or health determinant (fine particulate levels are a health hazard that influences asthma rates).

5.15.3  Affected Environment

5.15.3.1  Identification of Potentially Affected Communities

Those communities with boundaries that would be intersected by the proposed Project ROW were defined as the communities which might experience potential health effects (potentially affected communities, or PACs). Additionally, while the boundaries of Talkeetna, Fairbanks, and Wasilla would not be intersected by the proposed ROW, these communities are also considered in the analysis as these are nearby major population centers and service areas that would be connected to the proposed pipeline by roads and other infrastructure. Figure 5.15-1 shows the location of these PACs, and Table 5.15-5 lists the population for each PAC, the percentage of each population comprised of American Indian or Alaska Native (AIAN) descent, the approximate mile post of each PAC, and the distance of each PAC from the proposed Project. Additional communities are considered in this Public Health section under the discussion of potential effects to food, nutrition, and subsistence. Those PACs not shown in Table 5.15-5 were considered on the basis of historical subsistence use patterns but were not assessed under other HECs due to their distance from the proposed ROW. Table 5.14-1 in
Section 5.14 provides a listing of all communities for which subsistence resources may be affected.

Section 5.12 (Socioeconomics) provides a demographic overview of the boroughs and census areas crossed by each alternative, including population (see Table 5.12-1) and ethnic and racial composition data at the census block level (see Table 5.12-11). Additional socioeconomic data is presented in this Public Health section within the discussion of determinants of health for the PACs (Section 5.15.3.3). Information regarding land use and land ownership along the proposed ROW is provided in Section 5.9 (Land Use).

### TABLE 5.15-5  Potentially Affected Communities

<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>Prudhoe Bay</td>
<td>North Slope</td>
<td>2</td>
<td>0 (also 0 miles from gas conditioning facility)</td>
<td>5</td>
<td>2,174*</td>
<td>85.2</td>
<td>7.8</td>
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<td>Wiseman</td>
<td>Yukon-Koyukuk Census Area</td>
<td>235</td>
<td>0</td>
<td>21</td>
<td>14</td>
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<tr>
<td>Coldfoot</td>
<td>Yukon-Koyukuk Census Area</td>
<td>246</td>
<td>0</td>
<td>13</td>
<td>10</td>
<td>90.0</td>
<td>10.0</td>
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<td>Livengood</td>
<td>Yukon-Koyukuk Census Area</td>
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<td>0</td>
<td>29</td>
<td>13</td>
<td>69.2</td>
<td>23.1</td>
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<td>Ester</td>
<td>Fairbanks North Star Borough</td>
<td>FB 26</td>
<td>0</td>
<td>1,680</td>
<td>2,422</td>
<td>84.6</td>
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<tr>
<td>College</td>
<td>Fairbanks North Star Borough</td>
<td>FB 34</td>
<td>0</td>
<td>11,402</td>
<td>12,964</td>
<td>73.1</td>
<td>9.5</td>
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<tr>
<td>Fairbanks</td>
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<td>FB 34</td>
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<td>30,224</td>
<td>31,535</td>
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<td>10.0</td>
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<td>Four Mile Road</td>
<td>Yukon-Koyukuk Census Area</td>
<td>473</td>
<td>0 (also 13.7 miles from straddle and off-take facility)</td>
<td>38</td>
<td>43</td>
<td>53.5</td>
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<td>Yukon-Koyukuk Census Area</td>
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<td>0</td>
<td>402</td>
<td>378</td>
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<td>Anderson</td>
<td>Denali Borough</td>
<td>494</td>
<td>0</td>
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<td>Healy</td>
<td>Denali Borough</td>
<td>530</td>
<td>0</td>
<td>1,000</td>
<td>1,021</td>
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<td>McKinley Park</td>
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<td>Cantwell</td>
<td>Denali Borough</td>
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<td>Talkeetna</td>
<td>Matanuska-Susitna Borough</td>
<td>663</td>
<td>0</td>
<td>772</td>
<td>876</td>
<td>91.4</td>
<td>3.7</td>
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</table>
TABLE 5.15-5  Potentially Affected Communities

<table>
<thead>
<tr>
<th></th>
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<th></th>
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<tbody>
<tr>
<td>Trapper Creek</td>
<td>Matanuska-Susitna Borough</td>
<td>668</td>
<td>0</td>
<td>423</td>
<td>481</td>
<td>86.5</td>
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<tr>
<td>Y</td>
<td>Matanuska-Susitna Borough</td>
<td>686</td>
<td>0</td>
<td>956</td>
<td>1,483^b</td>
<td>74.5^b</td>
<td>0.8^a</td>
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<tr>
<td>Willow</td>
<td>Matanuska-Susitna Borough</td>
<td>707</td>
<td>0</td>
<td>1,658</td>
<td>2,102</td>
<td>90.8</td>
<td>5.2</td>
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<tr>
<td>Big Lake</td>
<td>Matanuska-Susitna Borough</td>
<td>731</td>
<td>0 (also 0 miles from Cook Inlet Natural Gas Liquid Extraction Plant Facility)</td>
<td>2,635</td>
<td>3,350</td>
<td>86.1</td>
<td>7.0</td>
</tr>
<tr>
<td>Wasilla</td>
<td>Matanuska-Susitna Borough</td>
<td>733</td>
<td>19.5</td>
<td>5,469</td>
<td>7,831</td>
<td>83.4</td>
<td>5.2</td>
</tr>
</tbody>
</table>

^a While the 2010 Census considered oil workers in its population estimate for Prudhoe Bay, all residents are employees of oil-drilling or oil-production and support companies and most travel to Anchorage or the lower 48 states when off-duty.

^b U.S. Census Bureau 2010 data is not available for the community of Y. The latest population and race estimates for Y were obtained from the U.S. Census Bureau 2005-2009 American Community Survey.


5.15.3.2 Community Profiles

The community profiles below (presented from North to South) are derived from the Alaska Community Database Community Information Summaries (CIS), which contain information about the accessibility of clean water and healthcare within the PACs, as well as a brief overview of each community’s history and accessibility via the transportation network (ADCCCED 2011). Information regarding grocery and convenience stores within the PACs is limited and, where available, was derived from the Yellow Pages.

North Slope Borough

Within the North Slope Borough, the Prudhoe Bay-Kaktovik Service Area is classified as a medically underserved area (MUA). The community of Prudhoe Bay is located within the borough and would potentially be subject to health effects from the proposed Project.
FIGURE 5.15-1  Locations of Potentially Affected Communities
**Prudhoe Bay**

Prudhoe Bay is a large work camp for the oil industry. The 2010 Census considered oil workers in its population estimate for Prudhoe Bay, estimating approximately 2,174 permanent residents, but all residents are employees of oil-drilling or oil-production and support companies most travel to Anchorage or the lower 48 states when off-duty. Approximately 7.8 percent of Prudhoe Bay’s population as estimated by the 2010 Census identify as AIAN (Table 5.15-5).

Prudhoe Bay was extensively developed for oil drilling in the 1970s and sits at the north terminus of an 800-mile long pipeline that transports crude oil to Valdez. Prudhoe Bay oil fields provide approximately 10 percent of the nation’s domestic oil supply (DOE 2012). More than 5,000 workers are employed in the oil fields and work long consecutive shifts. There is no economy in the area outside of the oil fields.

Sanitation facilities are located within the oil field group quarters. Health care is provided by medical staff employed by oil companies. Foods are most easily available at employee cafeterias which are designed to meet the needs of oil field or industrial workers.

**Yukon-Koyukuk Census Area**

The Yukon-Koyukuk Census Area contains three MUAs: Koyukuk-Middle Yukon, McGrath-Holy Cross Service Area, and Yukon Flats Service Area. The communities of Wiseman, Coldfoot, Livengood, Four Mile Road, and Nenana are located within the census area and would potentially be subject to health effects from the proposed Project.

**Wiseman**

An estimated 14 people live in Wiseman, with no individuals classified as AIAN (see Table 5.15-5). The town is situated about 13 miles north of Coldfoot. When mining activities increased on Nolan Creek in the early 1900s, people began moving from Coldfoot to Wiseman. Today, the Dalton highway runs nearby, following the pipeline. A dirt airstrip exists in Wiseman, but it is not maintained. The local school closed in 2002 due to low enrollment and children are now homeschooled. Residents are sustained by subsistence hunting, fishing, and trapping.

Local health care is provided by the Wiseman Health Clinic. Itinerant care is provided during a visit every October by a public health nurse. Emergency services are within 30 minutes of a higher-level satellite health care facility. Fairbanks hospitals offer auxiliary health care.

Some homes haul water and use outhouses, while others have individual wells and septic tanks.

**Coldfoot**

An estimated 10 people reside in Coldfoot, with 10.0 percent classified as AIAN (see Table 5.15-5). Once a bustling mining town, Coldfoot was abandoned when people began mining north in Wiseman. Coldfoot is located along the Dalton highway. Today, the community has a hotel, a restaurant, a gas station, an RV park, and a BLM office.
Houses are connected to individual wells and septic tanks. Residents must travel to Fairbanks hospitals for health care. Emergency service is provided by volunteers. Some grocery goods are available at the Coldfoot Camp Grocery.

Livengood

The population of Livengood is estimated at 13 people, with 23.1 percent of the population classified as AIAN (see Table 5.15-5). The village was founded in 1915 after gold was discovered on Livengood Creek. Livengood is 80 miles northwest of Fairbanks on the Elliott Highway, which provides year-round access. In addition, a 50-foot gravel runway is available.

Most residents of Livengood are seasonal and/or retired. The highway provides some opportunity for roadside services, but year-round employment is limited. Approximately two-thirds of residences are completely plumbed, with individual wells and septic tanks.

Four Mile Road

Four Mile Road is populated by approximately 43 individuals, with 30.2 percent classified as AIAN (see Table 5.15-5). It is located about 50 miles southwest of Fairbanks on the Parks Highway. The city of Nenana, located just south of Four Mile Road, has a growing community which in turn creates growth for Four Mile Road. Most residents of Four Mile Road also work in Nenana.

Fewer than half of the residences have complete plumbing, and health care services must be obtained through the Nenana Native Clinic or Fairbanks hospitals.

Nenana

The population of Nenana is estimated at 378 people, with 37.6 percent classified as AIAN (see Table 5.15-5). It is located 55 miles southwest of Fairbanks on the Parks Highway. Nenana is also located along the Alaska Railroad (ARR). The gold rush in 1902 brought many people to the area; however, by 1930 the population had dropped to fewer than 300 people. Currently, most jobs in Nenana are government-funded. It is the center of the rail-to-river barge transportation center for the Interior. The town enjoys a strong seasonal private-sector economy. In addition, subsistence foods such as salmon, moose, caribou, bear, waterfowl, and berries remain important. Basic groceries are available at Coghill’s Store.

Nenana is accessible by road, river, rail, and air. Daily buses to Fairbanks and Anchorage are available all year long. Local health care is provided by the Nenana Clinic, with emergency service provided by 911 telephone service, volunteers, and a health aide. Auxiliary health care is offered by the Nenana Volunteer Fire/Emergency Medical Service (EMS) Department.

Circulating loops distribute treated well water throughout the community. Sewage is collected by a piped gravity system and treated at a secondary treatment plan. The majority of the city is connected to the piped water and sewer system; the remainder of the residences have individual wells and septic systems.
**Fairbanks North Star Borough**

The FNSB is the second-largest population center in the state, with approximately 97,581 residents. Approximately 7 percent of the population was classified as AIAN. More than one-third of employment in the borough is provided through the public sector, including the FNSB school district, the University of Alaska Fairbanks, and the military. In 2011, nearly 8,600 soldiers were stationed in the FNSB on Fort Jonathan Wainwright or the Eielson Air Force Base. Retail services, gold mining (including the Fort Knox hard rock gold mine), tourism, transportation, and medical services also contribute to the local economy.

The FNSB is accessible by road via the Richardson, Parks, Steese, and Elliott Highways. Cargo transportation is provided by truck, rail, and air services. Air transportation is provided by scheduled jet services available at Fairbanks International airport. A public seaplane base is located on the Chena River.

The FNSB is classified as a Medically Underserved Population (MUP), designated at the request of the Alaskan Governor. The communities of Ester and College and the City of Fairbanks are located within the borough and would potentially be subject to health effects from the proposed Project.

**Ester**

Approximately 2,422 people live in the unincorporated community of Ester, with 6.7 percent classified as AIAN (see Table 5.15-5). It is located just 8.5 miles west of Fairbanks on the Parks Highway. Ester was originally a mining camp on Ester Creek, and enjoys a tourism industry based on the mining heritage. Residents of Ester have access to highways and all transportation options available in Fairbanks. Most people who live in Ester work in Fairbanks.

More than 80 percent of residences are fully plumbed; the remaining residences haul water from a central water source within the community. Residents travel to Fairbanks for health care services and groceries. In addition, the community of Ester holds a seasonal farmer's market. Emergency services are provided by volunteers and 911 telephone services, and auxiliary health care is offered by the Ester Volunteer Fire Department.

**College**

College is a large suburban area that is home to approximately 12,964 residents, with 9.5 percent classified as AIAN (see Table 5.15-5). It is located immediately northwest of Fairbanks and is the location of the University of Alaska at Fairbanks. Most residents of College are employed or attend school at the University.

The majority of residences are completely plumbed, with two-thirds connected to piped water and sewer and the remainder connected to individual wells and septic systems. Community water is supplied by a deep well, and water treatment is performed at a water treatment facility operated by College Utilities Corporation.
Residents of College obtain health care services from private clinics and Fairbanks hospitals. Auxiliary health care is offered by Chena/Goldstream Fire & Rescue and Fairbanks hospitals, and emergency service is provided by 911 telephone service, paid EMS service, volunteers, a health aide and the military.

**Fairbanks**

The City of Fairbanks is the largest community within the FNSB, with a population of 31,535. Approximately 10.0 percent of the population classified as AIAN (see Table 5.15-5). Fairbanks was home to Koyukon Athabascans for thousands of years before gold was discovered. A trading post was set up along the Chena River when the steamer Lavelle Young grounded on the banks of what is now Fairbanks on its way to establish a trading post in Tanacross. With the gold rush of 1902 Fairbanks expanded. With construction of the Alcan Highway and the Trans-Alaska pipeline the area experienced further growth in the community. Today, Fairbanks is the second largest settlement in Alaska.

Fairbanks is accessible by road, rail, and by air. It is the service and supply center for Interior Alaska and, decades ago, was the international crossroads for flights into Asia. Fairbanks has a diverse economy which includes tourism, manufacturing, communications, financial, transportation, medical, government, and military aspects.

Fairbanks is a small city and is part of the Interior EMS Region. Emergency service is provided by 911 telephone service, paid EMS service, volunteers, a health aide, and the military. Local hospitals or health clinics within the Fairbanks area include Fairbanks Memorial Hospital, Interior Community Health Center, Fairbanks Regional PHN, Chief Andrew Isaac Health Center, and Bassett Army Community Hospital/Ft. Wainwright. The hospitals are qualified acute care facilities and provide State-certified Medevac services. Auxiliary health care, specialized care (FNA Regional Center for Alcohol & Other Addictions), and long-term care services (Fairbanks Pioneers’ Home, Denali Center) are also available to the City of Fairbanks.

Water and sewer systems are operated by private companies. Treated water is distributed throughout the greater Fairbanks area by 15 circulating pump stations. Fairbanks supports several local, regional, and national grocery stores, including Fred Meyer, Safeway, Sam’s Club, Wal-Mart, and Stop & Shop. Goods are transported to the city by truck, air, and rail.

**Denali Borough**

The Denali Borough is classified as an MUP, designated at the request of the Alaskan Governor. The communities of Anderson, Healy, McKinley Park, and Cantwell are located within the borough and would potentially be subject to health effects from the proposed Project.

**Anderson**

The City of Anderson is home to approximately 246 individuals, with 2.8 percent classified as AIAN (see Table 5.15-5). The majority of residents are employees of the Clear Air Force Station and their families. Anderson is located on a spur road off the Parks Highway, 76 miles southwest of Fairbanks. A road connecting Anderson and Nenana was built allowing easier
access to Fairbanks in 1962. The Parks Highway, completed in 1973, allows access to Anchorage, which is 285 miles south of Anderson. Additionally, the ARR services Anderson and a state-owned runway is located at Clear Airport.

Residences have individual wells, septic systems, and plumbing, and Clear Air Force Station provides piped water and sewer to all base facilities. The Anderson School has a potable well.

The Anderson Health Clinic provides local health care to the community. The City of Anderson is part of the Interior EMS Region, with emergency service provided by 911 telephone service and volunteers. Auxiliary health care is offered by the Anderson Volunteer Fire Department.

**Healy**

Approximately 1,021 people live in the community of Healy, with 2.1 percent of the population classified as AIAN (see Table 5.15-5). Healy is located on a spur road off the Parks Highway 12 miles from the entrance to the Denali National Park and Preserve. It is about 109 miles southwest of Fairbanks. The town was established in 1904 and is home to the Usibelli Coal Mine, Alaska's only operating coal mine. Usibelli dominates the economy of Healy and is an important employer. Tourism to Denali Park supports RV Parks, guided rafting, helicopter tours, and small businesses. Healy is accessible by car, air, and rail. The Tri-Valley School is utilized by the surrounding area.

Healy is an isolated town/sub-regional center that is part of the Interior EMS Region. Emergency service is provided by 911 telephone service and volunteers. The Tri-Valley Community Center, a qualified emergency care center affiliated with the Interior Community Health Center in Fairbanks, provides local health care. Specialized care (Railbelt Mental Health & Addictions and Healy Senior Center) and auxiliary health care via the Canyon Clinic (summer only) are also offered.

The large majority of homes use individual wells and septic systems, and over 80 percent have full plumbing. Residents and visitors can acquire some grocery items from Mountain View Liquor & Grocery and the Denali General Store.

**McKinley Park**

The population of McKinley Park is estimated at 185 individuals, with no individuals classified as AIAN (see Table 5.15-5). It is located just outside the entrance to Denali National Park and Preserve. McKinley Park is primarily a seasonal community and tourism to the park is its main economic input. Year-round employment can be found at Usibelli Coal Mine and Golden Valley Electric nearby. Students travel to Cantwell to attend school.

While hotels are served by individual water wells and septic systems, most residences haul water and use outhouses. Residents must travel to the Healy Health Clinic in Healy for health services.

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3 A public comment was received indicating that the Tri-Valley Community Center provides some medical services year-round but is not staffed by a physician.
care services. Auxiliary health care is offered by the Denali National Park Ambulance (summer only) and the Healy Clinic, and emergency service is provided by volunteers and paid EMS service.

**Cantwell**

The community of Cantwell is home to approximately 219 residents, with 15.5 percent of the population classified as AIAN (see Table 5.15-5). It is located on the Parks Highway 210 miles north of Anchorage and 27 miles south of Denali Park and Preserve. Cantwell began as a flag stop on the ARR. The economy of Cantwell is primarily based on the highway tourism for Denali Park. Some part-time or seasonal jobs are available. Many people also depend on hunting, trapping, and fishing for subsistence.

Cantwell is accessible by road, rail, and air. The ARR provides train service. Two privately owned airstrips and one privately owned helipad are available. There is one school in Cantwell. Local health care is provided by Cantwell Clinic, a primary health care facility. Emergency service is provided by 911 telephone service, volunteers, and a health aide. The Cantwell Volunteer Ambulance offers auxiliary health care.

More than half of the residences in Cantwell have complete plumbing, and the majority has individual water wells and septic systems. Residents can shop for some grocery items at the Parkway Gift Shop.

**Matanuska-Susitna Borough**

The Matanuska-Susitna Borough is classified as an MUP, designated at the request of the Alaskan Governor. The communities of Talkeetna, Trapper Creek, Y, Willow, Wasilla, and Big Lake are located within the borough and would potentially be subject to health effects from the proposed Project.

**Talkeetna**

Approximately 876 people reside in the community of Talkeetna, with 3.7 percent classified as AIAN (see Table 5.15-5). It is located on a spur road off the Parks Highway, 115 miles north of Anchorage. Talkeetna began as a mining town and eventually a riverboat steamer station and then the ARR was built, bringing additional people to the area. The economy of Talkeetna today depends on tourism to Denali. It is popular for hunting, fishing, boating, skiing, dog mushing, and sightseeing.

Local health care is provided by the Sunshine Community Health Center, a qualified emergency care center. Residents also travel to the Mat-Su Regional Hospital between Palmer and Wasilla. Emergency service is provided by 911 telephone service and volunteers. Auxiliary health care is offered by Talkeetna Ambulance Service and the Valley Hospital in Palmer. Talkeetna Elementary School is located in the community. Middle and high school students attend Susitna Valley High located at the Y junction of the Talkeetna Spur Road and the Parks Highway.
The Matanuska-Susitna Borough maintains a piped water and sewer system in the community. Most residents have individual wells, septic tanks, and complete plumbing, and the high school operates its own water system. Groceries are available at Cubby’s Marketplace.

**Trapper Creek**

The population of Trapper Creek is estimated at 481, with 6.4 percent classified as AIAN (see Table 5.15-5). It is located 17 miles north of Talkeetna on the Parks Highway. The area is the product of federal homesteading and the initial residents were a group of homesteaders from Detroit, Michigan who settled in 1959. The economy of Trapper Creek is based on a variety of industries, such as education, transportation, and construction. Subsistence and sporting activities are still integral to the lifestyle in Trapper Creek.

Trapper Creek residents travel to Mat-Su Regional Hospital in Palmer or the Sunshine Community Health Center in Talkeetna for health care. These facilities provide auxiliary health care, along with Trapper Creek Ambulance Service and Anchorage hospitals. Emergency service is provided by 911 telephone service and volunteers. Some grocery items are available at The Alaska Country Store.

**Y**

The U.S. Census Bureau American Community Survey 2005-2009 estimated the population of Y at 1,483 people, with 0.8 percent of the population classified as AIAN (see Table 5.15-5). It is located along the Parks Highway between Willow and Talkeetna at the junction of Talkeetna Spur Road and the Parks Highway, 99 miles north of Anchorage. Many residents are self-employed in small businesses tied to the tourism industry, such as guiding or lodging.

The majority of occupied homes has individual wells, septic tanks, and complete plumbing. Seasonal-use homes haul water and use outhouses.

**Willow**

Approximately 2,102 people reside in Willow, with 5.2 percent of the population classified as AIAN (see Table 5.15-5). It is located on the Parks Highway, 41 miles north of Anchorage. The Willow area was historically occupied by Alaska Native Athabascans in semi-permanent villages. Gold was discovered in Willow Creek in 1897. During the construction of the ARR, surveyors, construction crews, and homesteaders began to settle in Willow. Today, many homes in Willow are vacant or used only for seasonal use. Residents are often self-employed in lodging, guiding, charter, or retail. Two saw mills also provide employment.

Willow is accessible by road and by air, although the airstrips are private. Groceries and goods are available at Camps Caswell Food & Tackle and at the Willow Creek Grocery.

Residents travel to Sunshine Community Health Center in Talkeetna or Mat-Su Regional Hospital in Palmer for health care. Emergency service is provided by 911 telephone service and volunteers, and auxiliary health care is provided by Willow Ambulance Service and Mat-Su Regional Hospital in Palmer.
The school in Willow operates its own water system. While most occupied homes use individual water wells and septic tanks and are fully plumbed, seasonal-use homes haul water and use outhouses.

**Wasilla**

The population of Wasilla is estimated at 7,831 residents, with 5.2 percent of the population classified as AIAN (see Table 5.15-5). Wasilla is located along the Parks Highway 43 miles north of Anchorage. The town was established following the building of the ARR. Many residents commute to Anchorage for work; however, the local economy is diverse. Tourism, agriculture, wood working, government, retail, and many other opportunities exist in Wasilla. Wasilla is accessible by road, rail, and air via private airstrips or the Anchorage International Airport.

Residents travel to Palmer for health care services, which are provided by the Mat-Su Regional Hospital, a qualified emergency care center. Specialized care is also available at the Alaska Addiction Rehabilitation Services/Nugen’s Ranch. Emergency service is provided by 911 telephone service and volunteers, with access to a higher-level satellite health care facility within 30 minutes. Auxiliary health care is offered by Matanuska-Susitna Borough Emergency Medical Services.

The City of Wasilla operates a sewer and piped water system; however, the majority of households use individual wells and septic systems. The City obtains water from two wells at Iditarod School and one well at Spruce Avenue. Groceries and goods are available at Steve’s Food Boy, Carr’s Quality Center (a division of Safeway), Fred Meyer, and G&G Foodmart.

**Big Lake**

Approximately 3,350 individuals reside in the unincorporated community of Big Lake, with 7.0 percent classified as AIAN (see Table 5.15-5). Big Lake is located 13 miles southwest of Wasilla. Initial inhabitants were Athabascan Dena’ina Natives. Homesteaders began arriving in 1929. The town is located on the shores of Big Lake and lake-front lots became available in the 1960s. The close proximity to Anchorage and Wasilla allows residents of Big Lake to commute out of the town for work. Several lodges on the lake support the recreational boating industry that exists in the summer months. Fresh produce, meats, and other groceries are available at Steve’s Food Boy store. Big Lake has one state-owned airstrip and several marinas and boat launches. Most (85 percent) homes have complete plumbing, while the remainder haul water and use outhouses. Health care services are obtained outside of Big Lake by traveling to the Mat-Su Regional Hospital in Palmer or to Anchorage hospitals. Emergency service is provided by volunteers and 911 telephone service.
Health Related Services within the PACs During Construction and Operation of the Proposed Project.

The community information presented in this section has been developed from local sources (e.g. community newspapers, and Websites), State of Alaska government publications and Websites (e.g. the Alaska Community Database), and information published online and in print by various public awareness and advocacy groups. Over time, it is possible that the quantity and level of health related services within each PAC may change. For that reason it is recommended that ACGD set up an outreach program to coordinate with the PACs to maintain and update an inventory of health related services. During construction and operation of the proposed Project, knowledge of the available services will help minimize the potential impacts to the PACs.

5.15.3.3 Baseline Health Status

Data Collection and Information Sources

The collection of data regarding health status indicators and determinants of health was completed by reviewing readily available public information from public health agencies and state, regional, and community-level data bases and publications. Additionally, the comments compiled during the scoping period held as part of the NEPA process were reviewed.

For each of the boroughs and census areas that would be crossed by the proposed Project and alternatives, baseline health conditions are described by selecting relevant categories of information. Two overarching categories of information were selected: health status indicators and determinants of health. Health status indicators represent the current health condition of the populations and communities using statistically developed descriptors of general overall health status. These include leading causes of death, death rates, and incidence of chronic diseases and morbidity. Health status indicators thus provide a picture of community health status without necessarily providing insights into the factors or causes that influence health status. Information on health status indicators is available at the state and regional level; it is rarely available for small communities (ANGDA 2010).

Determinants of health are factors which influence health status and determine health differentials or health inequalities. They are many and varied and include, for example, natural, biological factors, such as age, gender and ethnicity; behavior and lifestyles, such as smoking, alcohol consumption, diet and physical exercise; the physical and social environment, including housing quality, the workplace and the wider urban and rural environment; and access to health care. All of these are closely interlinked and differentials in their distribution lead to health inequalities (WHO 2011). The relevant determinants of health for this HIA were grouped into behavioral categories at the regional level. Behavioral categories were not available at the individual community level; however, access to clean water, sewage treatment services, healthcare, and emergency services for each PAC were evaluated (see Section 5.15.3.2 Community Profiles).
As previously described in Section 5.12, the underlying socioeconomic data used for analyzing the proposed action effect relies primarily upon U.S Census Bureau data. In particular, socioeconomic data was obtained from the 2010 Census and 2005-2009 ACS five-year estimates. While both of these data sources are compiled by the U.S. Census Bureau, there are fundamental differences in the two datasets. The 2010 Census has a much smaller margin of error as it is a survey of 100 percent of the population, while ACS data is an estimate based upon a population sample and will have a greater margin of error. The ACS was developed to obtain the same information previously collected on the long-form questionnaire of the 2000 Census, but more frequently than every 10 years. In contrast to previous censuses, the 2010 Census did not collect income and poverty information, so the most recent data for these socioeconomic indicators is from the ACS 2005-2009. All ACS estimates should be interpreted as average values over the designated period (U.S. Census Bureau 2009a).

It should be noted that some of the statistics reported in the discussion of health indicators and health determinants are based on a small sample size. Reported rates of disease based on less than 20 reported deaths are statistically unreliable and should be interpreted with caution.

Determinants of Health

Demographic Overview and Socioeconomic Conditions

This section identifies the socioeconomic conditions for the PACs. Information highlighted in this section includes educational attainment, poverty status, median household income, dropout rates, unemployment rates, worker residency status, and net-migration. Much of this information is provided in Section 5.12, however this section provides greater detail on specific communities rather than at the borough and census area level as provided in Section 5.12.

The U.S. Census Bureau ACS estimates that the communities of Prudhoe Bay and Coldfoot have no permanent residents 18 and older (see Table 5.15-6). This differs from 2010 Census population estimates provided in Table 5.15-2 above and is due to the different residency rules used by each survey. The ACS uses a 2-month residency rule where those individuals living at the sampled address at the time of interview plan to live or have lived at the address for more than two consecutive months are counted (U.S. Census Bureau 2009a). However, the 2010 Census considers oil workers in Prudhoe Bay as part of that community’s population.

<table>
<thead>
<tr>
<th>Community</th>
<th>18 years and older</th>
<th>Less than 9th grade education</th>
<th>9 to 12 grade education, but no diploma</th>
<th>High School graduate or GED</th>
<th>Some college, no degree</th>
<th>Associate Degree</th>
<th>Bachelor Degree</th>
<th>Graduate or Professional Degree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prudhoe Bay</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wiseman</td>
<td>6</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Coldfoot</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Livengood</td>
<td>70</td>
<td>7%</td>
<td>0%</td>
<td>43%</td>
<td>29%</td>
<td>11%</td>
<td>10%</td>
<td>0%</td>
</tr>
<tr>
<td>Ester</td>
<td>1,523</td>
<td>5%</td>
<td>4%</td>
<td>24%</td>
<td>31%</td>
<td>4%</td>
<td>20%</td>
<td>12%</td>
</tr>
</tbody>
</table>

TABLE 5.15-6 Educational Attainment for Population 18 Years of Age and Over
TABLE 5.15-6  Educational Attainment for Population 18 Years of Age and Over

<table>
<thead>
<tr>
<th>Community</th>
<th>18 years and older</th>
<th>Less than 9th grade education</th>
<th>9 to 12 grade education, but no diploma</th>
<th>High School graduate or GED</th>
<th>Some college, no degree</th>
<th>Associate Degree</th>
<th>Bachelor Degree</th>
<th>Graduate or Professional Degree</th>
</tr>
</thead>
<tbody>
<tr>
<td>College</td>
<td>11,033</td>
<td>1%</td>
<td>4%</td>
<td>21%</td>
<td>36%</td>
<td>9%</td>
<td>15%</td>
<td>13%</td>
</tr>
<tr>
<td>Fairbanks</td>
<td>25,968</td>
<td>3%</td>
<td>7%</td>
<td>35%</td>
<td>32%</td>
<td>7%</td>
<td>10%</td>
<td>6%</td>
</tr>
<tr>
<td>Four Mile Road</td>
<td>22</td>
<td>36%</td>
<td>0%</td>
<td>45%</td>
<td>18%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Nenana</td>
<td>299</td>
<td>5%</td>
<td>14%</td>
<td>33%</td>
<td>33%</td>
<td>2%</td>
<td>7%</td>
<td>5%</td>
</tr>
<tr>
<td>Anderson</td>
<td>542</td>
<td>0%</td>
<td>1%</td>
<td>37%</td>
<td>36%</td>
<td>14%</td>
<td>8%</td>
<td>4%</td>
</tr>
<tr>
<td>Healy</td>
<td>385</td>
<td>0%</td>
<td>5%</td>
<td>25%</td>
<td>36%</td>
<td>4%</td>
<td>23%</td>
<td>7%</td>
</tr>
<tr>
<td>McKinley Park</td>
<td>155</td>
<td>0%</td>
<td>6%</td>
<td>19%</td>
<td>24%</td>
<td>5%</td>
<td>39%</td>
<td>8%</td>
</tr>
<tr>
<td>Cantwell</td>
<td>90</td>
<td>2%</td>
<td>6%</td>
<td>40%</td>
<td>26%</td>
<td>10%</td>
<td>17%</td>
<td>0%</td>
</tr>
<tr>
<td>Talkeetna</td>
<td>636</td>
<td>0%</td>
<td>5%</td>
<td>39%</td>
<td>36%</td>
<td>3%</td>
<td>14%</td>
<td>2%</td>
</tr>
<tr>
<td>Trapper Creek</td>
<td>244</td>
<td>20%</td>
<td>20%</td>
<td>22%</td>
<td>23%</td>
<td>12%</td>
<td>0%</td>
<td>2%</td>
</tr>
<tr>
<td>Y</td>
<td>1,140</td>
<td>7%</td>
<td>25%</td>
<td>23%</td>
<td>30%</td>
<td>4%</td>
<td>6%</td>
<td>5%</td>
</tr>
<tr>
<td>Willow</td>
<td>1,161</td>
<td>2%</td>
<td>8%</td>
<td>25%</td>
<td>30%</td>
<td>6%</td>
<td>24%</td>
<td>5%</td>
</tr>
<tr>
<td>Big Lake</td>
<td>1,891</td>
<td>1%</td>
<td>2%</td>
<td>40%</td>
<td>29%</td>
<td>16%</td>
<td>11%</td>
<td>1%</td>
</tr>
<tr>
<td>Wasilla</td>
<td>6,951</td>
<td>2%</td>
<td>8%</td>
<td>38%</td>
<td>28%</td>
<td>6%</td>
<td>12%</td>
<td>6%</td>
</tr>
<tr>
<td>Alaska</td>
<td>499,977</td>
<td>3%</td>
<td>8%</td>
<td>30%</td>
<td>29%</td>
<td>7%</td>
<td>15%</td>
<td>8%</td>
</tr>
</tbody>
</table>

Source: U.S. Census Bureau 2009b.

Educational Attainment for Population 18 Years of Age and Over

Approximately 3 percent of the population 18 and older statewide has less than a ninth grade education (see Table 5.15-6). Evaluation of PACs reveals that 20 percent of Trapper Creeks’ 18 and older population has less than a ninth grade education, while 36 percent of Four Mile Road’s 18 and older population has less than a ninth grade education. This represents approximately eight people within Four Mile Road and nearly 50 people in Trapper Creek with less than a ninth grade education. Statewide, approximately 89 percent of the population has a high school diploma or some higher level of educational attainment. There are four PACs with lower proportions of their 18 and older populations with at least a high school diploma. These communities include Trapper Creek (59 percent), Four Mile Road (64 percent), Y (69 percent), and Nenana (81 percent) (U.S. Census Bureau 2009b).

Poverty Rate

Approximately 10 percent of the statewide population is impoverished (see Table 5.15-7). Five PACs exhibit higher poverty rates than the statewide rate and include the communities of Ester (19 percent), Y (20 percent), Four Mile Road (21 percent), Trapper Creek (22 percent), and Nenana (26 percent). These communities have greater poverty rates than the statewide average by factors ranging from 2 to 2.6 (U.S. Census Bureau 2009c).
<table>
<thead>
<tr>
<th>Community</th>
<th>Percent of Population below Poverty Line</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prudhoe Bay</td>
<td>NA</td>
</tr>
<tr>
<td>Wiseman</td>
<td>0%</td>
</tr>
<tr>
<td>Coldfoot</td>
<td>NA</td>
</tr>
<tr>
<td>Livengood</td>
<td>0%</td>
</tr>
<tr>
<td>Ester</td>
<td>19%</td>
</tr>
<tr>
<td>College</td>
<td>12%</td>
</tr>
<tr>
<td>Fairbanks</td>
<td>10%</td>
</tr>
<tr>
<td>Four Mile Road</td>
<td>21%</td>
</tr>
<tr>
<td>Nenana</td>
<td>26%</td>
</tr>
<tr>
<td>Anderson</td>
<td>4%</td>
</tr>
<tr>
<td>Healy</td>
<td>5%</td>
</tr>
<tr>
<td>McKinley Park</td>
<td>7%</td>
</tr>
<tr>
<td>Cantwell</td>
<td>3%</td>
</tr>
<tr>
<td>Talkeetna</td>
<td>6%</td>
</tr>
<tr>
<td>Trapper Creek</td>
<td>22%</td>
</tr>
<tr>
<td>Y</td>
<td>20%</td>
</tr>
<tr>
<td>Willow</td>
<td>12%</td>
</tr>
<tr>
<td>Big Lake</td>
<td>15%</td>
</tr>
<tr>
<td>Wasilla</td>
<td>14%</td>
</tr>
<tr>
<td>Alaska</td>
<td>10%</td>
</tr>
</tbody>
</table>

Source: U.S. Census Bureau 2009b.

**Median Household Income**

The median household income for the PACs as well as for Alaska statewide is presented in Table 5.15-8. Given the small sample size for the various communities there is a large margin of error for some communities’ median income estimates. Despite this, ACS data is the best available data for median household estimates. Statewide median household income is nearly 200 percent higher than the median household income in Trapper Creek. Similarly, statewide median household income is 135 percent higher than the median household income in Livengood, while it is nearly 100 percent higher than median household income in Four Mile Road (U.S. Census Bureau 2009d).
### TABLE 5.15-8  Median Household Income

<table>
<thead>
<tr>
<th>Community</th>
<th>Median Household Income in the Past 12 Months (2009 dollars)</th>
<th>Margin of Error (+/−)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prudhoe Bay</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Wiseman</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Coldfoot</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Livengood</td>
<td>$27,500</td>
<td>$37,349</td>
</tr>
<tr>
<td>Ester</td>
<td>$54,813</td>
<td>$8,466</td>
</tr>
<tr>
<td>College</td>
<td>$69,144</td>
<td>$4,179</td>
</tr>
<tr>
<td>Fairbanks</td>
<td>$51,365</td>
<td>$3,087</td>
</tr>
<tr>
<td>Four Mile Road</td>
<td>$33,125</td>
<td>$47,791</td>
</tr>
<tr>
<td>Nenana</td>
<td>$57,946</td>
<td>$25,218</td>
</tr>
<tr>
<td>Anderson</td>
<td>$62,813</td>
<td>$11,798</td>
</tr>
<tr>
<td>Healy</td>
<td>$87,232</td>
<td>$14,437</td>
</tr>
<tr>
<td>McKinley Park</td>
<td>$64,063</td>
<td>$48,491</td>
</tr>
<tr>
<td>Cantwell</td>
<td>$48,750</td>
<td>$20,749</td>
</tr>
<tr>
<td>Talkeetna</td>
<td>$42,596</td>
<td>$17,717</td>
</tr>
<tr>
<td>Trapper Creek</td>
<td>$22,614</td>
<td>$23,586</td>
</tr>
<tr>
<td>Y</td>
<td>$36,761</td>
<td>$13,795</td>
</tr>
<tr>
<td>Willow</td>
<td>$69,010</td>
<td>$12,884</td>
</tr>
<tr>
<td>Big Lake</td>
<td>$62,614</td>
<td>$14,220</td>
</tr>
<tr>
<td>Wasilla</td>
<td>$53,977</td>
<td>$5,312</td>
</tr>
<tr>
<td>Alaska</td>
<td>$64,635</td>
<td>$747</td>
</tr>
</tbody>
</table>

Source: U.S. Census Bureau 2009b.

