Susitna-Watana Hydroelectric Project
(FERC No. 14241)

Health Impact Assessment Study
Study Plan Section 15.8

Initial Study Report
Part A: Sections 1-6, 8-10

Prepared for

Alaska Energy Authority

SUSITNA-WATANA HYDRO

Clean, reliable energy for the next 100 years.

Prepared by

NewFields

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Abbreviation	Definition
ABVS	Alaska Bureau of Vital Statistics
ACR	Alaska Cancer Registry
ADEC	Alaska Department of Environmental Conservation
ADF&G	State of Alaska, Department of Fish and Game
ADHSS	Alaska Department of Health and Social Services
ADHSS BRFSS	Alaska Department of Health and Social Services Behavioral Risk Factor Surveillance System
ADHSS SOE	Alaska Department of Health and Social Services, Section of Epidemiology
ADNR	Alaska Department of Natural Resources
AEA	Alaska Energy Authority
AFN	Alaska Federation of Natives
Ahtna	Ahtna, Incorporated
AI/AN	American Indian and Alaska Native
AMAP	Arctic monitoring and assessment program
ANC	Alaska Native Corporations
ANMC	Alaska Native Medical Center
ANTHC	Alaska Native Tribal Health Consortium
ATR	Alaska Trauma Registry
CAC	Chugach Alaska Corporation
CFR	Code of Federal Regulations
CHA	community health aides
COPD	chronic obstructive pulmonary disease
CIRI	Cook Inlet Region, Inc.
CT	chlamydia trachomatis
DHC	Dena'ina Health Clinic

Abbreviation	Definition
DHSS	Alaska Department of Health and Human Service
EPA	U.S. Environmental Protection Agency
FERC	Federal Energy Regulatory Commission
FASDs	fetal alcohol spectrum disorders
FMD	Fishery Management Plan
GC	gonococcal infection
HEC	Health Effects Categories
HIA	Health Impact Assessment
Hib	Haemophilis Influenza, type B
HIV	human immunodeficiency virus
HMP	Health Management Plan
ILP	Integrated Licensing Process
ISR	Initial Study Report
KIT	Kenaitze Indian Tribe
LTBI	latent TB infection
LRIs	Lower Respiratory Infections
MMR	measles-mumps-rubella
NCHS	National Center for Health Statistics
PAC	potentially affected communities
PID	pelvic inflammatory disease
PWS	Public Water Systems
RSP	Revised Study Plan
RSV	Respiratory Syncytial Virus
RTA	road traffic accident
SDH	Social Determinants of Health

Abbreviation	Definition
SDWA	Federal Safe Drinking Water Act
SIDS	sudden infant death syndrome
SPD	study plan determination
STI	Sexually Transmitted Infections
TB	tuberculosis
TLK	traditional and local knowledge
VOC	volatile organic compounds
VPSO	village public safety officers
WHO	World Health Organization

1. INTRODUCTION

On December 14, 2012, Alaska Energy Authority (AEA) filed with the Federal Energy Regulatory Commission (FERC) its Revised Study Plan (RSP) for the Susitna-Watana Hydroelectric Project No. 14241 (Project), which included 58 individual study plans (AEA 2012). Section 15.8 of the RSP described the Health Impact Assessment Study. This study focuses on analyzing the potential positive and negative impacts of programs, projects, and policies on the health of residents in impacted communities. RSP Section 15.8 provided goals, objectives, and proposed methods for data collection regarding health impacts.

On February 1, 2013, FERC staff issued its study plan determination (February 1 SPD) for 44 of the 58 studies, approving 31 studies as filed and 13 with modifications. RSP Section 15.8 was one of the 31 studies approved with no modifications.

Following the first study season, FERC's regulations for the Integrated Licensing Process (ILP) require AEA to "prepare and file with the Commission an initial study report describing its overall progress in implementing the study plan and schedule and the data collected, including an explanation of any variance from the study plan and schedule." (18 CFR 5.15(c)(1)) This Initial Study Report (ISR) on the Health Impact Assessment Study has been prepared in accordance with FERC's ILP regulations and details AEA's status in implementing the study, as set forth in the RSP as approved by FERC's February 1 SPD (referred to herein as the "Study Plan").

2. STUDY OBJECTIVES

Health Impact Assessment (HIA) is a structured planning and decision-making process for analyzing the potential positive and negative impacts of programs, projects, and policies on the health of residents in impacted communities. This Study Plan uses the methods and guidelines in the Alaska Department of Health and Human Service's (DHSS's) "Technical Guidance for HIA in Alaska," July 2011 (www.epi.hss.state.ak.us/hia/AlaskaHIAToolkit.pdf).

As set forth in the Study Plan (RSP Section 15.8.1.1), the goals and objectives of the HIA include the following activities:

- Identify potentially affected communities (PACs) and establish a community engagement plan (where relevant).
- Through a review of the FERC scoping meetings and ongoing community engagement, identify public issues and concerns about how community health might be affected during construction and operation of the Project.
- Collect baseline health data at the state level, borough, or census area level, tribal level, and at the potentially affected community level, as possible.
- Identify data gaps and determine the most efficient method to fill those gaps, through community consultation and coordination with other studies, such as the Subsistence Resources Study (Study 14.5), Regional Economic Evaluation Study (Study 15.5), Social Conditions and Public Goods and Services Study (Study 15.6), and Recreation Resources Study (Study 12.5).

- Evaluate the baseline data against the Project description to initially determine the nature and extent of potential impact pathways, both positive and negative.
- Prepare an HIA baseline data report document which is transparent, scientifically rigorous, and understandable to the public.

3. STUDY AREA

The HIA study area, established by the Study Plan (RSP Section 15.8.3) includes those communities potentially affected by construction and operation of the Project, such as Cantwell and communities along the Alaska Railroad corridor, as well as those communities further away but potentially affected by the movement of workers, materials, and supplies by using the criteria available in the Technical Guidance for HIA in Alaska (DHSS 2011). The study would also include communities identified in the Regional Economic Evaluation Study (Study 15.5) and Air Quality Study (Study 15.9) that would experience changes in emissions resulting from reductions in fossil-fuel utility plant outputs as a result of the Project. In addition to the communities along transportation corridors and those identified in these other studies, the HIA study will initially consider all the communities being studied in the Subsistence Resources Study (Study 14.5). Together, all these communities have been initially identified as PACs for the Project analysis to help facilitate collecting baseline information that could be used in the analysis of Project effects. Some sample analysis factors that could be used to evaluate a community's possible nexus to the Project effects the following criteria are examined:

- Close geographic proximity to the Project,
- High likelihood for worker influx,
- Intense work force recruitment potential,
- High likelihood for change in key subsistence resources,
- High likelihood for change in transportation infrastructure,
- Potential for economic change including regional staging centers, and
- Existing high level of exposure to an environmental hazard that would be potentially exacerbated or improved by Project development.

4. METHODS AND VARIANCES IN 2013

As reflected in the study objectives, HIA is a preventive health tool that anticipates the human health impacts of new or existing development projects, programs, or policies. The overall goal of HIA is to minimize potential negative health effects while maximizing the health benefits of an action. The hallmark of a comprehensive HIA is the collection of new data, in order to address critical data gaps that have been identified during the scoping process. The HIA includes extensive stakeholder engagement. In accordance with the Study Plan, the study team initiated work on the HIA during the 2013 study season, as described below.

4.1. Project Overview and Issues Summary

In 2013, the study team developed the Project overview and issues summary as provided in the Study Plan (RSP Section 15.8.4.1) with no variances. In preparing the summary, the study team:

- Developed Project-specific criteria for establishing the PAC's analysis framework (PACs for health may not be the same as for other social sciences and must be established);
- Coordinated through community engagement, other social study areas, and other AEA licensing participant engagement programs to gather enough of the appropriate information to meet HIA needs; and,
- Identified potential health concerns and issues related to the Project.

The result of this effort has been incorporated into this ISR, in Section 5.1 below. The report generally follows the overall strategies and methodologies presented in the "Technical Guidance for HIA in Alaska."

4.1.1. Variances

In 2013, there were no variances in implementing the methodologies in the Study Plan (RSP Section 15.8.4.1) for developing the Project Overview and Issues Summary.

4.2. Phase 2: Baseline Data Collection

In 2013, the study team initiated baseline data collection as provided in the Study Plan (RSP Section 15.8.4.1) with no variances.

Following the completion of the Project overview and issues process, an analysis of available federal/state/regional/tribal/community/household level health data was initiated during the 2013 study season. Because the Study Plan contemplates that data collected by other licensing studies will be used in this analysis, the collection of baseline data is an ongoing process as data from these other studies become available, and the Study Plan expressly provides for the collection of baseline data over multiple years (see RSP Sections 15.8.6, 15.8.6). For example, the study team is using information from the Air Quality Study (Study 15.9) concerning existing and future air quality levels, and from the socioeconomic studies (Studies 15.5 and 15.6) for population projections and household characteristics, which have been shown to be key determinants of health. Coordination between studies avoids unnecessary duplication of effort and community 'survey fatigue.'

The output of the baseline data review to date, data gaps analysis, and field studies appears in Section 5.2, below, "Baseline Community Health Data Assessment." The information presented in Section 5.2 will be expanded upon based on continued baseline data collection efforts in the next study season and included in the Updated Study Report (USR).

4.2.1. Variances

In 2013, there were no variances in implementing the methodologies in the Study Plan (RSP Section 15.8.4.2) for collecting and analyzing baseline data.