### School District Dropout Rates

The dropout rates by district for those school districts in which PACs are located are presented in Table 5.15-9. Statewide the dropout rate for the 2009-2010 year equated to 5 percent. Dropout rates for those districts in which the PACs are located are relatively similar to the statewide dropout rates with exception of the Nenana City School District (22.5 percent) and the North Slope Borough School District (10 percent) (Alaska Department of Education and Early Development 2011a).
TABLE 5.15-9  School District Dropout Rates

<table>
<thead>
<tr>
<th>Community</th>
<th>School District</th>
<th>Number of Schools within Community (2010-2011)</th>
<th>Number of Students in District (2010-2011)</th>
<th>District Dropout Rate (2009-2010)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prudhoe Bay</td>
<td>North Slope Borough</td>
<td>0</td>
<td>1,879</td>
<td>10.0%</td>
</tr>
<tr>
<td>Wiseman</td>
<td>Yukon Koyukuk</td>
<td>0</td>
<td>1,387</td>
<td>6.4%</td>
</tr>
<tr>
<td>Coldfoot</td>
<td>Yukon Koyukuk</td>
<td>0</td>
<td>264</td>
<td>5.6%</td>
</tr>
<tr>
<td>Livengood</td>
<td>Yukon Flats</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ester</td>
<td>Fairbanks North Star</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>College</td>
<td>Fairbanks North Star</td>
<td>1</td>
<td>14,285</td>
<td>4.7%</td>
</tr>
<tr>
<td>Fairbanks</td>
<td>Fairbanks North Star</td>
<td>25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Four Mile Road</td>
<td>Yukon Koyukuk</td>
<td>0</td>
<td>1,387</td>
<td>6.4%</td>
</tr>
<tr>
<td>Nenana</td>
<td>Nenana City</td>
<td>2</td>
<td>1,151</td>
<td>22.5%</td>
</tr>
<tr>
<td>Anderson</td>
<td>Denali Borough</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Healy</td>
<td>Denali Borough</td>
<td>2</td>
<td>768</td>
<td>2.8%</td>
</tr>
<tr>
<td>McKinley Park</td>
<td>Denali Borough</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cantwell</td>
<td>Denali Borough</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Talkeetna</td>
<td>Matanuska-Susitna</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trapper Creek</td>
<td>Matanuska-Susitna</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Y</td>
<td>Matanuska-Susitna</td>
<td>1</td>
<td>17,079</td>
<td>5.2%</td>
</tr>
<tr>
<td>Willow</td>
<td>Matanuska-Susitna</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Big Lake</td>
<td>Matanuska-Susitna</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wasilla</td>
<td>Matanuska-Susitna</td>
<td>21</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alaska</td>
<td>NA</td>
<td>508</td>
<td>132,104</td>
<td>5.0%</td>
</tr>
</tbody>
</table>


Labor Force and Unemployment

The 2010 Census did not collect employment information, so the most recent labor force and unemployment data are from the ACS 2005-2009. As described previously in this section, although both the data from the 2010 Census and the ACS are compiled by the U.S. Census Bureau, there are fundamental differences in the two datasets. Population estimates for the two datasets differ because different survey methodologies were used. Therefore, the population estimates provided in Table 5.15-5 above, which are reported by the 2010 Census, differ slightly from the estimates provided in Table 5.15-10 reported by ACS. All ACS estimates should be interpreted as average values over the designated period (U.S. Census Bureau 2009a).
As shown in Table 5.15-10, the statewide average unemployment rate over the 2005-2009 period was 8.7 percent. Unemployment rates in Livengood (14.9 percent), Nenana (14.8 percent), Cantwell (15.2 percent), Y (11.2 percent), and Wasilla (15.9 percent) are between 30 percent and 80 percent higher than statewide unemployment rates over the same period. In contrast, unemployment rates in Fairbanks, Four Mile Road, Anderson, Healy, McKinley Park, and Willow were between 30 percent and 100 percent lower than statewide unemployment rates. All other communities exhibit unemployment rates similar to the statewide unemployment rate over the 2005-2009 period (U.S. Census Bureau 2009e).

**TABLE 5.15-10  Labor Force and Unemployment**

<table>
<thead>
<tr>
<th>Community</th>
<th>Population 16 and Over</th>
<th>In Labor Force</th>
<th>In Military</th>
<th>In Civilian Labor Force</th>
<th>Employed</th>
<th>Unemployed</th>
<th>Not in Labor force</th>
<th>Unemployment Rate</th>
<th>Percent not in Labor Force</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prudhoe Bay</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Wiseman</td>
<td>6</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>6</td>
<td>NA</td>
<td>100.0%</td>
</tr>
<tr>
<td>Coldfoot</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Livengood</td>
<td>70</td>
<td>47</td>
<td>0</td>
<td>47</td>
<td>40</td>
<td>7</td>
<td>23</td>
<td>14.9%</td>
<td>32.9%</td>
</tr>
<tr>
<td>Ester</td>
<td>1,545</td>
<td>957</td>
<td>7</td>
<td>950</td>
<td>926</td>
<td>24</td>
<td>588</td>
<td>2.5%</td>
<td>38.1%</td>
</tr>
<tr>
<td>College</td>
<td>11,358</td>
<td>7,980</td>
<td>199</td>
<td>7,781</td>
<td>7,090</td>
<td>691</td>
<td>3,378</td>
<td>8.9%</td>
<td>29.7%</td>
</tr>
<tr>
<td>Fairbanks</td>
<td>26,861</td>
<td>20,226</td>
<td>3,814</td>
<td>16,412</td>
<td>15,398</td>
<td>1,014</td>
<td>6,635</td>
<td>6.2%</td>
<td>24.7%</td>
</tr>
<tr>
<td>Four Mile Road</td>
<td>22</td>
<td>12</td>
<td>0</td>
<td>12</td>
<td>12</td>
<td>0</td>
<td>10</td>
<td>0.0%</td>
<td>45.5%</td>
</tr>
<tr>
<td>Nenana</td>
<td>313</td>
<td>182</td>
<td>0</td>
<td>182</td>
<td>155</td>
<td>27</td>
<td>131</td>
<td>14.8%</td>
<td>41.9%</td>
</tr>
<tr>
<td>Anderson</td>
<td>567</td>
<td>484</td>
<td>114</td>
<td>370</td>
<td>370</td>
<td>0</td>
<td>83</td>
<td>0.0%</td>
<td>14.6%</td>
</tr>
<tr>
<td>Healy</td>
<td>401</td>
<td>327</td>
<td>0</td>
<td>327</td>
<td>318</td>
<td>9</td>
<td>74</td>
<td>2.8%</td>
<td>18.5%</td>
</tr>
<tr>
<td>McKinley Park</td>
<td>155</td>
<td>146</td>
<td>0</td>
<td>146</td>
<td>146</td>
<td>0</td>
<td>9</td>
<td>0.0%</td>
<td>5.8%</td>
</tr>
<tr>
<td>Cantwell</td>
<td>94</td>
<td>66</td>
<td>0</td>
<td>66</td>
<td>56</td>
<td>10</td>
<td>28</td>
<td>15.2%</td>
<td>29.8%</td>
</tr>
<tr>
<td>Talkeetna</td>
<td>705</td>
<td>496</td>
<td>47</td>
<td>449</td>
<td>408</td>
<td>41</td>
<td>209</td>
<td>9.1%</td>
<td>29.6%</td>
</tr>
<tr>
<td>Trapper Creek</td>
<td>257</td>
<td>133</td>
<td>0</td>
<td>133</td>
<td>122</td>
<td>11</td>
<td>124</td>
<td>8.3%</td>
<td>48.2%</td>
</tr>
<tr>
<td>Y</td>
<td>1,224</td>
<td>685</td>
<td>0</td>
<td>685</td>
<td>608</td>
<td>77</td>
<td>539</td>
<td>11.2%</td>
<td>44.0%</td>
</tr>
<tr>
<td>Willow</td>
<td>1,197</td>
<td>661</td>
<td>8</td>
<td>653</td>
<td>638</td>
<td>15</td>
<td>536</td>
<td>2.3%</td>
<td>44.8%</td>
</tr>
<tr>
<td>Big Lake</td>
<td>1,968</td>
<td>1,326</td>
<td>0</td>
<td>1,326</td>
<td>1,200</td>
<td>126</td>
<td>642</td>
<td>9.5%</td>
<td>32.6%</td>
</tr>
<tr>
<td>Wasilla</td>
<td>7,244</td>
<td>4,696</td>
<td>71</td>
<td>4,625</td>
<td>3,888</td>
<td>737</td>
<td>2,548</td>
<td>15.9%</td>
<td>35.2%</td>
</tr>
<tr>
<td>Alaska</td>
<td>521,998</td>
<td>374,932</td>
<td>16,640</td>
<td>358,292</td>
<td>326,950</td>
<td>31,342</td>
<td>147,066</td>
<td>8.7%</td>
<td>28.2%</td>
</tr>
</tbody>
</table>

Source: U.S. Census Bureau 2009b.
Worker Residency Status and Net-Migration

The Alaska residency status by major standard occupational code is presented in Table 5.15-11. Statewide, approximately 19 percent of all workers are not Alaska residents. Occupations with the highest levels of non-resident employment include manufacturing (56.8 percent), farming, fishing & forestry (44.9 percent), and food preparation (24.1 percent) (Alaska Department of Labor & Workforce Development [DOLWD] 2010).

**TABLE 5.15-11 Alaska Residency Status by Occupation (2009)**

<table>
<thead>
<tr>
<th>Occupation</th>
<th>Standard Occupational Classification</th>
<th>Total Workers</th>
<th>Resident Workers</th>
<th>Nonresident Workers</th>
<th>Percent Nonresident</th>
</tr>
</thead>
<tbody>
<tr>
<td>Management</td>
<td>11</td>
<td>21,264</td>
<td>19,129</td>
<td>2,135</td>
<td>10.0%</td>
</tr>
<tr>
<td>Business and Finance</td>
<td>13</td>
<td>8,184</td>
<td>7,569</td>
<td>615</td>
<td>7.5%</td>
</tr>
<tr>
<td>Computer and Math</td>
<td>15</td>
<td>5,183</td>
<td>4,748</td>
<td>435</td>
<td>8.4%</td>
</tr>
<tr>
<td>Architecture and Engineering</td>
<td>17</td>
<td>7,662</td>
<td>6,389</td>
<td>1,273</td>
<td>16.6%</td>
</tr>
<tr>
<td>Sciences</td>
<td>19</td>
<td>5,827</td>
<td>4,749</td>
<td>1,078</td>
<td>18.5%</td>
</tr>
<tr>
<td>Social Services</td>
<td>21</td>
<td>6,922</td>
<td>6,315</td>
<td>607</td>
<td>8.8%</td>
</tr>
<tr>
<td>Legal</td>
<td>23</td>
<td>2,047</td>
<td>1,872</td>
<td>175</td>
<td>8.5%</td>
</tr>
<tr>
<td>Education</td>
<td>25</td>
<td>24,957</td>
<td>22,786</td>
<td>2,171</td>
<td>8.7%</td>
</tr>
<tr>
<td>Art and Entertainment</td>
<td>27</td>
<td>4,184</td>
<td>3,377</td>
<td>807</td>
<td>19.3%</td>
</tr>
<tr>
<td>Healthcare Practitioners</td>
<td>29</td>
<td>14,609</td>
<td>12,317</td>
<td>2,292</td>
<td>15.7%</td>
</tr>
<tr>
<td>Healthcare Support</td>
<td>31</td>
<td>9,933</td>
<td>9,071</td>
<td>862</td>
<td>8.7%</td>
</tr>
<tr>
<td>Protective Services</td>
<td>33</td>
<td>7,990</td>
<td>7,200</td>
<td>790</td>
<td>9.9%</td>
</tr>
<tr>
<td>Food Preparation</td>
<td>35</td>
<td>34,711</td>
<td>26,356</td>
<td>8,355</td>
<td>24.1%</td>
</tr>
<tr>
<td>Maintenance</td>
<td>37</td>
<td>15,376</td>
<td>12,417</td>
<td>2,959</td>
<td>19.2%</td>
</tr>
<tr>
<td>Personal Care and Service</td>
<td>39</td>
<td>15,425</td>
<td>11,915</td>
<td>3,510</td>
<td>22.8%</td>
</tr>
<tr>
<td>Sales</td>
<td>41</td>
<td>37,257</td>
<td>31,843</td>
<td>5,414</td>
<td>14.5%</td>
</tr>
<tr>
<td>Administrative</td>
<td>43</td>
<td>58,243</td>
<td>52,597</td>
<td>5,646</td>
<td>9.7%</td>
</tr>
<tr>
<td>Farming, Fishing and Forestry</td>
<td>45</td>
<td>3,254</td>
<td>1,794</td>
<td>1,460</td>
<td>44.9%</td>
</tr>
<tr>
<td>Construction and Extraction</td>
<td>47</td>
<td>36,221</td>
<td>28,307</td>
<td>7,914</td>
<td>21.8%</td>
</tr>
<tr>
<td>Installation, Maintenance, and Repair</td>
<td>49</td>
<td>18,391</td>
<td>15,383</td>
<td>3,008</td>
<td>16.4%</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>51</td>
<td>27,425</td>
<td>11,844</td>
<td>15,581</td>
<td>56.8%</td>
</tr>
<tr>
<td>Transportation</td>
<td>53</td>
<td>29,776</td>
<td>23,022</td>
<td>6,754</td>
<td>22.7%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>394,841</td>
<td>321,000</td>
<td>73,841</td>
<td>18.7%</td>
</tr>
</tbody>
</table>

Source: DOLWD 2009a.
As shown in Figure 5.15-2 below, migration to and from Alaska from 1970 to the late 1980s was dramatic. In the mid-1970s TAPs construction was the main driver for increased population migration for that period, with the creation of 60,000 jobs resulting from the oil boom of the 1980s (DOLWD 2009b). Migration to and from Alaska between the late 1990s to present has remained relatively constant.

Source: DOLWD 2009b.

**FIGURE 5.15-2** Timeline of Net Migration for Alaska

### Access to Health Care

According to the ADHSS, nearly one in five adults (19 percent) in Alaska between the ages of 18 and 64 do not have health care coverage (ADHSS 2010a). One of the key determinants of

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4 This reference refers to a digest of the Alaska Behavioral Risk Factor Surveillance System (BRFSS) by ADHSS. The BRFSS methodology used to develop this and other health indicator estimates has been used and evaluated by the CDC and participating states since 1984. In general, data from the CDC BRFSS and AK BRFSS are extremely reliable and valid; however, there are some limitations associated with the method of data collection used for BRFSS. First, the BRFSS data are collected by telephone. Individuals who live in households without a residential telephone are not included. Therefore, the BRFSS might exclude persons of lower socioeconomic status or households with cellular phones only. Second, the survey is based on non-institutionalized populations and excludes persons residing elsewhere, such as nursing homes or long-term-care facilities. Third, the BRFSS data are self-reported by respondents, which can be subject to recall bias. Fourth, the sampling frame of the BRFSS is the entire state; therefore, some rural areas might be represented by relatively few interviews. Fifth, many analyses could not be conducted for rural areas because of small sample sizes. Sixth, health conditions are reported based on diagnoses, so the data could overlook individuals whose health problems have not been tested.
health for Alaska is whether a community or a population is classified as “medically underserved.” MUPs and Medically Underserved Areas (MUAs) are designated by the Health Resources and Services Administration as having too few primary care providers, high infant mortality, high poverty, and/or high elderly population (U.S. Department of Health and Human Services 2011). Health Professional Shortage Areas (HPSAs) are designated by the US Department of Health and Human Services, Health Resources and Services Administration (HRSA) as areas that are lacking in primary medical care, dental or mental health providers, and may be geographic, demographic, or institutional.

HPSAs and MUAs/MUPs were reported for Alaskan boroughs and census areas by the ADHSS as of March 19, 2009, however, information for specific PACs is not available (ADHSS 2009a). Table 5.15-12 presents the HPSA and MUA/MUP designations for the potentially affected boroughs and census areas. Each borough and census area intersected by the proposed ROW is either characterized as an MUP or contains MUAs within its boundaries.

TABLE 5.15-12  HPSAs and MUAs/MUPs for Potentially Affected Boroughs and Census Areas

<table>
<thead>
<tr>
<th>Borough</th>
<th>Primary Care</th>
<th>Dental</th>
<th>Mental</th>
<th>MUA</th>
<th>MUP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fairbanks North Star Borough</td>
<td>Low income</td>
<td>CHC; applying for low income</td>
<td>CHC</td>
<td></td>
<td>yes</td>
</tr>
<tr>
<td>North Slope Borough</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes - Prudhoe Bay-Kaktovik Service Area</td>
<td></td>
</tr>
<tr>
<td>Yukon-Koyukuk Census Area</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes - Koyukuk-Middle Yukon, McGrath-Holy Cross, and Yukon Flats Service Areas</td>
<td></td>
</tr>
<tr>
<td>Denali Borough</td>
<td>yes</td>
<td>applied; CHC site</td>
<td>yes</td>
<td></td>
<td>yes</td>
</tr>
<tr>
<td>Matanuska-Susitna Borough</td>
<td>yes (north); 2 CHCs</td>
<td>yes (north); 2 CHCs</td>
<td>2 CHCs</td>
<td></td>
<td>yes</td>
</tr>
</tbody>
</table>

Notes:
CHC - there is at least one Community Health Center
yes - in HPSA columns indicates a geographic HPSA designation approved by the HRSA for all or part of the census area or borough
Source: ADHSS 2009a.

Lifestyle Choices

Physical Activity

Consistent physical activity is an important indicator of future cardiovascular risk. Moderate physical activity is defined as some activity that causes an increase in breathing or heart rate (30 or more minutes a day, 5 or more days per week). Vigorous physical activity is defined as some activity that causes a large increase in breathing or heart rate (20 or more minutes a day, or recognized. Health indicators that report BRFFS data are given for tobacco use and heart attacks later in this Section.
Within the study area, the North Slope Borough has the highest percentage of adults who are physically inactive (33.5 percent), the highest rate reported within the State of Alaska, followed by the Yukon-Koyukuk Census Area (27 percent), Denali Borough (26.1 percent), Fairbanks North Star Borough (22.9 percent), and the Matanuska-Susitna Borough (22.8 percent) (CDC 2011a).

**Tobacco Use**

The prevalence of smoking for adult Alaskans was 19 percent state-wide in 2009, with more men smoking than women and a disproportionately high prevalence among AIAN people. About 39 percent of AIAN adults reported smoking in 2009 (CDC 2009b). Tobacco use for specific geographic areas is not currently available past 2007. Reports of tobacco usage from 2007 reported the highest prevalence of smoking in the North/Interior Region (36 percent of adults). Prevalence of smoking among adults was 26 percent in Matanuska-Susitna Borough and 22 percent in the Fairbanks North Star Borough in 2007. Overall, in 2007, approximately 22 percent of adults were smokers statewide, suggesting that annual estimated smoking prevalence has decreased over the past several years (down to 19 percent estimated for 2009). Usage of smokeless tobacco is less common among Alaskans and ranged from 3 to 6 percent in 2007 for regions containing PACs. AIAN people report slightly higher rates of smokeless tobacco use (11 percent of adults) compared to Alaska non-native people (4 percent) (CDC 2009b).

**Substance Abuse**

The illegal use of drugs (e.g., marijuana, cocaine, and methamphetamine) and binge drinking are included in the category of substance abuse. The prevalence of binge drinking (defined as proportion of males having five or more drinks or females having four or more drinks on one occasion within a 30-day span) in Alaska is approximately the same as for the entire US. In 2008, 16 percent of Alaskan adults reported engaging in binge drinking. The prevalence was higher in males (22 percent) than females (10 percent). AIAN people reported significantly higher rates of binge drinking (26.7 percent) compared to Alaska non-natives (17.1 percent) during the period of 2007 to 2009 (CDC 2009b). The highest rate of binge drinking among Alaska Natives occurs in the Interior Region (22 percent). Rates of binge drinking are 21 percent in the Arctic Slope Region and 16 percent in the Anchorage/Matanuska-Susitna Region for Alaska Natives (Alaska Native Tribal Health Consortium 2009).

Marijuana use statistics are difficult to interpret due to differences in survey date, type, and definitions. But most surveys suggest that marijuana use is higher among AIAN youths than the overall population, for example:

- Approximately 45 percent of Alaska high school-aged students reported ever using marijuana (during their life) in a 2009 survey compared to 37 percent in the rest of the US (CDC 2009c).
- According to the Substance and Mental Health Services Administration (2004) data for 2002 and 2003, 49.3% of AIAN persons aged 12 or older reported having used marijuana sometime during their lifetime compared to 40.5% of all Americans.
Corresponding figures for the past year and past month for AIAN were 14.5% and 8.3%, respectively—comparable figures for all Americans were 10.8 and 6.2%. The latest figures (see Substance and Mental Health Services Administration 2011) for adolescents aged 12 to 17 from the National Survey on Drug Use and Health (NSDUH) indicated that 13.8% of AIAN adolescents reported using marijuana in the past month compared to a 6.9% national average.

- The National Center for Health Statistics (CDC 2010e) reports data for 2008. According to these data 6.2% of white-only persons 12 years of age or older reported using marijuana in the past month, compared to 8.2% for AIAN.
- The State of Alaska, Epidemiology (1997) department estimated that in 1995 29% of Alaskan high school students used marijuana in the past 30 days, compared to 29% for Alaska Natives and 25% of American high school students.
- Bachman et al., (1991), analyzing older data (1976-89) for high school seniors reported higher marijuana use rates than cited above and also that 30-day prevalence rates differed by ethnic/racial group (AI/AN higher than Caucasian) and males greater than females. Walters et al. (2002) reported that 38% of AIAN 12th graders used marijuana relative to 16% of non-AIAN students.

The use of methamphetamine (meth) has been reported for young Alaskans. Estimated meth use for 2002 to 2005 was almost 3 percent of 18 to 25 year olds surveyed (Rivera and Baker 2010). Alaskan youth are not more likely to use cocaine, heroin, meth, or ecstasy than youth elsewhere in the U.S. More specific regional data for substance abuse is not available for Alaska.

Subsistence Harvest

As described in Section 5.14 (Subsistence) and within this section, impacts to subsistence uses from the proposed Project would be greatest in the undeveloped Minto Flats vicinity and for subsistence users in communities that lie directly along the proposed Project (e.g., Minto, Nenana, Healy, Wiseman, Coldfoot, Anderson, McKinley Park, Cantwell, Trapper Creek, and Willow). Because subsistence impacts would be of a greater magnitude in these communities than for other subsistence communities described in Section 5.14, detailed harvest estimates for these communities, where available, are provided in Tables 5.15-13 through 5.15-19. Subsistence harvest data are not available for the communities of Wiseman, Coldfoot, and Willow.

Minto

Subsistence harvest data for Minto show 95.6 percent of households harvesting subsistence resources in 1984, with this level decreasing to 65 percent of households in 2004 (see Table 5.15-13). Across the same time period, the total harvested weight decreased from 190,619 pounds to 30,606 pounds, with per capita harvests decreasing from 1,015 pounds to 146 pounds. The dominant species harvested also changed. In 1984, salmon species comprised 67.6 percent (128,891 pounds) of the total harvest weight, followed by non-salmon...
fish (17.1 percent; 32,619 pounds) and moose (7.4 percent; 14,187 pounds). Other species harvested include small land mammals, birds and eggs, black bear, berries, and plants. In 2004, salmon species were not reported in the harvest data. Instead, subsistence harvest was predominantly comprised of moose (27,090 pounds; 88.5 percent) and non-salmon fish species (2,106 pounds; 6.9 percent), followed by small land mammals (1,035 pounds; 3.4 percent) and black bear (374 pounds; 1.2 percent) (ADF&G 2011). As discussed under the subheading Food and Nutrition below, moose – the largest contributor to subsistence harvest and subsistence use for Minto households – is an important source of protein, vitamin B12, and iron.

Minto’s seasonal round of subsistence harvest activity is described by Stephen R. Braund & Associates in Section 5.14 and presented in Table 5.15-13. Summer and fall seasons are filled with salmon fishing and fishing for a variety of non-anadromous fish. Spring and fall hunting for bears is important with some hunting in summer and late fall. Berry and plant harvesting are other important summer activities. Moose are a year-round harvest highly valued by local users with the peak harvests occurring in September, January, and February. Porcupines are also harvested year round, usually on an opportunistic basis. Upland birds (grouse and ptarmigan) in addition to hares are harvested in the fall and continue into the winter, particularly for ptarmigan and hares. Furbearers are important winter subsistence harvests, with furbearers still important to the economy as well despite low fur prices (Andrews 1988).

**Nenana**

As shown in Table 5.15-14, subsistence harvest data for Nenana show 64 percent of households using subsistence resources in 2004, with the total harvest equaling 47,692 pounds. Nenana residents harvested an estimated 99 pounds per capita, with the majority of the weight (84.3 percent, or 83 pounds per capita) derived from subsistence harvest of moose (ADF&G 2011). As discussed under the subheading Food and Nutrition below, moose – the largest contributor to subsistence harvest (with 49 percent of the harvest reportedly used) for Nenana households – is an important source of protein, vitamin B12, and iron. In 2004, salmon species were not reported in the harvest data. Non-salmon fish comprised 9.9 percent of the total harvest, with approximately 3,106 individual fish weighing a total of 4,738 pounds harvested. Other subsistence resources harvested include small land mammals (1,818 pounds; 3.8 percent), caribou (653 pounds; 1.4 percent), black bear (116 pounds; 0.2 percent), deer (85 pounds; 0.2 percent), and Dall sheep (65 pounds; 0.1 percent) (ADF&G 2011).
<table>
<thead>
<tr>
<th>ADF&amp;G Study Year</th>
<th>Resource</th>
<th>Percentage of Households</th>
<th>Estimated Harvest</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Use</td>
<td>Try to Harvest</td>
</tr>
<tr>
<td>1984</td>
<td>All Resources</td>
<td>n/a</td>
<td>97.8</td>
</tr>
<tr>
<td></td>
<td>Salmon</td>
<td>n/a</td>
<td>78</td>
</tr>
<tr>
<td></td>
<td>Non-Salmon Fish</td>
<td>n/a</td>
<td>73</td>
</tr>
<tr>
<td></td>
<td>Moose</td>
<td>n/a</td>
<td>84</td>
</tr>
<tr>
<td></td>
<td>Black Bear</td>
<td>n/a</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>Furbearers/Small Land Mammals</td>
<td>n/a</td>
<td>84</td>
</tr>
<tr>
<td></td>
<td>Birds and Eggs</td>
<td>n/a</td>
<td>84</td>
</tr>
<tr>
<td></td>
<td>Berries</td>
<td>n/a</td>
<td>80</td>
</tr>
<tr>
<td></td>
<td>Plants/Greens/Mushrooms</td>
<td>n/a</td>
<td>38</td>
</tr>
<tr>
<td>2004</td>
<td>All Resources</td>
<td>88</td>
<td>72</td>
</tr>
<tr>
<td></td>
<td>Salmon</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td></td>
<td>Non-Salmon Fish</td>
<td>57</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td>Moose</td>
<td>85</td>
<td>59</td>
</tr>
<tr>
<td></td>
<td>Black Bear</td>
<td>22</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>Furbearers/Small Land Mammals</td>
<td>57</td>
<td>32</td>
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Source: ADF&G 2011.
### TABLE 5.15-14 Nenana Harvest and Participation Rates, 2004

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<th>Receive</th>
<th>Number</th>
<th>Unit</th>
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<th>Mean HH Pounds</th>
<th>Per Capita Pounds</th>
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Source: ADF&G 2011.
### TABLE 5.15-15 Healy Harvest and Participation Rates, 1987

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Source: ADF&G 2011.
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<th>Harvest</th>
<th>Give</th>
<th>Receive</th>
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<th>Unit</th>
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<th>Mean HH Pounds</th>
<th>Per Capita Pounds</th>
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<td>0%</td>
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Source: ADF&G 2011.
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<th>Give</th>
<th>Receive</th>
<th>Number</th>
<th>Unit</th>
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<th>Mean HH Pounds</th>
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Source: ADF&G 2011.
### TABLE 5.15-18 McKinley Park Harvest and Participation Rates, 1987

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<th>Unit</th>
<th>Total Pounds</th>
<th>Mean HH Pounds</th>
<th>Per Capita Pounds</th>
<th>Percentage of Total Harvest (by Weight)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1987</td>
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<td>100</td>
<td>100</td>
<td>100</td>
<td>45</td>
<td>72</td>
<td>--</td>
<td>--</td>
<td>44,485</td>
<td>506</td>
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</tr>
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<td>43</td>
<td>43</td>
<td>13</td>
<td>41</td>
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<td>Individual</td>
<td>30,727</td>
<td>349</td>
<td>167</td>
<td>69.1%</td>
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<tr>
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<td>Non-Salmon Fish</td>
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<td>62</td>
<td>60</td>
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<td>36</td>
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<td>Pounds</td>
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<tr>
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<td>Individual</td>
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</tr>
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<td>2</td>
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<td>Individual</td>
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<td></td>
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<td>31</td>
<td>10</td>
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<td>34</td>
<td>11</td>
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<td>8</td>
<td>3.2%</td>
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<td>0%</td>
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<td>0</td>
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<td>0</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
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<td>28</td>
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<tr>
<td></td>
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<td>6</td>
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<td>6</td>
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<td>3</td>
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</tr>
<tr>
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<td>37</td>
<td>5</td>
<td>5</td>
<td>726</td>
<td>Individual</td>
<td>517</td>
<td>6</td>
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</tr>
<tr>
<td></td>
<td>Marine Invertebrates</td>
<td>0</td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>Individual</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td></td>
<td>Berries</td>
<td>89</td>
<td>89</td>
<td>89</td>
<td>26</td>
<td>15</td>
<td>1,203</td>
<td>Quarts</td>
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</tr>
<tr>
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<td>Plants/Greens/Mushrooms</td>
<td>16</td>
<td>16</td>
<td>16</td>
<td>2</td>
<td>0</td>
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<td>37</td>
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<td>0.1%</td>
</tr>
</tbody>
</table>

Source: ADF&G 2011.
<table>
<thead>
<tr>
<th>ADF&amp;G Study Year</th>
<th>Resource</th>
<th>Use</th>
<th>Try to Harvest</th>
<th>Harvest</th>
<th>Give</th>
<th>Receive</th>
<th>Number</th>
<th>Unit</th>
<th>Total Pounds</th>
<th>Mean HH Pounds</th>
<th>Per Capita Pounds</th>
<th>Percentage of Total Harvest (by Weight)</th>
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<td>98</td>
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<td>n/a</td>
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<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>100%</td>
</tr>
<tr>
<td></td>
<td>Salmon</td>
<td>23</td>
<td>n/a</td>
<td>23</td>
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<td>n/a</td>
<td>113</td>
<td>Individual</td>
<td>975</td>
<td>21</td>
<td>7</td>
<td>6.4%</td>
</tr>
<tr>
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<td>Black Bear Fish</td>
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<td>84</td>
<td>n/a</td>
<td>n/a</td>
<td>3,065</td>
<td>Pounds</td>
<td>3,350</td>
<td>71</td>
<td>25</td>
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<td>Black Bear</td>
<td>2</td>
<td>n/a</td>
<td>2</td>
<td>n/a</td>
<td>n/a</td>
<td>1</td>
<td>Individual</td>
<td>63</td>
<td>1</td>
<td>0</td>
<td>0.4%</td>
</tr>
<tr>
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<td>33</td>
<td>n/a</td>
<td>28</td>
<td>n/a</td>
<td>n/a</td>
<td>21</td>
<td>Individual</td>
<td>2,984</td>
<td>63</td>
<td>22</td>
<td>19.6%</td>
</tr>
<tr>
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<td>Individual</td>
<td>6,012</td>
<td>128</td>
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<td>39.4%</td>
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<tr>
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<td>49</td>
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<td>49</td>
<td>n/a</td>
<td>n/a</td>
<td>453</td>
<td>Individual</td>
<td>738</td>
<td>16</td>
<td>5</td>
<td>4.8%</td>
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<td>72</td>
<td>n/a</td>
<td>n/a</td>
<td>875</td>
<td>Individual</td>
<td>508</td>
<td>11</td>
<td>4</td>
<td>3.3%</td>
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<td>67</td>
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<td>67</td>
<td>n/a</td>
<td>n/a</td>
<td>497</td>
<td>Pounds</td>
<td>543</td>
<td>12</td>
<td>4</td>
<td>3.6%</td>
</tr>
<tr>
<td></td>
<td>Plants/Greens/Mushrooms</td>
<td>16</td>
<td>n/a</td>
<td>16</td>
<td>n/a</td>
<td>n/a</td>
<td>62</td>
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<td>1</td>
<td>0.4%</td>
</tr>
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<td>1999</td>
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<td>97</td>
<td>97</td>
<td>62</td>
<td>91</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>100%</td>
</tr>
<tr>
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<td>Salmon</td>
<td>70</td>
<td>47</td>
<td>38</td>
<td>17</td>
<td>50</td>
<td>899</td>
<td>Individual</td>
<td>4,630</td>
<td>49</td>
<td>23</td>
<td>16.8%</td>
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<td>Non-Salmon Fish</td>
<td>83</td>
<td>72</td>
<td>70</td>
<td>20</td>
<td>59</td>
<td>2081</td>
<td>Pounds</td>
<td>2,081</td>
<td>22</td>
<td>10</td>
<td>7.5%</td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>Individual</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
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<td>5</td>
<td>5</td>
<td>5</td>
<td>4</td>
<td>Individual</td>
<td>286</td>
<td>3</td>
<td>1</td>
<td>1.0%</td>
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<td>9</td>
<td>26</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td>Individual</td>
<td>742</td>
<td>8</td>
<td>4</td>
<td>2.7%</td>
</tr>
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<td>49</td>
<td>22</td>
<td>20</td>
<td>40</td>
<td>28</td>
<td>Individual</td>
<td>3,698</td>
<td>39</td>
<td>18</td>
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<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>Individual</td>
<td>105</td>
<td>1</td>
<td>1</td>
<td>0.4%</td>
</tr>
<tr>
<td></td>
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<td>84</td>
<td>53</td>
<td>26</td>
<td>32</td>
<td>71</td>
<td>24</td>
<td>Individual</td>
<td>12,368</td>
<td>132</td>
<td>61</td>
<td>44.8%</td>
</tr>
<tr>
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<td>13</td>
<td>16</td>
<td>3</td>
<td>8</td>
<td>11</td>
<td>2</td>
<td>Individual</td>
<td>160</td>
<td>2</td>
<td>1</td>
<td>0.6%</td>
</tr>
<tr>
<td></td>
<td>Furbearers/Small Land Mammals</td>
<td>40</td>
<td>36</td>
<td>32</td>
<td>11</td>
<td>13</td>
<td>853</td>
<td>Individual</td>
<td>970</td>
<td>10</td>
<td>5</td>
<td>3.5%</td>
</tr>
</tbody>
</table>
### TABLE 5.15-19  Cantwell Harvest and Participation Rates, 1982, 1999 and 2000

<table>
<thead>
<tr>
<th>ADF&amp;G Study Year</th>
<th>Resource</th>
<th>Use</th>
<th>Try to Harvest</th>
<th>Harvest</th>
<th>Give</th>
<th>Receive</th>
<th>Number</th>
<th>Unit</th>
<th>Total Pounds</th>
<th>Mean HH Pounds</th>
<th>Per Capita Pounds</th>
<th>Percentage of Total Harvest (by Weight)</th>
</tr>
</thead>
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<tr>
<td>2000</td>
<td>Marine Mammals</td>
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<td>1</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>Individual</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td></td>
<td>Birds and Eggs</td>
<td>59</td>
<td>58</td>
<td>54</td>
<td>8</td>
<td>11</td>
<td>1137</td>
<td>Individual</td>
<td>801</td>
<td>9</td>
<td>4</td>
<td>3.9%</td>
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<td></td>
<td>Marine Invertebrates</td>
<td>12</td>
<td>5</td>
<td>5</td>
<td>1</td>
<td>11</td>
<td>125</td>
<td>Pounds</td>
<td>125</td>
<td>1</td>
<td>1</td>
<td>0.5%</td>
</tr>
<tr>
<td></td>
<td>Berries</td>
<td>93</td>
<td>92</td>
<td>92</td>
<td>33</td>
<td>17</td>
<td>359</td>
<td>Individual</td>
<td>1,439</td>
<td>15</td>
<td>7</td>
<td>5.2%</td>
</tr>
<tr>
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<td>Plants/Greens/Mushrooms</td>
<td>28</td>
<td>25</td>
<td>24</td>
<td>13</td>
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<td>47</td>
<td>Gallons</td>
<td>188</td>
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<td>1</td>
<td>0.7%</td>
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<td>0</td>
<td>0</td>
<td>5</td>
<td>0</td>
<td>Individual</td>
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<td>0</td>
<td>0</td>
<td>n/a</td>
</tr>
<tr>
<td></td>
<td>Spruce Grouse</td>
<td>16</td>
<td>32</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>1</td>
<td>Individual</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>n/a</td>
</tr>
<tr>
<td></td>
<td>Rock Ptarmigan</td>
<td>42</td>
<td>42</td>
<td>16</td>
<td>16</td>
<td>21</td>
<td>29</td>
<td>Individual</td>
<td>29</td>
<td>2</td>
<td>&lt;1</td>
<td>n/a</td>
</tr>
<tr>
<td></td>
<td>Willow Ptarmigan</td>
<td>16</td>
<td>21</td>
<td>11</td>
<td>5</td>
<td>0</td>
<td>6</td>
<td>Individual</td>
<td>6</td>
<td>0</td>
<td>&lt;1</td>
<td>n/a</td>
</tr>
</tbody>
</table>

Source: ADF&G 2011.
Healy, Anderson, Trapper Creek, and McKinley Park

Subsistence harvest data for the communities of Healy, Anderson, Trapper Creek, and McKinley Park show similar patterns. As shown in Tables 5.15-15 through 5.15-18, these data are reported for the year 1987, with the exception of Trapper Creek data, which were reported for the year 1985. For each community, the majority of households (ranging from 85 percent in Anderson and 100 percent in both Trapper Creek and McKinley Park) used subsistence resources. Fish species (salmon and non-salmon) comprised the greatest percentage of total harvest by weight for these communities. As discussed under the subheading Food and Nutrition below, subsistence fish species are an important source of omega-3 fatty acids, which are protective against heart disease and other chronic diseases. Moose - an important source of protein, vitamin B12, and iron - was the second largest contributor to subsistence harvest, ranging from 12.7 percent of the total harvested weight for Trapper Creek to more than a fifth (22.7 percent) of total harvested weight for Healy. Other subsistence resources harvested by these communities include other large land mammals, small land mammals, birds and eggs, marine invertebrates, berries, and plants/greens/mushrooms (ADF&G 2011).

Cantwell

For the study years 1982 and 1999, the community of Cantwell relied on large land mammals for between 58 and 59 percent of its harvest (see Table 5.15-19). The number of moose harvested in 1982 (6,012) was less than half the number harvested in 1999 (12,368), while the number of caribou harvested fell from 63 individuals in 1982 to 39 individuals in 1999. Per capita consumption of moose ranged from more than double that of caribou in 1982 to more than triple the amount in 1999. Salmon and non-salmon fish species comprised around a quarter of the total harvested weight for both study years. Other large land mammals were reportedly harvested, along with small land mammals, birds and eggs, berries, and plants/greens/mushrooms. Marine invertebrates were also reportedly harvested in 1999.

For the year 2000, subsistence harvest data only include information on the number of birds harvested. Rock ptarmigan (29 individuals), willow ptarmigan (1 individual), and spruce grouse (1 individual) were harvested during the study year. (ADF&G 2011)

Food and Nutrition

The Alaska Native Health Board and Alaska Native Epidemiology Center (2004) Alaska Native Epidemiology Center of the Alaska Native Health Board, in collaboration with organizations and interested individuals throughout Alaska, developed the Alaska Traditional Diet Project (ATDP). The objective of the ATDP, conducted over a two-year period and completed in 2004, was to quantify the intake of subsistence foods among residents of villages in rural Alaska through the use of an interviewer-administered Food Frequency Questionnaire. Results were reported by the participating villages from five regional Tribal Health Corporations. The results reported by the Tanana Chiefs Conference (TCC) are applicable to the villages of Interior Alaska for which subsistence resources may be affected by the proposed Project (see Section 5.14). No data were reported for the villages located within the boundaries of the Arctic Slope Regional
Corporation, Athena Regional Corporation, or Cook Inlet Region Inc. that could be affected by the proposed Project.

The amount of the top 50 foods consumed (as measured by weight) was reported for the TCC region. Of the approximately 47,218 pounds of food reportedly consumed by the 33 survey participants in the region, only approximately 2,522 pounds (5.3 percent) were derived from subsistence foods, with the remainder (94.7 percent) consisting of store-bought foods. Altogether, sugary drinks such as Hi-C, Tang, and sugared soda pop comprised 31.1 percent of foods consumed by respondents. Of the six subsistence foods reportedly consumed within the top 50 foods, moose muscle and organs (1,145 pounds; 2.4 percent), king salmon (583 pounds; 1.2 percent), moose fat and marrow (380 pounds; 0.8 percent), silver salmon (243 pounds; 0.5 percent), blueberries (117 pounds; 0.2 percent), and cranberries (54 pounds; 0.1 percent) comprise a total of 5.3 percent. The ATDP reports that 97 percent of the respondents eat salmon, 94 percent eat moose, and 88 percent eat blueberries and cranberries (Alaska Native Health Board, Alaska Native Epidemiology Center 2004).

According to ATDP findings, subsistence foods contributed substantial amounts of protein, vitamin B12, iron, and omega-3 fatty acids to the diets of respondents in the TCC region. Subsistence foods also contributed to total fat and saturated fat intake, and were not substantial sources of folate, fiber, calcium, or Vitamin C. For the TCC region, moose, caribou, and salmon together provided 18 percent of respondents’ total energy consumed, as well as 74 percent of vitamin B12, 40 percent of the protein, and 7 percent of Vitamin A consumed. Salmon provided 94 percent of the omega-3 fatty acids consumed by respondents, with another 3 percent contributed by other subsistence fish species. Moose, caribou, and salmon also provided 30 percent of total fat and 28 percent of saturated fat intake, and were also the source of 28 percent of iron consumed.

For those respondents in the TCC region who indicated a decrease in the consumption of traditional foods compared to five years prior, the most common reason reported was a lack of transportation to gather and hunt. Only one respondent indicated that decreased consumption of subsistence foods was due to decreased availability of subsistence resources (Alaska Native Health Board, Alaska Native Epidemiology Center 2004).

5.15.3.4 Health Indicators

Data regarding the health status of individual communities along the proposed alignment are limited; however, some health status indicators are available at the state and borough/census area level.

Morbidity and Mortality

Statistics about the morbidity (illness) and mortality (death) rates of a population inform decision makers about “at risk” populations. Where data are available, mortality and incidence rates for diseases common to the study area are presented below.
Mortality

The most common chronic disease deaths statewide and within the study area are cancer, diseases of the heart (including coronary heart disease) unintentional injuries (accidents), chronic lower respiratory disease and cerebrovascular disease (see Table 5.15-20). Data shown in Table 5.15-20 are ranked according to the 2009 rank for each cause for the entire state of Alaska. The data in Table 5.15-20 originate from the Alaska Bureau of Vital Statistics and are for the period from 2007-2009.

<table>
<thead>
<tr>
<th>TABLE 5.15-20</th>
<th>Leading Five Causes of Death for Potentially Affected Communities – Age Adjusted Rates(^a) by Regional Level for years 2000-2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>Borough/CA</td>
<td>North Slope Borough</td>
</tr>
<tr>
<td>Malignant Neoplasms (Cancer)</td>
<td>256.0</td>
</tr>
<tr>
<td>Diseases of the Heart (Heart Disease)</td>
<td>198.6</td>
</tr>
<tr>
<td>Unintentional Injuries (Accidents)</td>
<td>112.1</td>
</tr>
<tr>
<td>Chronic Lower Respiratory Disease</td>
<td>100.9</td>
</tr>
<tr>
<td>Cardiovascular Disease (Stroke)</td>
<td>61.6(^*)</td>
</tr>
</tbody>
</table>

\(^a\) Age-adjusted rates are per 100,000 U.S. year 2000 standard population. Data are shown as found on the ABVS Website.

\(^b\) Rates based on fewer than 20 occurrences are statistically unreliable and should be used with caution.

\(^c\) Rates based on fewer than 6 occurrences are not reported.


Cancer

Cancer (malignant neoplasms) is a broad term to describe diseases in which abnormal cells divide without control and are able to invade other tissues. Cancer cells can spread to other parts of the body through the blood and lymph systems. There are many forms of cancer, which vary in terms of incidence (rate of occurrence of new cancer cases per 100,000 per year), ease of treatment, and mortality (rate of cancer deaths per 100,000 per year). Incidence and mortality rates vary by type of cancer, gender, age, and other factors (e.g., race/ethnicity and certain lifestyle variables, such as smoking and diet). Because cancer rates (either incidence or mortality) vary significantly with age (older persons have higher rates) it is most appropriate to compare rate data on an age-adjusted basis.

Public comment on an earlier draft of this document requested more detailed data by type of cancer, race/ethnicity, and location. To place these numbers in perspective, rates for Alaska (in total and for Alaska Natives and non-natives) are compared to rates for the United States as a whole. Data given in this section are for the period from 1996 to 2001 (ADHSS 2006b) and are age-adjusted to the year 2000 U.S. standard population (as are the data given in Table 5.15-20).
-Cancers with the Highest Mortality Rate by Type

Table 5.15-21 provides age adjusted mortality rates by type of cancer for Alaska and the nation as a whole for the seven cancer types with the highest mortality rates shown in descending order of Alaska mortality rate over the period 1996-2001. During this time period these cancer types accounted for 61.7% of all cancer deaths in Alaska.

The mortality patterns are broadly similar for Alaska and the U.S., except that Alaska mortality rates for lung cancer are slightly higher, and rates for female breast cancer and prostate cancer are slightly lower than corresponding U.S. rates. There are also differences in mortality rate by race/ethnicity. For example, the difference in lung cancer mortality rates between Alaska Natives and non-natives is probably a function of the difference in reported smoking rates discussed above.

TABLE 5.15-21 Cancer Mortality Rates by Type of Cancer 1996-2001 for Alaska, Alaska Whites, Alaska Natives, and the U.S. Overall Ranked in Descending Order of Alaska Death Rates. Results Shown for the Seven Cancer Types with the highest age-adjusted values.

<table>
<thead>
<tr>
<th>Type of Cancer</th>
<th>Alaska Rate per 100,000</th>
<th>Alaska White Rate per 100,000</th>
<th>Alaska Native Rate per 100,000</th>
<th>U.S. Rate per 100,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lung and Bronchus</td>
<td>59.3</td>
<td>59.0</td>
<td>71.2</td>
<td>56.5</td>
</tr>
<tr>
<td>Female Breast</td>
<td>25.1</td>
<td>26.2</td>
<td>23.3</td>
<td>27.4</td>
</tr>
<tr>
<td>Prostate</td>
<td>24.9</td>
<td>25.0</td>
<td>25.1</td>
<td>32.2</td>
</tr>
<tr>
<td>Colorectal</td>
<td>21.7</td>
<td>19.5</td>
<td>35.8</td>
<td>21.0</td>
</tr>
<tr>
<td>Pancreas</td>
<td>11.0</td>
<td>10.6</td>
<td>15.5</td>
<td>10.5</td>
</tr>
<tr>
<td>Ovary</td>
<td>8.7</td>
<td>9.7</td>
<td>5.8</td>
<td>8.9</td>
</tr>
<tr>
<td>Non-Hodgkin’s Lymphoma</td>
<td>8.3</td>
<td>9.6</td>
<td>5.3</td>
<td>8.4</td>
</tr>
</tbody>
</table>

Source: ADHSS 2006b.

-Cancers with the Highest Mortality Rate by Location

ADHSS (2006b) presents maps of age-adjusted cancer mortality data by borough/CA over the period 1996-2001 for the seven types of cancer with the highest mortality listed in Table 5.15-21. For example, Figure 5.15-3 shows a map of age-adjusted cancer mortality rate by borough/CA for lung and bronchus cancer (the cancer types with the highest mortality rate) over the period from 1996 to 2001. The color scheme used in Figure 5.15-3 is gradational between high rates (shown in red) and low rates (shown in blue). Blank regions on the map represent areas in which cancer rates were not calculated because there were 5 or fewer cancer deaths (or none) in that borough/census area. Numbers in the legend indicate the range of rates represented by a specific color, and the numbers in parentheses indicate the number of borough/census areas in that range.
As can be seen in this illustration, North Slope Borough, Yukon-Koyukuk, and the Kenai Peninsula had age-adjusted lung and bronchus cancer mortality rates between 78 and 88.3 per 100,000, whereas Matanuska-Susitna had an age-adjusted rate between 47.4 and 57.6 over the period from 1996-2001. ADHSS (2006b) provides similar cancer rate maps for the other leading causes of cancer mortality.

**-Cancers with the Highest Incidence Rate by Type**

Cancer incidence rates are significantly higher than the cancer mortality rates shown in Table 5.15-21 because not all types of cancer are fatal and the pattern of relative incidence varies because the probability of survival varies by cancer type. Table 5.15-22 provides data on cancer incidence rates for Alaska overall, Alaska Whites, Alaska Natives, and the U.S. overall ranked in descending order of overall Alaska incidence rates for the leading cancer types in terms of incidence for the years 1996 through 2001. During this time period, these cancer types accounted for 66.0% of all cancers diagnosed in Alaska.
As can be seen, there are material differences in the pattern of incidence rates by race/ethnicity. For example, Alaska Natives have substantially lower incidence rates of prostate, female breast, bladder, uterine, and non-Hodgkin’s Lymphoma cancer than whites, but a higher incidence rate for colorectal cancer.

### TABLE 5.15-22 Cancer Incidence Rates by Type of Cancer 1996-2001

<table>
<thead>
<tr>
<th>Type of cancer</th>
<th>Alaska rate per 100,000</th>
<th>Alaska white rate per 100,000</th>
<th>Alaska Native rate per 100,000</th>
<th>U.S. rate per 100,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prostate</td>
<td>165.1</td>
<td>177.7</td>
<td>80.3</td>
<td>172.4</td>
</tr>
<tr>
<td>Female Breast</td>
<td>140.1</td>
<td>148.6</td>
<td>129.5</td>
<td>134.9</td>
</tr>
<tr>
<td>Lung and Bronchus</td>
<td>77.5</td>
<td>76.2</td>
<td>92.5</td>
<td>62.5</td>
</tr>
<tr>
<td>Colorectal</td>
<td>60.9</td>
<td>52.9</td>
<td>109.6</td>
<td>53.9</td>
</tr>
<tr>
<td>Bladder</td>
<td>24.2</td>
<td>27.6</td>
<td>12.4</td>
<td>20.4</td>
</tr>
<tr>
<td>Uterus</td>
<td>21.6</td>
<td>24.3</td>
<td>13.0</td>
<td>24.5</td>
</tr>
<tr>
<td>Non-Hodgkin’s Lymphoma</td>
<td>20.3</td>
<td>22.7</td>
<td>12.2</td>
<td>19.3</td>
</tr>
</tbody>
</table>

Source: ADHSS 2006b. See also ADHSS 2011b

-Cancers with the Highest Incidence Rate by Location

ADHSS (2006b) presents maps of age adjusted cancer incidence data by borough/CA over the period 1996-2001 for the seven types of cancer with the highest incidence listed in Table 5.15-22. For example, Figure 5.15-4 shows a map of age-adjusted cancer incidence rate by borough/CA for prostate cancer (the cancer types with the highest incidence rate) over the period from 1996 to 2001. The color scheme used in Figure 5.15-4 is gradational between high rates (shown in red) and low rates (shown in blue). Blank regions on the map represent areas in which cancer rates were not calculated because there were 5 or fewer cancer cases (or none) in that borough/census area. Numbers in the legend indicate the range of rates represented by a specific color, and the numbers in parentheses indicate the number of borough/census areas in that range.

Figure 5.15-4 has more ‘white space’ because of several CA/boroughs with only a few cases. ADHSS (2006b) provides similar cancer incidence rate maps for the other cancer types with high incidence rates.
The Alaska Native Health Research and Alaska Native Epidemiology Center (Alaska Native Tribal Health Consortium 2006) provides relevant data on cancer incidence and mortality among Alaska Natives and other groups. Figures 5.15-5 and 5.15-6 show time trends in age-adjusted cancer incidence rates (all sites) for men (5.15-5) and women (5.15-6) over several five-year periods. Data are given for Alaska Natives and two reference populations, U.S. Whites and U.S. Blacks.

According to these data:

- Male Alaska Natives have substantially lower age-adjusted cancer incidence rates (all sites) than either the U.S. White or U.S. Black populations. There is an upward trend for all three populations.

- Female Alaska Natives have similar age-adjusted cancer incidence rates (all sites) compared to those found in the U.S. White or U.S. Black populations. There is a slight upward trend in age-adjusted incidence rates in each of these populations.

- Throughout most of this time period Alaska Native males have had slightly higher age-adjusted cancer (all sites) incidence rates than Alaska Native females, though this gap has narrowed in recent years.

**Heart Disease and Cerebrovascular Disease (Stroke)**

Many Alaskans are currently at risk for developing cardiovascular disease due to such risk factors as smoking, overweight, poor diet, sedentary lifestyle, high blood pressure and cholesterol, and lack of preventive health screening. Heart disease and stroke are major causes of mortality in the Alaska population (State of Alaska Epidemiology 1997). According to the publication Healthy Alaskans 2010, heart disease is the second leading cause of death in Alaska, and cerebrovascular disease (most commonly referred to as stroke) is the fourth leading cause of death in Alaska. In 1998, heart disease was the leading cause of death for men and the second leading cause of death for women in Alaska. Coronary disease mortality rates in Alaska are higher for men than women and higher for Alaska Whites than Alaska Natives (see data in Healthy Alaskans). In 1998 Alaskans had a lower age-adjusted death rate (2000 population) for heart disease than the overall United States rate.

In 1998, stroke was the second leading cause of death among women and the fifth leading cause of death among men in Alaska (ADHHS 2002b). Mortality rates for stroke in Alaska in 1998 were higher for females than males and higher for Alaska Natives than Alaska Whites. In contrast to mortality rates for heart disease, the mortality rate for stroke in 1998 was higher among Alaskans than the overall U.S. population.
Heart disease is an important public health issue in terms of morbidity as well as mortality. A substantial portion of outpatient medical visits, pharmacy dispensing, and rehabilitation services in the State are a direct result of heart disease and stroke experienced by Alaskans (ADHSS 2009b). While the number of deaths attributable to heart disease and stroke is reported by the ABVS for the boroughs/census areas (see below), it is difficult to measure the full impact of non-fatal heart disease and stroke in the study area, as few population-based morbidity data sources are currently available for analysis (ADHSS 2009c). As reported by the BRFSS, the percentage of year 2010 survey respondents that had ever been told they had a heart attack was 2.6 percent, with the same percentage reporting having ever been told they had angina or coronary heart disease. The percentage of respondents reporting having ever being diagnosed with a stroke was 2.9 percent (CDC 2011a).

**Chronic Lower Respiratory Disease**

COPD, or chronic obstructive pulmonary disease, is a progressive disease that makes it hard to breathe. Cigarette smoking is the leading cause of COPD. Long-term exposure to other lung irritants, such as air pollution, chemical fumes, or dust, also may contribute to COPD (National Heart Lung and Blood Institute 2010).

The Alaska Native Tribal Health Consortium [ANTHC] (2009) has summarized relevant data on mortality rates for COPD by race and region. Figure 5.15-7 shows average annual age-adjusted COPD mortality rates per 100,000 by region for Alaska Natives (2004-2007) and also comparisons between all Alaska Natives, Alaska Whites and U.S. Whites.

ANTHC (2009) summarized relevant data as follows:

- Although there appears to be variations between regions for COPD death rates, only Arctic Slope’s death rate is significantly higher (p<.05) than the rate for all other regions.
- The Alaska Native COPD death rate has increased 92% since 1980 (p<.05). The rate peaked in 1994-1998 and appears to be decreasing.

During 2004-2007, the Alaska Native COPD death rate was 40% higher than for Alaska Whites (p<.05) but not significantly different than for U.S. Whites.
FIGURE 5.15-7  Average Annual Age-Adjusted COPD Mortality Rates per 100,000 by Region, Alaska Natives, 2004-2007 (Alaska Native Tribal Health Consortium 2009)
Diabetes

Diabetes mellitus, commonly referred to as diabetes, is a metabolic disease characterized by high blood sugar levels, which result from defects in insulin secretion, insulin action, or both.

There are three major types of diabetes. The causes and risk factors are different for each type:

- Type 1 diabetes can occur at any age, but it is most often diagnosed in children, teens, or young adults. In this disease, the body makes little or no insulin. Daily injections of insulin are needed. The exact cause is unknown.

- Type 2 diabetes accounts for a majority\(^5\) of diabetes cases. It most often occurs in adulthood, but teens and young adults are now being diagnosed with it because of high obesity rates. Many people with type 2 diabetes do not know they have it.

- Gestational diabetes is high blood sugar that develops at any time during pregnancy in a woman who does not have diabetes.

Because of the relative prevalence of various diabetes types, the focus of this document is on type 2 diabetes. Diabetes is a major cause of heart disease and stroke and a leading cause of kidney failure, nontraumatic lower-limb amputations, and new cases of blindness among adults in the U.S. (CDC 2011b), reasons why Alaska has devised a strategic plan for its management.

The percentage of the population of each borough within the State of Alaska diagnosed with diabetes in 2008 ranged from 5.6 to 8.1 percent (age-adjusted), with the North Slope Borough reporting the highest percentage. Within the study area, the lowest percentages were reported in Denali Borough (6.1 percent), Matanuska-Susitna Borough (6.3 percent), and the Fairbanks North Star Borough (6.4 percent). The Yukon-Koyukuk Census Area reported a level of 7 percent (CDC 2011b).

\(^5\) According to the National Diabetes Information Clearinghouse (2011) type 2 diabetes accounts for about 90 to 95 percent of all diagnosed cases of diabetes among adults.
**Other Fatalities**

In 1998, the average life expectancy in Alaska was 74.7 years, slightly below the national average of 76.7 years. At 69.4 years the life expectancy for Alaska Natives is substantially lower than for non-Alaska Natives, demonstrating a broad public health discrepancy between Native and non-Native populations (ANTHC 2002; Indian Health Service 2011).

**Intentional and Unintentional Injuries**

Intentional (e.g., suicide, homicide) and unintentional deaths (e.g., poisoning, falls, and drowning) are important causes of fatalities. Table 5.15-23 below shows the total the number and age-adjusted rates of intentional (suicide and homicide) and unintentional fatalities for the potentially affected communities and Alaska as a whole.

<table>
<thead>
<tr>
<th>Borough/CA</th>
<th>Suicide</th>
<th>Homicide</th>
<th>Unintentional Deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number</td>
<td>Rate*</td>
<td>Number</td>
</tr>
<tr>
<td>North Slope Borough</td>
<td>9</td>
<td>43.6*</td>
<td>1</td>
</tr>
<tr>
<td>Yukon-Koyukuk Census Are</td>
<td>9</td>
<td>60.2*</td>
<td>3</td>
</tr>
<tr>
<td>Fairbanks North Star Borough</td>
<td>57</td>
<td>21.7</td>
<td>11</td>
</tr>
<tr>
<td>Denali Borough</td>
<td>1</td>
<td>N/A**</td>
<td>0</td>
</tr>
<tr>
<td>Matanuska-Susitna Borough</td>
<td>53</td>
<td>23.2</td>
<td>13</td>
</tr>
<tr>
<td>Alaska</td>
<td>456</td>
<td>22.7</td>
<td>104</td>
</tr>
</tbody>
</table>

* Age-adjusted rates are per 100,000 U.S. year 2000 standard population.  
** Rates based on fewer than 20 occurrences are statistically unreliable and should be used with caution.  
* Rates based on fewer than 6 occurrences are not reported.  
Source: ABVS 2012.

Reference to Table 5.15-23 shows that unintentional age-adjusted death rates are typically much higher than suicide and homicide rates for the various boroughs/CAs and Alaska as a whole. Table 5.15-24 provides a breakdown of unintentional death rates (2007-2009) for all of Alaska and Table 5.15-25 shows these various causes ranked in descending order of age-adjusted rate. Broadly, non-transport age-adjusted rates are higher than for transport accidents and, among non-transport accidents, poisoning rates are relatively high compared to the other categories given. It should be noted that many poisoning fatalities are alcohol related. (As noted below, this is not the only fatality rate linked to alcohol.)
### TABLE 5.15-24 Unintentional injury rates 2007 to 2009, Alaska total

<table>
<thead>
<tr>
<th>Broad category</th>
<th>Subcategory</th>
<th>Detailed category</th>
<th>Total Deaths</th>
<th>Age-adjusted rate&lt;sup&gt;a&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transport accidents</td>
<td>Subtotal</td>
<td></td>
<td>310</td>
<td>15.5</td>
</tr>
<tr>
<td></td>
<td>Motor vehicle accidents</td>
<td></td>
<td>263</td>
<td>13.2</td>
</tr>
<tr>
<td></td>
<td>Motor vehicle accidents</td>
<td>Snow machine</td>
<td>48</td>
<td>2.5</td>
</tr>
<tr>
<td></td>
<td>Motor vehicle accidents</td>
<td>ATV</td>
<td>21</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Water transport</td>
<td></td>
<td>18</td>
<td>8&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Air transport</td>
<td></td>
<td>27</td>
<td>1.3</td>
</tr>
<tr>
<td></td>
<td>Other transport</td>
<td></td>
<td>4</td>
<td>N/A&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>Non-transport accidents</td>
<td>Subtotal</td>
<td></td>
<td>715</td>
<td>39.8</td>
</tr>
<tr>
<td></td>
<td>Falls</td>
<td></td>
<td>73</td>
<td>5.6</td>
</tr>
<tr>
<td></td>
<td>Accidental discharge of firearms</td>
<td></td>
<td>6</td>
<td>3&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Smoke, fire, and flame</td>
<td></td>
<td>39</td>
<td>1.9</td>
</tr>
<tr>
<td></td>
<td>Drowning and submersion</td>
<td></td>
<td>73</td>
<td>3.6</td>
</tr>
<tr>
<td></td>
<td>Poisoning</td>
<td></td>
<td>348</td>
<td>16.9</td>
</tr>
<tr>
<td>Total</td>
<td>All</td>
<td></td>
<td>1025</td>
<td>55.3</td>
</tr>
</tbody>
</table>

<sup>a</sup> Age-adjusted rates are per 100,000 U.S. year 2000 standard population.

<sup>b</sup> Rates based on fewer than 20 occurrences are statistically unreliable and should be used with caution.

<sup>c</sup> Rates based on fewer than 6 occurrences are not reported.

Source: ABVS 2012.

### TABLE 5.15-25 Unintentional Injury Rates 2007 to 2009, Alaska Total Ranked by Age-Adjusted Rate<sup>a</sup>

<table>
<thead>
<tr>
<th>Leading Causes Ranked in Descending Order of Age-Adjusted Rate</th>
<th>Total Deaths</th>
<th>Age-adjusted rate&lt;sup&gt;a&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-transport accidents</td>
<td>Subtotal</td>
<td>715</td>
</tr>
<tr>
<td>Non-transport accidents</td>
<td>Poisoning</td>
<td>348</td>
</tr>
<tr>
<td>Transport accidents</td>
<td>Subtotal</td>
<td>310</td>
</tr>
<tr>
<td>Motor vehicle accidents</td>
<td></td>
<td>263</td>
</tr>
<tr>
<td>Non-transport accidents</td>
<td>Drowning and submersion</td>
<td></td>
</tr>
<tr>
<td>Non-transport accidents</td>
<td>Falls</td>
<td>73</td>
</tr>
<tr>
<td>Motor vehicle accidents</td>
<td>Snow machine</td>
<td></td>
</tr>
<tr>
<td>Non-transport accidents</td>
<td>Smoke, fire, and flame</td>
<td></td>
</tr>
<tr>
<td>Air transport</td>
<td></td>
<td>27</td>
</tr>
<tr>
<td>Motor vehicle accidents</td>
<td>ATV</td>
<td>21</td>
</tr>
<tr>
<td>Water transport</td>
<td></td>
<td>18</td>
</tr>
<tr>
<td>Non-transport accidents</td>
<td>Accidental discharge of firearms</td>
<td></td>
</tr>
<tr>
<td>Other transport</td>
<td></td>
<td>4</td>
</tr>
</tbody>
</table>

<sup>a</sup> Age-adjusted rates are per 100,000 U.S. year 2000 standard population.

<sup>b</sup> Rates based on fewer than 20 occurrences are statistically unreliable and should be used with caution.

<sup>c</sup> Rates based on fewer than 6 occurrences are not reported.

Source: ABVS 2012.
**Intentional Injuries**

Intentional fatal injuries include those that are self-inflicted (suicide) and inflicted by others (homicide). These are discussed in more detail in the following subsections.

-Suicide

Suicide is rightly viewed as a major health problem throughout the US, but particularly in Alaska and several other Western states. Figure 5.15-8 shows age-adjusted suicide rates by state for the 25 states with the largest suicide rates for 2007 ranked in descending order together with the overall US rate (CDC 2010g). Alaska had the highest age-adjusted rate (22.1 per 100,000) among the states, roughly twice the rate for the US as a whole (11.3 per 100,000). The year 2007 was not atypical in this regard. Suicide rates in Alaska have been significantly higher than those for the US as a whole for many years.

The State of Alaska *Epidemiology* Bulletin (2010) presented an analysis of suicide data for the period from 2004 to 2008 and concluded (among other things) that:

- 81% of completed suicides were male;
- The AIAN rate was 2.2 times greater than the White rate (40.9 vs. 18.5 per 100,000 persons, respectively);
- The highest rates by race, sex, and age were among AIAN males aged 20-29 years (150.2 per 100,000 persons) and females aged 15-19 and 35-39 years (50.0 per 100,000 persons for both groups);
- The most commonly documented life stressors were physical health problems (19%) and recent criminal legal problems (15%);
- The most commonly documented event characteristics included proven or suspected alcohol intoxication (43%) and current depressed mood (41%);
- 25% of the decedents had a documented current medical health problem of which 77% had a diagnosis of depression without bipolar disorder; and
- Firearms were the most common suicide method among males, whereas poisonings were the most common suicide method among females.

More useful demographic facts can be found in annual reports by the Statewide Suicide Prevention Council (e.g., Statewide Suicide Prevention Council 2010).

Suicide is a major cause of intentional death statewide and within the study area. The highest rates of suicide over the period from 2007-2009 in the study area are reported by the North Slope Borough (44.5 deaths per 100,000 population) and the Yukon-Koyukuk Census Area (52.9 deaths per 100,000 population). Both areas exceed the statewide average of 22.2 deaths per 100,000 population; however, with fewer than 20 occurrences reported by both the North Slope Borough and the Yukon-Koyukuk Census Area, these rates are statistically unreliable and should be used with caution (see footnotes to Table 5.15-23 for sources). Figure 5.15-9
presents a map of age-adjusted suicide death rates for Alaska by borough or CA for the period 2000-2009 (ABVS 2010b).

-Homicide

In the years from 1990 to 2010 Alaska’s homicide rates per 100,000 have been declining and broadly comparable to nationwide rates as shown in Figure 5.15-10. In 2010 Alaska ranked 25th in homicide rate. In the period from 2007 through 2009 for which data are given in Table 5.15-23, homicide rates in the study area were similar to the state average (5.2 homicides per 100,000 population), with a rate of 4.3 homicides per 100,000 population reported for the Fairbanks North Star and a rate of 5.0 for the Matanuska-Susitna Borough and fewer than 6 total homicides for the each of the remaining boroughs in the study area (Denali Borough, Yukon-Koyokuk Census Area, and North Slope Borough). It should be noted that rates based on fewer than 20 occurrences are statistically unreliable and should be used with caution (ABVS 2012).


- That 67% of victims were male; the rate for men was 1.9 times higher than the rate for women (8.0 vs. 4.1 per 100,000 population, respectively);
- The median age was 32 years (range: 0–85);
- That 46% of victims were White and 29% were AIAN;
- The rate among AIANs was 2.6 times greater than that of Whites (10.0 vs. 3.9 per 100,000 population, respectively);
- The highest rates by race, sex, and age were among AIAN males aged 30–34 years (103.7 per 100,000 population) and AI/AN females aged 40–44 years (48.1 per 100,000 population);
- Rates varied by region of homicide occurrence;
- The most commonly documented event characteristics were another precipitating crime (22%) and intimate partner violence (15%);
Figure 5.15-8: Age-Adjusted Suicide Rates (Completed Suicides per 100,000) for 2007 for the Twenty-Five States with the Highest Rates Ranked in Descending Order Together with the U.S. Average. Data from CDC 2010g.
FIGURE 5.15.9
Suicide Deaths by Census Area or Borough (2000-2009)

Source: ABVS 2010b (pg. 49)

*Rate based on fewer than 30 occurrences are statistically unreliable and should be used with caution.

**Rates based on fewer than 10 occurrences are not reported.
The most frequently documented victim characteristics included: a) proven or suspected alcohol intoxication (45%) - the majority (89/110, 81%) of these victims had a blood alcohol concentration >0.08 mg/dL; b) the victim knew the suspect(s) as an acquaintance or friend (20%) or was a child, grandchild, or sibling (12%) of the suspect(s); and c) the victim was a current or former spouse or partner of the suspect (12%); and

- The primary weapon (i.e., the weapon that killed the victim) used in most homicides was a firearm (51%), followed by a sharp instrument (13%), and personal weapons (e.g., fists, feet, and hands [12%]).

**Unintentional Injuries**

Statewide and throughout the boroughs/census areas within the study area, two of the most common causes of unintentional deaths in recent years were poisoning (with the exception of Denali Borough), typically via alcohol or drug overdose, and motor vehicle accidents. Unintentional death caused by drowning and submersion; falls; snow machine-related deaths; suffocation/choking; air transport accidents; ATV related accidents; exposure to smoke, fire, and flame; and other accidents are also reported (see Table 5.15-23) (ABVS 2010a).
According to data from the Alaska Native Epidemiology Center (2011) unintentional injuries were the third leading cause of death for both genders combined; it ranked second among men and third among women. Age-adjusted unintentional mortality rates for Alaska Natives and US Whites are shown by time period in Figure. 5.15-11. Although the disparity is substantial, the gap has narrowed in recent years.

![Graph showing age-adjusted unintentional mortality rates for Alaska Natives and US Whites for several time periods.](image)

**FIGURE 5.15-11**  Age-Adjusted Unintentional Mortality Among Alaska Natives and All Whites for Several Time Periods.

Source: Alaska Native Tribal Health Consortium (2009)
Traffic Fatalities

On average, 80 persons were killed per year on Alaska roads since 1994. (See Figure 5.15-12 for year to year data.)

Use of alcohol is a cause or contributing factor of many crashes in Alaska. Among the fatal accidents, 43 percent involve alcohol. Most fatalities occurred in July for the years 2005-2009. The crash statistics from 2010 showed a 12 percent decrease in fatal crashes from 2009. For 2011 (as of November 30, 2011) 56 fatal crashes have occurred in which 65 people were killed (ADOT&PF 2011a). Vehicle-vehicle collisions account for the majority of crashes, while collisions with fixed objects, moose, or other wildlife account for a substantially smaller portion of accidents (ADOT&PF 2008).

Failure to wear seatbelts is another contributing factor to vehicle fatalities. Figure 5.15-12 shows the number of vehicle fatalities by year from 1994 through 2010 and the number of fatalities not wearing seatbelts.

![Traffic Fatalities Diagram](image_url)

Source: Alaska Highway Safety Office, Transportation & Public Facilities 2012

**FIGURE 5.15-12** Annual vehicle fatalities and those not wearing seatbelts in Alaska, 1994-2010.
It is useful to place Alaska vehicle fatalities into context by comparing the observed fatality rate to national rates. The metric generally used for this purpose is the fatality rate per 100 million vehicle miles traveled (VMT). National rates are available from the National Highway Traffic Safety Administration (NHTSA) Fatality Analysis Reporting System (FARS) (2012). Estimates of vehicle miles traveled by state by year are published by the US Department of Transportation (DOT) Federal Highway Administration (FHWA) in an annual publication *Highway Statistics*. Using these data sources enables calculation of fatality rates per 100 million vehicle miles traveled. Figure 5.15-13 shows the comparison between fatality rates in Alaska (solid line) and nationwide (dashed line) from 1994 to 2010.

As can be seen, Alaska highway fatality rates are higher and more variable than, but generally comparable to national average rates. Both time series show declining fatality rates over this period.

**FIGURE 5.15-13** Fatality rates per 100 million vehicle miles traveled for Alaska and the US from 1994 to 2010

-Alaska highways

The Dalton Highway is a rough, industrial road that begins 84 miles north of Fairbanks and ends 414 miles later in Deadhorse near Prudhoe Bay. Between 1997 and 2006, there were 111 crashes and seven fatalities reported on Dalton Highway (BLM 2011). In 2011 one fatality, which occurred in Yukon-Koyukuk Borough, has been reported for Dalton Highway (ADOT&PF 2008).

The Parks Highway runs the 358 miles between Anchorage and Fairbanks and is the principal access road to Denali National Park; thus, this stretch of highway is heavily traveled (ADOT&PF 2006). In 2006, for example, 113 vehicle crashes were reported to ADOT&PF (2 fatalities). In 2010, 12 fatalities were reported (one in Nenana; two in Wasilla; one in Willow; three in Ester; one in Healy; and four outside of city boundaries). In 2011, four fatalities have occurred on Parks Highway (one in Big Lake; one in Trapper Creek; one in Healy; and one in Fairbanks) (ADOT&PF 2008).

-Role of alcohol

As noted above, in examining the above data it is important to note that alcohol plays an important role in both intentional (e.g., suicide [CDC 2009e] and homicide [State of Alaska Epidemiology 2010]) and unintentional (e.g., motor vehicle accidents [Rarig and Hull-Jilly 2011]) injuries and fatalities in Alaska (see also Hull-Jilly and Casto 2008). Moreover, alcohol-induced deaths (including fatalities from causes such as degeneration of the nervous system due to alcohol, alcoholic liver disease, gastritis, myopathy, pancreatitis, poisoning, and more) in Alaska are higher than those in the national overall. For example, between 2006 and 2008, Alaska's rate of alcohol-induced deaths was approximately 3 times the U.S. rate (ADHSS 2012b). The alcohol-induced death rate is significantly higher for Alaska Natives than for non-Natives. As noted by Segal (1998):

For example, 25 percent of all deaths in Alaska are alcohol-related (Alaska Department of Health and Social Services [ADHSS] 1994). More recently, of the 192 Native deaths (from any cause) that occurred in rural Alaska between 1990 and 1993, 128 (66.6 percent) were found to be alcohol related (i.e., the deceased had a blood alcohol concentration [BAC] of 0.08 or higher) (Demer 1997).

In 1981 the State of Alaska Legislature changed alcohol laws to give residents broad powers to regulate how alcohol came into their communities by a local option referendum. Following this decision, some communities opted for various types of alcohol controls. This action enabled researchers to analyze the effects of various alcohol-related policies on injury deaths among Alaska Natives living in small communities (see e.g., Berman and Hull 2000). Investigators Berman, Hull, and May (2000) concluded:
Injury death rates were generally lower during periods when alcohol sales, importation or possession were restricted than when no restrictions were in place (wet). More restrictive controls (dry) significantly reduced homicides; less restrictive control options (damp) reduced suicides. Accident and homicide death rates fell, on average by 74 and 66 per 100,000, respectively, for the 89 communities that banned sale and importation or possession. A control group of 61 small communities that did not change control status under the law showed no significant changes over time in accident or homicide death rates.

**Maternal and Child Care**

As noted in a 2005 publication by the State of Alaska Division of Public Health Bureau of Vital Statistics (ABVS 2005):

> Infant mortality is considered to be an important and comprehensive measure of the overall health of a community. Improvements in sanitation, nutrition, patient education, and the adequacy of prenatal care have drastically lowered infant mortality rates in most countries over the last century.

One key indicator of the quality and availability of maternal and child care is the infant mortality rate. This rate is the sum of the neonatal (under 28 days) and postneonatal (deaths to infants 28 days to 1 year old) mortality rates, measured in units of infant deaths per 1,000 live births.

Figure 5.15-14 shows a plot of the infant mortality rate for Alaska (solid line) compared to the national average (dashed line) over the period from 1994 to 2010. The year-to-year variability of Alaska mortality rates is greater, probably an artifact of the sample size, but the overall rates are comparable to the national averages. Both series have a slight downward trend (indicating improvement) over this period. State by state data are available in several reports (see e.g., Congressional Research Service [CRS] 2012).