5. RESULTS

The initial results associated with development of the HIA are presented below. Section 5.1 presents the "Project Overview and Issues Summary" required under the Study Plan (RSP Section 15.8.4.1), and an initial "Baseline Community Health Data Assessment," prepared from the baseline information collected to date (RSP Section 15.8.4.2), appears in Section 5.2.

Described within these Section 5 results, PACs are identified according to each HEC with underlying assumptions describing the potential impacts. The HIA will evaluate and consider communities identified in the interdependent studies as potential PACs. Figure 5-1 indicates all communities that may reflect potential impacts from a health perspective. Each community and population is further analyzed according to potential risk.

5.1. Project Overview and Issues Summary

This Project Overview and Issues Summary presents a generalized set of the geographical, time scale, and population boundaries of the HIA. This report, which generally follows the overall strategies and methodologies presented in the "Technical Guidance for HIA in Alaska," describes the following eight HECs used to categorize the issues and concerns:

1. Social Determinants of Health (SDH),
2. Accidents and Injuries,
3. Exposure to Potentially Hazardous Materials,
4. Food, Nutrition, and Subsistence Activity,
5. Infectious Disease,
6. Water and Sanitation,
7. Non-communicable and Chronic Diseases, and
8. Health Services Infrastructure and Capacity.

5.1.1. HEC 1: Social Determinants of Health

It is widely accepted that human health is strongly influenced by a constellation of factors such as educational opportunity, family dynamics, income and employment. Social and health scientists often refer to these factors as "determinants" because their influence on health is so strong. Many determinants are strongly influenced by individual factors such as genetics, lifestyle choices and personal circumstances. Based on large project experience in Alaska, the State HIA guidance has identified a suite of specific determinants that should be considered:

- Psychosocial issues related to drugs and alcohol
- Teenage pregnancy
- Family stress

- Domestic violence
- Depression and anxiety
- Isolation
- Work rotations and hiring practices
- Cultural change
- Economy, employment and education

Typically, these impacts may occur with in-migration of job seekers and workers, economic changes, project workforce management and mixing of cultural practices/ethnic groups during construction. The causal relationship between a project and SDH for any given individual is very complex, but some level of causality can be predicted for subgroups within a community that share certain individual traits.

5.1.1.1. Cultural Change

Some of the most challenging health issues for Alaskans are social and cultural changes that produce psychological distress resulting in adverse health behaviors (especially substance abuse and addictive behaviors) followed by depression and, in some cases, suicide. Psychosocial impacts are complex and involve a constellation of choices and causal factors. There may be instances when a project feature potentially exacerbates or ameliorates a psychosocial issue and the associated health outcomes. The most common negative examples are community fear that a project will affect their subsistence foods or the fear of environmental catastrophe. Conversely, improvements and stability in employment opportunities and income can have substantial positive impacts on family dynamics and cultural stability.

A portion of the Subsistence Resources Study (Study 14.5) program included traditional and local knowledge (TLK) workshops. Criteria for the TLK research are based on "consideration of the likelihood that the community has knowledge about the Project area (proximity of community or use area to the Susitna River watershed), as well as consideration of the presence of long-term knowledge held by at least a portion of the community (Alaska Native population or affiliation of a federally recognized tribe)." Inclusion criteria for investigating TLK requires:

- "Communities to be within the Susitna River watershed, or
- The study community's use area is located within the Susitna River watershed; and at least 50 percent of the community is Alaska Native, or is a federally recognized tribe is affiliated with the community."

These communities include:

- Cantwell
- Chickaloon
- Chitina
- Copper Center
- Eklutna
- Gakona
- Gulkana

- Tyonek
- Knik

The focus of TLK research is focused on beliefs related to potential project impacts in these communities. The HIA team is collecting specific information regarding community health beliefs and cultural healing/medicinal practices through focused key informant health interviews in a suite of potentially impacted communities. This work is being performed as an adjunct to the data collected during TLK workshops. The HIA team is coordinating with the subsistence resources and TLK study efforts.

5.1.1.2. Potential In-Migration

The influx of job seekers and workers can potentially trigger a shift away from traditional lifestyles leading to changes in family and community cohesion. Potential changes are complex and multi-factorial and include both positive and negative effects.

Many potential SDH impacts are tied to economic drivers. For example, in-migration of job seekers and worker family members may result in pressure on housing supplies and prices. Impacts can be mixed as rent-seeking activity may increase among existing owners and new income streams may be captured. Increases in income from employment can potentially trigger positive and negative behavioral changes at the household level, e.g., increased alcohol, and tobacco. Conversely, improved incomes in the hands of locally sourced workers may increase beneficial local trade store and home improvement spending. In addition, increased income can lead to improved access to health services that may facilitate an overall improvement in health status. Increased purchasing power at both the community and household level could potentially trigger investments in water and sanitation services and facilities.

Although the Project labor and employment plan is currently unknown, these communities have the potential to become labor resources for the Project and are included as PACs because of their close proximity to the Project area and proximity to transportation modes accessing the Project area:

- Willow (Railbelt & proximity to Project area)
- Chase (Railbelt)
- Healy (transportation route)
- Trapper Creek (transportation route & close proximity to Project area)
- Gold Creek (Railbelt & laydown yard)
- Cantwell (transportation route and potential work camp)
- Talkeetna (Railbelt & potential work camp)
- Chulitna (Railbelt)

Communities that are potential labor resources and potential targets for in-migration due to potential port locations are:

- Seward
- Anchorage

- Port MacKenzie
- Whittier/Portage

Other communities that are included in other Project studies such as Subsistence, etc., may also become labor resources for the Project and will be evaluated once the Project labor plans are fully known. In addition, communities that are not within the Project area along with the lower 48 states may also be targets for labor resources but are not considered as PACs for the Project.

During the ESHIA study periods, temporary labor camps are located at:

- Talkeetna
- Curry Camp
- Gold Creek
- Stephan Lake
- Spike Camps (Several temporary camps located along the Susitna River in various locations)

During Project construction, work camps will be present, potentially at Cantwell, but exact locations are not known. Management practices for work camps and the potential for interaction between workers and community members may generate health impacts.

5.1.2. HEC2: Accidents and Injuries

HEC 2 includes impacts related to both fatal and non-fatal injury patterns for individuals and communities. Road traffic accident (RTA) impacts are most likely to occur during peak construction when the highest volume and frequency of transport of workers, supplies, and heavy equipment utilization will occur. Communities and populations are potentially at increased risk for accidents and injuries due to:

- Influx of non-resident personnel (increased traffic on roadways, rivers, air corridors)
- Increased travel distances required for successful subsistence
- Increases vehicles and heavy equipment on transportation routes due to project transport requirements
- Project-related income and revenue potentially used for improved infrastructure and improved subsistence equipment/technology.

Three potential alternatives for road access and transmission lines have been identified for the Project; however, AEA has not decided which route(s) will be part of its license application to be filed with FERC.

It is expected that bulk materials (cement, fuel, reinforcing steel, etc.) and manufactured materials (transformers, power plants, etc.) for the dam will arrive in-state at one of four potential ports in south central Alaska and transported to the project site by rail. The four potential ports of entry include: the Ports of Whittier and Seward in the Valdez Cordova Census Area; the Port of Anchorage (MOA) and Port MacKenzie in the Mat-Su borough. The Ports of Seward and Whittier as well as the Port of Anchorage have intermodal connections via rail and road. Port MacKenzie is connected by road; however, expansion of rail service to connect the

port to the Alaska Railroad system is currently under construction and should be completed in 2016. As design progress and selection of a port of entry for materials is identified, the suite of PACs may change.

The three potential transportation corridors are:

- "Denali" – North-south corridor. Pathway of transport of materials from Fairbanks to Cantwell via Parks highway or Railroad; continuing from Cantwell to dam site via roughly 20 miles along the Denali Highway and on to a newly built road which runs due south for a distance of approximately 44 miles with a maximum elevation of approximately 4,100 ft. msl.
- "Chulitna" – East-west corridor. Pathway of transport of materials from Anchorage to Chulitna via railroad; continuing from Chulitna siding area to dam site via new gravel corridor along north side of Susitna River. The new road would run approximately 45 miles with a maximum elevation of approximately 3,250 ft. msl.
- "Gold Creek" – East-west corridor. Pathway of transport of materials from Anchorage (or other port) to Gold Creek via railroad; continuing from Gold Creek to dam via newly created gravel road along the south bank of Susitna River. The new road would be approximately 50 miles long with a maximum elevation of 3,500 ft. msl.
- Where possible, transmission lines will be co-located with the road access. A second transmission line is likely to provide duplicity and security for the Railbelt's Intertie.

Potential accidents and injuries related to vehicle operation from transport of Project materials on potential road and railways include:

- Willow (Road & Rail)
- Talkeetna (Rail)
- Gold Creek (Rail)
- Hurricane (Road)
- Trapper Creed (Road)
- Healy (Road – only if Fairbanks transport route is used by the Project)
- Seward (Rail)
- Anchorage (Rail)
- Chase (Rail)
- Chulitna (Rail)
- Cantwell (Road & Rail)
- Railbelt corridor
- Houston (Road & Rail)
- Wasilla (Road & Rail)
- Port Mackenzie (Road & Rail)
- Whittier/Portage (Rail)

Accidents and injuries related to changing distance of travel required for successful subsistence (increased ATV and boating accidents) include communities with potential subsistence use areas within the Susitna Watershed:

- Healy
- Trapper Creek
- Gold Creek
- Petersville
- Eklutna
- Gulkana
- Cantwell
- Talkeetna
- Chulitna
- Susitna
- Chickaloon
- Gakona
- Willow
- Chase
- Hurricane
- Wasilla
- Glenallen
- Paxson

- Copper Center
- Chilitna
- Tosina
- McCarthy
- Kenny Lake

The extent of subsistence use within these areas will be obtained with Subsistence Resources Study (Study 14.5) results.

Potential increases in alcohol use and substance abuse are also related to increased accidents and injuries, and include these communities that are potential work camp sites:

- Talkeetna
- Gold Creek
- Chulitna
- Cantwell
- Temporary construction camp locations

RTA risk throughout the summer will be driven by the high volume of tourism traffic (including recreational vehicles, buses, motorcycles, etc.) that typically occurs at this time throughout the state. During the winter, road conditions can be quite treacherous and Caribou crossings are at their highest.

5.1.3. HEC3: Exposure to Potentially Hazardous Materials

Exposure to Potentially Hazardous Materials includes Project emissions and discharges that lead to potential exposure. Exposure pathways can include:

- Food - Quality changes in subsistence foods
- Drinking water
- Air - Respiratory exposures to fugitive dusts, criteria pollutants, volatile organic compounds (VOCs), and other substances
- Indirect pathways, such as changing heating fuels/energy production fuels in communities.

In general, potential exposure pathways are through food, drinking water, work, air, refuse or debris by-products, as well as indirect pathways. Specific populations are potentially at risk due to potential increased mercury in fish, accidental release of potentially hazardous materials, and impacts to air quality.

Reservoir construction has the potential to lead to increased levels of mercury in fish through release of inorganic mercury from flooded vegetation and soils (e.g. Montgomery et al. 2000; Schetagne et al. 2000; Mailman et al. 2006). This issue is being investigated in the Mercury Assessment and Potential for Bioaccumulation Study (Study 5.7). Communities that may consume fish from the study area will be identified using data from the Subsistence Resources Study.

Depending upon the transportation route selected, potential exposure to (PM_{10}, $PM_{2.5}$) through diesel exhaust and roadway dusts from trucking/transportation of Project materials along transportation corridors:

- Willow (Road & Rail)
- Talkeetna (Rail)
- Gold Creek (Rail)
- Hurricane (Road)
- Trapper Creed (Road)
- Healy (Road – only if Fairbanks transport route is used by the Project)
- Port Mackenzie (Road & Rail)
- Anchorage (Rail)
- Chase (Rail)
- Chulitna (Rail)
- Cantwell (Road & Rail)
- Railbelt corridor
- Wasilla (Road & Rail)
- Houston (Road & Rail)
- Seward (Rail)
- Whittier/Portage (Rail)

Potential exposure to inadequate disposal of refuse and/or incineration ash and other Project related waste materials could potentially be a concern at work camp located in:

- Cantwell (Denali corridor)
- Gold Creek (Gold Creek Corridor)
- Chulitna (Chulitna corridor)
- Talkeetna

Improvements in air quality can occur in all populations that currently rely on fossil fuels, and that will become recipients of the energy produced by the Project.

5.1.4. HEC4: Food, Nutrition, and Subsistence Activity

HEC4 considers a project's potential impact on diet and food security. For example, project-driven landscape changes and associated infrastructure may affect the availability of subsistence resources via changes to habitat utilization, and fish and wildlife migration routes. Changes in wildlife habitat, hunting patterns, and food choices may influence the diet and cultural practices of local communities. Because many rural Alaskans rely on mixed cash and subsistence economy, impacts on important subsistence species can affect food security.

In addition to direct impacts, indirect project impacts to subsistence resources may occur as a result of population influx from project workers, job seekers and/or extended family members. For example, workers housed in open camps (where this is the case) may compete with community members for subsistence resources via recreational hunting and fishing during time off. Similarly, project-driven increases in total residential population (job seekers and extended families) can facilitate competition for subsistence resources. The influx of extended family (more mouths to feed) may result in shift from a mixed cash/subsistence based economy to one that is predominantly cash based. A shift away from subsistence-based diet can lead to the purchase and consumption of store-bought processed foods. On the positive side, increased income may facilitate greater purchasing power, improved efficiency of subsistence activities (snowmobile purchases, better rifles, etc.) and therefore, improved food security.

Here, subsistence impacts could occur with disruption of wildlife migration pathways due to Project-driven landscape change associated with civil engineering changes associated with construction activities. Impacts may also occur cumulatively over time as the watershed undergoes ecological transformation. These issues are being investigated in a series of terrestrial and botanical resources (Studies 10.5 through 11.9).

Camp catering services, food handlers, and food supply chain are important sources of potential positive and negative impacts to the local population. Food inflation can be triggered by a project's efforts to "buy or source locally"; conversely, local supplying can be a positive source of income. Food handler/catering issues are extremely important, and a camp catered food-borne infectious disease outbreak can rapidly spread from food handlers to camp residents and then to distant communities via rotating staff. Similarly, rotating local employees, can "import" local foods into the camp environment with potential adverse consequences. Here, the Project catering plan, when available, will be evaluated to determine potential community related nutrition impacts.

Nutritional impacts mediated by dietary choices would occur on a cumulative timescale, while an outbreak of foodborne illness spreading to the community would be felt more acutely.

HEC 4 relies upon the Subsistence Resources Study (Study 14.5) and nutritional surveys and considers:

- Effect on diet: how changes in habitat, hunting patterns, and food choices will influence the diet of and cultural practices of local communities, and
- Effect on food security: 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.

Potentially affected communities from a nutrition perspective fall within the criteria developed by the Subsistence Resources team. Criteria for inclusion require:

- The community be located within the Susitna River watershed, or
- Located outside the Susitna River watershed but previously documented subsistence use areas that extend into the watershed, or
- A community preliminarily identified by ADF&G as requiring updated harvest information.

There are 12 communities, noted in Table 5.5-1, for which there is no household level field work planned by the Subsistence Resources Study (Study 14.5) because existing data is sufficient from their (subsistence) perspective. However, these 12 communities constitute a data gap from an HIA perspective because no data currently exists to determine food security, consumption, and caloric intake. These data are needed to evaluate impacts to nutrition status. If data gaps are identified following a review of the Subsistence Study results, the food consumption portion of the ADF&G survey may be conducted in these communities by the AEA HIA team.

Changes in wildlife habitat, hunting patterns, and food choices may influence subsistence and dietary choices. Data gaps exist with respect to location of hunting and fishing areas, type and

number of animals harvested, and origin of hunters with use in watershed areas – these data will be obtained from Harvest data, Subsistence Study, and Wildlife Habitat Mapping Study. These PACs have previously documented subsistence use areas within the watershed:

- Healy
- Chickaloon
- Gakona
- Tonsina
- Lake Louise
- Cantwell
- Glenallen
- Paxson
- Kenny Lake
- Skwentna
- Eklutna
- Gulkana
- Copper Center
- McCarthy

PACs without use data (but may use watershed for subsistence) include:

- Susitna
- Willow
- Wasilla
- Talkeetna
- Trapper Creek
- Willow Creek
- Chase
- Petersville
- Chulitna
- Hurricane
- Palmer
- Tazlina
- Nelchina
- Tolsana
- Copperville
- Silver Springs

5.1.5. HEC5: Infectious Disease

HEC5 considers a project's potential for influence on patterns of infectious diseases. Pathways include:

- Influx of personnel
- Crowded or enclosed living and working conditions that may increase:
    - Respiratory infections, including TB
    - Skin infections
    - Ecto-parasite related conditions
- Mixing populations with low and high prevalence Sexually Transmitted Infections (STIs) due to in-migration and commercial trade can create an increased risk for transmission of syphilis, HIV, chlamydia, and gonorrhea

Overcrowding in community homes to due influx of extended family can lead to an increase in prevalence of respiratory infections such as influenza and TB. Vaccination coverage is often incomplete in under populated rural settings, which can potentially lead to outbreaks of measles, chicken pox, etc.

In 2007-08, the top Reportable Infectious diseases in Alaska were chlamydia, gonorrhea, hepatitis C, pneumococcal pneumonia, and tuberculosis. Project-related in-migration into port facilities, communities that will become construction camp locations, and communities that become targets for job seekers can influence changes in the distribution of communicable infectious diseases.

Other considerations for Project-driven impacts on patterns of infectious disease include impacts on wildlife hosts of zoonotic disease. For example, the improper disposal of kitchen wastes could

leads to congregation of canid hosts (e.g. red fox), facilitating outbreaks of rabies. This situation has occurred with a large resource development project in Alaska (Ballard et al. 2001) and presents a potential danger to Project workers as well as community residents.

Communities where HEC 5 impacts may occur will be evaluated once identified. Timescale and geographical impacts are dependent upon incubation periods of disease, worker rotation schedule, workers' place of residence, and behavioral choices.

5.1.6. HEC6: Water and Sanitation

HEC6 includes changes to access, quality and quantity of water supplies. Adequate provision of water and sanitation services is a critical public health infrastructure. Water and sanitation related adverse health concerns for a project are largely related to community influx. For example, population increases can lead to an overburdening of existing services and systems, generating increases in water and fecal/oral related illnesses.

Potential 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.
- Increased demand on water and sanitation infrastructure secondary to influx of non-resident workers.
- Revenue from the project that supports construction and improved maintenance of water and sanitation facilities.