The average rates shown in Figure 5.15-14 are relevant, but conceal some important differences among population subgroups. Specifically there are important differences in infant mortality rates (including both neonatal and postneonatal mortality) for Alaska Natives compared to non-natives (see e.g., Toffolon-Weiss *et al.* 2008, State of Alaska Epidemiology 2006, or CDC 2012). Historically, Alaska Natives have experienced higher infant mortality rates than non-natives, though the gap has apparently narrowed over the years (Toffolon-Weiss *et al.* 2008). Comparing risk ratios (RR) between Alaska Native and non-native infant mortality rates over the period from 1992-2001 the Alaska Maternal-Infant Mortality Review researchers (State of Alaska Epidemiology 2006) concluded that there were several cause specific rate differences that were statistically significant, including SIDS or asphyxia, preterm birth, congenital anomalies, infections, and neglect or abuse (sub-optimal medical care had an elevated RR, but was not statistically significant in this study).
CDC (2012) reported results of an epidemiological study of postneonatal mortality among Alaska Native infants over the period from 1989 through 2009. Here are some of the key findings:

- Among AIAN infants, significant risk factors for postneonatal mortality included pre-term birth (RR for births at < 34 weeks = 4.6; RR for birth at 34-36 weeks = 1.9) and low birth rate (RR = 3.8), unmarried mother with no father indicated (RR = 3.5), maternal pre-natal alcohol and cigarette use (RR = 2.2 and 1.9, respectively), and maternal education < 12 years (RR = 1.6).

- RRs for maternal age gave an unexpected pattern (RRs for age <19 = 1.2 compared to RR for maternal age between 19 and 34 = 1.4), but these differences were not statistically significant. Other studies for total infant mortality rate (see e.g., the US Department of Health and Human Services, Office of Minority Health 2011) indicated that infant mortality rates in 2007 decreased monotonically when comparing maternal age class intervals (< 20 years, 20-24 years, 25-29 years, 30-34 years, 35-39 years).
The State of Alaska (H&SS) publishes an *Alaska Maternal and Child Health Data Book* (MCH) that contains relevant data on demographics, reproductive health, prenatal health, prenatal substance abuse, maternal health, infant health, child health, and childhood home environment. The data presented in the MCH Data Book (Young et al. 2011) help to ‘explain’ some of the differences between Alaska Native and non-native infant mortality rates. For example:

- There are differences in the distribution of maternal ages between Alaska Natives and non-natives. More Alaska Native than non-Native births were to mothers ages 15-19 years (17.3% vs. 7.5%, respectively), while a higher percentage of non-Native mothers were 35 years or older (13.3% vs. 7.8%).

- There are differences in the level of education and marital status of mothers between Alaska Natives and non-natives. Compared to non-Native mothers, Alaska Native mothers were more likely to have less than 12 years of education (28.2% vs. 9.8%) and were less likely to be married (31.8% vs. 72.8%).

- Non-Native women were more likely than Alaska Native women to receive prenatal care in the first trimester during the entire eight-year period 2000-2008.

- For Alaskan births that occurred during 2007-2008, reported prenatal use of all substances except for alcohol was higher among Alaska Native women compared to non-Native women. Reported alcohol use was nearly twice as high among non-Native women as among Alaska; and Native women (6.3% vs. 3.5%, respectively).

- The reported prevalence of cigarette use among Alaska Native women was three times higher than for non-Native women (30.5% vs. 10.2%, respectively).

Differences in demographic (among other factors) factors give rise to differences in infant mortality rates among various boroughs/CAs in Alaska. Table 5.15-26 shows the latest available data on infant mortality for boroughs/CAs containing potentially affected communities.
TABLE 5.15-26 Neonatal\(^a\), Postneonatal\(^b\), and Total Infant Mortality Rates\(^c\) for Potentially affected Boroughs/CAs and the State of Alaska

<table>
<thead>
<tr>
<th>Period Reported</th>
<th>Fairbanks North Star Borough</th>
<th>Matanuska-Susitna Borough</th>
<th>State of Alaska</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Neonatal</td>
<td>Post-neo-natal</td>
<td>Total</td>
</tr>
<tr>
<td>2007-2009</td>
<td>1.7</td>
<td>1.7</td>
<td>3.5</td>
</tr>
<tr>
<td>2006-2008</td>
<td>1.5</td>
<td>1.9</td>
<td>3.5</td>
</tr>
<tr>
<td>2005-2007</td>
<td>2.1</td>
<td>1.4</td>
<td>3.5</td>
</tr>
<tr>
<td>2004-2006</td>
<td>2.1</td>
<td>2.3</td>
<td>4.5</td>
</tr>
<tr>
<td>2003-2005</td>
<td>3.6</td>
<td>2.8</td>
<td>6.4</td>
</tr>
<tr>
<td>2002-2004</td>
<td>3.0</td>
<td>3.6</td>
<td>6.6</td>
</tr>
<tr>
<td>2001-2003</td>
<td>2.8</td>
<td>3.3</td>
<td>6.1</td>
</tr>
<tr>
<td>2000-2002</td>
<td>2.2</td>
<td>3.3</td>
<td>5.5</td>
</tr>
<tr>
<td>1999-2001</td>
<td>3.6</td>
<td>2.7</td>
<td>6.3</td>
</tr>
<tr>
<td>1998-2000</td>
<td>3.2</td>
<td>2.3</td>
<td>5.5</td>
</tr>
<tr>
<td>1997-1999</td>
<td>3.5</td>
<td>2.1</td>
<td>5.6</td>
</tr>
<tr>
<td>1996-1998</td>
<td>3.2</td>
<td>2.3</td>
<td>5.5</td>
</tr>
<tr>
<td>1995-1997</td>
<td>4.8</td>
<td>3.4</td>
<td>8.2</td>
</tr>
<tr>
<td>1994-1996</td>
<td>3.3</td>
<td>3.1</td>
<td>6.5</td>
</tr>
<tr>
<td>1993-1995</td>
<td>3.2</td>
<td>3.0</td>
<td>6.2</td>
</tr>
<tr>
<td>1992-1994</td>
<td>2.4</td>
<td>2.6</td>
<td>5.1</td>
</tr>
</tbody>
</table>

\(^a\) Neonatal rates are deaths to infants less than 28 days of age per 1,000 live births.

\(^b\) Postneonatal rates are deaths to infants 28 days to 1 year of age per 1,000 live births.

\(^c\) Total infant mortality rates are the sum of neonatal and postneonatal rates per 1,000 live births.

** Too few data for reliable rates to be calculated.

Source: ABVS 2011

Note: ABVS does not report data for the same time periods for each census area or borough. Using the available data from AKDHHS, this table lists the Yukon-Koyukuk Census Area, the North Slope Borough and the Denali Borough with one set of time periods and the Fairbanks North Star Borough and Matanuska-Susitna Borough with another.

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**Morbidity**

This section addresses various infectious diseases including sexually transmitted diseases (STDs, including Chlamydia, gonorrhea, and HIV/AIDS) and infectious respiratory bacterial or viral illnesses. STDs pose a continuing concern to health authorities and are addressed in *Health Alaskans 2010.*

**Chlamydia Infections**

Chlamydia is a common sexually transmitted disease (STD) caused by the bacterium, *Chlamydia trachomatis,* which (among other things) can damage a woman's reproductive organs. Even though symptoms of Chlamydia are usually mild or absent, serious complications that cause irreversible damage, including infertility, can occur "silently" before a woman ever recognizes a problem.

Rates of Chlamydia infection are disproportionately high for women, certain ethnic/racial minorities, and young adults. And rates are substantially higher for Alaska than the US as a whole. For example:

- Alaska had the highest Chlamydia infection rate in the nation in 2010. It ranked second among all states in rates of Chlamydia infection in 2009 with a rate of 752.7 per 100,000 persons, compared to 409.2 for the US as a whole (see CDC 2010f). Figure 5.15-15 shows a map of the US with Chlamydia rates shown for each state.

- Chlamydia rates for Alaskan women are much higher than for men with 66 percent of 2010 cases diagnosed in women (ADHSS 2011c).

- Chlamydia rates reported for AIAN people are greater than for whites (CDC 2011d) and

- Chlamydia rates are higher for younger persons. Eighty-six percent of 2010 cases in Alaska occurred in people 30 years old or younger (ADHSS 2011c).

Geographically, the Northern Region has the highest rates of Chlamydia (22,250 per 100,000 people). The community of Prudhoe Bay (North Slope Borough) is a PAC which falls within the Northern Region. The second highest Chlamydia rates occur in the Southwest Region (1,803 per 100,000 people) but no PACs are located within this region. The third highest rates occur in the Interior Region (816 per 100,000 people), which contains the PACs of Ester and Fairbanks (Fairbanks North Star Borough); Nenana (Yukon-Koyukuk Census Area); and Anderson, Cantwell and Healy (Denali Borough). The Anchorage/Matanuska-Susitna (Southcentral Alaska) Region had the fourth highest rates of Chlamydia (601 per 100,000 people) (ADHSS 2011c). The PACs of Big Lake, Talkeetna, Trapper Creek, Wasilla, Willow, and Y are located within Southcentral Alaska.
Gonococcal Infections

Gonorrhea (GC) is a STD caused by the bacteria *Neisseria gonorrhoeae*. Untreated gonorrhea can cause serious and permanent health problems in both women and men. For example (Palo Alto Medical Foundation 2012):

- In women, gonorrhea is a common cause of pelvic inflammatory disease (PID). Women with PID do not necessarily have symptoms. PID can damage the fallopian tubes enough to cause infertility.
- In men, gonorrhea can cause epididymitis, a painful condition of the testicles that can lead to infertility if left untreated.
- Gonorrhea can spread to the blood or joints. This condition can be life threatening. In addition, people with gonorrhea can more easily contract HIV, the virus that causes AIDS. HIV-infected people with gonorrhea are more likely to transmit HIV to someone else.

As with Chlamydia, rates of gonorrhea infection are disproportionately high for women, certain ethnic/racial minorities, and young adults. And rates are substantially higher for Alaska than the US as a whole. For example:
• Alaska had the ninth highest gonorrhea infection rate in the nation in 2009 with a rate of 144.3 per 100,000 population compared to 99.1 for the US as a whole (CDC 2010f). By 2010 Alaska’s rate was the second highest in the country (ADHSS 2011d). Rates came down in 2011, but remain higher than national averages (ADHSS 2011d).

• GC rates for Alaskan women are much higher than those for men. In 2009, the rates were 157 and 132 cases per 100,000 for women and men in Alaska (CDC 2010f).

• GC rates reported for AIAN people are greater than for whites (ADHSS 2011d).

• GC rates are typically higher for younger persons. National data for 2009 indicate that young adults 20 to 24 had the highest rates of GC infections (CDC 2010f).

The CDC reports gonorrhea rates by borough. The PAC of Prudhoe Bay falls within the North Slope Borough, which is categorized as the borough with the highest rates of gonorrhea (greater than 600 per 100,000 people). The PACs of Coldfoot, Four Mile Road, Nenana, Livengood, and Wiseman fall within the Yukon-Koyukuk Borough which report moderate rates of gonorrhea in young people (between 300 and 600 cases per 100,000 people). The remaining PACs fall within Fairbanks North Star, Denali, or Matanuska-Susitna Boroughs, all of which report low gonorrhea rates of less than or equal to 300 per 100,000 people (CDC 2009d).

HIV Infections

HIV is the human immunodeficiency virus. It is the virus that can lead to acquired immune deficiency syndrome, or AIDS. As noted in a recent State of Alaska Epidemiology Bulletin:

Over 1 million persons in the United States are estimated to be living with human immunodeficiency virus (HIV) infection, and >50% of those infected persons are men who have sex with men (MSM). Human Immunodeficiency Virus (HIV) is transmitted through unprotected sexual activity, the sharing of injection equipment for intravenous drug use, and from mother to child during childbirth and breastfeeding. Both HIV and acquired immune deficiency syndrome (AIDS) are reportable conditions in Alaska. Persons at greatest risk for acquiring HIV in Alaska are MSM, high risk heterosexuals, and injection drug users (IDU).

HIV and AIDS cases are routinely identified in the State of Alaska; however, the prevalence of HIV/AIDS in the Alaskan population is low (ADHSS 2010b). Since 1982, 1,394 cases of HIV were reported to the Alaska SOE. In 2010, 77 cases were reported. In 2010 and for years previous, males represented the majority of infected individuals. Overall, 44 percent of 2010 cases were diagnosed in white people, 17 percent in AIAN people, and 13 percent in black people. The majority of diagnoses for the entire time span (1982-2010) occurred in the Anchorage/Matanuska-Susitna area. Approximately 80 percent of all HIV/AIDS diagnoses occurred in what the Alaska State HIV/STD Program refers to as “Urban Centers”, which include the Municipality of Anchorage, Fairbanks North Star Borough, and the Juneau Borough (ADHSS 2010c). The PACs of College, Ester, and Fairbanks occur within these more high-risk Urban Centers. The remaining PACs lie within “Urban Satellites”, “Rural Hubs”, or “Rural Areas” which individually account for less than 10 percent of the total HIV/AIDS diagnoses in Alaska.
A recent State of Alaska Epidemiology Bulletin (ADHSS 2012a) provides information on an HIV outbreak in Fairbanks over the period 2011-2012.

The CDC has developed a High-Impact prevention approach for reducing new cases of HIV in the United States (CDC 2011c). This approach has the potential to positively impact prevention efforts by targeting high-risk populations in appropriate geographic locations. Strategies with proven effectiveness include: access to testing and care for HIV-infected individuals; antiretroviral therapy; access to condoms and sterile syringes; prevention programs for HIV-infected individuals and their partners, and those at high risk; and sexually transmitted disease (STD) screening and treatment. Some STDs can increase the risk of HIV infection. The CDC aims to educate the U.S. population about HIV/AIDS and effective prevention measures. Cost-effectiveness is a critical component of the High-Impact prevention approach, so that the greatest amount of prevention can be extracted from each federal dollar allocated to this cause.

The Division of Sexually Transmitted Diseases Prevention has provided funding to evaluate the reduction of barriers to individuals seeking healthcare and to increase STD screening opportunities in rural and urban areas of Alaska (CDC 2010a).

**Infectious Respiratory Bacterial or Viral Illnesses in Alaska**

Influenza rates in Alaska tend to mirror those throughout the U.S. Influenza surveillance is based on reporting of positive influenza antigen "rapid" tests by health care providers and laboratories, positive influenza cultures, outbreaks in schools and nursing homes, outbreaks following vaccination, and incidences of pediatric influenza deaths (ADHSS 2007a). The peak influenza activity in Alaska for the 2008-09 season occurred in February and March 2009. The three most common strains were influenza A (H1), A (H3), and B. The first case of H1N1 in Alaska was reported in May 2009. Statistics indicate that the 2009-10 season levels of H1N1 were less than the previous year (ADHSS 2010d).

Influenza rates are updated weekly by the Alaska State Virology Laboratory. Incidences of infectious viral diseases do not appear to be above normal for 2011. In recent reports (September 24 -29, 2011), four cases of influenza A (H3) were isolated and originated in the Anchorage/Matanuska-Susitna Region or the Interior Region. One case of influenza B was also diagnosed in the Interior as was one case of Respiratory Syncytial Virus (RSV). The RSV season lasts longer in Alaska than in other states. During the 2006-07 season, an outbreak of RSV occurred in the North Slope Region (ADHSS 2007b). RSV was also identified in nine other Alaska communities that year, including Anchorage and Fairbanks. Several strains of adenovirus were identified (Type 1,2,3,14) in the Interior Region and the Northern Region (Bond 2011). In 2011, 48 infants in a neonatal intensive care unit in an Anchorage hospital were infected with mild Methicillin-resistant *Staphylococcus aureus* (MRSA) causing respiratory or gastrointestinal illness (ADHSS 2011e). In previous years, MRSA infections have occurred at rates similar to those seen elsewhere in the U.S.; however, Alaska Natives are more likely to experience MRSA infection than other groups (ADHSS 2009d).

Alaska experienced higher rates of tuberculosis (TB) in 2010 (8 per 100,000 population) compared to the United States average (3.6 per 100,000 population). The TB rate in Alaska in
2010 was 50 percent higher than in 2009. Alaska Native people bear a disproportionate burden of TB in Alaska as 65 percent of 2010 TB cases occurred in this population even though this group only represents 15 percent of the general population. The incidence of TB in Alaska is not evenly distributed throughout the state. The highest rates are found in the Northern and Southwest Regions. The Northern Region usually reports the greatest numbers of TB cases in the state. In 2010, the incidence of TB in the Northern Region was 46.5 per 100,000 population, almost six times greater than the statewide incidence (ADHSS 2010e). The city of Anchorage reports a large proportion of outbreaks occurring in homeless people.

**Other Baseline health data**

**Oral Health**

A 2008 CDC survey indicated that 65.3 percent of Alaska residents visited a dental clinic in the previous 12 months compared to 68.5 percent of persons nationally (CDC 2010b). Oral health problems are pronounced among low-income and Alaska Native populations, and a 1999 Indian Health Service Oral Health Survey found that visitors to Alaska Native dental clinics experienced twice the number of decayed or filled teeth compared to non-Natives on average (Indian Health Service 1999).

**Gender-Based Violence and Child Abuse**

Domestic violence is a major public health problem in Alaska that disproportionately affects vulnerable populations such as Alaska Natives and those in poor general health. Alaska has among the highest rates of domestic violence in the nation. At 73.3 cases per 100,000, Alaska has the highest rate of forcible rape of any state in the U.S., nearly 2.5 times the national average of 31.8 cases per 100,000 (Council on Domestic Violence & Sexual Assault 2010). Alaska also has the highest homicide rate for females killed by a male perpetrator, with a rate of 2.87 per 100,000 in 2003. Alaskan children are frequently victims of sexual abuse in a cycle that perpetuates high overall domestic violence rates: the sexual assault rate for Alaskan children is six times the national average. The prevalence of domestic violence and sexual assault in Alaska is accompanied by a shortage of victim services. The Alaska Network on Domestic Violence and Sexual Assault estimates that in 2006, almost 30 percent of Alaskans were unable to access victim services or encourage others to do so because of a shortage of services in their area at the time (National Coalition Against Domestic Violence 2010), and a study by the ADHSS further documented that those in fair-to-poor general health or lacking social and emotional support are disproportionately vulnerable to domestic violence (Utermohle and Wells n.d.).

Sexual violence is similarly elevated within the Alaska Native population. In 2006, 31 percent of Alaska Natives experienced intimate partner violence in their lifetime, compared to 20.2 percent among Caucasians (Utermohle and Wells n.d.).
5.15.4 Environmental Consequences

This section describes the health impacts related to construction, operations and maintenance of the proposed action and alternatives. Before addressing the consequences of the action proposed by the AGDC, it is useful to provide some perspective on the scale of this proposed Project. Because the consequences of construction and operation of the Trans Alaska Pipeline System (TAPS) are relatively fresh in the memory of many Alaskans and much has been written about TAPS, both favorably and unfavorably (see e.g., Coates 1991; Cole 1997; Fears 1978; McGrath 1977; Mead 1978; Roderick 1997; Rogers 1970; Roscow 1977; and Strohmeyer 1993) over the years, it is relevant to draw some comparisons with this benchmark. It is not within the scope of this document to attempt to assess the impacts of TAPS; the literature cited above provides a spectrum of viewpoints. Some such as David Brower of the Friends of the Earth (quoted in Coates 1991) denounced TAPS as ‘the greatest environmental disaster of our time’, whereas others, such as the poet William R. Wood (quoted in Coates 1991) described the pipeline as modest, benign, romantic, and certainly beautiful with the phrase, ‘A silken thread, half hidden across the palace carpet.’

It is useful to contrast the scale of the ASAP with that of TAPS. Doubtless TAPS has had some negative impacts on the health of Alaskans. But it has also conferred many benefits including providing revenue to the state for many programs that provide health benefits. As economist Scott Goldsmith (2011) observes, the State of Alaska has received a substantial economic windfall from Alaskan oil:

*Extra spending for services and unique programs. About 44%—$70 billion—of oil revenues went for, among many other things, new and expanded operating programs; construction of schools, community facilities, and other infrastructure; loans to students, fishermen, and others; and aid to municipalities and schools. Some revenues funded the start-up of special corporations that make home mortgage loans and promote economic development. Most famously, in 1982 the state began sending annual checks (Permanent Fund dividends) to every resident, from the earnings of the Permanent Fund.*

A more recent article by Goldsmith (Goldsmith 2012) notes that over the period from 1977 to 2012, spending by the State of Alaska totaled $177 billion (in 2011 $). Of this total, approximately 90 percent ($159 billion) was funded by oil revenues.

At the time that TAPS was constructed it was described by the *New York Times* as “the largest single private construction Project and private capital investment in history.” The costs of completion of TAPS (completed in 1977) were estimated at approximately $8 billion in dollars of the day—or in terms of today’s dollars (using the reported purchasing power of the dollar in terms of producer prices) slightly more than $22 billion (Alyeska 2009; U.S. Census Bureau 2011a). The estimated cost for the Alaska Stand Alone Gas Pipeline (ASAP) (see 5.12.3.2) is $8.4 billion, slightly more than one-third as much.
Oil company personnel (and contractors) were on scene in appreciable numbers in the late 1960s and actual TAPS pipeline construction began in 1974. Thus people-related impacts were felt prior to and during construction from the late 1960s through 1977. The schedule for the proposed ASAP Project is to have construction activity over a two and one-half year period from 2017 through 2019, so the duration of construction-related impacts is less for ASAP than TAPS.

Construction labor provides another benchmark for comparison—in part because construction labor is one of the determinants of short-term impacts. Peak TAPS construction employment (including contractors) was 28,072 in October 1975 (Alyeska 2009). Over the period from 1969 through 1977 an estimated 70,000 persons worked on TAPS (Alyeska 2009). This proposed gas pipeline is estimated to have up to 6,400 workers (5,500 on the pipeline and 900 on the facilities) at peak construction (see Section 2.2.5), approximately 23 percent as that of TAPS.

Operating labor for TAPS varied over time. Alyeska employment at the present is reported to be 811, 13 times greater than the estimate, ranging from 50 to 75 employees, for the proposed Project during the operations and maintenance phase (Alyeska 2008; AGDC 2011d).

In considering the possible impact of the construction workforce, it is useful to note that the 6,400 worker figure quoted above is a peak value. As shown in Figure 5.15-16, the estimated size of the workforce varies with season and year, reaching the peak value in the Summer of 2017. Averaged over all periods, the workforce (mainline and other facilities) totals approximately 3,140 persons.

The design and construction of TAPS presented many significant challenges. In fact, TAPS was given the Outstanding Civil Engineering Achievement (OCEA) award by the American Society of Civil Engineers (this point underscores the significant difficulties faced and the fact that design and construction solutions were found) (Thomas 2005). In the intervening 40 years, many lessons have been learned about the construction and operation of pipelines in the harsh arctic environment. In principle, this should mean that construction and operations of the new pipeline should be more efficient and safer.

The Alaska population and infrastructure have changed significantly between 1970 and the present. Alaska’s population was approximately 302,000 in 1970 (SSDAN 2011). The population in 2010 was slightly more than 710,000, 2.4 times greater (U.S. Census Bureau 2011b). And the transportation and other infrastructure of Alaska are more developed now than in the late 1960s. Fueled by petroleum development (Goldsmith 2009), the Alaskan economy has grown substantially and petroleum-related tax and other revenues have provided revenues to improve public health. The above comments are not intended to minimize the impacts of the proposed Project, rather to provide some rough benchmarks for comparison with Alaska’s experience with TAPS.
Thus, the Alaska experience with TAPS might provide some *qualitative* indication of the types of impacts that might be expected from construction and operation of the proposed Project. But there are important quantitative differences in the scale of these two pipelines in both absolute and relative terms.

### 5.15.4.1 No Action

Selection of the No Action alternative means that the proposed gas pipeline will not be constructed and operated. The short- and long-term impacts of the proposed pipeline will not occur and 500 million standard cubic feet per day (MM scfd) of North Slope natural gas and natural gas liquids (NGLs) will not be transported and made available to Fairbanks, Anchorage, and the Cook Inlet Area. The No Action alternative avoids the negative impacts of proposed

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Project construction and operation of ASAP but also foregoes the economic and public health benefits.

Construction

No Project-related construction impacts will occur if the No Action alternative is selected.

Operations & Maintenance

No Project-related operation and maintenance impacts will occur if the No Action alternative is selected. As noted previously, this also means that no beneficial health-related (e.g., those related to the provision of clean natural gas to Fairbanks and other destinations) or socioeconomic benefits will result.

Cumulative Effects

It is unclear whether or not construction and operation of the proposed Project would impact the likelihood of other energy related developments in Alaska. According to the ASAP Project Plan “ASAP is an intrastate Project independent of proposed interstate natural gas pipeline Projects.” (AGDC 2011c). Over time there have been several proposed approaches for delivering North Slope gas to consuming regions in Alaska and elsewhere.⁶ Although numerous studies have been done, to date no Project has been implemented. Several statements have been made to the effect that construction and operation of the proposed Project does not foreclose the possibility of other gas pipeline Projects going forward. Nonetheless the cumulative effects section (see 5.20) identifies several possible Projects under consideration.

Whether or not the proposed Project is constructed and operated, there are significant cumulative effects of other present and proposed oil and gas Projects and state and federal activities. Cumulative effects are discussed in Section 5.20 and health-related impacts are discussed in Section 5.15.4.2 below.

5.15.4.2 Proposed Action

This extended section examines the consequences of the proposed action (building and operating the proposed Project), including construction, operations and maintenance, and cumulative effects. The impacts considered include HECs identified in the Alaska Toolkit (see above), public input during the scoping process, and comments received on earlier drafts of this document.

⁶ According to one source, natural gas projects for Alaska were studied or proposed as far back as 1960, see Galbraith (2009) for an excellent history. See also Seaton (2008).
The construction activities are scheduled to take place over approximately a three year period. The proposed Project is expected to be in operation for the productive life of the natural gas field(s) supply. The estimated useful life of the pipeline is the economic life (which is the controlling factor) and is estimated to extend past the maximum duration of the lease, which is 30 years (AGDC 2011b). Pipeline impacts (positive and negative) would occur during both the construction and operations phases but (see below) the negative impacts are likely to be greater during the construction period than the operations period. During the pipeline construction phase negative effects on HECs are likely to be associated with the Accidents and Injuries HEC. This is because of the disruptions that are associated with construction and the influx of a relative large number of workers during this period. The expected large and very positive impacts on air quality and public health in and around the Fairbanks area associated with the cumulative effects of the proposed action (see below) likely outweigh the negative short term impacts.

Relatively few workers are required to operate and maintain the system and potentially negative impacts, discussed below, range from low to medium. HECs that are judged to have medium impacts are the Accidents and Injuries; Food, Nutrition and Subsistence; Infectious Diseases; and Social Determinants of Health HECs and are discussed below. During the operations phase most of the impacts are likely to be positive (e.g., improved air quality in certain areas resulting from the substitution of natural gas for other fossil fuels and resulting health benefits to residents of Fairbanks), substantial, enduring, and of direct benefit to the health of Alaska residents. The construction impacts then can be likened to an “investment” which provides “dividends or returns” of various types during the operations phase.

There would be material positive health and economic impacts resulting from operation of the proposed Project. These result from reduced emissions of fine particulate matter in Fairbanks (already a non-attainment area for fine particulates) as combustion of natural gas results in lower emissions rates of fine particulates (and other pollutants) than oil, coal, or wood, which are presently used in Fairbanks. Providing natural gas to Fairbanks would require the expansion of the present limited distribution system in Fairbanks. Because this is technically a separate Project, the impacts are discussed under the subheading Cumulative Effects.

There are details of the proposed Project that have not been fully developed or documented. What are believed reasonable assumptions are made for this analysis of impacts. The reader should remember that various lease stipulations have been established (AGDC 2011a). Among these is 1.4.3.1 “The Lessee shall submit for approval the following plans, each of which shall
cover Construction, Operation, Maintenance, and Termination activities.” Subheadings under this address 22 activities. Moreover, Section 1.4.3.2 requires that “These plans shall provide sufficient detail and scope to allow the Pipeline Coordinator to determine if they are consistent with the requirements of this Lease. All applicable State and federal requirements shall be incorporated into the plans and programs of this Lease.” Thus, there is further regulatory review of life-cycle activities.

**Construction**

This section addresses the likely impacts associated with the construction of the proposed Project. These impacts arise from the direct physical effects of construction activities and those associated with the presence of construction personnel necessary to complete the job over the three-year construction period.

**Conceptual site model**

It is convenient to use a conceptual site model to address possible impacts of construction and operation activities of ASAP. According to an ADEC (2005) guidance document:

> A conceptual site model (CSM) is a way to describe and evaluate how people, animals, and plants might come in contact with contaminants at a location. It shows the current and possible future spread of contamination in the environment. Developing a CSM is a critical step in evaluating a contaminated site, and must be prepared during the initial stage of the cleanup process, the site characterization phase. The CSM identifies all:

- Present and future ways people or animals may be exposed (exposure pathways),
- Routes the contaminants may take as they move through soil, groundwater, and/or
- Surface water, (migration routes), and
- Possible types of people who could be exposed (potential receptors) for further analysis at a site.

More generally, a CSM is a written and/or pictorial representation of an environmental system and the various processes that determine the transport and fate of contaminants through various environmental media to environmental receptors and their most likely exposure modes.

- Environmental media could include air, surface and groundwater, subsurface area (vadose zone) soil, sediment, and food chain.
- Components of a CSM include:
  - sources of contaminants,
  - pathways of environmental transport,
  - identification of proposed barriers (countermeasures) and
  - pathways to ecological and human receptors.
For a desktop-level analysis it is appropriate to focus on what are likely to be the most important pathways, such as those shown below. (Moreover, the reader should be aware that ASAP design details have not been made final at this stage, but all are subject to state and federal regulations.)

To illustrate ‘branches’ of the CSM, here are some sources and pathways relevant to the construction phase:

- Construction activities involve operation of large earth-moving equipment (see 5.16.2.2), skip loaders, trucks, nonroad engines, and other mobile sources powered by diesel or gasoline and are sources of combustion emissions, including NO\textsubscript{x}, CO, VOVs, SO\textsubscript{2}, PM\textsubscript{-10}, PM\textsubscript{-2.5}, and small amounts of HAPs.
- Construction activities may also involve burning of cleared materials. These air emissions might be inhaled (the exposure pathway) by workers (generally not addressed in HIAs) and residents (generally the focus of HIAs) in the area.
- Construction activities, such as land clearing, grading, excavation, concrete work, drilling and blasting, and vehicle traffic on paved and unpaved roads are sources of respirable airborne particulate matter (fugitive emissions), including PM\textsubscript{-10} and PM 2-5.
- Construction activities include building and operation of the various work camps used to house the construction workforce. The construction activity will generate air emissions and operation of the camps will result in generation of various water effluents (such as gray water and sewage).
- Operation of the construction equipment offers the potential for leaks and spills (some of which are volatilized and become air emissions and others contaminant of soils, surface, or groundwater) from the equipment itself, fuel tanks, and related sources.
Each of these branches terminates with a possible human exposure pathway (inhalation, dermal contact, ingestion). And each of the exposure pathways are subject to various engineering and work practice controls.

For example, leaks and spills from construction equipment (see POD 7.11.2) would be subject to a Spill Prevention and Control Plan (SPCP):

The SPCP should include:

- Performance of maintenance, including refueling, of construction vehicles to prevent spills
- Storage of fuels and other hazardous materials containment requirements
- Identify individuals responsible for implementing the SPCP
- Define measures for storage and disposal of each kind of waste
- Specify spill response and cleanup procedures
- Describe spill response equipment to be used, including personal protective equipment
- Reporting requirements
- Periodic inspection and documentation requirements

The SPCP will be developed in accordance with all pertinent regulations and will follow BMPs. It will address specific requirements, such as:

- Refueling of vehicles will not be performed within 100 feet of a wetland, stream, or other water body.
- Fuel storage areas will be lined and bermed to contain 110 percent of the volume of fuel stored.
- Vehicle maintenance trucks will contain small spill response kits.
- Drip trays will be used under vehicles when parked to capture fuel, oil, and grease from vehicle leaks.
- All personnel will be trained in the notification and spill response requirements of the SPCP.
- Personnel will be trained in proper use of freeze depressant during hydrostatic testing.

A Spill Prevention and Control and Countermeasure Plan (SPCC) must be developed for each storage facility (e.g., tank) with a capacity to store in excess of 1,320 gallons of fuel. SPCCs are preventative measures to assure that a spill is contained and countermeasures are established to prevent petroleum spills from reaching navigable waters. The SPCC must be maintained on site.

As a second example (see POD 7.11.1) relates to waste handling:

Proper waste management is necessary to provide for human safety and environmental protection. A Comprehensive Waste Management Plan will be developed and followed so that hazardous and nonhazardous wastes generated by ASAP construction activities are minimized, identified, handled, stored,
transported, and disposed of in a safe and environmentally responsible manner, and in full compliance with applicable state, federal, and local laws and regulations.

Each worker, contractor, and vendor working on ASAP is individually responsible for performing daily work tasks in a manner that conserves resources, limits impacts to the environment, and minimizes the generation of wastes. Details of how wastes are to be handled will be provided in the Comprehensive Waste Management Plan, including the following:

- Waste accumulation areas, including satellite accumulation areas, central accumulation areas,
- Recyclable accumulation areas, and universal waste accumulation areas,
- Management of recyclable metals, burnable wastes, and oily wastes,
- Waste transport and disposal, including sampling (as necessary), profiling, and manifesting,
- Wastewater treatment, including disposal of domestic wastewater and hydrostatic testing water,
- Municipal waste treatment,
- Waste fluid handling, including fuels and lubricants for equipment.

It is anticipated that, where possible, materials will be reused or recycled. Burnable and oily wastes may be burned for heat recovery and to reduce waste volume. Domestic wastewater from camps and hydrostatic testing water will be treated and discharged in accordance with applicable permit stipulations, where possible. Hazardous and toxic wastes will be accumulated and transported offsite for appropriate disposal at a licensed disposal facility. Other wastes will likely be disposed of in an appropriate landfill.

Waste disposal sites, including landfills, or monofills may be permitted for this Project; however, requirements and potential locations have not yet been identified.

Finally a CSM needs to address the exposed population. (It is worth noting here that most of the area in the vicinity of the ASAP footprint is sparsely populated.)

Water and Sanitation

Water and sanitation need to be considered in terms of operation of the 14 stationary construction camps (see Plan of Development [POD] Section 7.2.3). Potentially relevant impacts include those related to:

- Change in potable water access;
- Change in water quantity;
- Change in water quality; and
- Change in demand on water and sanitation infrastructure due to the influx of non-resident workers.
As described under the subheading Exposure to Hazardous Materials (following), construction of the proposed Project should not materially increase exposure of the PACs to toxic and hazardous substances. Therefore, effects on water quality due to the use of hazardous materials in the proposed Project are not anticipated. As noted above, Under the Comprehensive Waste Management Plan (CWMP), which would be developed for the proposed Project, solid waste would be reused, recycled, burned, or disposed of in accordance with applicable regulations. In addition, domestic wastewater produced from work camps would be treated and discharged in accordance with applicable permits. Construction of the proposed Project would therefore have negligible effects on water quality.

The proposed Project is estimated to require a total of approximately 1,088 million gallons of surface water (see Table 7.4-5 of the POD) for construction activities and hydrotesting, with additional water required for horizontal directional drilling (HDD). The AGDC has not yet determined from which surface water bodies it would obtain the necessary water supplies so it is not possible to examine impacts in detail. However, the AGDC would need to obtain (and comply with provisions of) the necessary permits prior to water withdrawal, thereby minimizing any potential adverse effects to potable water supplies.

Work (construction) camps would require food service, drinking water, wastewater treatment, and solid waste management. The AGDC would need to obtain the necessary permits and comply with relevant regulations (e.g. 40 CFR 122; 18 AAC 31.020; 18 AAC 72.010, 200, and 215; AAC 80.200; 18 AAC 60 and others, see POD pp. 22-30), and would manage waste according to the CWMP. Therefore, an increased demand on water and sanitation infrastructure due to the work camps would be managed and mitigated according to the CWMP, permits obtained from the Alaska Department of Environmental Conservation (ADEC), and contracts with local service providers.

As described above, it is estimated that approximately 6,400 workers would be required (peak value) to construct the proposed pipeline. The majority of these construction workers would be housed in the 15 work camps. In the areas where construction workers would be required to provide their own housing, such as the construction of the final 29 miles of the proposed Project, the construction of the natural gas liquids extraction plant (NGLEP) facility, and construction of the Fairbanks Lateral, it is expected that construction workers would reside in the numerous motels, RV parks, and other short-term lodging facilities available in the greater Wasilla and Fairbanks areas.

Approximately 545 construction employees would reside in local lodging in Wasilla during the construction of the final 29 miles of mainline construction, while an additional 100 construction workers would reside in the community due to construction of the NGLEP. Further, a maximum of 800 construction workers would reside in Fairbanks during construction of the Fairbanks Lateral.

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7 Upon completion of construction activities, water will be needed for hydrostatic testing, to confirm that the pipeline meets design criteria and is leak-free.
8 Additionally, the ADEC publishes guidance documents on best management practices for temporary camps, which contain useful information (ADEC 2011a).
Lateral. As described under the Affected Environment subheading, water and sewer systems are operated by private companies in the City of Fairbanks. The City of Wasilla operates a sewer and piped water system; however, the majority of households use individual wells and septic systems.

**Scoring**

Scores shown below are developed using the risk assessment matrix given in Tables 5.15-3 and 5.15-4. Scoring is based on the following judgments:

- Health effect score: Low, 0 unlikely to be perceptible;
- Duration: High, 2, medium-term, 2.5 years;
- Magnitude: Low, 0, minor intensity;
- Extent: Low, 0, limited to individual cases;
- Severity rating equals sum of scores: 2;
- Likelihood rating: Very unlikely 1 – 10 percent; and
- Impact rating from Table 5.15-4 = low (−).

In summary, the negative impact of the construction phase of the proposed Project within the Water and Sanitation HEC is estimated to be low.

**Accidents and Injuries**

Construction of the proposed Project has the potential to affect the Accidents and Injuries and Health Infrastructure and Delivery health effect categories (HECs) if it caused the following to occur:

- Change in unintentional injury (e.g., drowning, falls, snow machine, ATV injury) rates;
- Change in roadway incidents and injuries: This is addressed below relative to possible injuries related to operation of trucks and buses associated with construction activities; and
- Changes to safety during subsistence activities: There are no data to support the hypothesis that safety of participants engaged in subsistence activities would be positively or negatively impacted⁹.

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⁹ Snowmachine and ATV accidents are a common occurrence in areas where subsistence users harvest resources (see Table 5.15-25). Alteration of access routes to subsistence areas might impact accident rates in the event that required harvest trip distances were substantially increased. The average annual number of ATV/snowmachine fatalities in the potentially affected Boroughs/CAs was 9.33 persons over the years 2007-2009 (ABVS, 2012). If average trip distances were to increase by 10% for example, and all ATV/snowmachine trips were for harvesting purposes, then the average incremental number of fatalities would be less than one person per year.
Construction of the proposed gas pipeline would result in the possibility of accidents and injuries (fatal and nonfatal). Accidents/injuries could occur to two populations: those who construct (and later operate) the proposed Project (occupational injuries) and the general population (non-occupational injuries). It is conventional practice to address only non-occupational health effects in an HIA. However, occupational injuries (fatal and nonfatal) are considered here because these could place demands on existing health care facilities (see next section) and, moreover, some data (such as for highway fatalities) do not distinguish between those occupationally injured and ‘bystanders.’ These are addressed separately in this analysis.