Communities and populations potentially affected by water and sanitation related changes due largely to community in-migration and stress on existing infrastructure are those listed in Section 5.1.1.2.

Communities and populations who may experience changes to water supply and systems along the Susitna River and Railbelt are:

- Chulitna
- Chase
- Talkeetna
- Trapper Creek
- Susitna

Impacts can occur cumulatively if there is sustained population growth.

5.1.7. HEC7: Non-communicable and Chronic Disease

HEC7 considers how a project might change patterns of chronic diseases. 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 air 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.

Negative changes in exercise and dietary habits are associated with increases in non-communicable and chronic disease, particularly diabetes and cardiovascular diseases. It has been observed at many industrial locations that workers often experience significant changes in weight, i.e., rapid weight gain. There is potential that changes in diet from life in work camps may result in adverse health outcomes (i.e. weight gain, cardiovascular disease, diabetes, etc.). A shift from high physical activity to sedentary lifestyles may contribute to increased obesity rates, cardiovascular disease rates and diabetes rates. Increased wages may lead to increased expenditure on processed foods versus subsistence products. Chronic diseases such as hypertension and diabetes were consistently cited as one of the most important health issues during the community observation interviews. Improvements in air quality may lessen the burden of chronic obstructive pulmonary disease (COPD) over time, particularly in areas where baseline air quality is poor.

Using information from the Subsistence Resources Study (Study 14.5) and updated Project description information (i.e. location of camps and employment), HEC 7 PACs will be designated based upon their potential to experience:

- Changes in diet related to subsistence resources that may indirectly affect incidence of chronic conditions.
- Shifts away from traditional lifestyle, life in work camps, and decreases in physical activity that may potentially affect the communities with use areas within the Susitna watershed.
- Construction personnel who reside in work camps are at risk for developing weight fluctuations while on and off rotation that can lead to non-communicable diseases.

HEC 7 impacts are generally cumulative, occurring over both construction and operations and impact PACs wherever locally sourced employees may be procured.

5.1.8. HEC8: Health Services Infrastructure and Capacity

HEC8 considers how a project may influence health services, infrastructure and capacity. Pathways include:

- Increased revenues used to support or bolster local/regional services and infrastructure
- Increased demands on infrastructure and services by in-migration or residents injured on the job, especially during construction phases
- Increased roadway accidents and injuries that can overwhelm local fragile medical emergency response systems

Increased revenue can be used to support or bolster local/regional services and infrastructure, and may potentially affect these communities that currently support health facilities:

- Cantwell
- Healy
- Chulitna
- Gold Creek
- Talkeetna

Increased demands on health infrastructure and services by incoming non-resident workers or residents, especially during construction phases may potentially affect these communities:

- Fairbanks
- Wasilla
- Anchorage
- Talkeetna
- Cantwell
- Chulitna
- Gold Creek

Increased demand on emergency response services will become a potential impact along transportation routes that are listed in Section 5.1.2, Accidents and Injuries.

5.2. Baseline Health Conditions

5.2.1. HEC 1: Social Determinants of Health

Both health outcome and determinant data are used to establish baseline health status for HEC1. An outcome is a health event that has actually occurred, while a determinant is a "setting" or context that strongly influences health status.

Life expectancy, maternal and child health, intimate partner violence and sexual violence, oral (dental) health, suicide rates, and substance dependence are health outcomes used as general indicators of physical and social wellness. Family structure, economic status, educational attainment, family stability, and cultural continuity are health determinants that are associated with positive and negative health outcomes. Regional information is compared to information for all Alaska Natives, Alaskans statewide, and to the U.S. population, where possible.

5.2.1.1. Life Expectancy

Life expectancy data give some indication of the overall health of a population. Current information on life expectancy at birth is unavailable for residents of the individual PACs, but is available for Alaska. Based on year 2000 population data, the life expectancy at birth for the State of Alaska is 74.9 years for males and 79.7 years for females. Overall total US data are similar, 74.0 years for males and 79.4 years for females (ADOLWD 2009). Consistent with global life expectancy trends, Alaska has seen an increase in life expectancy since 1950; however, both Alaska and the rest of the U.S. have seen a slower rate of increase in life

expectancy than has been experienced by the 10 nations with the best life expectancy during this same time period (Kulkarni et al. 2011). Life expectancy for Alaskans in 2007 increased slightly to 75.9 years for males and 80.5 years for females. This was similar to the increase in the entire U.S. population (to 75.6 for males and 80.8 for females) (Kulkarni et al. 2011).

Life expectancy at birth for Alaska Natives was 67.2 years for males and 73.7 years for females in 2000 (IHS 2011). During the decade 1999–2008, the life expectancy for all Alaska Natives (70.1 years) lagged behind both non-native Alaskans (75.6 years) and the general U.S. population (77.8 years; NSB 2012).

The 2010 Mat-Su Borough demography has a slight predominance of males (51.7 percent). Alaska natives are 5.5 percent of the population. The 2010 Valdez-Cordova Census Area reported population data that were 53.4 percent males and 13.6 percent Alaska Native. In the Kenai Peninsula Borough, 52.4 percent of the population was male and 7.4 percent was Alaska Native. The Denali Borough had the greatest percentage of males (54.9 percent) and the lowest percentage of Alaska Natives (3.6 percent) of the Study Area Boroughs. These populations are similar to the 2010 State of Alaska demographics, i.e., 52 percent male and 14.8 percent Alaska Native. Table 5.2-1 displays the demographic profile of study area communities.

5.2.1.2. Maternal and Child Health

In the United States, more than 80 percent of women will become pregnant and give birth to at least one child in her lifetime (CDC 2010). Maternal and child health outcomes (e.g. low birth weight) can profoundly influence youth and adult health status and can suggest current or future challenges (or improvements) to human health (AMAP 2009). This section presents components of maternal and child health including initiation of prenatal care, infant mortality, low-birth weight, teen-birth rates, and substance use during pregnancy.

Infant Mortality

Infant mortality is an important indicator for population health and is influenced by living conditions, food security, domestic conflict, socio-economic wellbeing, and access to health services. Infant mortality can be separated into neonatal deaths, which occur during the first 28 days of life, and post-neonatal deaths, which occur from the 28th day to one year of life. Whereas neonatal deaths are associated with the quality of prenatal and perinatal health care, post-neonatal deaths are more closely associated with socio-economic conditions (AMAP 2009).

The Mat-Su Borough experienced a slightly lower infant mortality rate of 5.5 per 1,000 live births compared with 6.3 per 1,000 in Alaska in 2007-2009 (Table 5.2-2). Rates were zero for Denali and too few cases to report a rate in Valdez. In 2009, the infant mortality rate for the United States was 6.9 per 1,000 live births (Alaska Bureau of Vital Statistics 2013). In the Kenai Peninsula, the rate for the period 2007-2009 was 3.9 percent. The total number of infant deaths, however was less than 20.

Low weight at birth (< 2500 grams) is multifactorial and can also be related to the health of the mother (Marmot and Wilkinson 2006). Low birth weight is associated with an increased risk of disability and death in infants (NCHS 2010). Low birth weight is both an indicator of the health of the maternal population and a determinant of the health of the infant. According to the Alaska

Bureau of Vital Statistics in 2009, 5.8 percent of all births in the Mat-Su Borough were classified as low birth-weight babies compared to 5.9 percent in the State of Alaska. The percentage of low birth weight babies born to Alaska Native mothers in the Mat-Su was 3.4 percent. Valdez Cordova Census Area had the highest percentage of low birth weight babies at 8.1 percent overall and 18.8 for babies born to Alaska Natives. In Denali, there were no low birth weight babies born in 2009. In the Kenai Peninsula, 4.3 percent of all babies born were of low birth weight; the rate was 3.7 percent for Alaska Natives.

Adequacy of Prenatal Care

Initiation of prenatal care during the first trimester is an important marker of improved infant health outcomes (Krueger and Scholl 2000). Prenatal care not only identifies women at risk for complications during delivery, but also enables screening and treatment of medical conditions that may arise during pregnancy. Some conditions, such as preeclampsia, hemorrhage, and intra-partum infection, may be life threatening to both the mother and developing fetus. Prenatal appointments further allow for interventions involving behavioral risk factors associated with poor birth outcomes, such as smoking (WHO 2005). Adequate prenatal care has been shown to increase the likelihood of a healthy pregnancy and reduce the likelihood of adverse birth outcomes (CDC 2010).

The Adequate Prenatal Care Utilization Index (APCNU) is a measure that combines the initiation of prenatal care and the number of prenatal visits. A ratio of actual to recommended visits is calculated, and if the ratio is 110 percent or greater, care is considered "adequate plus" prenatal care. If the ratio is greater than 80 percent but less than 110 percent, care is considered "adequate". A ratio between 50 percent and 79 percent is considered "intermediate," and a ratio of less than 50 percent is considered "inadequate" (CDC 2010). The categories of "adequate" and "adequate plus" were also combined to create the category "adequate or better" (Alaska Native Epidemiology Center 2009).

In 2009, 73.5 percent and 54.2 percent of all pregnant women in the Mat-Su Borough, and Valdez-Cordova Census Area (respectively) were documented via birth certificate reporting as having received adequate or better (adequate and adequate plus) prenatal care. The percentage for the Kenai Peninsula was higher at 69.1 for all Borough residents, and 61.7 for Alaska Natives. These levels of performance favorably compares to the overall State of Alaska, where nearly 57.4 percent of all pregnant women reported experiencing adequate or better prenatal care (Table 5.2-3). Of pregnant Alaska Native women, 61.6 percent in the Mat-Su Borough, and 51.8 percent in the Valdez-Cordova Census Area received adequate or adequate plus prenatal care, compared to 44.3 percent of all Alaska Natives in 2009. In the Denali Borough 52.4 percent of all races received adequate or adequate plus prenatal care, which was lower than in the entire State of Alaska. The percentage of all Alaska women receiving adequate or adequate plus care decreased from 2007 to 2009; hence, prenatal care remains a critical issue that appears to be experiencing some challenges (ADHSS BVS 2012).

Initiation of prenatal care during the first trimester may serve as a marker of improved infant health outcomes (Krueger and Scholl 2000). According to the Alaska Bureau of Vital Statistics, in 2009, 78.3 percent of all pregnant women and 71 percent of pregnant Alaska Native women in the Matanuska-Susitna (Mat-Su) Borough made their initial prenatal visit during the first

trimester compared with 80 percent of all pregnant women in Alaska (ADHSS BVS 2011). In 2009, 87.4 percent of all pregnant women and 85.7 percent of pregnant Alaska Native women in the Valdez-Cordova Census Area made their initial prenatal visit during the first trimester. The same year, 85.5 percent of all pregnant women in the Kenai Peninsula and 80.2 percent of Native Alaska pregnant women made their initial prenatal visit during the first trimester.

Substance Use during Pregnancy

Substance use during pregnancy refers to the consumption of alcohol, tobacco, and/or drugs during the partum period. Substance use endangers both the mother and the fetus and can lead to premature detachment of the placenta, sudden infant death syndrome (SIDS), and developmental problems in childhood (WHO 2005). Excessive alcohol use during pregnancy puts infants at risk for fetal alcohol spectrum disorders (FASDs), the leading preventable cause of birth defects and mental retardation (Healthy People 2020). During 2009, the percentage of infants born to all mothers who reported drinking alcohol during the pregnancy in the Mat-Su Borough was 1.4 percent; in the Denali Borough 0 percent; and in the Valdez-Cordova Census Area 2.5 percent. These levels are lower than the 3.1 percent reported for the all Alaska mothers (3.1 percent; ADHSS BVS 2012).

Smoking during pregnancy is the single most important contributor to low birth weight (CDC 2004, Brooke 1989, Kramer 1987). In the Mat-Su Borough in 2009, 15.3 percent of infants were born to mothers who reported smoking during pregnancy, in the Denali Borough 4.5 percent, reported smoking during pregnancy, and in the Valdez-Cordova Census Area, 18.0 percent of mothers reported smoking during pregnancy. In the Kenai Peninsula Borough, 14 percent reported smoking during pregnancy. Overall, these numbers are similar to the percentage for the State of Alaska, in which 15.6 percent of infants were born to mothers reporting smoking during pregnancy (Alaska Bureau of Vital Statistics [ABVS] 2013). Nearly 23 percent of Alaska Native mothers in the Mat-Su Borough reported smoking during pregnancy (Table 5.2-4).

Teen Birth Rates

Infants born to teen-age mothers (defined by Alaska Native Epidemiology Center 2009 as women aged 15 to 19 years) are at increased risk of preterm birth, low birth weight, and death during infancy. They are more likely to have health problems as children, drop out of school, be incarcerated during adolescence, give birth as a teenager, and be unemployed as a young adult (Ventura et al. 2011). Teen-age mothers are less likely to receive a high school diploma, which may negatively impact their future health (Alaska Native Epidemiology Center 2009).

Table 5.2-5 shows that in 2009, 10.7 percent of all babies were born to 15 to 19 year olds in the Mat-Su Borough, which was slightly higher than for all Alaskans (9.8 percent). In 2009, 8.9 percent of all babies were born to mothers 15 to 19 years old. The statewide teen pregnancy rate for all races was 9.9 percent. In 2009, the percentage of Alaska Native teen-aged (<20 years) mothers in the Mat-Su Borough was 17.8 percent, and in the Valdez-Cordova Census Area was 18.8 percent, which was similar to the percentage for all Alaska Natives statewide (16.1 percent; ABVS 2013). During 2009, the teen birth rate for 15-19 year olds in the Kenai Peninsula Borough (11 percent) was slightly higher than the rate for all Alaskans (9.8 percent). The rate for

Alaska Natives in the Kenai Peninsula Borough (11 percent) is lower than the rate for all Kenai Peninsula residents (13 percent) and below that for Alaska Natives statewide (16.1 percent).

5.2.1.3. Suicide

Suicide can function as a broad indicator of mental health in a population. Alaska has a rate twice the national average, a higher rate of suicide in rural regions, and a higher incidence of suicide among men versus women. Figure 5.2-1 displays age-adjusted suicide rates over time by region for 2001-2010. In 2010, the age-adjusted rate was 23/100,000. The actual number of lives lost to suicide in 2010 was 163. Alaska's rural regions have the highest rates of suicide, because the population of most communities is small (relative to the number of actual suicides. Alaska's largest metropolitan area, Anchorage-Wasilla-Palmer, has had the highest number of suicides for several years.

From 2007-2009, there were 53 suicides in the Mat-Su Borough with an age-adjusted rate of 23.2 deaths per 100,000 people, the same rate experienced state-wide (22.8 deaths per 100,000 persons) among all races (ADHSS 2011).

In general, Alaskan Natives experience a higher suicide death rate than non-native Alaskans or U.S. whites (Alaska Native Epidemiology Center 2009). From 2004-2007, the suicide death rate for Alaska Natives living in the Mat-Su region was 32.6 deaths per 100,000 people, lower than the prevalence for all Alaska Natives (43.1 per 100,000 people) but higher than the borough, state, and the U.S. rates (Figure 5.2-2). Suicide death rates for Alaska Natives living in the Valdez-Cordova Census Area and the Kenai Peninsula Borough were unavailable for 2004-2007.

5.2.1.4. Substance Abuse

Substance abuse influences a significant number of health outcomes, e.g., accidents and injuries, domestic violence, mortality, etc. Substance abuse includes illegal drugs (e.g., marijuana, cocaine), alcohol addiction, and binge drinking. According to the Alaska Native Epidemiology Center, substance abuse for adolescents is defined as having used alcohol, marijuana or cocaine in the past 30 days. Binge drinking is defined as having 5 or more drinks on one or more occasion in the past 30 days. The excessive drinking measure reflects the percent of the adult population that reports either binge drinking, defined as consuming more than 4 (women) or 5 (men) alcoholic beverages on a single occasion in the past 30 days, or heavy drinking, defined as drinking more than 1 (women) or 2 (men) drinks per day on average (ADHSS BRFSS 2011).

The County Health Rankings report reveals that 16 percent of the residents of the Mat-Su Borough report participation in 'excessive drinking' as binge and heavy drinkers, lower than the 19 percent reported for all Alaskans but twice the national benchmark of 8 percent. Data the Valdez-Cordova Census Area and the Kenai Peninsula Borough were similar (21 percent and 18 percent). The highest level of excessive drinking for this time period was in the Denali Borough where 27 percent of residents reported excessive drinking (Population Health Institute 2013).

Overall, Alaska Native regional data from the state's Behavioral Risk Factor Surveillance System (BRFSS) for 2004–2007 are shown in Figure 5.2-3. The self-reported percentages of binge drinking are lower for the Anchorage/Mat-Su Region Alaska Natives (16 percent) than the

binge drinking percentages for all Alaska Natives, all Alaskans and all races in the U.S. Data is not available for Valdez-Cordova Census Area Alaska Natives or Denali Borough Alaska Natives. In the Kenai Peninsula Region, 13.6 percent of Alaska Natives had engaged in binge drinking during this time.

5.2.1.5. Economic Indicators

Economic status may create a powerful context for human health and improved household and community income is associated with better health outcomes. While there are many indicators used to assess economic status, the HIA reports median household income, employment, and the percentage of households living below poverty levels. This information is largely dependent on the Social Conditions and Public Goods and Services Study (Study 15.6). Information that will be needed to complete the analysis of the direct effects of the Project includes:

- Final location of the Project components
- Duration and schedule of construction phase
- Cost of materials and supplies during construction
- Approximate cost of materials and supplies during construction that will be spent locally, versus non-locally
- Size of total workforce, including how many workers will be hired locally versus non-locally (data from the ADLWD on employment by occupation will be used to estimate the percent of out-of-state workers)
- Total size of construction workforce by month, or peak number of workers and when that peak would occur
- Summary of construction workforce by craft or discipline
- Total construction wages or average construction pay, including benefits
- Total number of workers required for operation and maintenance of the Project, and total wages including benefits
- Approximate cost of materials, supplies, and services that will be purchased locally versus non-locally during operations
- For trucks that would be used, estimated number and size, number of trips per day and week to and from the Project site, travel route, and capacity of the roads on which the trucks will be traveling
- The number of residences or businesses that could be displaced by construction of the Project
- Number of acres of agricultural/pasture land or timberland that will be removed from production

Median Household Income

Median household income is one important measure of economic well-being and a key determinant of human health (Braveman et al. 2011). Median means that half of the households have higher income and half of the households have lower income. In Alaska, income includes all monetary sources of income including wages, the Permanent Fund Dividend, Corporation Dividends and Public Assistance. Income does not include subsistence resources. For 2007-2011, the estimated median household income among the PAC Boroughs was highest in the Denali

Borough at $82,898. In the Mat-Su, Borough, Valdez Cordova Census Area, and the Kenai Peninsula Borough, median income was $70,343, $62,238, and $59,296 respectively.