Occupational injuries include those for proposed Project construction workers and those for workers that support the construction activity, such as those that could occur to employees of the ARR or trucking companies, who transport pipe sections from Seward to Fairbanks and later from Fairbanks to storage locations.

**Direct Construction Workers**

One basis for estimating construction worker fatalities is to scale this from experience with TAPS. Because the construction period for TAPS was longer than that Projected for the proposed Project and the number of workers expected to be employed by the proposed Project is fewer than that for TAPS, such an estimate is likely to overstate possible fatalities. Moreover, it is likely that some of the lessons learned in TAPS and other construction activities would make fatality rates lower.

According to the Alyeska Factbook (2009) there were a total of 32 fatalities directly related to TAPS construction activities (including employees of Alyeska, contractors and subcontractors, but excluding those employed by common carriers). As noted previously, the peak TAPS employment was 28,072, whereas the peak proposed Project construction employment is estimated to be 6,400. Thus, an order of magnitude estimate of possible construction fatalities would be 32 x (6,400/28,072) \( \approx 7.3 \) persons. This calculation does not take into account the longer construction period for TAPS (hence greater exposure duration) or any possible improvements in safety performance since TAPS was completed in 1977. As a check on this estimate, Schnitzer and Bender (1992) estimated the fatality rate for construction workers in Alaska over the period 1980 to 1985 and estimated a fatality rate of 49.1 per 100,000 workers per year. The corresponding estimate for the proposed Project would be a maximum of 49.1/100,000 workers annually x 6,400 workers x 2.5 years or \( \approx 7.9 \) workers, which is virtually identical with the above estimate.

Husberg et al. (2005) from the *National Institute for Occupational Safety and Health* (NIOSH) analyzed data from the Alaska Trauma Registry on hospitalized nonfatal injuries to Alaska construction workers over the period from 1991-1999. On average over this period the injury rate was 0.39 injuries/100 workers annually. Assuming this rate is representative, an upper bound to the estimated injury rate for the proposed Project construction workers would be 6,400 workers (peak) x 2.5 years (construction period) x 0.39/100 workers \( \approx 62 \) hospitalized injuries. This probably overstates the expected number because the peak labor force is used rather than an average.
Other Workers

Other workers who could suffer fatal and nonfatal injuries include those who transport pipe sections via rail and truck.

Consider rail transport first. The ARR would be the primary transport of pipeline materials between the Port of Seward (where pipe would be offloaded from ships) and Fairbanks. Pipe offloaded from marine transport at Seward would be placed on rail cars and shipped to Fairbanks for double-jointing and coating. After pipe has been double-jointed and coated, it would be distributed to laydown yards by rail or truck depending upon the final destination. According to the AGDC, a total of 3,800 rail cars would be required to transport pipe sections from Seward to Fairbanks. It is assumed that after double-joining and coating, approximately half (1,900 rail cars) would be reshipped southwards by rail and the balance northwards by truck. It is also assumed for the first journey from Seward to Fairbanks that the necessary freight cars would originate in Anchorage and thus the shipment would include the following stops: Anchorage (origin) to Seward, Seward to Fairbanks, and return to Anchorage.\(^1\) Additional trips are required to take the double-jointed and coated pipeline sections southwards, entailing a trip from Anchorage to Fairbanks and return.\(^1\) Data are available on injuries (fatal and nonfatal) to rail employees and other persons and train miles (used for normalizing injury data) from the Federal Railway Administration (FRA). Table 5.15-27 shows ARR accident data for the period from 2001 to 2010. Averaged over the 10-year period the fatal and nonfatal injury rate for employees were 0.266 and 48.664 injuries, respectively, per million train miles. Similarly the fatal and nonfatal injury rates for non-employees (trespassers, train accidents, and highway-rail crossing accidents) were 0.266 and 0.730 per million train miles.

Using these data, an estimated 0.033 employees and 0.033 other (non-railroad) persons could suffer a fatal injury as a result of pipeline being transported for the proposed Project (see Tables 5.15-28 and 5.15-29). Non-railroad employees could be injured from rail-auto collisions, trespassers killed after being struck by trains, and related incidents. The fact that the estimated fatalities are much less than 1 simply means that the probability (calculated from the Poisson distribution) of zero fatalities is high; \(\approx 0.97\) for both employees and others, a direct consequence of the relatively low fatality rates for the ARR. Using the nonfatal injury rates, the estimated number of injuries associated with these train trips are 6 and 0.09, respectively. Although zero fatalities and injuries to both groups is a clear goal of the ARRC, these

\(^{10}\) It is possible that ARRC could arrange for other cargo for the backhaul, but for exposure calculation purposes this is included in the pipeline transport risk.

\(^{11}\) The entire distance is included even though pipe would be unloaded at intermediate facilities.
calculations suggest that the impacts of rail transit of pipeline are relatively small based on present accident rates.

The ARRC has a good safety record compared to the average of other railroads in the U.S., which reflects existing safety programs on the railroad, the low population density in Alaska, relatively few grade crossings, and relatively slow speeds of the trains. Because these rates are low, it might be argued that the data are too sparse for statistical precision. Accordingly, data for all railroads tracked by the FRA is presented in Table 5.15-31 and the ARRC calculations based on the record of all railways has been replicated. Referring to Table 5.15-30 (bottom rows) the same calculations show higher, but similar, values in order-of-magnitude terms.

The estimated number of freight train trips per day (assuming a 2.5-year period and operations 5 days per week over a 50-week year\textsuperscript{12}) required to haul the pipe for the proposed Project is 0.23. At present ARRC hauls about 2 freight trains per day from Anchorage (excluding short-haul coal or gravel trains), so the pipe shipments are unlikely to create capacity problems for ARRC—and, therefore, the possibility that accident rates would increase as a result of increased train traffic.

Truck accidents hauling pipe have the potential to cause injuries to truck drivers and other motorists and pedestrians. Approximately 9,000 truckloads of pipe would need to be delivered to laydown yards along the pipeline (north of Fairbanks). Assuming an average haul distance of 400 miles/trip (out and return), delivering the pipe to the laydown yards entails a total of 3.6 million vehicle miles (see Table 5.15-32). Commercial motor vehicle fatality rates for the State of Alaska are available from the Department of Transportation & Public Facilities.

\textsuperscript{12} Assuming a 50-week year probably overstates the actual number of weeks in the year. The exact figure is unavailable, but estimates so calculated are likely to be conservative (not understate).
### TABLE 5.15-27 Annual Accident Data for Alaska Railroad Road Corporation, 2001-2010

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<th>Category</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
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<th>2008</th>
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<th>10-year Average</th>
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<td>Injuries</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.000</td>
</tr>
<tr>
<td><strong>Highway-rail crossing accidents</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deaths</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0.100</td>
</tr>
<tr>
<td>Injuries</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0.400</td>
</tr>
<tr>
<td><strong>Subtotal - non-railroad employees</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deaths</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>0.400</td>
</tr>
<tr>
<td>Injuries</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>1.100</td>
</tr>
<tr>
<td>Total train miles</td>
<td>1,423,898</td>
<td>1,444,912</td>
<td>1,575,403</td>
<td>1,629,170</td>
<td>1,738,641</td>
<td>1,528,291</td>
<td>1,512,545</td>
<td>1,433,823</td>
<td>1,418,848</td>
<td>1,357,035</td>
<td>1,506,257</td>
</tr>
<tr>
<td>Employee death rateb</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.6</td>
<td>0.0</td>
<td>0.0</td>
<td>0.7</td>
<td>1.4</td>
<td>0.0</td>
<td>0.266</td>
</tr>
<tr>
<td>Employee injury rateb</td>
<td>73.7</td>
<td>38.1</td>
<td>34.3</td>
<td>34.4</td>
<td>33.4</td>
<td>29.4</td>
<td>40.3</td>
<td>78.8</td>
<td>81.8</td>
<td>51.6</td>
<td>48.664</td>
</tr>
<tr>
<td>Non-employee death rateb</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.6</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>2.1</td>
<td>0.0</td>
<td>0.266</td>
</tr>
<tr>
<td>Non-employee injury rateb</td>
<td>1.4</td>
<td>2.1</td>
<td>1.3</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.7</td>
<td>0.0</td>
<td>0.0</td>
<td>2.2</td>
<td>0.730</td>
</tr>
</tbody>
</table>

a Other accidents/incidents are events other than train accidents or crossing incidents that cause physical harm to persons.
b Rates are incidents per million train miles per year.

Source: Federal Railroad Administration 2011
### TABLE 5.15-28  Estimate of ARCC Train Traffic Associated with Rail Transportation of Pipe Sections (ARCC data)

<table>
<thead>
<tr>
<th>Distance calculation:</th>
<th>Delivery from Seward to Fairbanks</th>
<th>Delivery from Fairbanks to Camps</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>From: Anchorage</td>
<td>To: Seward</td>
</tr>
<tr>
<td></td>
<td>From: Seward</td>
<td>To: Fairbanks</td>
</tr>
<tr>
<td></td>
<td>From: Fairbanks</td>
<td>To: Anchorage</td>
</tr>
<tr>
<td></td>
<td>From: Anchorage</td>
<td>To: Fairbanks</td>
</tr>
<tr>
<td></td>
<td>From: Fairbanks</td>
<td>To: Anchorage</td>
</tr>
<tr>
<td></td>
<td>Total: 940</td>
<td>Total: 711.4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Number of trains required:</th>
<th>Delivered north to Fairbanks</th>
<th>Delivered from Fairbanks south for construction</th>
<th>Total trains required</th>
<th>Total train miles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of rail cars</td>
<td>3800</td>
<td>1900</td>
<td>142.5</td>
<td>123,092</td>
</tr>
<tr>
<td>Rail cars/train</td>
<td>40</td>
<td>40</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trains required</td>
<td>95</td>
<td>47.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Miles/train</td>
<td>940</td>
<td>711.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Train miles</td>
<td>89,300</td>
<td>33,792</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Average number of trains per day</th>
<th>Project length (Years)</th>
<th>2.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work weeks/year</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>Work days/week</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Ave. Trains/day</td>
<td>0.23</td>
<td></td>
</tr>
</tbody>
</table>

### TABLE 5.15-29  Estimated Death and Injury Rates Based on ARRC Accident Data (From Tables 5.15-27 & 5.15.28)

<table>
<thead>
<tr>
<th></th>
<th>Employee deaths</th>
<th>Employee injuries</th>
<th>Non-employee deaths</th>
<th>Non-employee injuries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rate per million Train miles</td>
<td>0.266</td>
<td>48.664</td>
<td>0.266</td>
<td>0.73</td>
</tr>
<tr>
<td>Estimate</td>
<td>0.033</td>
<td>5.990</td>
<td>0.033</td>
<td>0.090</td>
</tr>
<tr>
<td>P(0) if Poisson</td>
<td>0.9678</td>
<td>0.9678</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P(1 or more)</td>
<td>0.0322</td>
<td>0.0322</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### TABLE 5.15-30  Estimated Death and Injury Rates Based on National Railroad Accident Data (From Tables 5.15-28 & 5.15.31)

<table>
<thead>
<tr>
<th></th>
<th>Employee deaths</th>
<th>Employee injuries</th>
<th>Non-employee deaths</th>
<th>Non-employee injuries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rate per million Train miles</td>
<td>0.705</td>
<td>17.913</td>
<td>1.101</td>
<td>2.506</td>
</tr>
<tr>
<td>Estimate</td>
<td>0.087</td>
<td>2.205</td>
<td>0.136</td>
<td>0.308</td>
</tr>
<tr>
<td>P(0) if Poisson</td>
<td>0.9169</td>
<td>0.8733</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P(1 or more)</td>
<td>0.0831</td>
<td>0.1267</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Sources:
Distances: ARRC 2010.
Cars/train: estimated 40 89' railcars per train, used above (Renfrew, Pers. Comm. 2011) (ARRC estimate of cars per train is in general agreement with national average reported by RITA-BTS 2006).
National average: BTS estimate of average tons freight/train in 2004 = 3,100 Tons/train.
BTS estimate of average cargo load/car in 2004 = 61Tons/car, Average cars/train = 51 Cars/train.
Death and injury rates are based on Federal Railroad Administration statistics for ARRC (see Table 5.15-23) and all railroads (Table 5.15-25).
### TABLE 5.15-31  Annual Accident Data for All Federal Railroad Administration Railroads, 2001-2010

<table>
<thead>
<tr>
<th>Category</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>10-year Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Employees on duty:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deaths</td>
<td>22</td>
<td>20</td>
<td>19</td>
<td>25</td>
<td>25</td>
<td>16</td>
<td>17</td>
<td>25</td>
<td>16</td>
<td>20</td>
<td>20.500</td>
</tr>
<tr>
<td>Injuries</td>
<td>7,648</td>
<td>6,524</td>
<td>6,076</td>
<td>5,769</td>
<td>5,535</td>
<td>4,999</td>
<td>5,222</td>
<td>4,722</td>
<td>4,253</td>
<td>4,190</td>
<td>5,493.800</td>
</tr>
<tr>
<td>Employees, other accidents(^a)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deaths</td>
<td>544</td>
<td>579</td>
<td>527</td>
<td>507</td>
<td>492</td>
<td>528</td>
<td>503</td>
<td>486</td>
<td>444</td>
<td>462</td>
<td>507.200</td>
</tr>
<tr>
<td>Injuries</td>
<td>9,518</td>
<td>8,220</td>
<td>7,997</td>
<td>7,754</td>
<td>7,710</td>
<td>7,505</td>
<td>8,274</td>
<td>7,713</td>
<td>7,111</td>
<td>7,297</td>
<td>7,909.900</td>
</tr>
<tr>
<td>Subtotal - Railroad employees</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deaths</td>
<td>566</td>
<td>599</td>
<td>546</td>
<td>532</td>
<td>517</td>
<td>544</td>
<td>520</td>
<td>511</td>
<td>460</td>
<td>482</td>
<td>527.700</td>
</tr>
<tr>
<td>Injuries</td>
<td>17,166</td>
<td>14,744</td>
<td>14,073</td>
<td>13,523</td>
<td>13,245</td>
<td>12,504</td>
<td>12,435</td>
<td>11,364</td>
<td>10,127</td>
<td>11,084</td>
<td>13,403.700</td>
</tr>
<tr>
<td>Trespasser (not located at highway-rail crossings)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deaths</td>
<td>511</td>
<td>540</td>
<td>498</td>
<td>472</td>
<td>458</td>
<td>511</td>
<td>470</td>
<td>457</td>
<td>417</td>
<td>435</td>
<td>476.900</td>
</tr>
<tr>
<td>Injuries</td>
<td>404</td>
<td>395</td>
<td>398</td>
<td>406</td>
<td>420</td>
<td>481</td>
<td>407</td>
<td>433</td>
<td>345</td>
<td>388</td>
<td>407.700</td>
</tr>
<tr>
<td>Train accidents</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deaths</td>
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<td>15</td>
<td>4</td>
<td>13</td>
<td>33</td>
<td>6</td>
<td>9</td>
<td>27</td>
<td>4</td>
<td>8</td>
<td>12.500</td>
</tr>
<tr>
<td>Injuries</td>
<td>310</td>
<td>1,884</td>
<td>232</td>
<td>346</td>
<td>787</td>
<td>220</td>
<td>309</td>
<td>324</td>
<td>120</td>
<td>102</td>
<td>463.400</td>
</tr>
<tr>
<td>Highway-rail crossing accidents</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deaths</td>
<td>421</td>
<td>357</td>
<td>334</td>
<td>371</td>
<td>359</td>
<td>369</td>
<td>339</td>
<td>290</td>
<td>263</td>
<td>257</td>
<td>334.400</td>
</tr>
<tr>
<td>Injuries</td>
<td>1,157</td>
<td>999</td>
<td>1,035</td>
<td>1,094</td>
<td>1,053</td>
<td>1,070</td>
<td>1,058</td>
<td>990</td>
<td>741</td>
<td>847</td>
<td>1,004.400</td>
</tr>
<tr>
<td>Subtotal - non-railroad employees</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deaths</td>
<td>938</td>
<td>912</td>
<td>836</td>
<td>856</td>
<td>850</td>
<td>886</td>
<td>818</td>
<td>774</td>
<td>668</td>
<td>700</td>
<td>823.800</td>
</tr>
<tr>
<td>Injuries</td>
<td>1,871</td>
<td>3,278</td>
<td>1,665</td>
<td>1,846</td>
<td>2,260</td>
<td>1,771</td>
<td>1,747</td>
<td>1,747</td>
<td>1,206</td>
<td>1,337</td>
<td>1,875.500</td>
</tr>
<tr>
<td>Total train miles</td>
<td>711,549,906</td>
<td>728,674,146</td>
<td>743,330,718</td>
<td>770,152,268</td>
<td>789,033,596</td>
<td>809,222,612</td>
<td>789,173,803</td>
<td>768,640,705</td>
<td>663,638,682</td>
<td>708,258,563</td>
<td>748,267,500</td>
</tr>
<tr>
<td>Employee death rate(^b)</td>
<td>0.8</td>
<td>0.8</td>
<td>0.7</td>
<td>0.7</td>
<td>0.7</td>
<td>0.7</td>
<td>0.7</td>
<td>0.7</td>
<td>0.7</td>
<td>0.7</td>
<td>0.705</td>
</tr>
<tr>
<td>Employee injury rate(^b)</td>
<td>24.1</td>
<td>20.2</td>
<td>18.9</td>
<td>17.6</td>
<td>16.8</td>
<td>15.5</td>
<td>17.1</td>
<td>16.2</td>
<td>17.1</td>
<td>16.2</td>
<td>17.913</td>
</tr>
<tr>
<td>Non-employee death rate(^b)</td>
<td>1.3</td>
<td>1.3</td>
<td>1.1</td>
<td>1.1</td>
<td>1.1</td>
<td>1.1</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
<td>1.101</td>
</tr>
<tr>
<td>Non-employee injury rate(^b)</td>
<td>2.6</td>
<td>4.5</td>
<td>2.2</td>
<td>2.4</td>
<td>2.9</td>
<td>2.2</td>
<td>2.3</td>
<td>2.2</td>
<td>1.6</td>
<td>1.9</td>
<td>2.506</td>
</tr>
</tbody>
</table>

\(^a\) Other accidents/incidents are events other than train accidents or crossing incidents that cause physical harm to persons.

\(^b\) Rates are incidents per million train miles per year.

### TABLE 5.15-32  Fatal and Nonfatal Injuries Associated with Truck Haulage of Pipeline

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Value</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Truckloads</td>
<td>Truckloads required to distribute pipe to laydown yards</td>
<td>9,000</td>
<td>Estimate from AGDC staff</td>
</tr>
<tr>
<td>Haul distance</td>
<td>Average haul distance (miles)</td>
<td>400</td>
<td>Assumed out and return distance from Fairbanks to laydown yards</td>
</tr>
<tr>
<td>Vehicle miles</td>
<td>Estimated vehicle miles</td>
<td>3,600,000</td>
<td>Calculation</td>
</tr>
<tr>
<td>Fatality rates</td>
<td>Fatality rate/100 million vehicle miles</td>
<td>0.106</td>
<td>Average for Alaska for CY05 through CY 11</td>
</tr>
<tr>
<td></td>
<td>Fatality rate/100 million vehicle miles</td>
<td>2.4</td>
<td>Year 2006 for all of USA</td>
</tr>
<tr>
<td>Nonfatal injury rates:</td>
<td>Injury rate/100 million vehicle miles</td>
<td>2.256</td>
<td>Not given, estimated from ratio of national rates</td>
</tr>
<tr>
<td></td>
<td>Injury rate/100 million vehicle miles</td>
<td>51.1</td>
<td>Year 2006 for all of USA</td>
</tr>
<tr>
<td>Fatal injuries:</td>
<td>Based on Alaska data</td>
<td>0.004</td>
<td>Fatalities</td>
</tr>
<tr>
<td></td>
<td>Based on all US data</td>
<td>0.086</td>
<td>Fatalities</td>
</tr>
<tr>
<td>Nonfatal injuries:</td>
<td>Based on Alaska data</td>
<td>0.08</td>
<td>Nonfatal injuries</td>
</tr>
<tr>
<td></td>
<td>Based on all US data</td>
<td>1.84</td>
<td>Nonfatal injuries</td>
</tr>
</tbody>
</table>

Sources:
- Alaska fatality rate: ADOT&PF 2011c
- Alaska injury rate: Not given, estimated from ratio of federal injury/fatality rates.

These vary from year to year, but over the period from calendar year (CY) 2005 through 2011 these have averaged 0.106 fatalities per 100 million vehicle miles (ADOT&PF 2011c). Based on these inputs the estimated number of fatalities associated with shipments of pipe from Fairbanks to laydown yards is only 0.004, implying a high probability (0.996 from the Poisson distribution) that no fatalities would result. As a frame of reference the average number of fatalities per year for all large trucks in Alaska over the period from 1994 to 2007 was 6.1 (ADOT&PF 2009).

As a second check on the plausibility of these estimates the average fatality rate nationally in 2006 was 2.4 per 100 million vehicle miles, significantly greater than that for Alaska (DOT 2007). Using the national rate and the vehicle miles required to haul the pipe leads to an estimated number of fatalities of 0.086 persons—larger, but still quite small in total (the probability of zero fatalities given this rate is 0.917). Data are available on a national basis for nonfatal injuries, for which the rate was 51.1 nonfatal injuries per 100 million vehicle miles. Using this rate the estimated number of nonfatal injuries associated with hauling pipe in this case would be 1.84 persons. Similar rate data for Alaska could not be found, but assuming the same ratio of nonfatal to fatal injury rates leads to 0.08 injuries in total.

Whichever basis is chosen for estimation, the estimated injuries (fatal and non-fatal) are relatively small.
Other components of the proposed Project need to be transported. For example, elements of the gas conditioning facility (GCF) need to be transported to the North Slope. According to the POD:

Module sections of the GCF will be transported to the facility site via barge to West Dock, then transported on existing roads and assembled on site. A barge lift of nine barges is expected to be required. No modification to the existing West Dock infrastructure will be required. Additional details regarding the size and assembly/construction of the GCF will be developed as the Project progresses.

Injuries from seaborne transit are not addressed in this document. The haul distance from West Dock to the site is so short that no calculation is made.

Workers will be transported to work camps using a mixture of aircraft and bus transportation, the exact mix to be determined. In the following, it is assumed that all bus transportation is used. Table 5.15-33 contains estimates of the number of fatalities and injuries associated with bussing construction workers to work camps. This calculation as well indicates that there are likely to be relatively few fatalities (0.003) and nonfatal injuries (0.15) associated with bus transportation.

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Value</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of workers to be transported weekly</td>
<td>Peak workers</td>
<td>6,400</td>
<td>Estimate from AGDC staff</td>
</tr>
<tr>
<td>Average occupancy</td>
<td>Persons per bus</td>
<td>30</td>
<td>Estimate</td>
</tr>
<tr>
<td>Number of buses</td>
<td>Buses per week</td>
<td>213</td>
<td>Calculation</td>
</tr>
<tr>
<td>Weeks per year</td>
<td></td>
<td>50</td>
<td>Weeks</td>
</tr>
<tr>
<td>Construction duration</td>
<td></td>
<td>2.5</td>
<td>Years</td>
</tr>
<tr>
<td>Bus trips required</td>
<td></td>
<td>53,333</td>
<td>Assumes 2 trips required per worker per week (out and back)</td>
</tr>
<tr>
<td>Miles per trip</td>
<td></td>
<td>400</td>
<td>Assuming 200 mile distance and 2 “out and back” trips.</td>
</tr>
<tr>
<td>Total distance</td>
<td>Vehicle miles</td>
<td>21,333,333</td>
<td>Calculation</td>
</tr>
<tr>
<td>Alaska commercial vehicle fatality rate</td>
<td>Fatalities per 100 million vehicle miles</td>
<td>0.016</td>
<td>Average for Alaska for CY05 through CY 09</td>
</tr>
<tr>
<td>Alaska Injury rate</td>
<td>Non-fatal injuries per 100 million vehicle miles</td>
<td>0.712</td>
<td>Average for Alaska for CY 05 through CY09</td>
</tr>
<tr>
<td>Estimated total fatalities</td>
<td></td>
<td>0.003</td>
<td>Calculation</td>
</tr>
<tr>
<td>Estimated total injuries</td>
<td></td>
<td>0.15</td>
<td>Calculation</td>
</tr>
</tbody>
</table>

Finally, it is likely that additional truck deliveries and pickups would be required throughout the duration of the construction activity. The POD does not provide estimates of the additional number of truck trips necessary to support construction activities. For illustrative purposes, the incremental fatalities and nonfatal injuries are calculated if an average of 5 additional truck trips, each of 400-mile haul distance (out and back), were required assuming 7 days per week and 50 weeks per year over a 2.5-year period (see Table 5.15-34). This calculation is likely to overstate the required number of truck trips. This calculation suggests that 0.03 incremental fatalities and approximately 0.59 incremental nonfatal injuries would result. *The data do not permit a way to separately account for workers and others, so it is assumed (certain to overstate totals) that this number of fatalities and nonfatal injuries occurs to each group.*

**TABLE 5.15-34 Additional Fatalities and Casualties Associated with Other Truck Traffic**

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Value</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trucks per day to each construction camp</td>
<td>trips/day</td>
<td>5</td>
<td>Assumption</td>
</tr>
<tr>
<td>Distance per truck</td>
<td>miles/trip</td>
<td>400</td>
<td>Assumed out and return distance</td>
</tr>
<tr>
<td>Number of camps</td>
<td></td>
<td>15</td>
<td>AGDC 23 November 2011</td>
</tr>
<tr>
<td>Days per week</td>
<td>days</td>
<td>7</td>
<td>Assumption</td>
</tr>
<tr>
<td>Weeks per year</td>
<td>weeks</td>
<td>50</td>
<td>Assumption</td>
</tr>
<tr>
<td>Years</td>
<td>years</td>
<td>2.5</td>
<td>POD</td>
</tr>
<tr>
<td>Total distance</td>
<td>vehicle miles</td>
<td>26,250,000</td>
<td>Calculation</td>
</tr>
<tr>
<td>Alaska commercial vehicle fatality rate</td>
<td>Fatalities per 100 million vehicle miles</td>
<td>0.106</td>
<td>Average for Alaska for CY05 through CY11</td>
</tr>
<tr>
<td>Alaska commercial vehicle injury rate</td>
<td>Nonfatal injuries per 100 million vehicle miles</td>
<td>2.256</td>
<td>Not given, estimated from ratio of national rates</td>
</tr>
<tr>
<td>Estimated total fatalities</td>
<td></td>
<td>0.03</td>
<td>Calculation</td>
</tr>
<tr>
<td>Estimated total nonfatal injuries</td>
<td></td>
<td>0.59</td>
<td>Calculation</td>
</tr>
</tbody>
</table>


Summing the above figures (see Table 5.15-35), the estimated numbers of occupational fatal and nonfatal injuries are 7.37 and 68.8, respectively and the estimated numbers of non-occupational fatal and nonfatal injuries are 0.07 and 0.84, respectively, over the lifetime of the proposed construction Project. The impacts on pipeline workers are consistent with other construction Projects.
TABLE 5.15-35  Estimated Total Fatalities and Injuries Associated with All Vehicle Traffic during Pipeline Construction

<table>
<thead>
<tr>
<th>Category</th>
<th>Occupational</th>
<th>Others</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fatalities</td>
<td>Non-Fatal Injuries</td>
<td>Fatalities</td>
<td>Non-Fatal Injuries</td>
</tr>
<tr>
<td>Construction</td>
<td>7.3</td>
<td>62</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Rail</td>
<td>0.033</td>
<td>5.99</td>
<td>0.033</td>
<td>0.09</td>
</tr>
<tr>
<td>Trucks hauling pipeline</td>
<td>0.004</td>
<td>0.08</td>
<td>0.004</td>
<td>0.008</td>
</tr>
<tr>
<td>Buses</td>
<td>0.003</td>
<td>0.15</td>
<td>0.003</td>
<td>0.15</td>
</tr>
<tr>
<td>Additional truck traffic</td>
<td>0.03</td>
<td>0.59</td>
<td>0.03</td>
<td>0.59</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>7.37</strong></td>
<td><strong>68.81</strong></td>
<td><strong>0.07</strong></td>
<td><strong>0.84</strong></td>
</tr>
</tbody>
</table>

Sources: Tables 5.15-28 – 5.15-34 for fatality and injury estimates. As noted in the main text, data for other for the Trucks and Buses categories are conservatively assumed to be the same for workers.

One commenter raised a question regarding a possible increase to accidents and injuries to non-workers resulting from higher use of roads etc. and another commenter noted that the increase in drivable area might be relevant to consider. In principle, these are appropriate comments to consider. Studies on the impacts of energy developments in Sublette County, Wyoming by the Ecosystem Research Group (2007), for example, concluded that vehicle related accidents in this county increased from 175 in 1995 to approximately 350 in 2005. The estimates presented in Table 5.15-35 indicate that transportation-related fatal and non-fatal injuries total approximately 8 persons during the construction phase. Even if the traffic estimates were underestimated by a factor of three, the corrected estimate would be less than 25 persons. But what about the incremental road miles associated with access roads during construction or later operation? AGDC estimates that the total length for new temporary and new permanent roads is 36.9 miles and 61.8 miles of existing roads are proposed for access use. The combined total for new and existing roads is 98.7 miles for both the proposed Project mainline and the Fairbanks lateral. For perspective note that data from 2009 indicate that Federal and State agencies, municipal governments and local communities reported 15,718 miles of public roads in Alaska (ADOT&PF 2011b), so the incremental road mileage is not large in relative terms. More to the point, the round trip travel distances assumed in the above calculations was 400 miles, so even if this total were increased by twice 100 miles to 600, the estimated injury total would be increased by a factor of 1.5 to less than 12 persons. To improve safety along access roads, AGDC will not allow public access where AGDC has control. For other areas, AGDC has proposed security patrols and will develop measures to prevent public access by installing warning signs and barriers where appropriate.

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13 Access road estimates are listed in the AGDC response to a July 10, 2012 Request For Information (RFI).
14 Safety measures for access roads are listed in the AGDC response to a July 10, 2012 RFI.
Scoring

Scores shown below are developed using the risk assessment matrix given in Tables 5.15-3 and 5.15-4. Scoring is based on the following judgments:

- Health effect score: Very high, 3. Although the expected number of fatal and nonfatal injuries is very low (and might be zero), a strict interpretation of the text in Table 5.15-3 would appear to justify very high;
- Duration: High, 2, medium-term, 2.5 years;
- Magnitude: Very high, 3, if a fatal or serious nonfatal injury were to result;
- Extent: Low, 0, limited to individual cases;
- Severity rating equals sum of scores: 8 from above calculations;
- Likelihood rating: Extremely unlikely less than 1 percent; and
- Impact rating from Table 5.15-4 = medium (•).

In summary, the negative impact of the construction phase of the proposed Project within the Accidents and Injuries HEC is estimated to be medium.

Health Infrastructure and Delivery

Construction of the proposed Project has the potential to affect the Accidents and Injuries and Health Infrastructure and Delivery HECs if it caused the following to occur:

- Change in number or quality of clinics and staff: Medical technicians would be available at each construction camp, but their purpose would be to attend those engaged in proposed Project construction activities;
- Change in services offered (e.g. prenatal checks, x-ray, and laboratory services): The proposed Project would not be intended to provide these services;
- Change in accessibility of health care: No change is envisioned; and
- Change in utilization/clinic burden from non-resident influx: This is addressed in the discussion of accident rates for workers (see below).

Alaska’s present health infrastructure and delivery system and goals for the future have been defined by the State of Alaska Division of Public Health.
Proposed Project construction activities would have little, if any, impacts on the present system or goals. Injuries (fatal and nonfatal) to residents not affiliated with the proposed Project are reviewed above. Few injuries would be expected for workers and residents alike. The number of occupational injuries (see estimates in Table 5.15-35) would be unlikely to be large enough to overwhelm present trauma or health care resources. It would also be possible that construction workers could experience acute cardiovascular or respiratory symptoms most likely as a result of exacerbation of a pre-existing or possibly a new disease while working at construction camps. Although the relatively low estimated number of fatalities and accidents will likely not impact the availability of health care, each borough and census area intersected by the proposed ROW is either characterized as an MUP or contains MUAs within its boundaries (see Section 5.15.3.3). These classified, underserved areas are unlikely to experience pressure on the local infrastructure because seriously sick or injured workers would be flown out to either Fairbanks or Anchorage and would not materially impact local medical facilities. With regard to routine care for construction workers, in-state workers are already part of the health care demand, and out-of-state workers would probably address their routine health needs when they are back home due to the relatively high cost of health services provided in Alaska. Additional impacts discussed below would also be unlikely to have any negative impacts the present health status or future plans for Alaskans. When the proposed Project is completed (see discussion of cumulative effects below) there would likely be positive impacts as a result of substituting natural gas for other fossil fuels or wood in parts of the area (e.g., Fairbanks). Construction workers who become ill or injured would be evacuated to larger metropolitan areas (e.g., Anchorage or Fairbanks) where adequate medical facilities are available.

Epidemiological studies have consistently shown that employed workers are healthier than those in the general population, something termed the healthy worker effect (HWE) (Carpenter 1987; Li and Sung 1999; Thygesen et al. 2011). As noted by Li and Sung (1999)

…the HWE reflects that an individual must be relatively healthy in order to be employable in a workforce, and both morbidity and mortality rates within the workforce are usually lower than in the general population.

The HWE is regarded as a methodological challenge for epidemiologists seeking to quantify the effects of occupational exposure to toxic substances, for example, but is potentially a beneficial effect in this context. In practical terms this means that employed construction personnel are more likely to have lower mortality and morbidity than the overall Alaskan population, meaning that they are less likely to require medical attention (other than to deal with injuries). This statement does not mean that workers will be either disease or injury free. For perspective, it is

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15 See Alaska Health Care Commission 2009; Foster and Goldsmith 2006; Foster and Goldsmith 2011. This said, Alaskans spend about the same percentage of their incomes on health care as the rest of the US (see Fried and Shanks 2011).

16 Burns et al. (2011) found that standard mortality ratios for workers in the US Chemical industry were 79 (compared to a reference population of 100) for all causes, 81 for heart diseases, and 70 for non-malignant respiratory disease. Tsai et al. (2003) measured an SMR of 74 for all-cause mortality in a cohort of refinery workers.
useful to note that the estimated peak construction force in the Summer of 2017 totals 6,400 workers across all areas, whereas the combined population of Fairbanks and Anchorage is nearly 330,000. Thus, the incremental population (and possibly demand for health services) is at most 1.6%. For most of the construction period the number of workers will be substantially lower than this 6,400 figure.

One of the public comments on the draft EIS asked if there were any data on hospitalizations or medical evacuations of transient workers engaged in petroleum Projects. Only limited data are available and whether or not these data can be meaningfully extrapolated to the ASAP is questionable. For example, Jobin (2003) provides such data for the Chad Oil Export Project. In this Project the number of hospitalizations among Project workers varied by quarter from 11 to 43 (average rate 2.5 per 1,000) and the number of evacuations ranged from 3 to 14 (average rate 0.88 per 1,000) among a construction workforce ranging in size from approximately 3,500 to 12,500 workers. If these rates are at all representative, the increased burden on external health care providers is likely to be modest.

Scoring

Scores shown below are developed using the risk assessment matrix given in Tables 5.15-3 and 5.15-4. Scoring is based on the following judgments:

- Health effect score: Low, 0, effects unlikely to be perceptible;
- Duration: High, 2, medium-term, 2.5 years;
- Magnitude: Low, 0, minor intensity;
- Extent: Low, 0, limited to individual cases;
- Severity rating equals sum of scores: 2 from above calculations;
- Likelihood rating: Very unlikely 1-10 percent; and
- Impact rating from Table 5.15-4 = low (-).

In summary, the negative impact of the construction phase of the proposed Project within the Health Infrastructure and Delivery HEC is estimated to be low.

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17 This figure does not take into account the fact that workers will be relatively young. Older people (particularly those aged 65 and older) require more frequent admission to hospitals and their average length of stay is longer on average. According to 2006 data from the National Hospital Discharge survey (DeFrances et al. 2008), “In 2006, those aged 65 years and older made up 38% of all hospital discharges and used 43% of the days of care.”
Exposure to Hazardous Materials

Construction activities have the potential to result in exposure to hazardous materials from:

- Changes in physiologic contaminant levels such as fugitive dust, criteria pollutants, persistent organic pollutants, and volatile organic compounds, and
- Changed levels of the same substances in subsistence resources.

Of these two possibilities the key exposure pathway for humans are air emissions associated with construction activities (see discussion of CSM above).

The POD comments as follows:

“The proposed Project will have a localized effect on air quality during the Project construction phase primarily due to diesel-powered mobile construction equipment and perhaps some windblown dust during the summer construction season. These potential particulate matter impacts in the Fairbanks nonattainment area for particulate matter (PM) 2.5 [see below] from construction of the Fairbanks Lateral will be mitigated by BMP [best management practices] measures for fugitive dust control and the use of ultra-low-sulfur diesel fuel by construction equipment. Since much of the proposed pipeline will parallel or share existing transportation corridors, including the Parks Highway and the ARRC railroad, fugitive dust emissions will be managed as a public safety factor to people traveling on the highway and railroad. Some open burning may be conducted during construction and will be subject to applicable Alaska Department of Environmental Conservation (ADEC) air quality regulations.” [Material in square brackets added for clarity.]

Section 5.16 describes the fugitive dust, criteria pollutants, and volatile organic compounds (VOCs) that would be generated by the proposed Project. As described therein, emissions from construction equipment combustion, fugitive dust, and open burning would be controlled to the extent required by the ADEC. As a result, if the AGDC complies with applicable regulations, the emissions from proposed Project construction-related activities would not significantly affect local or regional air quality. Therefore, construction of the proposed Project should not significantly increase exposure of the PACs to these substances.