For Alaska the median income was $69, 014 and for the U.S. it was $51,425 (Table 5.2-6). Only median income in Valdez Cordova was lower that that of the state as a whole. Income was higher in all of the PAC boroughs as compared to the U.S. Additional economic indicators (i.e. per capita income and poverty) are displayed in Table 5.2-6.

Educational Attainment

The level of educational attainment in a household can strongly influence a variety of health outcomes. In one study, high school graduates have been found to live an average of six to nine years longer than high school dropouts (Wong et al. 2002). Adults with low educational attainment were more likely to die from cardiovascular disease, cancer, and lung disease (Muenning 2005). Multiple possible mechanisms have been proposed to account for this trend. Education positively impacts lifestyle choices and health-related decisions. Better-educated people are also less likely to be employed in dangerous jobs (Muenning 2006).

Table 5.2-7 compares Mat-Su Borough residents with the State of Alaska and the U.S., based on 2009 US Census data, American Communities Survey. The percent of residents over age 25 in the State of Alaska and in the PAC Boroughs who have graduated from high school is over 90 percent. The percentage of residents with bachelor's degrees ranged from 20.9 percent (Mat-Su) to 24.5 in the Valdez Cordova Census Area. These levels were below that for the state as a whole (27.2 percent) and the U.S. (28.2 percent).

Family Structure

Family stability refers to families where parents are healthy and employed; where members experience infrequent housing changes; and family members experience infrequent divorce and remarriage, or few separations due to immigration and job seeking.

Family stability has been shown to provide numerous benefits to children, such as more effective child supervision and parental monitoring, less family conflict, and more family cohesion (Robertson et al. 2008). Good parental monitoring, in particular, results in better child physical and mental health (Proeschold 2010).

Families in the Mat-Su Borough appear to be stable compared to families in the State of Alaska and the U.S (see Table 5.2-8).

Many of the communities in the Mat-Su Borough have families with both parents in the household. This is not the case in the other PAC Boroughs, where the percentage of two parent households is lower than the state (34.3 percent versus 19.7 to 28.1 percent).

Cultural Indicators

In Alaska, subsistence practices are a component of cultural identification and community cohesion. The Alaska Federation of Natives (AFN) describes subsistence as "the hunting, fishing, and gathering activities which traditionally constituted the economic base of life for

Alaska's Native peoples and which continue to flourish in many areas of the state today. Subsistence, being integral to our worldview and among the strongest remaining ties to our ancient cultures, is as much spiritual and cultural, as it is physical (AFN 1993)."

Subsistence practices anchor the customs and traditions of many cultural groups in Alaska. These customs and traditions encompass sharing and distribution networks, cooperative hunting, fishing, and ceremonial activities. Participation in subsistence activities promotes transmission of traditional knowledge from generation to generation and serves to maintain people's connection to the physical and biological environment. Further input will be obtained reflecting other study area communities from the TLK workshop; subsistence study results and targeted HIA key informant interviews.

5.2.2. HEC 2: Accidents and Injuries

HEC2 includes impacts related to both fatal and non-fatal injury patterns for individuals and communities. Accidents and injuries are an important cause of mortality and morbidity in Alaska (see Table 5.2-9).. The term 'unintentional injury' refers to causes of injury or death other than suicide and homicide. Fatal injury information is drawn from the ABVS, while non-fatal injuries are typically obtained from the Alaska Trauma Registry (ATR) Alcohol use is a powerful risk factor for accidents and injuries; alcohol related injury events are reported, as are local option laws in PACs. The presence of law enforcement or village public safety officers (VPSO) influences safety in rural communities.

5.2.2.1. Fatal Injuries

The most recent fatal injury data available from the ADHSS Bureau of Vital Statistics is from 2009. During 2007-2009, there were 117, 1,105 and 21 fatal injuries in the Mat-Su, Denali, and Kenai Peninsula Boroughs, and Valdez-Cordova Census Area, respectively (Figure 5.2-4). The leading cause of non-transportation related fatalities in Mat-Su was poisoning (20.0/100,000) and the leading cause of transportation related fatalities was motor vehicle accidents (13.7/100,000). Unintentional poisoning is often related to alcohol overdose. The Mat-Su Borough has a higher rate of poisoning deaths than the state as a whole (20.0 vs. 16.9/100,000) and a similar rate of fatal motor vehicle fatalities as compared to state of Alaska as a whole (13.7 vs. 13.2/100,000). There was only 1 death by motor vehicle in the Denali Borough, 5 in Valdez-Cordova Census Area, and 38 motor vehicle fatalities in the Kenai Peninsula Borough. Fatal injury patterns in the Kenai Peninsula Borough were most similar to the Mat-Su, except there were fewer poisoning deaths and more deaths due to: falls, smoke, flame, and fire; and drowning and submersion.

5.2.2.2. Non-fatal Injury

The Alaska Trauma Registry (ATR) records non-fatal injuries that are serious enough to require admission to a health care facility. Data available for the period 2004-2008 indicated there were 2,530 non-fatal accidents and injuries in the Mat-Su Borough with an average of 500 injuries per year. Males accounted for almost 60 percent of these injuries. Individuals between 15-24 years of age were the most commonly injured and accounted for 18 percent of all injuries for this period.

The most common cause of non-fatal injury requiring hospitalization in the Mat-Su Borough area was falls (32 percent), followed by motor vehicle accidents (17 percent), and suicide attempts (11 percent). These three causes of injury alone accounted for 60 percent of all non-fatal injuries during this period. Figure 5.2-5 lists the 10 most common non-fatal injuries in this region for the period 2004-2008.

Non-fatal injury data for the Denali and Kenai Peninsula Boroughs and the Valdez-Cordova Census Area is under request with the ATR. The most recent crude non-fatal unintentional injury hospitalization rate by tribal health organization dates back to 2001. These data are considered outdated and represents a data gap.

5.2.2.3. Alcohol Related Accidents and Injuries

Alcohol consumption and injury death are strongly related. In 1997, Landen reported that in the U.S. in injury fatality cases where blood alcohol was actually recorded, more than 65 percent had a blood alcohol concentration (BAC) of ≥80 mg/dL (≥0.08 percent). The legal limit for blood alcohol concentrations in the majority of states, including Alaska, is 80 mg/dL (0.08 percent). These authors also report that living in a wet village was an independent risk factor for injury death (Landen et al. 1997).

For non-fatal injury, ATR records reveal that alcohol use was documented over in 20.6 percent of all non-fatal injury cases for the Mat-Su Borough. See Figure 5.2-6 for a ranking of the top 10 causes of non-fatal injury by percentage involving alcohol.

5.2.2.4. Fatal Injuries Among Alaska Natives

From 2005 to 2007, the most common cause of injury among Alaska Natives statewide was suicide, which accounted for 28.7 percent of deaths among all Alaska Natives. The leading causes of injury for all Alaska Natives are shown in Table 5.2-10; the top 3 were suicide, unintentional poisoning (generally via alcohol ingestion), and motor vehicle traffic accidents.

Unintentional injury deaths for Alaska Natives residing in the Interior and the Copper River/Prince William Sound Regions were more than twice that of Alaska whites and U.S. whites as a whole (Figure 5.2-7). Of the three regions, the Anchorage/Mat-Su region had the lowest age-adjusted unintentional injury death rate (71.7), however this is still above that for Alaska whites and U.S. whites as a whole (47.1 and 39.3, respectively). The Kenai Peninsula had the highest at 76.4.

5.2.2.5. Intentional Fatal Injury and Self-Harm: Suicide and Homicide

Suicide attempts are ranked second in the most common causes of injury hospitalization for all Alaska Natives. For leading causes of injury deaths for all Alaska Natives between 2005 and 2007, suicide ranked first, with 141 deaths (Table 5.2-11). Homicide ranked second, accounting for 21.7 percent of all intentional injury deaths.

5.2.3. HEC 3: Exposure to Potentially Hazardous Materials

When gathering data on exposure to potentially hazardous materials, the HIA considers and evaluates available air, water, and soil monitoring data. Study area data from relevant interdependent studies are pending and the HIA will assess these data as they become available.

5.2.3.1. Sources of Existing Contamination

Alaskans in rural communities have multiple possible contamination exposure sources, including (i) industrial fuel and biomass combustion, (ii) pollution transported through the air, water or locally bio-accumulated from global sources (e.g. atmospheric long range transport of mercury and POPs), (iii) naturally occurring substances such as asbestos and mercury, and (iv) local waste processes such as individual septic systems or honey pots.

Inhalation is the principal exposure pathway to airborne contaminants. Pollutants can also dissolve in water sources or deposit on terrestrial surfaces. Contaminant bioaccumulation in subsistence resources is a pathway for exposure to humans. This pathway is important for Alaskans due to high consumption rates of subsistence products.

Impacts related to exposure to potentially hazardous materials include project emissions and discharges. Potential exposure pathways include:

- Food- Quality changes in subsistence foods (risk based on analysis of foods or modeled environmental concentrations)
- Drinking water impacts from changes to ground and/or surface water sources
- 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 contaminants on a worker's clothing.
- Indirect pathways-such as changing heating fuels/energy production fuels in communities.

Redwood et al. (2012) examined the prevalence of self-reported lifetime exposure to nine occupational and environmental hazards among American Indian and Alaska Native (AI/AN) adults enrolled in the Education and Research Towards Health study in the Southwest U.S. and Alaska. The top three hazards experienced by AI/AN people in Alaska were petroleum products, military chemicals, and asbestos.