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18 There are six criteria pollutants for which National Ambient Air Quality Standards (NAAQS) have been established by the EPA. These include carbon monoxide, ozone, particulate matter, nitrogen oxides, sulfur dioxide, and lead (see http://www.epa.gov/air/urbanair/).
Fugitive dust, for example, is one of the materials that would be generated as part of construction activities. Fugitive dust results from vehicle traffic on unpaved roads and construction activities. The EPA estimates that 40 percent of fugitive dust emissions come from unpaved roads. Excessive fugitive dust and particulate matter emissions can have significant impacts on human health and mortality (Brook et al. 2002, 2010; Fairbanks North Star Borough 2009; Koenig et al. 1993; Pope III et al. 2002, 2006a, b, 2009a, b; Schwartz and Neas 2000; EPA Integrated Science Assessment 2009; Verbrugge 2009 and contained references). People most at risk from breathing particulate pollution are children, the elderly, and people with respiratory or heart disease (see the corresponding section addressing impacts during the operations phase for an extensive discussion of this topic). Healthy people can be affected as well, especially outdoor exercisers. Fugitive dust and particulate matter emissions have been linked to asthma, emphysema, chronic bronchitis, chronic obstructive pulmonary disease, and cardiovascular disease. The EPA has developed National Ambient Air Quality Standards (NAAQS) applicable to particulate material. For example, standards for all particles less than 10 microns (µm) in diameter, PM10, mandate a 24-hour maximum concentration of 150 micrograms per cubic meter (µg/m³). Additionally, there are concentration standards for fine particles less than 2.5 µm (PM 2.5); these are 35 µg/m³ (24-hour limit) and 15 µg/m³ (annual limit). These primary standards were established to protect public health, including the health of “sensitive” populations such as asthmatics, children, and the elderly—these standards, in general, do not consider costs. The ADEC currently relies on two regulations that were based on the Federal Clean Air Act:

- 18 AAC 50.045(d) an industrial activity or construction Project shall take “reasonable precautions” to prevent particulate matter from being emitted into the ambient air; and
- 18 AAC 50.220 Air Pollution Prohibited. No person may permit any emission which is injurious to human health or welfare, animal or plant life, or property, or which would unreasonably interfere with the enjoyment of life or property.

The ADEC is currently reviewing the situation and could issue additional fugitive dust regulations in the future. In any event, the ADEC has the authority to take regulatory action against any operator who violates ambient air quality standards. It should be noted that the proposed Project originated and is managed by a state agency and compliance with applicable regulations would be expected.

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19 The EPA defines fugitive dust as “particulate matter that is generated or emitted from open air operations (emissions that do not pass through a stack or a vent)”. The most common forms of particulate matter (PM) are known as PM10 (particulate matter with a diameter of 10 microns or less) and PM2.5 (particulate matter with a diameter of 2.5 microns or less). The ADEC (2011b) cites the EPA definition in: http://www.dec.state.ak.us/air/ap/docs/Fugitive%20Dust%20FAQs%203-31-11.pdf.

20 There are several methods that can be used to reduce fugitive dust emissions on roads, such as wetting.

21 See Turner and Nipataruedi 2011. The percentage is likely to be even higher in Alaska, which has approximately 31% of all roads paved (ADOT&PF 2011b).

22 These standards are reviewed every five years and some have argued that these are too stringent, but the EPA believes these are appropriate, based on a careful review of the health effects literature. Moreover there is increased mortality with short-term exposure to PM2.5 at concentrations that are less than 20 µg/m³, which is beneath the health-based 24-hour standard of 35 µg/m³ (see Fairbanks North Star Borough 2009).
Other toxic and hazardous substances that could be used during construction of the proposed Project include some pesticides, paints, solvents, petroleum products, and fertilizers. The proposed Project would be subject to the following regulations regarding the use of toxic and hazardous materials:

- Pipeline Safety Regulations (49 CFR Parts 190-199);
- Resource Conservation and Recovery Act (42 USC 3251 et seq.);
- Comprehensive Environmental Response, Compensation and Liability Act and the Superfund Amendments and Reauthorization Act (42 USC 9601);
- Emergency Planning and Community Right-to-Know Act (42 USC 9601; 40 CFR 255, 370, and 372);
- Toxic Substances Control Act (15 USC 2601);
- Hazardous Materials Transportation Act (49 USC 1801-1819); and
- Occupational Safety and Health Administration (29 USC §§651-678).

In addition to complying with these regulations, the proposed Project would also follow several plans intended to ensure the proper handling and disposal of hazardous and nonhazardous wastes. As noted above, these plans include a comprehensive waste management plan (CWMP), Spill Prevention and Control Plan (SPCP), and a Spill Prevention Control and Countermeasure Plan (SPCCP). Therefore, construction of the proposed Project should not lead to significant exposure of the PACs to these substances.

**Scoring**

Scores shown below are developed using the risk assessment matrix given in Tables 5.15-3 and 5.15-4. Scoring is based on the following judgments:

- Health effect score: Low, 0, effects unlikely to be perceptible;
- Duration: High, 2, medium-term, 2.5 years;
- Magnitude: Low, 0, minor intensity;
- Extent: Low, 0, limited to individual cases;
- Severity rating equals sum of scores: 2 from above calculations;
- Likelihood rating: Unlikely 10-33 percent; and
- Impact rating from Table 5.15-4 = low (-).

In summary, the negative impact of the construction phase of the proposed Project within the Exposure to Hazardous Substances HEC is estimated to be low.
**Food, Nutrition, and Subsistence**

Construction of the proposed Project would have the potential to affect the Food, Nutrition, and Subsistence HEC if it caused the following to occur:

- Change in amount of dietary consumption of subsistence resources;
- Change in composition of diet; and
- Change in food security.

Subsistence is discussed in detail in Section 5.14. Section 5.14 examines both direct (physical) and indirect (socioeconomic) impacts of proposed Project construction activities. Some key conclusions relative to subsistence include:

- Impacts to subsistence during the construction phase are expected to be temporary in duration.\(^{23}\) The timing of pre-construction and construction activities would have direct effects on subsistence activities. Subsistence impacts would be most acute in the area around Minto Flats which is largely undeveloped, whereas other areas of the proposed Project already experience impacts associated with the TAPS and Parks Highway corridors.

- The introduction of invasive species (both fish and/or aquatic plants) could impact fish habitat and/or productivity and impact fish availability to subsistence users. Unlike the other construction impacts which are expected to be short-term, the introduction of invasive species could become a long-term impact if their spread is uncontrolled, thus potentially signaling a long term reduced fish availability for subsistence users along the proposed Project and users downstream of the impacted areas. Reduced fish availability could potentially occur and affect subsistence uses in all three study regions and have the greatest effect on communities in the Interior (where fish account for over 70 percent of harvest) and Southcentral (where fish account for over 50 percent of harvest) with less impact on communities in the North Slope (where fish account for less than 20 percent of the harvest).

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\(^{23}\) One commenter noted that, even if the construction period were brief, it was possible that some of the effects on the diet of certain residents would be longer-term. This possibility cannot be categorically dismissed, but there are no data to estimate the delayed effects of any possible change in diet.
• Large-scale impacts on fish are not indicated.

• User access to subsistence areas could be temporarily reduced due to both physical and regulatory barriers related to the use of explosives, water extraction efforts, pipe laydown, noise, traffic, and other construction activities. Short-term decreased user access and increased competition for subsistence resources would have the greatest effect in the undeveloped Minto Flats vicinity and for subsistence users in communities that lie directly along the proposed Project, in particular the communities of Anderson, Cantwell, Coldfoot, Healy, McKinley Park, Minto, Nenana, Trapper Creek, Willow, and Wiseman.

• Section 5.14.3.2 also notes that subsistence users might decrease consumption of a subsistence resource if there is fear over the possible effects of contamination. Such concerns with respect to oil and gas developments have been reported (see e.g., Moses et al. 2009 and contained references, EPA 1995, Alaska Native Health Board and Alaska Native Epidemiology Center 2004, and the Alaska HIA Toolkit). According to 5.14.3.2, contamination concerns regarding ASAP would be “most present among subsistence users in communities that lie directly along the [proposed] Project.” It is relevant to note that the Environmental Public Health Program is engaged in an ongoing effort to characterize the safety of subsistence foods in Alaska. This process involves an assessment of the health benefits and risks of subsistence food consumption (State of Alaska Epidemiology 2012 and more specifically Egeland et al. 1998).

• Certain effects would be mixed. Some residents of potentially affected communities could find employment in the proposed Project. Employed subsistence users could have less time available for subsistence activities due to employment commitments and could travel less to traditional places. Furthermore, a decline in the consumption of traditional foods means an increased cost for obtaining substitute foods. Employment would however provide the benefit of increased income which residents could in turn use to participate in subsistence activities.

• Section 5.14 concludes that there would be no major impact on the availability of subsistence resources. However, this section also notes that the compressor station located near the Minto Flats Game Refuge could introduce additional noise, emissions, and activity in an area of the Project and disrupt subsistence users and resources.

One additional issue of potential concern related to subsistence resources during construction is the possibility that workers might compete with subsistence users resulting in either diminished harvests or greater subsistence effort. (There is anecdotal evidence for this hypothesis in the case of TAPS.)

Within the limits of present law, the proposed Project could reduce the possibility for competition for subsistence resources between traditional users and construction workers by following the standard practice of prohibiting workers from hunting or fishing while on the job or when company transportation has been used to bring them to a remote site. Nonetheless under
present Alaska laws workers (both Alaska residents and non-residents) could legally obtain hunting and fishing licenses and exercise their rights when not on the leasehold. Additionally, there are a set of stipulations discussed in more detail below in Section 5.15-5 (Mitigation) that specifically are relevant to hunting, fishing, trapping, and camping (AGDC 2011a). These include:

**1.21 Hunting, Fishing, Trapping, and Camping**

1.21.1 With respect to Lessee’s agents, employees, Contractors, and the employees of each of them, the Lessee shall prohibit hunting, fishing, trapping, shooting, and camping within the Leasehold.

1.21.2 The Lessee’s agents, employees, Contractors, and the employees of each of them shall not use Project equipment, including transportation to and from the job site, for the purpose of hunting, fishing, shooting, and trapping.

Workers would be provided food when at construction camps. This food would be trucked or flown in and should not impact the existing markets used by area residents. From a public health perspective, if subsistence resources were significantly and negatively impacted, the concern would be related to dietary shifts in the short- and long-term. As noted in the technical guidance for health impact assessments in Alaska (ADHSS 2011f):

*Subsistence diets that consist of fish and other seafood, terrestrial (moose and caribou) and marine mammals (whale and seal), and local flora (berries) are sources of lean protein, rich in nutrients, and are considered highly nutritious. These subsistence resources are critical to basic food security in many Alaskan communities, where market foods are of limited availability, lower quality, and are prohibitively expensive. In rural Alaska, a gradual shift towards a Westernized diet has been associated with a decline in nutritional status, and associated with an increasing incidence of nutritionally-related conditions such as diabetes, obesity, heart disease, and dental caries.*

Based on the available information presented in Section 5.14, the impacts of the proposed Project during the construction phase would not be large or long lasting.

Another relevant document addressing subsistence impacts is contained in Appendix L (ANILCA Section 810 Analysis of Subsistence Impacts) prepared by Merben R. Cebrian, Wildlife Biologist, BLM Central Yukon Field Office. With regard to the direct effects this analysis concludes:

*Under Alternative B (Proposed Action), access to subsistence resources will not be significantly hampered by the proposed activity. The proposed activity would not significantly restrict subsistence uses and needs in or near the proposed activity area. The impacts to subsistence resources and access discussed above would be minimal. There is no reasonably foreseeable significant decrease in the abundance of harvestable resources, and in the distribution of harvestable resources due to the proposed action.*
This analysis reaches different conclusions with regard to cumulative effects (see below).

### Scoring

Scores shown below are developed using the risk assessment matrix given in Tables 5.15-3 and 5.15-4. Scoring is based on the following judgments:

- **Health effect score**: Medium, 1, effect results in annoyance, minor injuries, or illnesses that do not require intervention;
- **Duration**: High, 2 medium-term, 2.5 years;
- **Magnitude**: High, 2, Those impacted will be able to adapt to the health impact with some difficulty and will maintain pre-impact level of health with support;
- **Extent**: High, 2, might affect certain PACs, such as Minto;
- **Severity rating equals sum of scores**: 77 from above calculations;
- **Likelihood rating**: Unlikely 10-33 percent; and
- **Impact rating from Table 5.15-4 = medium (-)**.

In summary, the negative impact of the construction phase of the proposed Project within the Food, Nutrition, and Subsistence HEC is estimated to be medium.

### Infectious Diseases

Construction of the proposed Project would have the potential to affect the Infectious Disease HEC, for example, if it caused the following to occur:

- Change in transmission of pediatric acute respiratory disease rates;
- Change in acute adult respiratory disease rates (TB, bronchitis, influenza);
- Change in STD rates (e.g., Chlamydia, gonorrhea, HIV);
- Change in gastro intestinal outbreaks; and
- Change in antibiotic-resistant staph skin infections.

Experience with other pipelines and published texts on the state-of-the-art on social and environmental impacts on pipelines (Goodland 2005; van Hinte et al. 2007; ADHSS 2011g; Parfomak 2008) suggest that the potential for infectious diseases (particularly STDs) is one of the relevant impacts associated with pipeline construction and operation in other parts of the world. Medically, infectious diseases (also called communicable diseases) can be defined as

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24 It may even have implications for protection of critical infrastructure. As one report states: “Epidemics and pandemics of infectious diseases such as Severe Acute Respiratory Syndrome (SARS) and avian influenza (bird flu) have the potential to disrupt critical infrastructure by infecting critical workers or restricting their movement” (Parfomak 2008). The Bush Administration’s National Strategy for Pandemic Influenza states that “while a pandemic will not damage power lines, banks or computer networks, it will ultimately threaten all critical
clinically evident illnesses (i.e., those with characteristic medical signs or symptoms) resulting from the infection, presence and growth of pathogenic biological agents in an individual host organism. The transmission of pathogen can occur in various ways including physical contact, contaminated food, body fluids, objects, airborne inhalation, or through vector organisms (e.g., animals, insects). The State of Alaska includes 56 such infectious diseases ranging (alphabetically) from AIDS to Yersiniosis\(^\text{25}\) that are required to be reported by health care providers (ADHSS 2011h). Many can be prevented by immunizations (ADHSS 2001b), others by improved personal hygiene, food selection and preparation, and yet others (e.g., STDs) by the use of condoms. Many can be successfully treated by antibiotics.

The public health concern with respect to evaluating proposed development Projects is that these diseases can be transmitted by infected construction workers (potentially from outside the area). In the Alaska context the diseases of particular concern include infectious respiratory diseases (e.g., pneumonia, influenza) and STDs (AIDS, syphilis, gonorrhea, and Chlamydia).

The interest in STDs in connection with proposed pipeline development Projects partially reflects experience and/or concerns with similar Projects in Canada (see e.g., Goldenberg et al. 2008a, b, c; Shandro et al. 2011; Wernham, n.d.), anecdotal reports from gas developments in the ‘lower 48’ (AP 2011; Farnham 2012; Kulesza 2011; Schechter 2011), and less developed countries and partially because of concerns related to TAPS impacts (CEE Bankwatch Network, Gender Action 2006; Jobin 2003; Pacific Environment 2011; Sakhalin Environmental Watch 2011; for TAPS see e.g., anecdotal information presented in Cole 1997). A recent HIA on oil and gas development on Alaska’s North Slope concluded that contact between oil workers and previously isolated Inupiat villages could result in increased rates of HIV and syphilis (Wernham 2007b).

Moreover, as noted earlier is this section the rates of STDs in Alaska are relatively high, particularly for Chlamydia, but also for gonorrhea. Regions with particularly high rates within Alaska include (in descending order of 2010 age-adjusted rates) Norton Sound, Yukon-Kuskokwim, Northwest Arctic, Arctic Slope, and Bristol Bay, all with age-adjusted rates greater than or equal to 1,000/100,000 (ADHSS 2010f). Rates vary with gender (females higher than males), age (young adults have the highest incidence, 68 percent of cases among those less than 25 years old), and race/ethnicity (AIAN greater than average) (ADHSS 2011c).

The State of Alaska has an active HIV/STD program (ADHSS 2011i). Although there are effective tests for STDs, known methods for reducing the likelihood of transmission, and effective cures (if diagnosed), STDs are a valid public health concern (ADHSS 2010f). The State of Alaska now provides free at-home testing kits available from www.iwantthekit.org.

\[^{25}\text{Yersiniosis is a relatively uncommon infection contracted through the consumption of undercooked meat products, unpasteurized milk, or water contaminated by the bacteria.}\]
Other Infectious Diseases

Other infectious diseases that could affect the worker population and potentially affect other persons include hepatitis (A, B, and C) and bacterial pneumonia (each of these conditions is reportable to public health authorities in Alaska). These diseases differ in the how they are spread, whether or not vaccination is possible, types of treatment required, and seriousness. Hepatitis A, B, and C, for example, can be spread by sexual activity, eating food or drinking contaminated water (hepatitis A only), sharing needles among drug users (hepatitis B and C). There are vaccines for hepatitis A and B, but not C. There is no treatment for hepatitis A beyond supportive care, but there are treatments of varying efficiency for hepatitis B and C (Immunization Action Coalition 2007). Bacterial pneumonia can be transmitted via inhalation of bacteria (contact with others) or by aspiration of the secretions from the throat, mouth, or nose. Bacterial pneumonia is treated using antibiotics. Because these diseases are contagious, isolation or removal of infected workers from the camps would be required.

Perspectives

As noted in the POD (AGDC 2011b):

*Personnel housing and support services will be provided by mobile construction camps, stationary construction camps, and existing commercially available lodging. Fifteen construction camps are planned for the Project. All the temporary construction camps planned for this Project will be located on previously disturbed sites, most of which were developed during TAPS construction. The two proposed camps that will not be located on previously developed campsites are Chulitna Butte and Sunshine. However, both of these camps are planned for development on previously disturbed sites. Chulitna Butte is located on the existing ARRC Hurricane rail siding and the Sunshine is located at the site of the Talkeetna Bluegrass festival.*

It is anticipated that a rotational scheme would be employed wherein workers are transported by aircraft or bus from selected locations (e.g., Prudhoe, Fairbanks, and Anchorage) to the work camps. There they would work for a defined period (e.g., one week) and, upon shift completion, be transported back to their starting points. A work shift would typically be 12 hours, so the worker would have to use the remaining 12 hours for attending to personal chores, eating, and sleeping. While at the camps, there would be little opportunity for interaction (e.g., sexual contact) with other persons. This is a policy designed (among other things) to lower opportunities to transmit STDs, particularly with persons living in the general area of the camps.
• Some anecdotal accounts of life in work camps in the ‘lower 48’ (see e.g., Irvine 2011) suggest that the work schedules “leaves little time for the rowdiness that you might expect at a place like this. The quiet is most often broken by the sound of footsteps on the gravel that fills the camp walkways...these men might watch a little TV, shoot some pool or hang out for a chat and a smoke. They use computers next to the laundry room or Wi-Fi on their own laptops to communicate with the outside world, and cell phones, when they work.”

• Other anecdotal reports paint a different picture. Ward Koeser, the Mayor of Williston, ND was quoted (see Farnham 2012) as referring to the 5,000 to 6,000 workers living in work camps a few miles outside of town: “When they come in to go to the bar, they don’t always behave themselves.” According to Dr. Andre Corriveau (Chief Medical Officer Alberta): “There is a high number of young men [with STI's] who work in the oilsands area” (Driedger 2012).

Operators of work camps in the ‘lower 48’ have instituted a variety of measures that would limit opportunities to transmit STDs such as a prohibition of alcohol or drugs, women in rooms, visitors after a certain hour, or unauthorized visitors (see e.g., Carrns 2012; Irvine 2011; Kramer 2012; Snyder 2012; Sulzberger 2011).

In areas where construction workers would be required to provide their own housing (with 460 to 690 residing in the Wasilla area, and a maximum of 500 to 1,000 residing in the Fairbanks area), the likelihood of interaction between workers and local residents would be greater.

The possible impact of a transient workforce on STD rates and possible ways of mitigating this impact has been examined in several studies of development Projects (particularly in newly industrializing or less developed countries such as Botswana, Brazil, Cameroon, Chad, Malaysia, Papua New Guinea, Uganda, Yemen).26 The assumption in these analyses is that the construction workforce would be largely male (who would typically be well paid relative to the local population) and (even if married) unaccompanied by their spouses, which might lead to an influx of sex workers and/or greater sexual contact with members of the local population. Cole (1997) recounts stories of prostitution in Fairbanks and Valdez when TAPS was constructed. One commenter asked if there were data available on STDs rates associated with construction of mineral development Projects. Jobin (2003) examined the rates of STDs among workers in a Chad Oil Export Project. He reported that the number of STDs varied by quarter from 109 to 595 cases among a workforce ranging in size from approximately 3,500 to 12,500 workers. On an overall basis these data average approximately 39 cases per 1,000 workers, a figure higher than the present incidence in Alaska, but lower than reported by the World Health Organization (WHO 2001) for Sub-Saharan Africa. However, by the third and fourth quarters of 2011, the incidence rate of STDs on this Project decreased to 5.12 cases per 1,000 workers (Esso Exploration and Production Chad, Inc. 2012). (It should be noted that only 6.95% of the

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26 See e.g., Jobin 2003; Dangote Group 2004; Bell et al. 2004; Yemen LNG Company Ltd. 2006; ERM 2008; Skansa 2008; Papual New Guinea Liquefied Natural Gas project 2009; Mengwe 2010; and Sinoh Environmental Sdn. Bhd. 2012.
workforce were expatriates in 2011.) Whether or not these data are representative of what might be found with ASAP is questionable.

In most cases the mitigation strategies proposed or implemented for dealing with STDs on mineral development Projects have included attempting to minimize the size of the transient workforce (generally determined to be infeasible) and provision of a health education and outreach program. Table 5.15-36 lists a number of possible measures that might be considered in developing a mitigation strategy for ASAP listed in increasing order of stringency. As a practical matter, feasible mitigation measures are limited to an education and outreach program, which might also include providing condoms and test kits for STDs. More stringent alternatives (such as mandatory STD testing, or certain access restrictions27) are unlikely to be feasible, or even legal in the United States.

Each camp would have a medical technician on-staff. Camp facilities would include a private examination room and a reception and service area. Equipment would include refrigeration facilities for storage of perishable medicines, sterilization equipment, and storage for medical supplies. Workers who contract other infectious diseases would be evacuated to treatment facilities away from the camps in much the same way as occupational injuries would be treated.

As discussed in the mitigation section, a reasonable precaution would be to offer free (but voluntary) vaccines to workers. Although it does not appear feasible at present to make vaccination mandatory for construction workers,28 it is feasible to have a health outreach program that provides literature and aggressively promotes voluntary immunizations for several infectious diseases (e.g., influenza and hepatitis A and B).

For the present, it is necessary to address the possible impact of transmission of infectious diseases in qualitative terms. The possibility of impacts cannot be dismissed out of hand, but the relative isolation of construction workers into work camps and the availability of free immunizations for certain infectious diseases as well as an outreach program that provides relevant health information to workers would likely reduce possible impacts. This assessment is consistent with findings of the Health Impact Assessment prepared by the State of Alaska HIA Program, Department of Health and Social Services for the Point Thomson EIS29 with regard to the potential concern that construction workers might exacerbate the STD problem in noting (ADHSS 2011j):

27 Presumably there would be a sign-in sign-out system at the camp and visitor restrictions.
28 The CDC has failed to ensure such a policy, even for health care workers, even though the Society for Healthcare Epidemiology, the Infectious diseases Society of America, and the American Academy of Pediatrics have endorsed this policy for health care workers. For guidance on Prevention Strategies in health care settings see CDC 2010d and Federal Register 2010. Certain hospitals have imposed mandatory requirements and been supported by some legislators. The American Academy of Pediatrics (2010) has published guidance for the mandatory requirements.
29 One commenter on an earlier draft noted that the Point Thomson project is located on the North Slope and may have limited applicability to other potentially affected communities. This comment is acknowledged and should be considered by the reader.
Project camps are closed and FIFO [Fly in Fly out] system drastically minimizes interaction with local communities. [Material in brackets added for clarity.]

TABLE 5.15-36 Possible options for reducing the impact of the construction workforce on STDs

<table>
<thead>
<tr>
<th>Option</th>
<th>Ease of implementation</th>
<th>Other issues</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outreach program among workforce</td>
<td>Relatively straightforward</td>
<td>Effectiveness unknown</td>
</tr>
<tr>
<td>Outreach and distribution of free condoms</td>
<td>Relatively straightforward</td>
<td>Possible opposition by some on religious grounds and participation unknown</td>
</tr>
<tr>
<td>Outreach, free condoms, and free at-home testing kits(^{30})</td>
<td>Relatively straightforward; kits could be purchased to defray costs and free program impacts</td>
<td>Use of these kits voluntary. Kits successful only for certain diseases (Chlamydia, Gonorrhea, and trichomonas).</td>
</tr>
<tr>
<td>Mandatory pre-employment screening for STDs</td>
<td>Technically feasible, might be viewed as invasive by workforce</td>
<td>Legal and/or policy analysis(^{31}) appropriate (e.g., compliance with Americans with Disabilities Act)(^ {32}).</td>
</tr>
<tr>
<td>Mandatory periodic testing for STDs</td>
<td>More costly and probably more controversial than just pre-employment testing. Some tests (e.g., urine sample or oral fluid sample) relatively non-invasive and capable of detecting certain infections (e.g., Chlamydia or gonorrhea). But testing for other STDs involves more invasive methods (e.g., blood tests, physical examination).</td>
<td>Legal and/or policy analysis appropriate to answer such questions as who gets tested, how are positives handled, is testing voluntary or mandatory, are (or how are) partners identified/ notified, etc.</td>
</tr>
<tr>
<td>Access controls(^ {33})</td>
<td>These could include access controls for persons entering the work camps or on workers exiting the work camps when not on duty. Physically this is easy to do, but other issues are relevant.</td>
<td>Access controls on exiting workers probably infeasible in US. Raises several implementation issues—e.g., can a worker be refused exit right to visit a sick relative, etc.?</td>
</tr>
</tbody>
</table>

Scoring

Scores shown below are developed using the risk assessment matrix given in Tables 5.15-3 and 5.15-4. Scoring is based on the following judgments:

- Health effect score: High, 2, effect results in moderate injury or illness that may require intervention. This assessment is based on the possibility that STD rates might increase;
- Duration: High, 2 medium-term, 2.5 years;

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\(^{31}\) Has been highly controversial for healthcare workers in certain countries, see e.g., Salkeld et al. 2009, 2010.

\(^{32}\) Lawsuits have been filed by applicants denied jobs on the basis of being HIV positive (see Sawyer 1997).

\(^{33}\) Certain access controls such as a prohibition on unauthorized visitors are readily implemented. Access controls to prevent workers from leaving the facility are not easily implemented.
• Magnitude: High, 2, those impacted will be able to adapt to the health impact with some difficulty (e.g., requiring testing and treatment for STDs) and will maintain pre-impact level of health and support;

• Extent: High, 2 Entire PACs; village level;

• Severity rating equals sum of scores: 88 from above calculations;

• Likelihood rating: Unlikely 10-33 percent; and

• Impact rating from Table 5.15-4 = Medium (−).

• In summary, the negative impact of the construction phase of the proposed Project within the Infectious Diseases HEC is estimated to be medium.

Non-communicable and Chronic Disease

Construction of the proposed Project would have the potential to affect the Non-communicable and Chronic Disease HEC, for example, if it caused the following to occur:

• Change in cardiovascular disease rates;

• Change in type 2 Diabetes Mellitus (DM) rates;

• Change in chronic lower respiratory disease rates; and

• Change in cancer rates.

As discussed under the Affected Environment subheading, the leading causes of death attributable to non-communicable chronic diseases in the proposed Project area are cancers, heart disease, and chronic obstructive pulmonary disease (COPD). Following cancer, the most common chronic diseases statewide and within the proposed Project area are chronic obstructive pulmonary disease, cardiac disease, vascular disease, and type-2 (adult onset) diabetes. Asthma should be included in the list of chronic respiratory diseases of concern because, although fatality rates are lower than for many of the other diseases included here, asthma results in a large number of hospitalizations and emergency department visits (ADHSS 2001c). Asthma rates are similar for Alaska Natives and non-natives (ADHSS 2006a; Stout et al. 1999). These diseases differ in terms of risk factors but there are several similarities. For

34 Chronic lower respiratory diseases are diseases that affect the lungs. The most deadly of these is chronic obstructive pulmonary disease (COPD), which makes it more difficult to breathe. COPD includes two main illnesses: 1) emphysema: With emphysema, some of the walls of the air sacs (alveoli) in the lungs are damaged, increasing the work of breathing and making it more difficult to get necessary oxygen; and 2) chronic bronchitis: With chronic bronchitis, the lining of the lungs’ airways are red and swollen. Over time, the airways become narrow and partly clogged with mucus that cannot be cleared, which makes it more difficult to get necessary oxygen.

35 There are numerous useful reports on cancer in Alaska, see Alaska Native Tribal Health Consortium 2006; ADHSS 2002a; and ADHSS 2011g.

36 As noted in Healthy Alaskans 2010, “Asthma is a common, chronic respiratory disorder that may include wheezing, shortness of breath, cough, and pain or tightness in the chest. Asthma can be prevented and controlled by avoiding triggers (tobacco smoke, allergens, pollutants, and infections) and the use of appropriate medications.” (ADHSS 2002b).
example, sedentary lifestyles, diet, obesity, smoking, second hand smoke and exposure to criteria pollutants are risk factors for asthma and cardiovascular disease (BLM 2007; ADHSS 1997). Lifestyle, diet, obesity, and age are risk factors for diabetes (Islam-Zwart and Cawston 2008; ADHSS 2005). Risk factors for cancer depend upon the type of cancer. Ranked in terms of mortality in Alaska the four leading types of cancer are lung and bronchus, female breast, prostate, and colorectal (ADHSS 2006b):

- Lung cancer risk factors are primarily related to smoking (including secondhand smoke), but also include medical conditions (fibrotic lung diseases), age, and exposure to certain toxic substances, such as asbestos and possibly particulate matter (EPA 2010a; Wood 2011);
- Reported risk factors for breast cancer include: age; number of first-degree relatives with breast cancer; ages at menarche (first menstrual cycle), first birth, and menopause; and prior breast biopsy for benign breast disease (Chlebowski et al. 2005);
- Reported risk factors for prostate cancer include age, race/ethnicity (African Americans have higher rates), high fat diet, lack of exercise, and family history (Zangwill 2011);
- Reported risk factors for colorectal cancers include age, heredity, race/ethnicity (Alaska Natives have lower incidence rate compared to most other ethnicities (in particular Caucasians) diet, obesity, being a long-time smoker, alcohol use, and having type-2 diabetes (CDC 2010c; American Cancer Society 2011); and
- Reported risk factors for diabetes include weight, fat distribution, inactivity, family history, race, and age (ADHSS 2003; Mayo Clinic 2011).

Exposure to criteria pollutants can exacerbate and perhaps even cause several of the important chronic diseases, including asthma, COPD, and cardiovascular diseases. Thus, if the concentrations of criteria pollutants, particularly fine particulates (PM 2.5), were to exceed the NAAQS, adverse health effects would result. As noted previously, proposed Project construction activity has the potential to emit particulate matter. However, these emission levels are unlikely to lead to exceedances of NAAQS. Although the potential exists for a negative effect, it would be limited and unlikely.

Changes in diet that might result from loss of subsistence resources have the potential to increase obesity, one of the risk factors for diabetes.

**Scoring**

Scores shown below are developed using the risk assessment matrix given in Tables 5.15-3 and 5.15-4. Scoring is based on the following judgments:

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37 Some would make a stronger statement. The NPR-A EIS notes that substantial health effects might accrue even at levels lower than the NAAQS.
• Health effect score: Low, 0, while increases in prevalence of the chronic diseases listed here could result in loss of life (from certain chronic illnesses) severe injuries, or chronic illness that requires intervention, the linkages between these and construction of the proposed Project are weak. Note that this assessment is consistent with results of the HIA for Pt. Thomson, which rated this “low” reflecting the possibility that a change in diet due to possible subsistence losses might lead to increased obesity (ADHSS 2011);

• Duration: High, 2, medium-term, 2.5 years;

• Magnitude: Low, 0, those impacted will not be able to adapt to the health impact or to maintain pre-impact level of health, which would justify a high rating, but the linkage between proposed Project construction and increases in chronic diseases is weak;

• Extent: Low, 0, limited to individual cases;

• Severity rating equals sum of scores: 2 from above calculations;

• Likelihood rating: Very unlikely 1-10 percent; and

• Impact rating from Table 5.15-4 = low (-).

• In summary, the negative impact of the construction phase of the proposed Project within the Non-communicable and Chronic Disease HEC is estimated to be low.

**Social Determinants of Health**

The Northeast NPR-A Supplemental *Integrated Activity Plan / Environmental Impact Statement* (IAP/EIS) contains a useful description of what is meant by the *Social Determinants of Health* (SDH) [BLM 2007; Wernham 2007a]:

> An impressive body of data has demonstrated a direct association between measurable societal factors which have been collectively termed the “social determinants of health” (SDH) and disparate incidence, prevalence, and mortality rates for most diseases. The effects of the SDH on disparate rates of disease often persist even after controlling for standard risk factors such as smoking rates, cholesterol and blood pressure levels, and overall poverty. The SDH include factors such as income inequity within a society, the “social gradient” (or disparities of social class), stress, social exclusion, decreasing social capital (the social support networks which provide for needs within a group or community), unemployment, cultural integrity, and environmental
quality. The World Health Organization provides an excellent review of the data regarding the importance of the SDH to the health status of populations (Wilkinson and Marmot, 2003), and much of the current focus within the U.S. Centers for Disease Control is on addressing health disparities through the determinants of health framework (see U.S. CDC Social Determinants of Health Working Group, online at http://www.cdc.gov/socialdeterminants/).

The determinants of health status in North Slope Inupiat communities are complex, and reflect a wide array of considerations, including genetic susceptibility, behavioral change, environmental factors, diet, and socio-cultural inputs. The identification of potential influences on, or “determinants,” of health status is an essential step for public health programs seeking to address health disparities. With regard to oil and gas development, state, regional, and village-specific influences on health and health behavior can be identified.

Although focused on the North Slope, this discussion provides a useful framework to structure the proposed Project analysis. And, indeed, this framework is used for discussion of possible impacts associated with the operations phase of the analysis. In evaluating the effects of construction, however, the operative question is what effects on health (related to SDH) would result from the 2.5 years of construction activity?

Construction of the proposed Project would have the potential to impact the Social Determinants of Health HEC if it caused the following to occur:

- Change in maternal and child health status (e.g., infant mortality, initiation of prenatal care, low birth weight, smoking during pregnancy, child abuse, or alcohol use during pregnancy);
- Change in depression/anxiety prevalence;
- Change in the substance abuse rate;
- Change in the suicide rate;
- Change in teen pregnancy rates;
- Change in domestic violence and family stress; and
- Change in economy and employment.

Adverse changes in any of these variables would certainly be important if they were to occur. However, as discussed below, these changes are not judged to be likely.
Maternal Status

Changes to maternal and child health status would have the potential to occur if women and children in the PACs experienced a change in nutrition, incidence of non-communicable disease, access to health care, clean water and sanitation, or exposure to contaminants or infectious disease as a result of proposed Project construction.

Infant Mortality

Consider infant mortality, for example. Figure 5.15-17 below shows the trends in infant mortality for Alaska Natives, Alaska White, and U.S. White groups from 1981 (a few years after oil began flowing through TAPS) through 2005 (Toffolon-Weiss et al. 2008). As can be seen all three trends show a substantial decrease (improvement) over this time period. Infant mortality rates were substantially higher for Alaska Natives in the early years, but the gap has decreased over time. It is possible, but unlikely, that rates for Alaska Natives would have improved even more had there been no oil development. This is because there has been a significant improvement in health care delivery systems and outreach activities over this period. There is little reason to believe that proposed Project construction activities would reverse this progress. A plot of neonatal mortality rates also shows improvement and a lower gap between Alaska Natives and Whites in Alaska (Toffolon-Weiss et al. 2008). The trends are less pronounced for post-neonatal mortality rates and the gap between Alaska Natives and Whites slightly greater, but even for this index, rates have decreased for Alaska Natives.

Maternal Smoking

Data are available for the period from 1990 through 1999 for smoking during pregnancy (ADHSS 2001d). Rates were higher for Alaskans than those for the U.S. as a whole throughout this period. Nonetheless, both trends show decreasing rates of smoking among pregnant mothers. Thus, existing oil production activities over this period did not lead to increasing smoking rates and it is difficult to imagine that a material change in this trend would result from the construction phase of the proposed Project.

Alcohol Use during Pregnancy

Data are also available on alcohol use during pregnancy among Alaskans (Alaska Native Tribal Health Consortium 2008). Figure 5.15-18 (note log scale on Y axis) shows data for Alaska Natives and Whites over the period from 1996 through 2005. Rates were materially greater for Alaska Natives over this time period, but the rate of improvement was also greater. As with the other indices, this trend is encouraging.  

One commenter noted that this period was relatively stable in terms of oil and gas in Alaska with no large scale development. This commenter requested that data on alcohol use during pregnancy be reported for earlier years, such as those during the period when TAPS was being constructed. Unfortunately, such data are not available [personal communication Dr. Ellen Provost (Director, Alaska Native Epidemiology Center of Alaska Native Tribal Health Consortium (907) 729-1900 and Dr. Peter Holck (907) 729-4561)]. Maternal alcohol use only started being recorded on birth certificates in 1988 and data are available only as far back as 1991 (Alaska Maternal and Child Health Data Books). There are some discrepancies between these two sources, but both indicate a declining trend over the period covered in Figure 5.15-18. Drs. Provost and Holck also noted that the data on maternal alcohol use is self-reported and that social stigma over maternal alcohol use may have increased over the years, which may bias the data.
Teen Pregnancy Rates

The teen pregnancy rates for Alaska have been systematically higher than the U.S. as a whole. Nonetheless, Alaska teen pregnancy rates have decreased substantially between 1991 and 2005 (ADHSS 2007c). There is no reason to believe that this trend would be reversed as a result of proposed Project construction activities. A similar conclusion was reached in the Pt. Thomson HIA (ADHSS 2011j).

Changes in Domestic Violence and Family Stress

Domestic violence is an important issue in many states, including Alaska where rates of certain forms of domestic violence are significantly higher than the U.S. as a whole (National Coalition Against Domestic Violence 2010; Rosay and Morton 2011). And domestic violence rates against Alaska Native women are higher than women overall (Bachman et al. 2008). The Supplemental IAP/EIS for NPR-A offers the following comments:

*Social and psychological problems – including alcohol and drug problems, unintentional and intentional injury (a high percentage of which are associated with alcohol use), depression, anxiety, and assault and domestic violence – are now highly prevalent on the North Slope (as they are in many rural Alaska Native and Arctic Inuit villages in Canada and Greenland) and cause a disproportionate burden of suffering and mortality for these communities.*
The NPR-A document also notes:

Research in circumpolar Inuit societies suggests that social pathology and related health problems, which are common across the Arctic, relate directly to the rapid socio-cultural changes that have occurred over the same time period.

Social change, both positive and negative is ongoing in Alaska. The relevant question in connection with the direct effects of this action is whether construction of the proposed Project would cause or materially exacerbate problems. The size and scope of this proposed Project is not expected to lead to material adverse impacts, but it is possible that some effects will occur for families of Alaska residents employed by this Project.

**Suicide Rates**

Suicide rates are consistently higher for Alaska than the U.S. overall and higher for Alaska Natives than Alaska Non-Natives (ADHSS 2011k). Year-to-year data are highly variable and there are no obvious time trends in the data over the period from 1996 to 2005.

Construction of the proposed Project would have the potential to affect depression and anxiety rates if residents of the PACs located near the proposed Project experienced fear of a catastrophic incident from development of the proposed Project and/or perceptions that the proposed Project threatened a way of life. While catastrophic events produce anxiety for local residents, scoping comments reveal that the most acute anxiety is produced by a perceived loss of a way of life: loss of cultural identity, loss of historic lands, loss of cultural practices (Alaska Natives) and general alterations to a rural lifestyle through progressive (cumulative) development of rural areas of the state.

Researchers have identified and explored the link between losing one’s way of life and depression and suicide. As reported by the Substance Abuse and Mental Health Services Administration (2010):

*Drs. Chandler and Lalonde, researchers at the University of British Columbia, have found a distinct, positive relationship between some particular aspects of what they refer to as “cultural continuity” and reduced suicide and suicidal behavior among Native youth. Based on their studies, “First Nations communities that succeed in taking steps to preserve their heritage culture and work to control their own destinies are dramatically more successful in insulating their youth against the risks of suicide.” Their theory is that, when youth have a secure sense of the past, present, and future of their culture, it is easier for them to develop and maintain a sense of connectedness to their own future (i.e., self-continuity).*

Chandler and Lalonde have written extensively about self-continuity and the need for a personal narrative in understanding one’s place in life, which they contend is closely tied to cultural continuity and suicide prevention among Native communities. A detailed discussion of this topic
is beyond the scope of this document but can be found in a series of articles by the researchers and available online at http://web.uvic.ca/~lalonde/manuscripts.

As an alternative viewpoint, some contend that employment opportunities associated with ASAP might have a beneficial impact (Statewide Suicide Prevention Council 2010):

The availability of jobs and economic opportunities has a lot to do with personal feelings of self-worth and the health of a community. Research has documented a connection between unemployment, poverty and other social determinants and low self-esteem, anxiety, and isolation. Unemployment and economic distress are factors that can increase the risk of suicide. Review of Alaska’s unemployment data shows a weak connection between unemployment and suicide rates.

Changes in Economy or Employment

These are discussed in the section on socioeconomics (Section 5.12). Construction of the proposed Project would create employment opportunities for construction workers, Alaskans and non-Alaskans alike. The POD notes:

The Project could provide employment opportunities for isolated communities that currently have high unemployment rates. In addition, first-class cities and first-class boroughs with taxing authority may have the opportunity to generate tax revenue.

Clearly domestic violence, family stress, and suicide rates are potentially important and should not be dismissed out of hand. Construction activities on the proposed Project will provide jobs for Alaskans and others, probably including some from the PACs—a benefit. But these jobs involve work schedules that have the potential to disrupt family life. (For references on the effects of rotating shift work see studies by Bianchi 2011; Davis et al. 2008; Leupp et al. 2010; Perry-Jenkins et al. 2007; Kalil et al. 2010; Tausig and Fenwick 2011 as well as numerous anecdotal sources. For references specifically related to Fly In Fly Out [FIFO] work schedules and lifestyle and family issues see Beach and Cliff 2003; Carson and Taylor 2012; Clifford 2009; Gallegos n.d.; Storey 2010; Taylor and Simmonds, 2009 and contained references.) And families of non-workers might be affected without enjoying the benefits of employment. The relevant issue is the extent to which the construction phase of this proposed Project is likely to have material adverse health effects. Based on the overall size and timeline of the proposed Project these effects are judged to be medium, as shown in the detailed scoring results given below.

Scoring

Scores shown below are developed using the risk assessment matrix given in Tables 5.15-3 and 5.15-4. Scoring is based on the following judgments:

- Health effect score: High, 2. This score is judged appropriate because present trends in most indicators (see above) are encouraging. Increases in suicide rates or domestic violence would certainly be significant if they were to occur. Nonetheless, there is not
expected to be a direct linkage between the construction of the proposed Project (alone) and increased suicide or domestic violence rates. As possible points of reference, the HIA prepared for the Pt. Thomson EIA concluded (depending upon the alternative selected) that there would be no impact or a low impact, whereas the Wernham (2007b) HIA also on North Slope development concluded that the Project “carried a high risk of adverse impacts on rates of social pathology because of planned development in a region of great cultural and practical importance to the surrounding communities”;

- Duration: High, 2, medium-term, 2.5 years;
- Magnitude: Very high, 3, those impacted (however few) will not be able to adapt to the health impact or to maintain pre-impact level of health;
- Extent: Medium, 1, limited to households;
- Severity rating equals sum of scores: 8 from above calculations;
- Likelihood rating: Unlikely 10-33 percent; and
- Impact rating from Table 5.15-4 = medium (-).

In summary, the negative impact of the construction phase of the proposed Project within the Social Determinants of Health HEC is estimated to be medium.

**Operations and Maintenance**

Each of the specific headings shown below have HECs that correspond to those discussed in the assessment of construction impacts and are not duplicated here.

This section addresses post-construction impacts of the proposed Project during the operations phase. Negative impacts are not expected to be material (see below) and positive impacts very significant, particularly for residents of Fairbanks (see the cumulative effects discussion). These benefits would result from reduced PM 2.5 emissions from household heating units because clean burning natural gas would be substituted for other fossil fuels and wood in many cases. In addition, Fairbanks residents would save money because of lower heating costs.

Compared to the construction phase where the peak number of workers was 6,400, the number of workers required for day-to-day operations (50) is almost negligible.

As stated in the POD, the O&M facilities include:

_Three O&M facilities are planned for the ASAP, one at the GCF in Prudhoe Bay, one in Fairbanks, and one at the Cook Inlet NGL Facility in Wasilla. Each location will include office facilities, a maintenance garage, and both warm and cold warehouse space. The Wasilla O&M facility will also house the pipeline control systems. Each O&M facility will be accessible via road and will have sufficient parking for staff, visitors, and maintenance vehicles._
In contrast to the exposure pathways associated with the construction phase identified in the CSM, fugitive
dust emissions would be much smaller (no earthmoving and much lower truck traffic) during the operations
phase. There would be no construction camps and associated wastewater discharges etc.

**Water and Sanitation**

As described under the subheading Exposure to Hazardous Materials, operation of the
proposed Project would probably not increase exposure of the PACs to toxic and hazardous
substances. Therefore, effects to water quality due to the use of hazardous materials in the
proposed Project are not anticipated. Under the CWMP, which would be developed for the
proposed Project, solid waste would be reused, recycled, burnt, or disposed of in accordance
with applicable regulations. Operation of the proposed Project would therefore have negligible
effects on water quality.

The AGDC has indicated that it would require the use of water for operations and maintenance;
however, estimates of the amount of water required or potential sources for that water have not
been provided. The AGDC would need to obtain the necessary permits prior to water
withdrawal, thereby minimizing any potential effects to potable water supplies. It is anticipated
that the operations and maintenance of the facilities and infrastructure planned for development
of the proposed Project would require only 58 workers, with most workers concentrated at the
facilities near Prudhoe Bay, Fairbanks, and Cook Inlet. The increased demand on existing
water and sanitation infrastructure would be negligible.

**Scoring**

Scores shown below are developed using the risk assessment matrix given in Tables 5.15-3
and 5.15-4. Scoring is based on the following judgments:

- Health effect score: Medium, 1. The effect might result in annoyance, minor injuries, or
  illnesses that do not require intervention;
- Duration: Very high, 3, long-term, 30 years;
- Magnitude: Low, 0, effect is judged to have minor intensity;
- Extent: Low, 0, limited to individual cases;
- Severity rating equals sum of scores: 4 from above calculations;
- Likelihood rating: Unlikely 10-33 percent; and
- Impact rating from Table 5.15-4 = low (−).

In summary, the negative impact of the operations and maintenance phase of the
proposed Project within the Water and Sanitation HEC is estimated to be low.
**Accidents and Injuries**

Accidents and injuries include occupational injuries (those suffered by proposed Project personnel) and those that could be incurred by non-employees. Considering the relative number of proposed Project employees and contractors that would be involved in this phase compared to the number during construction, the occupational injuries Projected for the construction activity are unlikely to be material.

Accidents/injuries to members of the general public would likewise likely be few in number. Accidents/injuries resulting from leaks, fires, or explosions would be minimized as a result of the proposed Project safety program. According to the POD, this includes:

> The ASAP will be designed, constructed, operated, and maintained in accordance the requirements of the Pipeline and Hazardous Materials Safety Administration (PHMSA) within the U.S. Department of Transportation. These requirements are included in 49 CFR Subtitle B and are intended to ensure adequate protection for the public from natural gas pipeline failures. The ASAP will meet or exceed these requirements. These requirements address:

- Pipeline safety programs and rulemaking procedures (49 CFR Part 190)
- Annual reports, incident reports, and safety-related condition reports for natural gas pipelines (49 CFR Part 191)
- Minimum federal safety standards for transportation of natural gas by pipeline (49 CFR Part 192)

An O&M Plan will be developed as discussed in Section 10.1 and a Safety Plan will be developed as discussed in Section 7.10. O&M will be performed in a manner that is protective of personal health, safety, and is protective of the environment.

**Damage Prevention**

A Damage Prevention Program as identified in 49 CFR 192.614 will be implemented to prevent damage from excavation activities, including excavation, blasting, boring, tunneling, backfilling, the removal of aboveground structures by either explosive or mechanical means, and other earthmoving operations. As part of the Damage Prevention Program, the pipeline operator would participate in the state one-call system for excavators to call for excavation activities (utility locates) as required by 49 CFR 192.614. Participation in the one-call system may not be necessary if access to the pipeline is physically controlled by the operator.

**Public Awareness**

The operator of ASAP will develop a public education program that follows the American Petroleum Institute’s (API) Recommended Practice 1162. The education program will include provisions on the one-call notification system (utility locate), hazards associated with an unintended release and indications that a release has occurred, and reporting procedures and steps to be taken if a release occurs.
Nationwide PHMSA regulates 297,000 miles of onshore gas transmission lines and according to a study by the National Academy of Sciences the annual fatality rate in 2000 was approximately 0.091 fatalities per billion ton-miles, lowest among the various transportation modes (Federal Register 2011; NAS 2004).

The PHMSA data indicate that over the period from 1992 through 2011, the average annual fatalities and injuries associated with onshore gas transmission lines were 2.15 and 10.45, respectively (PHMSA 2011a). Many gas transmission pipeline accidents result from careless digging and other construction activity and, considering the remoteness of the right-of-way, these are less likely with the proposed Project than with most other gas pipelines (PHMSA 2011b). Assuming that the fatality and injury rates are proportional to the length of the pipeline, the length of the proposed pipeline is 772 miles (including both the main pipeline and the short pipeline to Fairbanks as given in the POD), and that fatal and nonfatal injury rates for proposed Project are the same as those experienced nationally over the period from 1991 to 2010, the estimated number of fatalities over the 30-year period would be 30 x (2.15/297,000) x 772 = 0.167 and the corresponding number of injuries would be 30 x (10.45/297,000) x 772 = 0.8181. The fatality and injury data include both pipeline workers and others, so even assuming conservatively that all those killed or injured are not pipeline workers indicates that the incremental number of injuries (fatal and nonfatal) would be relatively small.40

Scoring

Scores shown below are developed using the risk assessment matrix given in Tables 5.15-3 and 5.15-4. Scoring is based on the following judgments:

- Health effect score: Very high, 3. Although the expected number of fatal and nonfatal injuries is very small and the effect is highly unlikely, the effect would be serious to those affected;
- Duration: Very high, 3, long-term, 30 years;
- Magnitude: Very high, 3, those impacted will not be able to adapt;


40 Average annual fatal and nonfatal injury rates were used in the above computation. The largest annual number of fatalities for onshore gas transmission pipelines was 15 in the year 2000. If the annual fatality rate for the proposed project were equal to the largest annual rate experienced nationally, the projected number of fatalities over the 30-year period would be 1.17 persons. The largest number of annual nonfatal injuries nationally was 61 in 2010. Assuming this rate would lead to 4.8 nonfatal injuries over the 30-year period.
• Extent: Low, 0, limited to individual cases;
• Severity rating equals sum of scores: 9 from above calculations;
• Likelihood rating: Extremely unlikely < 1 percent; and
• Impact rating from Table 5.15-4 = medium (-).
• In summary, the negative impact of the operations and maintenance phase of the proposed Project within the Accidents and Injuries HEC is estimated to be medium.

Health Infrastructure and Delivery

Adverse impacts on health infrastructure and delivery systems would be expected only if proposed Project operations were to result in increased injuries from pipeline accidents or increased need for medical services. The above calculations indicate that injuries from pipeline accidents are expected to be relatively few in number. Moreover (see discussions of exposure to hazardous materials and non-communicable and chronic disease below) the operation of the pipeline has the potential to reduce demand for medical services in Fairbanks, which would be a beneficial impact.

The HIA prepared for the Pt. Thomson Project concluded that there would be positive impacts on health infrastructure and delivery, an indirect consequence of incremental revenues from that Project, which would also be true for the proposed Project.

Scoring

Scores shown below are developed using the risk assessment matrix given in Tables 5.15-3 and 5.15-4. Scoring is based on the following judgments:

• Health effect score: Low, 0;
• Duration: Very high, 3, long-term, 30 years;
• Magnitude: Low, 0, effects are of minor intensity;
• Extent: Low, 0, limited to individual cases;
• Severity rating equals sum of scores: 3 from above calculations;
• Likelihood rating: Extremely unlikely < 1 percent; and
• Impact rating from Table 5.15-4 = low (-).
In summary, the negative impact of the operations and maintenance phase of the proposed Project within the Health Infrastructure and Delivery HEC is estimated to be low.

**Exposure to Hazardous Materials**

Section 5.16 (Air Quality) describes the fugitive dust, criteria pollutants, and VOCs that would be generated by the proposed Project. With respect to natural gas pipeline operations, the pipeline alone generally does not have any significant air emissions associated with its operation. There could be fugitive emissions from pipeline connections (i.e., valves). Such emissions would be generally very minor in nature and typically would not be subject to the requirement to obtain a permit.

Operation of the GCF and compressor stations would emit combustion-related pollutants such as NOx, CO, PM, VOCs, and SO$_2$. Preliminary emission estimates trigger the need for those facilities to obtain prevention of significant deterioration (PSD) and Title V operating permits. As discussed in Section 5.16 (Air Quality), upon meeting the permit requirements, the proposed Project as permitted by the ADEC would not cause or contribute to a violation of any federal, state, or local air quality standards. Therefore, operation of the proposed Project should not significantly increase exposure of the PACs to these substances.

Other toxic and hazardous substances that would be generated by proposed Project operations include some components of natural gas and NGLs (isobutene, pentanes, hexanes, hydrogen sulfide, butane, and ethane), as well as pesticides, paints, solvents, petroleum products, and fertilizers. As described under the Construction subheading, the proposed Project would be subject to numerous regulations regarding the use of toxic and hazardous materials. In addition to complying with these regulations, proposed Project operations would also follow a CWMP, SPCP, and a SPCCP. Therefore, operation of the proposed Project should not lead to exposure of the PACs to these substances.

Finally, operation of ASAP would result in various emissions when the natural gas was ultimately consumed in Fairbanks, Anchorage, and other cities. Compared to present emission levels, these emissions are expected to be much smaller. The benefits are discussed in the cumulative effects section.

**Scoring**

Scores shown below are developed using the risk assessment matrix given in Tables 5.15-3 and 5.15-4. Scoring is based on the following judgments:

- Health effect score: Low, 0, the effect is unlikely to be perceptible. This assumes compliance with NAAQS;
- Duration: Very high, 3, long-term, 30 years;
- Magnitude: Low, 0, effects are of minor intensity;
- Extent: Low, 0, limited to individual cases;
Severity rating equals sum of scores: 3 from above calculations;

Likelihood rating: Extremely unlikely < 1 percent; and

Impact rating from Table 5.15-4 = low ( ).

In summary, the negative impact of the operations and maintenance phase of the proposed Project within the Exposure to Hazardous Materials HEC is estimated to be low.

Food, Nutrition, and Subsistence

These are potentially important for both health and lifestyle reasons. However, even during the construction phase these were not determined to be significant. During the operations phase far fewer people are required, which would lead to even lower impacts.

A cleared ROW and the construction of new access roads could attract additional harvesters who use off highway vehicles (OHVs) to the proposed Project area. Increased access in areas that do not follow existing transportation or utility corridors, particularly between the TAPS corridor and Parks Highway in the Minto Flats vicinity could have an impact on subsistence uses. These impacts would have the greatest potential effect on the nearby communities of Minto and Nenana that have documented use of this area. Due to their proximity, Livengood subsistence users might also be affected. However, as during the construction phase, within the limits of present law, the proposed Project could reduce the possibility for competition for subsistence resources between traditional users and pipeline workers by following the standard practice of prohibiting workers from hunting or fishing while on the job or when company transportation has been used to bring them to a remote site. Workers could obtain licenses for hunting as do any other visitors to Alaska but must provide/obtain their own transportation (see the discussion of applicable hunting and fishing stipulations in the discussion of construction impacts).

New access roads and increased traffic and noise from aerial and ground-based pipeline inspections have the potential to displace and reduce the availability of terrestrial wildlife for subsistence uses. Indeed, such activity is required as part of stipulation 1.8 in the stipulations document associated with the proposed Project (ADCG 2011a):

1.8 Surveillance and Monitoring

1.8.1 A Surveillance and Monitoring Program for the Pipeline shall be approved by the Pipeline Coordinator prior to start-up of the Pipeline. The program shall be designed to at a minimum:

(a) Provide for and protect public health and safety;
(b) Prevent and mitigate damage to natural resources;
(c) Prevent and mitigate erosion;
(d) Maintain Pipeline integrity and monitor any Pipeline movement that may affect integrity (Stipulation 3.11); and
(e) Protect public and private property.

A detailed surveillance program has not yet been established, but such a program could include aerial overflights and other physical inspections.

Fish availability could also be affected during O&M from the chilled pipeline, which could reduce the water temperature at stream crossings and affect fish behavior or cause direct effects on fish habitat. In addition, resource availability would also be reduced in the unlikely event that a leak in the pipeline led to a forest fire. As noted previously, gas transmission accidents are relatively rare.

Concern of contamination, risk of fires, decreased resource availability, and increased competition along certain parts of the proposed ROW near Minto Flats would have potential indirect implications for hunters’ efforts, costs, and risks associated with having to travel to other places in search of resources or obtaining substitute foods. Therefore, O&M of the proposed Project could lead to a decrease in the amount of dietary consumption of subsistence resources, resulting in a change in the composition of diet and a decrease in food security. These effects would be negligible for most subsistence users given that the proposed Project ROW generally follows existing or officially designated transportation and utility corridors. Effects would be greater in the area around Minto Flats (primarily affecting subsistence users in Minto, Nenana, and Livengood), which is largely undeveloped.

The above conclusions are consistent with the findings of the ANILCA Section 810 Analysis of Subsistence Impacts discussed above in the section dealing with construction impacts and in Appendix L. Specifically, as noted above Appendix L offers the following conclusion regarding effects of ASAP:

The proposed activity would not significantly restrict subsistence uses and needs in or near the proposed activity area.

Scoring
Scores shown below are developed using the risk assessment matrix given in Tables 5.15-3 and 5.15-4. Scoring is based on the following judgments:

- Health effect score: Medium, 1;
- Duration: Very high, 3, long-term, 30 years;
- Magnitude: High, 2, Those impacted will be able to adapt to the health impact with some difficulty and will maintain pre-impact level of health with support;
- Extent: High, 2, as some communities (e.g., Minto) might be impacted;
- Severity rating equals sum of scores: 8 from above calculations;
- Likelihood rating: Unlikely 10-33 percent; and
- Impact rating from Table 5.15-4 = medium (-).
- In summary, the negative impact of the operations and maintenance phase of the proposed Project within the Food, Nutrition, and Subsistence HEC is estimated to be medium.

**Infectious Diseases**

Possible impacts of infectious diseases are discussed in some detail in the corresponding section on construction impacts. For the O&M phase the number of workers is very much smaller and so too would be the possible impacts. Moreover, unlike the case with the construction phase, where workers might include those from out of state, it is likely that all or nearly all of the workers would be Alaska residents.

**Scoring**

Scores shown below are developed using the risk assessment matrix given in Tables 5.15-3 and 5.15-4. Scoring is based on the following judgments:

- Health effect score: High, 2, because those affected may require medical treatment in the event they develop an infectious disease;
- Duration: Very high, 3, long-term, 30 years;
- Magnitude: High, 2, affected individuals should be able to adapt, but may require medical intervention;
- Extent: Low, 0, as this would be limited to individual cases;
- Severity rating equals sum of scores: 7 from above calculations;
- Likelihood rating: Very unlikely 1-10 percent, because the number of workers involved in operations is very much smaller than the number of construction workers; and
- Impact rating from Table 5.15-4 = medium (-).
- In summary, the negative impact of the operations and maintenance phase of the proposed Project within the Infectious Diseases HEC is estimated to be medium.

**Non-communicable and Chronic Disease**

It is likely that any impacts of operation of the proposed Project on non-communicable diseases would be positive, chiefly because of improvements in air quality in Fairbanks resulting from probable decreases in the frequency of exceedances of the PM 2.5 NAAQS. However, realization of these benefits would require expansion of the gas distribution network in Fairbanks. Therefore, this topic is presented in the cumulative effects section. The scoring given immediately following addresses impacts on non-communicable and chronic diseases.
associated with the proposed Project only and does not address the impacts if the gas
distribution system in either Fairbanks or Anchorage is expanded.

Scoring

Scores shown below are developed using the risk assessment matrix given in Tables 5.15-3
and 5.15-4. Scoring is based on the following judgments:

- Health effect score: Low, 0, while increases in prevalence of the chronic diseases listed
  here could result in loss of life (from certain chronic illnesses), severe injuries, or chronic
  illness that requires intervention, the linkage between these and operations and
  maintenance of the proposed Project is weak;
- Duration: Very High, 3, long-term, 30 years;
- Magnitude: Low, 0, those impacted will not be able to adapt to the health impact or to
  maintain pre-impact level of health, which would justify a high rating, but the linkage
  between proposed Project operations and increases in chronic diseases is weak;
- Extent: Low, 0, limited to individual cases;
- Severity rating equals sum of scores: 3 from above calculations;
- Likelihood rating: Very unlikely 1-10 percent; and
- Impact rating from Table 5.15-4 = low (-).
- In summary, the negative impact of the operations and maintenance phase of the
  proposed Project within the Non-communicable and Chronic Disease HEC is estimated
to be low.

Note that this assessment changes when the benefits associated with the expansion of the gas
distribution system are included.

Social Determinants of Health

The possible impacts of the proposed Project on social determinants of health during the
construction phase are discussed above. During that 2.5-year period as many as 6,400 workers
would be engaged in construction activities. During the 30-year operations and maintenance
phase 50 – 75 workers are planned. So effects related to the presence of workers are not at
issue.

Perhaps of greatest potential concern would be possible impacts on subsistence arising in
selected PACs (e.g., Minto, Nenana, and Livengood, see Section 5.14). Subsistence is
important in several contexts including health and sociocultural impacts. Section 5.14 also
notes:

*After construction, increased user access along the proposed Project ROW in the Minto
Flats will be a long-term concern and could affect subsistence uses. A cleared ROW
may attract additional harvesters to an area who use off road vehicles (e.g.,*
snowmachines and ATVs) to travel along the ROW. Because the proposed Project ROW generally follows existing or officially designated transportation and utility corridors including the TAPS corridor and Parks Highway, an increase in user access and in additional harvesters would not be expected in these areas. However, increased access in areas that do not follow existing transportation or utility corridors, particularly between the TAPS corridor and Parks Highway in the Minto Flats vicinity, could have an impact on subsistence uses. These impacts would have the greatest effect on the nearby communities of Minto and Nenana who have documented use of this area. Due to their proximity, Livengood subsistence users would also likely be affected. Preventative access measures such as boulders, berms, or fencing will be used to limit access to the Proposed Project ROW...These preventative measures would help lessen the impact of increased use along the ROW although would not likely eliminate the impact.

Section 5.14 raises the possibility that pipeline leaks could become ignited and increase the severity of forest fires, which could adversely affect subsistence resources. Whether or not this is likely, the possibility could increase anxiety among residents of PACs. This problem would be greatest in the summer, when wildfires are more frequent.

One relevant aspect of the potential for leaks is the system(s) that will be used to detect and respond to leaks. The POD (see pg. 93) offers the following comments on leak detection and response:

A Supervisory Control and Data Acquisition (SCADA) system will be implemented to collect measurements and data along the pipeline, including flow rate through the pipeline, operational status, pressure, and temperature readings. This information may all be used to assess the status of the pipeline.

- The SCADA system will provide pipeline personnel with real-time information about equipment malfunctions, leaks, or any other unusual activity along the pipeline.
- The pipeline operator will develop and implement an Emergency Response Plan in accordance with 49 CFR 192.615 to minimize the hazards resulting from a pipeline emergency, including a leak. The Emergency Response Plan will at a minimum include:
  - Procedures for receiving, identifying, and classifying notices of events which require immediate response by the operator;
  - Procedures for notifying fire, police, and other public officials as necessary; establishing and maintaining adequate means of communication with appropriate officials; and coordinating responses in the event of an emergency;
  - Procedures for the prompt and effective response to a notice of emergency events, including gas detection inside or near a building, fire near or involving the pipeline or related facilities, explosions near or involving the pipeline or related facilities, or a natural disaster;
o Availability of personnel, equipment, tools, and materials needed at the scene of an emergency;

o Procedures for emergency shutdown and pressure reduction in any section of the pipeline system as necessary to minimize hazards to life or property; and

o Procedures for protecting life and property in the event of an emergency.

A second relevant aspect is the probable frequency of gas leaks. Data are available from PHMSA on the frequency of “significant pipeline incidents”, which includes pipeline leaks. Over the 20-year period from 1992 through 2011, the number of significant pipeline incidents on the 297,000 miles\(^{41}\) of onshore gas transmission lines averaged 45.2 per year (PHMSA 2011a). If the proposed Project experienced a comparable rate the expected number of significant incidents per year would be \((45.2/297,000) \times 772 = 0.12\). This estimate might overstate the potential for leaks because many are related to corrosion (at least in the initial years) or disturbance by digging activities and these would be expected to be less of an issue for a new pipeline located in a remote area. Moreover, not all leaks would become ignited.

**Scoring**

Scores shown below are developed using the risk assessment matrix given in Tables 5.15-3 and 5.15-4. Scoring is based on the following judgments:

- Health effect score: Medium, 1 because of the possibility of an increase in prevalence of depression and anxiety;
- Duration: Very high, 3, long-term, 30 years;
- Magnitude: High, 2, affected individuals should be able to adapt, but may require medical intervention. This is a conservative estimate;
- Extent: High, 2, as this might affect entire PACs;
- Severity rating equals sum of scores: 8 from above calculations;
- Likelihood rating: Judged to be Very unlikely 1-10 percent; and
- Impact rating from Table 5.15-4 = medium (-).

In summary, the negative impact of the operations and maintenance phase of the proposed Project within the Social Determinants of Health HEC is estimated to be medium.

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\(^{41}\) See Advance Notice of Proposed Rulemaking by the PHMSA published on Thursday August 25, 2011 in the Federal Register (76 FR 53086).
Summary and Discussion

Table 5.15-37 summarizes the impact ratings for effects on public health associated with the proposed Project. Technically, the impact ratings for non-communicable and chronic diseases for operation of the proposed Project belong in the discussion of cumulative effects—and are placed there (see below), because expansion of the gas distribution system in Fairbanks is required. Nonetheless a major purpose of the proposed Project is to provide low cost and clean burning natural gas to Fairbanks (and other communities). Therefore, the health impacts of the proposed Project are included in the operation section.

<table>
<thead>
<tr>
<th>Category</th>
<th>HEC considered</th>
<th>Project Phase</th>
<th>Project Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Construction</td>
<td>Operations and Maintenance</td>
</tr>
<tr>
<td>Water and sanitation</td>
<td>Change in potable water access, Change in water quantity, Change in water quality, and Change in demand on water and sanitation infrastructure due to the influx of non-resident workers.</td>
<td>Low (-)</td>
<td>Low (-)</td>
</tr>
<tr>
<td>Accidents and Injuries</td>
<td>Change in unintentional injury (e.g., drowning, falls, snow machine injury) rates: Construction activities will not impact injury rates in the PACs. Change in roadway incidents and injuries: This is addressed below related to possible injuries related to operation of trucks and buses associated with construction activities. Changes to safety during subsistence activities: There are no data to support the hypothesis that safety of participants engaged in subsistence activities would be positively or negatively impacted.</td>
<td>Medium (-)</td>
<td>Medium (-)</td>
</tr>
<tr>
<td>Health Infrastructure and Delivery</td>
<td>Change in number or quality of clinics and staff: Medical technicians will be available at each construction camp, but their purpose is to attend those engaged in proposed Project construction activities. Change in services offered (e.g. prenatal checks, x-ray, and lab services): The ASAP program is not intended to provide these services. Change in accessibility of health care. Change in utilization/clinic burden from non-resident influx: This is addressed in the discussion of accident rates for workers (see below).</td>
<td>Low (-)</td>
<td>Low (-)</td>
</tr>
<tr>
<td>Exposure to Hazardous Materials</td>
<td>Changes in physiologic contaminant levels such as fugitive dust, criteria pollutants, persistent organic pollutants, and volatile organic compounds, and Changed levels of the same substances in subsistence resources.</td>
<td>Low (-)</td>
<td>Low (-)</td>
</tr>
<tr>
<td>Food, Nutrition, and Subsistence</td>
<td>Change in amount of dietary consumption of subsistence resources, Change in composition of diet, and Change in food security,</td>
<td>Medium (-)</td>
<td>Medium (-)</td>
</tr>
<tr>
<td>Infectious Diseases</td>
<td>Change in transmission of pediatric acute respiratory disease rates, Change in acute adult respiratory disease rates (TB, Bronchitis, Influenza), Change in sexually transmitted diseases (STD) rates (e.g. Chlamydia, gonorrhea, HIV), Change in GID outbreaks, and Change in antibiotic-resistant staph skin infections.</td>
<td>Medium (-)</td>
<td>Medium (-)</td>
</tr>
</tbody>
</table>
TABLE 5.15-37  Summary of Impact Rankings for Effects on Public Health Associated with the Proposed Project

<table>
<thead>
<tr>
<th>Category</th>
<th>HEC considered</th>
<th>Project Phase</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>Construction</td>
</tr>
<tr>
<td>Non-communicable and Chronic Disease</td>
<td>Change in cardiovascular disease rates,</td>
<td>Low (-)</td>
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<tr>
<td></td>
<td>Change in type 2 Diabetes Mellitus (DM) rates,</td>
<td></td>
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<td></td>
<td>Change in chronic lower respiratory disease rates, and</td>
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<td></td>
<td>Change in cancer rates.</td>
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</tr>
<tr>
<td>Social Determinants of Health</td>
<td>Change in maternal and child health status (e.g., infant mortality, initiation</td>
<td>Medium (-)</td>
</tr>
<tr>
<td></td>
<td>of prenatal care, low birth weight, smoking during pregnancy, child abuse,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>or alcohol use during pregnancy),</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Change in depression/anxiety prevalence,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Change in the substance abuse rate,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Change in the suicide rate,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Change in teen pregnancy rates,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Change in domestic violence and family stress,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Change in economy and employment.</td>
<td></td>
</tr>
</tbody>
</table>

As shown in Table 5.15-37, most of the health impacts are rated as “low” using the risk assessment system described in Tables 5.15-3 and 5.15-4. Accidents and injuries are rated as “medium” as are social determinants of health during the construction and the operation and maintenance phase. Finally, changes in non-communicable diseases are rated as positive and “very high” for reasons discussed at length in the next section.

The impact rankings for some categories in Table 5.15-37 are ranked higher than would be expected because of the way the ranking system is constructed. Specifically, the overall ratings for accidents and injuries in both construction and operation phases are rated as “medium”. This rating follows from direct application of the four-step rating process. The impacts at issue here are non-occupational fatalities or injuries that might result from train, truck, or bus accidents. There are no foreseeable incremental non-occupational accidents or injuries (e.g., falls, snow machine accidents) resulting from either construction or operation of the proposed Project. Detailed calculations are given above for fatal and nonfatal injuries resulting from train, truck, or bus accidents. These calculations are based on published data from authoritative sources on fatal and nonfatal injury rates for each of these transportation modes. The calculated casualty rates are low. For example, during the 2.5-year construction phase the estimated incremental number of non-occupational fatalities is 0.07 and that for injuries is 0.84. Applying the four-step process leads to an overall rating of “medium” for this impact. Consider first the health effect; the score for this is set to very high based on the descriptive statement in Table 5.15-3, “Effect resulting in loss of life, severe injuries or chronic illness that requires intervention”. Consider next the “magnitude” category—certainly anyone fatally injured would fall into the “very high” category; “those impacted will not be able to adapt to the health impact or to maintain pre-impact level of health.” Adding these results to the duration and extent results in a total score of 8 or “high” for the severity rating. And even though the outcome can be calculated to be extremely unlikely, application of the scoring rules results in an impact of medium. The assigned rank appears to be an artifact of the scoring system. One consequence of this rating is that mitigation measures need to be developed for this impact. These are easy
enough to devise (as shown in Section 5.15-5) and having a road safety program is not unduly burdensome.

Now consider “infectious disease” impacts. Applying the same scoring rules leads to an overall rating of “medium” for this impact during both construction and operations phases. Based on the extensive discussion above, this rating is plausible. Providing free vaccinations and a health outreach program on STDs for construction workers is recommended above—and the expected outcomes would fully justify mitigation efforts. The reader should ponder the following question; “At the margin, which program is likely to provide greater benefits, an immunization program for such diseases as influenza and hepatitis A and B, or a road safety program?” Both programs are recommended.

Application of the scoring system to effects on subsistence resources leads to impacts of medium during both the construction and operations and maintenance phases. This comes about because of possible impacts on subsistence resources as a result of the compressor station near the Minto Flats Game Refuge.

The strongest conclusion of this analysis is that greater use of natural gas is likely to have a significant and positive impact on public health of residents of Fairbanks. Burning natural gas for home heating would result in lower fine particulate emissions. Fine particulate concentrations (even at levels beneath the NAAQS) are harmful to health (mortality and morbidity) and Fairbanks is located in a non-attainment area for fine particulates. Though it would require expansion of gas distribution system to implement (and is thus discussed in cumulative effects below), this benefit could only be achieved with the proposed Project (or a similar pipeline).

Cumulative Effects

The impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such actions is addressed in Section 5.20 of this EIS. This section addresses the cumulative effects on health-related measures. Measured against all the cumulative health effects from state and federal programs, other oil and gas activities, and other industrial developments, the incremental impacts of the proposed Project are unlikely to be large. Nonetheless, they are positive and material for residents of Fairbanks and Anchorage. These are discussed first.

Potential Health Effect Benefits to Fairbanks

When fully operational, the proposed Project would provide access to relatively low cost natural gas for inhabitants of Fairbanks. This would require expansion of the present gas distribution
The proposed Project would provide substantial health benefits to residents of Fairbanks. The following points (each addressed in more detail below) are relevant:

- Fairbanks geography and climate are relevant in two important ways. First, Fairbanks experiences cold winters, which means that heating requirements are relatively large, (and, since Fairbanks is relatively isolated, unit heating costs are substantial). Second, the Fairbanks geography and climate result in frequent atmospheric inversions, trapping emissions and elevating concentrations of criteria pollutants, particularly in the winter.

- Fairbanks is a non-attainment area for PM 2.5\textsuperscript{43} and a maintenance area for carbon monoxide.\textsuperscript{44} This means that the Fairbanks air is unhealthy several days per year (most often in the winter). For example, Fairbanks averaged 28 days per winter (October through March) for the years 2005 to 2010 when air quality with respect to PM 2.5 was unhealthy (see Figure 5.15.-19 discussed below). Fye et al. (2009) report that “generally speaking, Fairbanks experiences 25-30 days with measured PM 2.5 concentrations in excess of the revised PM 2.5 standard, all of which occur in the winter”.

- Many scientifically sound studies indicate that elevated concentrations of PM 2.5 result in increased mortality and morbidity. A study in Alaska demonstrates a clear association between air quality and hospital visits (ADHSS 2010\textsuperscript{g}). Moreover, the EPA Clean Air Scientific Committee has recently recommended that the NNAQS for PM2.5 be further reduced and this will likely occur in the next year or two; if this recommendation is implemented it will put the Fairbanks region further out of compliance.

- Combustion of various fuels, particularly wood, is a major source of winter PM 2.5 emissions and exceedances of the PM 2.5 NAAQS.

- On a heat content (e.g., British Thermal Unit [BTU]) basis, natural gas emits smaller quantities of all criteria pollutants than other fossil fuels and wood.

Authoritative studies on ways to reduce

\textsuperscript{42} Fairbanks Natural Gas, LLC (FNG) is the natural gas utility providing gas service to Fairbanks, Alaska. The company initiated service to its first customer during the spring of 1998. Over 1000 residential and commercial customers now have access to natural gas. FNG continues to broaden its underground distribution system to serve the Fairbanks community. FNG purchases natural gas from the Cook Inlet area. The purchased gas is then condensed into Liquefied Natural Gas (LNG). Then, by way of truck and trailer, the LNG is transported to Fairbanks where it is temporarily stored (see FNG 2005).

\textsuperscript{43} Relevant background documents are available at http://www.dec.state.ak.us/air/PM2.5_AK.htm (ADEC 2011c).

\textsuperscript{44} The EPA designated the urban portion of the Fairbanks North Star Borough (FNSB) a non-attainment area for carbon monoxide (CO) in 1991. The FNSB has not violated the National Ambient Air Quality Standard (NAAQS) for carbon monoxide since 1999. The EPA approved the FNSB’s CO attainment plan and the FNSB officially became a Carbon Monoxide Maintenance Area on September 27, 2004 (see ADEC 2011d).
PM 2.5 emissions recommend that burning of wood be eliminated or reduced. Switching to natural gas would reduce winter emissions appreciably.

- Although natural gas is now available in Fairbanks, in percentage terms relatively few households use natural gas. The Fairbanks Natural gas company notes that over 1,000 residential and commercial customers currently use natural gas. Sierra Research (2010) estimated that there were 1,370 natural gas heaters operating within the Fairbanks nonattainment area which is about 3.5 percent of the total number of heaters operating in the non-attainment area. Northern Economics (2012) notes that there are approximately 23,465 residential and 1,794 commercial structures in the Fairbanks region that are candidates for conversion to natural gas heating. Assuming that the distribution system was expanded, the natural gas from the proposed Project could substitute for a large fraction of home heating fuels. These reduced emissions should result in improved public health and reduced hospital visits.

- The availability of lower-cost natural gas would result in a net economic benefit to Fairbanks residents.

More detail on each of these points is provided below.