5.2.3.2. Air Quality

Air pollution has been shown to increase the risk of or exacerbate a number of respiratory and cardiac conditions. The elderly, children, and those with underlying health problems are particularly vulnerable to the effects of air pollution.

According to the United States Environmental Protection Agency (EPA), tribes in Alaska face unique challenges to protecting air quality and reducing health risks in their communities (EPA 2011):

- Most Tribes do not have a reservation or defined lands where they can assert jurisdiction to address air quality issues.
- Frozen ground prevents burying waste in landfills, and many communities resort to burning trash that creates air pollution.
- Electricity primarily comes from diesel generators that produce particulate and other air pollutants.
- The cold climate means people spend significant time indoors in homes and buildings where indoor air pollution can accumulate.
- Many homes have older wood stoves that can be inefficient and create air pollution.
- Dust from unpaved roads may contain pollutants that can be inhaled or deposited on subsistence food sources.

Ware et al. (2013) conducted surveys focused on understanding the demographics, home heating practices, indoor activities, community/outdoor activities, and air quality perceptions in rural Alaskan communities over a two-year period. Results from these surveys showed that there is an elevated potential for PM10/PM2.5 exposures in rural Alaska. Significant indoor air quality concerns included mold, lack of ventilation or fresh air, and dust. Important outdoor air pollution concerns identified were open burning/smoke, road dust, and vehicle exhaust (e.g., snow machines, ATVs, etc.). Dadvand et al. (2013) performed an assessment to quantify the association between maternal exposure to particulate air pollution and term birth weight and low birth weight (LBW). The study concluded that maternal exposure to particulate pollution was associated with LBW at term across study populations. A baseline burden of poor indoor air quality increases susceptibility to changes in outdoor air quality.

2009 Alaska Wildfire Emissions Inventory

ADEC is responsible for statewide fire data surveillance and for preparing the annual Alaska Enhanced Smoke Management Plan emission inventory reports. These reports summarize: fire type, start and end dates, locations, and acreages using data provided by the Division of Forestry. Emission factors (tons of pollutant per acre) are used for the various vegetation types with the Division of Forestry data to estimate emissions (MACTEC 2011). The complete report describing the 2009 Alaska Wildfire Emissions Inventory can be accessed online at: http://fire.ak.blm.gov/content/admin/awfcg_committees/Air Quality and Smoke Management/6_2009 AK WF EI rpt 050411.pdf.

ADEC Point Source Inventory

ADEC is required by Federal Regulations 40 CFR 51.321 to submit a statewide point-source emission inventory to the EPA every 3 years. ADEC requires individual facilities to provide detailed process-level emissions for criteria pollutants and information regarding stack characteristics and location. The ADEC point source inventory can be accessed online at: https://myalaska.state.ak.us/dec/air/airtoolsweb/EmissionInventory.aspx.

EPA National Emission Inventory (NEI)

The NEI is principally based upon emission estimates and emission model inputs provided by state, local, and tribal air agencies, supplemented by EPA generated data. The NEI is developed on a 3-year cycle, with the current version based on 2008 data and commonly referred to as the NEI2008. The majority of the NEI2008 point source inventory is based on data provided directly from the ADEC point source inventory described above. Other NEI2008 inventory sectors (on-road mobile, non-road mobile, and area sources) are based on data, methods, and models that were developed primarily for use in the lower 48 states and may not be entirely representative of the conditions in the study area. Additional information about the NEI and NEI2008 can be found online at: http://www.epa.gov/ttn/chief/net/2008inventory.html#inventorydoc.

Alaska Rural Communities Emission Inventory

The NEI2008 for non-point sectors may not accurately estimate emissions in Alaska, especially in rural areas. ADEC and Sierra Research, Inc., developed on-road and non-road emission inventories representative of rural areas in Alaska for the calendar year 2005 (Sierra Research 2007). The full report that describes the Alaska Rural Communities Emission Inventory can be accessed online at: http://www.epa.gov/region10/pdf/tribal/wrap_alaska_communities_final_report.pdf.

In a 2010 ADEC rural dust survey distributed among 250 villages (response rate 33 percent), most respondents reported that some residents of their communities were highly affected by dust releases. The most frequently reported community health effects were irritation of eyes, nose, and throat (72 percent of responses); asthma (72 percent of responses); coughing (68 percent of responses); chronic bronchitis (56 percent of responses); shortness of breath (50 percent of responses); emphysema (48 percent of responses); and tightness of the chest (44 percent of responses). More dusty days occur in June, July, and August, with averages above 20 days each month. For May, September, and October 13-19 dusty days per month is typical. The fewest dusty days occur in winter, an average of 19 dusty days during the 6-month period from November through April. Dust seasons vary somewhat among different regions of Alaska. Information for specific communities is not available (ADEC 2010). A map of dust complaints reported to ADEC throughout rural Alaska can be found at: http://dec.alaska.gov/air/anpms/Dust/Dust_docs/web percent20map percent2012-2011 percent20(2).pdf.

5.2.3.3. Water Quality

The State of Alaska conducts surface and groundwater water quality monitoring investigations regularly. However, the Clean Water Act mandates that each state develop a program to monitor and report on the quality of its surface and ground waters and prepare a report describing the status of its water quality. Alaska updates its report every two years (ADEC 2010).

EPA encourages States/Tribes to use a five-category system for classifying all water bodies (or segments) within its boundaries regarding the waters' status in meeting the State's/Tribe's water quality standards. The categories are: all designated uses are supported, no use is threatened (category 1); available data and/or information indicate that some, but not all, designated uses are supported (category 2); there is insufficient available data and/or information to make a use

support determination (category 3); available data and/or information indicate that at least one designated use is not being supported or is threatened, but a total maximum daily load is not needed (category 4); and, available data and/or information indicate that at least one designated use is not being supported or is threatened, and a total maximum daily load is needed (category 5) (EPA 2011). The majority of Alaskan waters fall into category 1. There are 44 water bodies in category 2, 304 in category 3, 33 in category 4a, 4 in 4b, 0 in 4C, and 28 in category 5.

5.2.4. HEC 4: Food, Nutrition, and Subsistence Activity

The Alaska Federation of Natives describes subsistence as "the hunting, fishing, and gathering activities which traditionally constituted the economic base of life for Alaska's Native peoples and which continue to flourish in many areas of the state today" (AFN 1993).

Subsistence is part of a rural economic system, called a "mixed subsistence market" economy, wherein families invest money into small-scale, efficient technologies to harvest wild foods. Fishing and hunting for subsistence resources provide a reliable economic base for many rural regions. Subsistence is focused toward meeting the self-limiting needs of families and small communities (Wolfe and Walker 1987). Participants in this mixed economy in rural Alaska augment their subsistence production by cash employment. Cash (from commercial fishing, trapping, and/or wages from public sector employment, construction, fire fighting, oil and gas industry, or other services) provides the means to purchase the equipment, supplies, and gas used in subsistence activities. The combination of traditional and commercial-wage activities provide the economic basis for the way of life so highly valued in rural communities (Wolfe and Walker 1987).

ADF&G confirms that subsistence fishing and hunting are important sources of employment and nutrition in almost all rural communities (ADF&G 2007). Traditional fishing, hunting, and gathering are sources of nutrition for residents in areas of Alaska where food prices are high. While some people earn income from employment, these and other residents rely on subsistence to supplement their diets throughout the year. Furthermore, traditional and cultural activities support a healthy diet and contribute to residents' overall wellbeing. Data from the 2013 ADF&G surveys will remain a data gap in this baseline section until results become available to the HIA team in the next study season. This section reports the results that are available.

5.2.4.1. Micronutrient Deficiencies

Vitamin D deficiency is a common problem for children and adults in Alaska, which can lead to bone disorders such as rickets and is also associated with an increase the risk of TB, dental caries, and autoimmune disorders. Vitamin D deficiency has been found to be common in Alaskan children, particularly among those who are breastfed, and routine vitamin D supplements are recommended the Alaska Division of Health and Social Services Section of Epidemiology (ADHSS SOE 2003). Iron deficiency is also extremely common among rural Alaskan children, particularly in the northern and southwestern regions, although the cause is not entirely understood. It is probably not caused by a single factor (NSB 2012). Helicobacter pylori infection has been shown to be associated with iron-deficiency anemia among school-aged children in southwest Alaska (NSB 2012); however, observed patterns make either nutritional deficiency or H. pylori infection unlikely to be the sole etiology of the high prevalence of anemia

in rural Alaska (Alaska Native Epidemiology Center 2008). Among young children, persistent prenatal conditions appear to contribute to high rates of iron-deficiency and anemia in children up to at least age 5 years (NSB 2012). There are no reported deaths by malnutrition or other nutritional disorders in the Mat-Su Borough, Denali Borough or the Valdez Cordova Census Area.

5.2.4.2. Contribution of Subsistence Activities

The Mat-Su Valley has been a productive agricultural area with farms, dairies and gardens since it was settled in the 1930s. The area has grown not only in population but also in retail services, including grocery stores. The County Health Ranking system defines limited access to healthy foods as "percent of population who are low-income and do not live close to a grocery store" (Population Health Institute 2013). Among the Project Boroughs, Mat-Su and the Kenai Peninsula Boroughs had the lowest percentage of residents with limited access to healthy food at 6 percent which was similar to that of the State of Alaska overall (8 percent). The Denali Borough had the highest percentage of residents with limited access to healthy foods at 19 percent while 11 percent of the Valdez Cordova Census area residents had limited access.