**Fairbanks Geography and Climate**

Fairbanks is Alaska’s second largest city (U.S. Census Bureau 2011c). The combination of geography, temperature, and wind patterns results in frequent temperature inversions that can trap atmospheric pollutants. As noted in a National Academy of Sciences study (2002) of carbon monoxide in Fairbanks:

> Ground-based inversions of considerable strength (typically a few degrees Celsius per 100m but sometimes much stronger) topped by weaker inversions reaching as high as about 1–2 km are normal in winter and can occur anytime during the year. A surface inversion due to net energy loss from the surface occurs in the few meters closest to the ground, although the weaker inversion topping it may be caused by subsidence or transport of warmer air aloft. The combination of high albedo (reflection of sunlight due to snow cover) and the low solar elevation (failure of the sun to rise high in the sky) characteristic of northern latitudes in winter creates little heating of the ground and weak

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45 The Fairbanks Natural Gas Website: (FNG 2005).
vertical mixing between the surface and overlying air. With clear skies and low absolute water-vapor content, the ground loses considerably more energy by radiation to space than it is able to absorb from the sun. Those surface conditions may persist in Fairbanks for days, and the situation is exacerbated by the insulation provided by high-albedo snow cover. Although such an inversion may weaken or even dissipate during the middle of the day, it tends to become reestablished or strengthened throughout the late afternoon and into the night. The upper part of the inversion appears to be associated with subsiding (downward) southeasterly flow crossing the Alaska Range. Although the lack of surface warming in winter is common, it now appears that recent exceedances [of the carbon monoxide NAAQS] occurred with the upper-level inversion also in place. [Material in square brackets added for clarity.]

Temperature inversions trap other pollutants as well, particularly PM 2.5. As noted previously, Fairbanks was formerly a nonattainment area for carbon monoxide and is presently a nonattainment area for PM 2.5.

Figure 5.15-19 shows data on the number of days where the 24-hour NAAQS for PM 2.5 (35 μg/m³) was exceeded over the years from 2005 through 2010.

![Number of PM 2.5 Exceedance Days by Season, 2005-2010](source)

**FIGURE 5.15-19 Number of PM 2.5 Exceedance Days by Season, 2005-2010**

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46 The Fairbanks area has not had an exceedance for carbon monoxide since the year 2000. The ADEC Department of Air Quality graphically shows the number of exceedances per year on their Website: at: [http://dec.alaska.gov/air/anpms/comm/docs/Fairbanks_8Hr_CO_chart.pdf](http://dec.alaska.gov/air/anpms/comm/docs/Fairbanks_8Hr_CO_chart.pdf).
The second key point about the weather in Fairbanks is that it is cold in the winter—perhaps obvious but important nonetheless. A commonly used measure that is proportional to energy requirements for heating is the heating degree day. According to the National Weather Service (2011):

Degree day is a quantitative index demonstrated to reflect demand for energy to heat or cool houses and businesses. This index is derived from daily temperature observations at nearly 200 major weather stations in the contiguous United States. The “heating year” during which heating degree days are accumulated extends from July 1st to June 30th and the “cooling year” during which cooling degree data are accumulated extends from January 1st to December 31st. A mean daily temperature (average of the daily maximum and minimum temperatures) of 65°F is the base for both heating and cooling degree day computations. Heating degree days are summations of negative differences between the mean daily temperature and the 65°F base; cooling degree days are summations of positive differences from the same base.

Data on heating degree days over a 30-year period are available for many locations in the United States (NOAA 2011). For Fairbanks, the 30-year annual average is 13,980 heating degree days. Here are corresponding average annual heating degree days for a sample of other cities in the United States: Anchorage, AK, 10,470; Juneau, AK, 8,574; San Francisco, CA, 2,862; San Diego, CA, 1,063; Washington, DC, 3,999; New York, NY, 4,744; and Miami, FL, 155. Heating degree days can be added over periods of time to provide a rough estimate of seasonal heating requirements. In the course of a heating season based on the foregoing data, for example, the number of heating degree days for San Francisco is 2,862 whereas that for Fairbanks is 13,980. Thus, one can say that, for a given home of similar structure and insulation, around five (13,980/2,862 = 4.88) times the energy would be required to heat the home in Fairbanks than in San Francisco. Comparing the energy needed to heat a home in Fairbanks and Anchorage (13,980/10,470 = 1.33), about 33 percent more energy is needed for heating in Fairbanks than in Anchorage.\footnote{This assumes that the houses in Fairbanks and Anchorage are the same size and have the same insulation. In fact (see Information Insights, 2009) although the number of BTUs per ft\textsuperscript{2} for space heating in Fairbanks is greater than that for homes in Anchorage, the actual energy consumption is higher in Anchorage because the average house in Anchorage is about 15 percent larger in area than the average house in Fairbanks.} Compared to most U.S. cities the annual heating requirement, typically measured in \textit{British Thermal Units} (BTUs), is substantially greater in Fairbanks. Homes in Fairbanks need to be heated for eight months of the year and the costs for various heating fuels are high (Fye et al. 2009).
Fairbanks Non-Attainment

As noted previously, Fairbanks is a non-attainment area for PM 2.5 and a maintenance area for carbon monoxide. Among other things, the State of Alaska is required to develop a state implementation plan (SIP) to ensure compliance. The deadline for PM 2.5 nonattainment is December 2014 but under certain conditions the deadline may be postponed to 2019. To qualify for an extension, the state must demonstrate that all local control measures that are reasonably available and technically feasible for the area are currently being implemented to bring about attainment of the standard by the alternative attainment date for the area.

Unfortunately, as shown in Figure 5.15-20, the overall trend in PM 2.5 winter months exceedances suggests that air quality (as measured by this index) is actually getting worse, rather than improving. It is clear that additional measures need to be taken if compliance is to be achieved in this non-attainment area.

48 In part this is an artifact of the change in the NAAQS for PM 2.5. Nonetheless, it shows that Fairbanks was increasingly out of compliance with applicable standards.
Health Effects of Elevated PM 2.5 Concentrations

As discussed in the section on chronic health effects associated with construction, there is extensive literature supporting the proposition that elevated levels of fine particulates are unhealthy (see Brook et al. 2002, 2010; Chow et al. 2006; Dockery and Stone 2007; Dominici et al. 2006; Fairbanks North Star Borough 2009; Koenig et al. 1993; Laden et al. 2000, 2006; Pope III 2000; Pope III and Fulton 2011; Pope III et al. 2002, 2006a, b, 2009a, b; Samet et al. 2000; Schwartz and Neas 2000; Slaughte et al. 2005; EPA 2009; Verbrugge 2009 and numerous references included at the end of this section) and lead to increased mortality and morbidity.

Table 5.15-38 (from Brook et al. 2010) summarizes the assessment of the available evidence for both short- and long-term effects of PM 2.5 on cardiovascular mortality, cardiovascular hospitalizations, ischemic heart disease, heart failure, vascular diseases, and cardiac arrhythmia/cardiac arrest.

<table>
<thead>
<tr>
<th>Health outcomes</th>
<th>Short-Term Exposure</th>
<th>Longer-Term Exposure</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(Clinical cardiovascular end points from epidemiological studies at ambient pollution concentrations)</td>
<td>(Days)</td>
</tr>
<tr>
<td>Cardiovascular mortality</td>
<td>↑↑↑</td>
<td>↑↑</td>
</tr>
<tr>
<td>Cardiovascular hospitalizations</td>
<td>↑↑↑</td>
<td>↑</td>
</tr>
<tr>
<td>Ischemic heart disease(^a)</td>
<td>↑↑↑</td>
<td>↑↑</td>
</tr>
<tr>
<td>Heart failure(^a)</td>
<td>↑↑</td>
<td>↑</td>
</tr>
<tr>
<td>Ischemic stroke(^a)</td>
<td>↑↑</td>
<td>↑</td>
</tr>
<tr>
<td>Vascular diseases(†)</td>
<td>↑</td>
<td>↑</td>
</tr>
<tr>
<td>Cardiac arrhythmia/cardiac arrest</td>
<td>↑</td>
<td>↑</td>
</tr>
</tbody>
</table>

Notes:
The arrows are not indicators of the relative size of the association but represent a qualitative assessment based on the consensus of the writing group of the strength of the epidemiological evidence based on the number and/or quality, as well as the consistency, of the relevant epidemiological studies.

Subclinical cardiovascular end points (such as blood pressure, systemic inflammation, and arrhythmias) are also addressed in the source material.

\(\uparrow\uparrow\uparrow\) - Indicates strong overall epidemiological evidence.

\(\uparrow\uparrow\) - Indicates moderate overall epidemiological evidence.

\(\uparrow\) - Indicates some but limited or weak available epidemiological evidence.

\(†\) Deep venous thrombosis only.

\(\uparrow\uparrow\uparrow\) Indicates fatal and nonfatal events.

Source: Adapted from Table 6 in Brook et al. 2010.

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\(^{49}\) Ischemic heart disease (IHD), or myocardial ischaemia, is a disease characterized by ischaemia (reduced blood supply) of the heart muscle.

\(^{50}\) An arrhythmia is a problem with the rate or rhythm of the heartbeat. During an arrhythmia, the heart can beat too fast, too slow, or with an irregular rhythm.
Adverse effects of exposure to PM 2.5 can occur at concentrations beneath the NAAQS. Dr. Lori Verbrugge (see Fairbanks North Star Borough 2009; Verbrugge 2009) of the Alaska Division of Public Health was quoted as:

Dr. Verbrugge said the literature was very clear and consistent about the health effects of PM2.5 and cited over 20 separate studies that consistently showed an increase in mortality associated with long-term particulate exposure. Collectively, the studies showed a 6–17% increase in relative mortality with each 10 μg/m³ of PM2.5 exposure. She said the available data showed there is increased mortality with short-term exposure to PM2.5 concentrations that are less than 20 μg/m³, which is considerably below the new “health-based” 24-hour standard of 35 μg/m³.

The State of Alaska, Department of Health and Social Services, Division of Public Health performed a study (2010a) of the association between air quality and hospital visits over the period from 2003 to 2008. Many studies have larger sample sizes, but this is of interest because it is so specific to Fairbanks. Key study results included:

A total of 5,718 hospital visits consisting of 1,596 emergency room visits and 4,122 hospitalizations were analyzed (Table); the mean 24-hr PM2.5 level was 20.1 μg/m³ (range: 0.2–673.8 μg/m³).

Hospitalizations for the following health conditions were statistically associated with increased mean 24-hr PM2.5 levels: for each 10 μg/m³ increase in the mean 24-hr PM2.5 level 1 day prior to a hospital visit, there was a 7% increased risk for a cerebrovascular disease-coded visit in persons aged <65 years (P<0.05; 95% confidence interval [CI]: 1%–12%); a 6% increased risk for a cerebrovascular disease-coded visit in persons aged >65 years (P<0.05; 95% CI: 1%–12%); and a 6% increased risk for a respiratory tract infection-coded visit in persons aged <65 years (P<0.05; 95% CI: 1%–11%).

Thus, it is clear that increased concentrations of ambient PM 2.5 levels in FNSB are associated with increased risk of hospitalizations due to cerebrovascular in all persons and respiratory tract infections in persons aged less than 65 years during the study period.

Reducing PM 2.5 emissions would have specific benefits for children as well as adults. Specifically:

- Respiratory health problems in children: asthma incidence and prevalence would be reduced;
- Exacerbation of symptoms in children with asthma and health-care utilization for respiratory problems would be reduced;
- The decrease in lung growth and development would be reversed; and
- The increase in middle ear infections (otitis media) attributable specifically to wood smoke would be reversed.
Major Sources of PM 2.5 Emissions in Fairbanks

Fye et al. (2009) provides data on the major sources of PM 2.5 emissions in Fairbanks. On a year round basis, wildfires account for the majority of PM 2.5 emissions. But wildfires occur in the summer months and do not impact the winter PM 2.5 concentrations that contribute to the Borough’s non-attainment status.

Figure 5.15-21 (data for 2008) show that wood stoves from residential heating account for the largest percentage of FNSB winter PM 2.5 emissions. For this reason, studies on possibilities for air quality improvement in Fairbanks (see e.g., Davies et al. 2009; Fye et al. 2009) have examined options to replace wood stoves as part of a program designed to ensure NAAQS compliance. As part of the effort to replace wood stoves, consumers have been urged to improve air quality by choosing to burn dry, seasoned wood over green, unseasoned wood. Burning green wood is likely to generate more PM 2.5 material because it does not burn as completely or as hot as seasoned wood and users need to burn more to provide the same level of heating. The efficiency loss associated with burning green wood is described in a New York State Environmental Protection Bureau document (2008) as follows:

*Burned wet, damp, or green wood reduces the efficiency and heat output of any wood combustion device and increases particulate emissions. The energy that could be released in the form of heat is instead used to boil off the water content of the wood, which in freshly cut, green wood can be as much as fifty percent of the total weight. Thus, to generate the same amount of heat, more wood must be burned, increasing emissions of carbon dioxide – the most important pollutant responsible for global warming. In addition, when energy is expended to change water into steam, the temperature of the fire is decreased leading to incomplete combustion of the wood fuel. When that happens, increased amounts of unburned particulates will be emitted with the steam and combustion gases.*
Natural Gas Has Lower Emissions per Million BTUs

Studies on combustion emissions that contrast natural gas with other fuels show two clear results. First, natural gas emits lower amounts of nearly all pollutants than other fuels per unit of energy delivered. Table 5.15-39 provides data from the EPA and the Energy Information Administration (EIA) on the pounds of various air pollutants emitted per billion BTU of energy.

**TABLE 5.15-39 Pounds of Air Pollutants Produced per Billion BTU of Energy**

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Natural gas</th>
<th>Oil</th>
<th>Coal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon dioxide</td>
<td>117,000</td>
<td>164,000</td>
<td>208,000</td>
</tr>
<tr>
<td>Carbon monoxide</td>
<td>40</td>
<td>33</td>
<td>208</td>
</tr>
<tr>
<td>Nitrogen oxides</td>
<td>92</td>
<td>448</td>
<td>457</td>
</tr>
<tr>
<td>Sulfur dioxide</td>
<td>0.6</td>
<td>1,122</td>
<td>2,591</td>
</tr>
<tr>
<td>Particulates</td>
<td>7.0</td>
<td>84</td>
<td>2,744</td>
</tr>
<tr>
<td>Formaldehyde</td>
<td>0.750</td>
<td>0.220</td>
<td>0.221</td>
</tr>
<tr>
<td>Mercury</td>
<td>0.000</td>
<td>0.007</td>
<td>0.016</td>
</tr>
</tbody>
</table>

Notes:
No post combustion removal of pollutants. Bituminous coal burned in a spreader stoker is compared with No. 6 fuel oil burned in an oil-fires utility boiler and natural gas burned in uncontrolled residential gas burners. Conversion factors are: bituminous coal at 12,027 BTU per pound and 1.64 percent sulfur content; and No. 6 fuel oil at 6.287 million BTU per barrel and 1.03 percent sulfur content—derived from Energy Information Administration, Cost and Quality of Fuel for Electric Utility Plants (1996).
Source: DOE 1999 (Table 2, in EIA 1998).
As can be seen from the chart, natural gas emits significantly lower amounts of several pollutants per unit heat output.

The contrast is even sharper when wood stoves (Nacher et al. 2007) are included in the energy mix. Figure 5.15-22, for example, shows the average emissions as measured in pounds per million BTUs. Thus, in principle, replacement of other home heating systems with gas furnaces would reduce PM 2.5 emissions and those of other criteria pollutants. This strategy would not be successful if natural gas were already used extensively in Fairbanks. Data from Sierra Research (2010) performed for ADEC Projects (from a statistical sample) show that of 40,043 heating devices in the Fairbanks Non-attainment area, only 1,369 (3.4 percent) used natural gas heating. Therefore, assuming that the gas distribution system was expanded sufficiently, there is substantial opportunity to replace oil furnaces (52.8 percent of heating units) and wood (23 percent of heating units) heating systems.


FIGURE 5.15-22 Relative Emissions of Finer Particles by Source

51 Definitions of these devices are given in Fye et al. (2009). Among those unfamiliar to the average reader, a non-certified wood stove is a heating appliance capable of burning wood fuel or wood-derived biomass fuel. This generally consists of a solid metal closed fire chamber, a grate, an adjustable air control, and a stove pipe and chimney system manufactured prior to 1988 when the EPA started regulation of wood stoves. An EPA-certified wood stove is a heating appliance built after 1988 in conformity with the EPA performance standards designed to reduce PM emissions from the stove. A pellet stove is an interior wood burning stove that utilizes crushed wood known as pellets or biomass as the fuel source for combustion.
Studies on Compliance Alternatives

Two useful studies of possible compliance options for Fairbanks have been published (Davies et al. 2009; Fye et al. 2009). The Cold Climate Housing Research Center (CCHRC) [Davies et al. 2009] focused directly on residential heating sources of PM 2.5 in the FNSB. The Fye et al. (2009) study considered additional options. Both are useful studies that merit careful review by interested readers.

One of the useful exhibits prepared by Davies et al. (2009) is a summary of the residential and commercial emissions of PM 2.5 associated with heating, shown in Figure 5.15-23. Details of the models and assumptions are provided in Davies et al. (2009). As can be seen, natural gas heating emissions are very small compared to those for other heating sources. The majority of these emissions occur during the winter months when most heating demand occurs.

The Davies et al. (2009) study identifies numerous options for reducing these emissions. However, this study did not envision the availability of increased supplies of natural gas, such as would be supplied by the proposed Project (if a gas distribution system were added).

Source: Davies et al. 2009.

FIGURE 5.15-23 Comparison of Residential and Commercial PM 2.5 Emissions
These are not the only anthropogenic sources of PM 2.5 emissions. There are other point sources, such as power plants and mobile sources to be considered. Fye et al. (2009) considered these and other possible sources in another analysis of PM 2.5 compliance options. These investigators focused on options for regulating residential wood burning stoves and heavy-duty diesel emissions from trucks, buses, and heavy equipment.

Fye et al. (2009) offered the following rationale for excluding other PM 2.5 sources in their analysis:

*There are other potentially high sources of PM2.5 content in the Fairbanks area that could be targeted for reduction of emissions, but the necessary investment would not be justified based on the amount of PM2.5 removed and the timing of those emissions. For example: large producers, like local power plants, seem like they would be big contributors, but they already have strict EPA and federal guidelines on the waste they produce. Additionally, the majority of the waste output from the power plants is in the form of gas elements, such as NOx and SOx. Only 460 tons/year (TPY) of PM10 particulate matter is produced by local power plants out of a total of 27,299 TPY in the Fairbanks monitoring area. This equates to only 1.7% of the total PM10 output. Assuming a similar level of PM2.5 generation, it would not seem cost effective to enforce a regulation requiring retrofit of power plant equipment.*

*Wildfire is another high contributor to poor air quality, but this only occurs in the summer and does not impact the winter PM 2.5 level that contribute to the Boroughs [sic] non-attainment status.*

*Another area that was briefly evaluated was 2-stroke snowmobile PM 2.5 emissions and what could be done with these to improve the output from the engines. At only a third the total TPY that are produced by diesel engines, the 2-stroke recreational snowmobiles produced more PM 2.5 output than all heavy and light gasoline vehicles (11 TPY). Studies have been done using additives to the gasoline and oil mixture without much success. Some reduced emissions output results were identified with specially designed clean 2-stroke engines using both atomizing carburetors and catalytic converters, although this is an extremely pricey modification to retrofit on a snowmobile and these have not been widely implemented in new models being sold. Additional consideration [sic] that most people do not tend to ride or use recreational snowmobiles during extremely cold weather conditions indicated this line of research was not worth pursuing as a possible solution for 24-hour PM 2.5 emission levels when an inversion occurs.*

Fye et al. (2009) identified several options related to home heating including a public awareness program and voluntary burn ban, mandatory compliance during non-burn days during periods of extreme cold or stagnant air, change out programs, voluntary replacement tax credits, retrofit, decommissioning at time of sale of property as well as options to reduce PM 2.5 emissions from heavy-duty diesels. FNSB has implemented some options for home heating devices, including a removal, replacement, and repair program (DeHaven and Miller 2011).
Fye et al. (2009) did not consider any alternatives related to the substitution of natural gas for other fuels as the proposed Project was not a concrete proposal at that time.

Northern Economics (2012) recent analysis on the Fairbanks North Star Borough Gas Distribution System also estimates the decrease in criteria pollutants associated with converting from the status quo to natural gas (and propane). If conversion to natural gas for heating takes place in most of the Fairbanks North Star Borough the region will see PM2.5 emissions decrease from approximately 2,200 tons per year to less than 200 tons per year and lead to a significant reduction in NOx and SO2 emissions and would help to bring the region into attainment with ambient PM2.5 standards for air quality.

Fuel Cost Issues

Cost is one of the relevant issues to be considered in connection with attempts to shift the mix of fuels used for residential and commercial space heating. Whether heating units are retrofit to reduce emissions or replaced by units that burn another fuel, the homeowner or business has to pay for these change outs. Current residential estimates for converting to natural gas are as low as $1,000 to $1,500 to convert from oil to gas and as high as $12,000 to $20,000 for a boiler replacement, chimney upgrade (or replacement) and other hydronic (or forced air) connections (Northern Economics 2012). Various incentives, such as the Home Energy Rebate Program established by the Alaska legislature, have been proposed or enacted, but costs are still involved and, at present, lower cost gas has not been an option.

At present, the cost per million BTUs for various energy sources ranges from $12.32/MM BTU for white birch to $57.76 for electricity. Natural gas ($23.00/MM BTU) is more expensive than wood, coal ($16.67/MM BTU), or wood pellets ($21.16/MM BTU), but less costly than #2 fuel oil ($29.54) and HD5 propane ($44.38/MM BTU) (FNG 2011). So, provided the home or business has access to natural gas, it would be less costly than #2 fuel oil, propane, or electricity, but more expensive than wood, coal, or wood pellets. Furthermore, many homes or businesses do not have access to natural gas at present.

In contrast, the cost for natural gas in Anchorage is $8.85/MM BTU (this includes the cost of the natural gas and ENSTAR charges [ENSTAR 2011]). Indeed, ENSTAR estimates of the average monthly costs to heat a home in the Anchorage area are $127.37 for natural gas, $361.41 for #1 fuel oil, $523.02 for electricity, and $616.30 for propane. It is not surprising that natural gas is the choice for all housing units with access. Provided that customers in Fairbanks could be supplied natural gas at prices (even allowing for delivery and capital recovery charges for a distribution network) approaching those in Anchorage, there would be an economic incentive for Fairbanks residents and businesses to switch. Such an estimate is plausible. According to the ASAP Project Plan the estimated natural gas cost at Fairbanks would be $10.45/MM BTU, substantially less than the cost of energy from wood (AGDC 2011c).

The cost benefits could be substantial for many Fairbanks residents if the proposed Project were constructed and operated. For example, Sierra Research (2010) estimated that for all households equipped with central oil, the average annual oil consumption was 1,135 gallons. At an average price of $3.90/gallon the annual cost per equipped household would be 1,135...
gallons x $3.90/gallon = $4,426 per year (FNG 2011). Even at present natural gas prices of $23/MM BTU, the average annual price for households equipped with natural gas the annual cost (Sierra Research 2010) was $2,159. At a price of $10.45/MM BTU (Project Plan) the annual cost would be ($10.45/$23) x $2,159 = $980. Thus, households presently equipped with natural gas would save approximately $1,179/year (after taxes) and those equipped with oil would have an incentive of $4,426 - $980 = $3,446 (after taxes) annually to switch. Payback times for converting from oil to gas heat would be short.

A recent analysis on the costs associated with implementing a natural gas distribution network throughout the Fairbanks North Star Borough indicates that the system will represent a significant overall savings in annual fuel cost in the region as compared to the status quo. Northern Economics (2012) concludes that in 2021, the first full year of operations, the savings are approximately $315 million or a savings from the status quo of about 60 percent. The analysis concludes that the net present 2012 dollar value savings of converting is estimated at approximately 5.36 billion over a 50 year study period (2015-2065).

Benefits Revisited

Operation of the proposed Project (assuming a distribution system were constructed) would enable Fairbanks residents to switch fuels to natural gas from wood, coal, and oil and reduce PM 2.5 emissions and probably (depending upon Project transmission charges and local distribution charges) save money as well. Reduced PM 2.5 emissions would ease the problem of compliance with NAAQS and reduce costs associated with mortality and morbidity. And perhaps most importantly, it would impact the health of young children both in terms of acute health outcomes and potential risks for development of life threatening lung and heart diseases, plus reduce health care costs. Thus, operation of the proposed Project would result in substantial public health benefits as well as economic benefits to Fairbanks residents.

Substitution of natural gas for other fossil fuels and wood would also reduce emissions of other criteria pollutants, a collateral benefit.

The purpose and need section of the ASAP POD outlines other benefits of the system as well. These have not been quantified in this analysis.

Before presenting scores for reductions in PM 2.5 emissions (below) it is worthwhile mentioning one other relevant study. Although the EPA does not generally consider cost in setting NAAQS, it does periodically estimate the costs and benefits of EPA standards. One EPA study (2010b), The Benefits and Costs of the Clean Air Act, 1990 – 2020, is particularly noteworthy. This study compares the benefits and costs associated with the imposition of NAAQS. The costs of control and the benefits, chiefly those related to improvements in public health, are quantified in economic terms. The study notes that implementation of federal and regional control programs to meet the national particulate matter and ozone standards accounts for the majority of the compliance costs for those sources considered. But it also noted:
The most significant known human health effects from exposure to air pollution are associated with exposures to fine particulate matter and ground-level ozone pollution. [Emphasis added.]

Elsewhere this report states:

The particulate matter differences [with and without Clean Air Act standards] are worth emphasizing because reductions in fine particle exposures are responsible for the vast majority of the benefits which could be evaluated in economic terms for this study. [Material in brackets added for clarity.]

Thus, the EPA was most certain about the estimates of benefits and the magnitude of these benefits were largest for reductions in particulate matter reductions—a worthwhile perspective to keep in mind when reviewing the findings of this assessment.

The analysis presented above does not consider possible benefits that might result as a result of converting vehicles to natural gas.

**Scoring**

In interpreting the following the reader should bear in mind that the overall impact is positive. The methodology recommended for health impact analysis does not appear to be tailored with this in mind. Nonetheless, for consistency the risk assessment matrix given in Tables 5.15-3 and 5.15-4 is utilized. Scoring is based on the following judgments:

- Health effect score: Very high, 3 because the benefits would avoid mortality or morbidity;
- Duration: Very high, 3, long-term, 30 years;
- Magnitude: Very high, 3;
- Extent: High, 2, as the benefit would accrue to at least the residents of Fairbanks;
- Severity rating equals sum of scores: 11 from above calculations; and
- Likelihood rating: Very likely (+) 90-99%. Impact rating from Table 5.15-4 = Very high and positive impact on health and wellbeing in the Fairbanks area.

**Cumulative effects on subsistence**

Appendix L presents the ANILCA Section 810 Analysis of Subsistence Impacts. This analysis concludes that the direct effects of construction and operation of ASAP on subsistence would be minimal and that there is no foreseeable significant decrease in the abundance of harvestable resources and in the distribution of harvestable resources.
However, the analysis of cumulative effects results in a different conclusion:

The BLM has found in this ANILCA 810 Evaluation that the cumulative case in this EIS may significantly restrict subsistence uses.

Based on this finding BLM will take the following steps:

Therefore, the BLM will undertake the notice and hearing procedures required by the ANILCA Sec. 810 (a)(1) and (2) in conjunction with release of the Draft EIS in order to solicit public comment from the potentially affected communities and subsistence users.

Should the proposed action have a positive finding, the determination that the requirements of ANILCA §810 (a)(3)(A), (B), and (C) have been met will be analyzed in the Final ANILCA §819 Evaluation, and will be presented in the FEIS, and will include testimony and input from the communities in which subsistence hearings will be held.

Additional Perspectives on Cumulative Effects

As noted at the beginning of Section 5.15.1.2, cumulative effects include impacts from all past, present, and foreseeable future activities. Cumulative impacts are discussed in detail in Section 5.20 and a list of the past, present, and foreseeable future activities are provided in Table 5.20-1. Even if limited to health impacts alone discussion of the impacts associated with the activities in Table 5.20-1 could be very long indeed. Rather than provide an encyclopedic description of all these impacts, a short summary of the key points is provided.

First, as noted previously, measured against all the cumulative health effects from state and federal programs, other oil and gas activities, and other industrial developments, the incremental impacts of the proposed Project on public health would not likely be large. Put another way, whether or not this proposed Project goes forward would not materially affect the cumulative impacts of all other state, federal, and industrial developments. Further, residents of Fairbanks and Anchorage would benefit economically and in health terms as a result of this proposed Project. Moreover, various possible mitigation strategies for the proposed Project would have beneficial effects at the margin, but would not eliminate or materially reduce all cumulative impacts.

In the case that some proposed oil and gas or infrastructure improvement activities are concurrent with the construction phase of the Project, there would be the potential for the increased negative effects on public health from an influx of workers in localized areas. As shown in this section, these types of Projects require a public review process and permits through various agencies who would require mitigation of negative impacts and the Projects would be unlikely to have large impacts on public health.⁵²

⁵² A public comment suggested that the Foothills West Transportation Access Project as an example of another project that would bring a large number of workers into an area already being used for the proposed project. The Foothills project would create a permanent, all season road and pipeline corridor from the Dalton Highway near

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Second, Alaska Native health issues, impacts, and status are very important to consider. Although very important, this is not a new issue or one solely associated with oil and gas developments. Kraus and Buffler (1979), for example, address issues such as sociocultural stress, alcohol abuse, and suicide among Alaska Natives before significant oil developments or other activities included in the cumulative effects analysis.

Third, despite excellent programs by various agencies, the overall public health situation in Alaska can fairly be described as improving but mixed. The Report to Congress to the Interagency Access to Health Care in Alaska Task Force (Federal Task Force 2010) noted:

> The overall health status of Alaskans does not vary greatly from all Americans when one considers its younger age demographic. Alaskans annually report that they are in good or excellent health at a higher rate than the national average. The non-Native all-causes death rate is similar to the national average. There are significant differences, however. The 2005 life expectancy of 78.5 years is slightly more than the U.S. rate of 75.0. The health status of Alaskans is, however, characterized by high rates of unintentional causes of deaths (violent deaths due to injuries and homicide), rates of tobacco and alcohol use that are higher than the national average, a relatively high incidence of infectious diseases, and dramatic disparities in health between Alaska Natives and other Alaskans.

Nonetheless, Alaska does well on some traditional measures of health status. Alaska consistently has one of the lowest rates of low-birth-weight deliveries in the nation as well as an infant mortality rate and teen birth rate lower than the national rate. Mortality due to coronary heart disease is also lower than the U.S. rate. It is important to keep in mind Alaska’s unique demographics when comparing health status of Alaskans to those in other states. With its younger population and large Alaska Native population, the averages may conceal more than they explain.

Direct comparisons between Alaska Natives and non-Natives highlight troubling differences. For example, a 2009 report showed that significantly more non-Natives than Alaska Natives rated their health as very good or excellent. One uncommon difference between the two groups is that non-Natives have a higher rate of diabetes than Natives, the reverse of the pattern in every other state with sizable AIAN populations. However, the rate of the increase in the prevalence of diabetes among Alaska Natives is among the highest in the nation, for example, exceeding 200% between 1997 and 2007 in Norton Sound and Bristol Bay.

Galbraith Lake to Umiat. Details about the employment and construction seasons are unpublished. Public meetings have taken place, but no formal documents describing the employment related to the project are available from the Foothills EIS Website: (http://www.foothillswesteis.com/). Without this information it is difficult to make assumptions about how the proposed Project and the Foothills project would impact public health.
Some of the risk factors for poor health highlight lifestyle differences as well. For example, Alaska Natives are twice as likely to be current smokers (41%). Although Alaskans are less likely to report inactivity than the national average, obesity has increased by 64% for Alaska Natives from 1991-1992 figures.

There have been vast improvements over the past 30 years in the health of Alaskans, including Alaska Natives. Much of the improvement is in public health, with sanitation and clean drinking water being the most notable. However, there still remain over 100 villages without adequate drinking water and sanitation despite decades of leadership from the IHS (now provided through a tribal self-governance compact with the Alaska Native Tribal Health Consortium) and other state and Federal partners, and over a decade of service from the Denali Commission.

Although heart disease is the second leading cause of death for Alaska Native people, the Alaska Native heart disease death rate decreased by 43% between 1980 and 2007. Infant mortality is down by 50% for both groups since 1980 through 1983, but the Native rate is still double that of non-Natives. Mental health service is the second most common service offered after respiratory illness services at Alaska Native outpatient clinics.

Suicide has also received special attention in Alaska. Suicide is the 4th leading cause of death for Alaska Native people and the 10th leading cause of death for non-Natives. The suicide rate for Alaskan men is about 3 times that of women. Men aged 20-29 years had the highest suicide rate of any age group, male or female. During 2004-2007, the Alaska Native suicide death rate was 3.6 times greater than for U.S. non-Natives and 2.5 times greater than for Alaska non-Natives.

The state and the Alaska Native Health System have addressed the suicide issue with grant-funded programs as well as behavioral health programming. Unfortunately, as discussed elsewhere in this report, shortages across every level of the system leave large gaps in providers and programs.

Fourth, provision of health services in Alaska is quite expensive because of the relatively high cost of living, low population density, shortages of medical personnel, lack of infrastructure, and other factors (Federal Task Force 2010). At present, more than 50 percent of the state’s residents receive health care paid primarily by the Federal Government (Federal Task Force 2010). The Federal Government is very active in Alaska with large military installations and its support of health and social services to Alaska Natives. Federal government expenses are largely supported by taxpayers in other states, and Alaska ranks near the top annually in the ratio of federal expenditures in the state compared to federal taxes paid by state residents (Federal Task Force 2010). Health care is dependent on government and resource industries, since it provides service to residents whose jobs are created by government or the resource industry.
Fifth, the oil and gas industry (past, present, and future) has been a major driving force in Alaska's economy since TAPS became operational (see e.g., Goldsmith 2009 for an assessment of Alaska's economy if the oil & gas industry did not exist). Revenues from the oil and gas industry accrue to the State of Alaska, Native Corporations, and local government as well as firms in the oil industry. In turn, these revenues are used to fund public health and other government programs. A 2003 study of the Cumulative Effects of Alaska Oil Development by the National Academy of Sciences (NRC 2003) offered the following comments in connection with the Alaska North Slope:

The North Slope Borough, the Alaska Native Claims Settlement Act, and hence the Arctic Slope Regional Corporation were created as a result of the discovery and development of North Slope oil. Without it, they would not exist or, if they did, would bear little resemblance to their current form. Modern western culture, including oil development and the revenue stream it created, has resulted in major, important, and probably irreversible changes to the way of life in North Slope communities. The changes include improvements in schools, health care, housing, and other community services as well as increased rates of alcoholism, diabetes, and circulatory disease. There have been large changes in culture, diet, and the economic system. Many North Slope residents view many of these changes as positive. However, social and cultural shifts of this magnitude inevitably bear costs in social and individual pathology. These effects accumulate because they arise from several causes, and they interact. As adaptation occurs, the communities and the people who make them up interact in new and different ways with the causes of social change. The largest changes have occurred since the discovery of oil at Prudhoe Bay in 1968.

This study also noted that links between North Slope oil and gas activities and health impacts were not well understood (a situation that still exists today):

Human-health effects of oil and gas activities have not been well documented. Although some problems on the North Slope—increased use of alcohol and drugs, increased obesity, and other societal ills—are evident, it is not possible to say with the limited data available to what degree they are the direct result of oil and gas activities. Other concerns are widespread among Native residents of the North Slope. The degree to which increased financial resources related to oil have balanced adverse effects by improving the quality and accessibility of local medical care is unknown. These questions are in great need of additional reliable information.

The NPR-A Supplemental IAP/EIS quotes George Ahmaogak, former Mayor of the North Slope Borough as follows:

The benefits of oil development are clear — I don’t deny that for a moment. The negative impacts are more subtle. They’re also more widespread and more costly than most people realize. We know the human impacts of development are significant and long-term. So far, we’ve been left to deal with them on our own. They show up in our
health statistics, alcohol treatment programs, emergency service needs, police responses —— you name it.

Although as NRC notes, establishing links between oil and gas activities and cumulative impacts on health is difficult to do and many questions remain, it is fair to state that the impacts appear mixed. Having said this, it is relevant to consider what might happen to Alaska’s future if additional oil and gas development as envisioned in the Cumulative Effects Section 5.20 were not to occur. Presumably the federal contribution to the public health of Alaskans would continue as before, but with no new oil and gas Projects, revenues to the state and local governments as well as Native Corporations would decrease substantially over time. It is beyond the scope of this EIS to attempt to forecast how either state of local agencies would alter budgets allocated to public health initiatives, but it seems likely that these budgets would be adversely impacted by revenue shortfalls. Under these circumstances it is hard to imagine that things would revert to the status quo ante or that adverse health impacts would be lessened.

5.15.4.3 Denali National Park Route Variation

Under the Denali National Park Route Variation, the following PAC would be located in closer proximity to the proposed pipeline than under the proposed action: McKinley Park. The Denali National Park Route Variation would be located along the Parks Highway east of the McKinley Village area. This alternative is expected to result in similar effects to the HECs as the proposed action. The most substantial difference between the Denali National Park Route Variation and the mainline pipeline between MP 540 and MP 555 of the proposed action would be effects to the Food, Nutrition, and Subsistence HEC. As described in Section 5.14, types of potential construction (e.g., resource disturbance due to noise) and operation-related subsistence impacts would be similar as those described for the mainline. Subsistence-related impacts from the Denali National Park Route Variation would likely be less than the corresponding mainline route between MP 540 and MP 555 because the Denali National Park Route Variation would be immediately adjacent to the Parks Highway where noise and disturbance are already occurring. Any potential subsistence impacts from either the Denali National Park Route Variation or the mainline between MP 540 and MP 555 would be negligible to overall community subsistence use patterns in the area.

Because tourists frequent some of these areas during the summer, it is appropriate to adjust construction schedules to minimize conflicts.

5.15.5 Monitoring and Evaluation

Stipulation 1.8 addresses Surveillance and Monitoring which, among other things is designed to (a) Provide for and protect public health and safety and (b) Prevent and mitigate damage to natural resources. A conscientious program, including specifically air quality monitoring during both construction and operations phases is recommended.
5.15.6 References

ABVS. See Alaska Bureau of Vital Statistics.

ADCCED. See Alaska Department of Commerce, Community, and Economic Development.

ADEC. See Alaska Department of Environmental Conservation.

ADF&G. See Alaska Department of Fish and Game.

ADHSS. See Alaska Department of Health and Social Services.

ADOT&PF. See Alaska Department of Transportation & Public Facilities.

AGDC. See Alaska Gasline Development Corporation.


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EPA. See U.S. Environmental Protection Agency.


FNG. See Fairbanks Natural Gas, LLC.


NAS. See National Academy of Sciences.


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NCADV. See National Coalition Against Domestic Violence.


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NRC. See National Research Council.


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SSDAN. See Social Science Data Analysis Network.


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USACE. See U.S. Army Corps of Engineers.


WHO. See World Health Organization.


5.15.6.1 Personal Communications