Food Security

Food security means having enough food to fully meet basic needs at all times. At present, there are no known acute shortages of major dietary components (e.g., proteins, carbohydrates, grains, fruits, or vegetables) in any of the PACs. While many residents in the communities engage in subsistence hunting, fishing, and gathering as a part of their diets, the percentage of their food supply currently comes from subsistence activities is currently unknown.

Food costs

The University of Alaska Fairbanks (UAF), Cooperative Extension Service (CES), performs a Food Cost Survey (FCS) every quarter. Information on the specific vegetables, fruits, grains, carbohydrates and proteins included as well as quarterly results for the last 10 years is available online (CES UAF 2011).

The UAF CFS reports that in March 2012 (the last quarter available) it cost a family of 4, $157.71 to purchase the 104 items in the market basket at a grocery store in Palmer-Wasilla, $11 more than the same products cost in Anchorage. This weekly cost equates to almost $7,500 for food over the course of a year or 11 percent of the annual median family income for Mat-Su Borough residents.

5.2.5. HEC 5: Infectious Diseases including STIs

Reportable communicable diseases include infectious and parasitic diseases, such as tuberculosis, septicemia, viral hepatitis, HIV, and STIs as well as influenza and pneumonia. Communicable diseases disproportionally affect poor populations and are exacerbated by unsanitary conditions, unsafe water, and inadequate personal hygiene. Children and adults without proper immunization are at higher risk of contracting infections and left untreated, chronic infections can lead to cancers, such as cervical (caused by HPV) and liver cancer (Hepatitis B and C); (WHO 1999).

Reportable infectious and parasitic diseases were not among the leading cause of death among all races in the Mat-Su, Kenai Peninsula or Denali Boroughs nor the Valdez-Cordova Census Area Pneumonia (4 deaths), septicemia (1 death), and viral hepatitis (2 deaths) were the only causes of death due to infectious diseases in the Valdez-Cordova Census Area between 2007 and 2009, accounting for approximately 4.3 percent of all deaths (164) between 2007 and 2009 (Table 5.2-12; ADHSS BVS 2013). Pneumonia (12 deaths), tuberculosis (1 death), septicemia (8 deaths), viral hepatitis (8 deaths), and HIV (2 deaths) were the causes of death due to infectious diseases in the Mat-Su Borough between 2007 and 2009, accounting for approximately 2.8 percent of all deaths (1,225) between 2007 and 2009 (ADHSS BVS 2013). In the Kenai Peninsula, the leading cause of death due to infectious disease was pneumonia (11 deaths), followed by viral hepatitis (6 deaths), and septicemia (5). There were no deaths due to any infectious or parasitic disease in the Denali Borough and no influenza deaths were reported during the same time period in any borough. Over the previous decade, deaths due to diseases have remained relatively stable, while the number of deaths due to pneumonia appears to be decreasing slightly. Age-adjusted rates of death from communicable diseases have been similar to those experienced in the state of Alaska since 2000 (ADHSS BVS 2013).

The Bureau of Vital Statistics does not report infectious disease data by race. Therefore, data from the Alaska Native Epidemiology Center is used as a representation of infectious disease burden for Alaska Natives. Overall reportable infectious disease cases for all Alaska Natives January 2007 to October 2008 are shown in Table 5.2-13.

5.2.5.1. Respiratory Infections

Lower Respiratory Infections (LRIs) refer to infections affecting the lung tissue and air sacs, commonly referred to as pneumonia. Pneumonia most often causes illness in children less than 5 years and older adults (>65 years). Also at higher risk are those with other medical conditions, such as chronic liver, heart or lung disease (NAID 2011). The transmission of respiratory infections depends on many of the same factors as other infectious diseases. In particular, crowding, poor nutrition and underlying health problems, tobacco smoking and secondhand smoke, inadequate water supplies, and poor ventilation and indoor air quality, increase the risk of respiratory infections.

Immunization is one of the best defenses against respiratory diseases, and immunization rates (with a critical coverage goal of greater than 80 percent) for both children and adults serve as critical performance indicators. By 2 years of age, it is recommended that all children have received 4 doses of diphtheria-tetanus-pertussis (DTP), 3 doses of polio, 1 dose of measles-mumps-rubella (MMR), 3 doses of Hepatitis B, and 3 doses of Haemophilis Influenza, type B (Hib) vaccines. This recommendation is referred to in shorthand as "4:3:1:3:3:1" (ADHSS 2005).

In 2011, the State Office of Epidemiology reported a significant decrease in the number of Alaskan children vaccinated in 2009. According to an Epidemiology Bulletin, "In 2009, completion of the 4:3:1:3:3 ("0" = Hib series, which was excluded from the 2009 analysis due to a national shortage of this vaccine that year) standard series coverage rate in Alaska was 56.6 percent. With this coverage rate, Alaska ranked 48th in the country for 1+ MMR (85.2 percent) and 50th for 1+ varicella (76.0 percent). Alaska also ranked in the bottom 10 percent of states for completion of 4+ DTaP and 3+ rotavirus vaccines" (ADHSS SOE 2011).

5.2.5.2. Influenza

Influenza, or 'the flu,' refers to a common systemic illness involving the upper respiratory tract, caused by the influenza virus. People with the flu typically experience cough, fever, fatigue, and muscle aches along with other symptoms, and they may or may not seek medical care. The severity of the illness depends on many factors, including the strains of viruses circulating in a given season and the underlying health condition of the person infected. Statewide, Alaska Natives experience higher rates of serious influenza infections than non-Native Alaskans" (NSB 2012).

5.2.5.3. Bronchiolitis and Respiratory Syncytial Virus

Bronchiolitis is a common infection of the small airways, occurring most often in the winter months. It affects infants most severely and can result in prolonged illness, hospitalization, and even respiratory failure. The most common cause of bronchiolitis is a virus called Respiratory Syncytial Virus (RSV). RSV infection is a major cause of illness and hospitalization in Alaska and, in particular, among Alaska Native infants, where rates far exceed U.S. rates (NSB 2012).

5.2.5.4. Tuberculosis

In 2011, Alaska had the highest incidence of TB in the nation (9.3 per 100,000 population). In contrast to the majority of newly identified TB cases in the U.S. which occur in the foreign-born population, most new TB cases in Alaska are locally acquired, and occur primarily in the Alaska Native population. Furthermore, much of Alaska's prospective TB burden is due those who currently have latent TB infection (LTBI), as 5–10 percent of LTBI patients progress to active TB without therapy (ADHSS SOE 2012a).

In 2012, a total of 66 cases of TB were reported to the Alaska Tuberculosis Program. This incidence of 9.0 cases per 100,000 population was a 1% decrease in the number of cases and a 3% decrease in the incidence of tuberculosis when compared to 2011 (ADHSS SOE 2013a).

Between 2003 and 2012, 121 foreign-born persons originating from 24 countries were diagnosed with TB in Alaska. The Philippines was the country of origin for the majority (56%) of cases, followed by Lao PDR (8%), the Republic of Korea (7%), Mexico (6%), and Thailand (4%; ADHSS SOE 2013a).

5.2.5.5. Childhood Immunization Initiatives

A review of the CDC's National Immunization Survey coverage data revealed that Alaska ranked below the U.S. average for all standard series vaccines included in the 2009 ranking. In response Alaska Division of Public Health is attempting to increase rates statewide by:

- Strengthening partnerships with health care providers;
- Surveying parents to determine perceived barriers to immunizations;
- Increasing educational opportunities for providers and parents;
- Using VacTrAK (Alaska's Immunization Information System) for development and publication of immunization coverage rates for specific communities.

5.2.5.6. Zoonotic and Vector Borne Disease

Rabies

Between 2008 and 2012, 46 animals were involved in the 61 cases of rabies exposure in Alaska (ADHSS SOE 2013b):

- 33 (72%) were dogs, five (11%) were bats, four (9%) were foxes, and two (4%) were wolves.
- All of the terrestrial animals involved were living in areas of Alaska known to be enzootic for rabies; and
- Five (11%; four dogs and one wolf) were laboratory-confirmed as being positive for rabies.

Although rabies is currently not enzootic in the study area, Project-induced changes to the watershed may have the potential alter the ecology of this disease. Figure 5.2-8 displays the current regions where rabies is enzootic among fox.

West Nile Virus

To date, in Alaska there have been no recorded human or animal case of locally acquired West Nile virus (WNV) (ADF&G 2013). Although ADF&G does expect to eventually detect the infection in birds migrating to Alaska within the next few years, WNV is unlikely to become permanently established in Alaska's birds. According to the ADF&G, "Locally acquired WNV could occur only if viremic migratory birds arrive in Alaska when the appropriate species of mosquitoes are active and when temperatures would permit adequate amplification of virus. With all those factors in place, virus could potentially spill over into non-migratory birds, humans, horses, or other Alaskan animals (ADF&G 2013).."

5.2.5.7. Sexually Transmitted Infections (STIs)

STIs among Alaska residents are disproportionately distributed by race, gender, and age. Between 2007 and 2008, STIs comprised almost 90 percent of all Alaska Native reportable infectious disease cases. Chlamydia trachomatis (CT) was by far the most commonly reported infectious disease, accounting for 80 percent of all reported infectious diseases, followed by Gonorrhea with 10-fold fewer cases. CT is a bacterium that can cause pelvic inflammatory disease (PID), ectopic pregnancy, infertility, and preterm labor. Infants born to infected women are at risk for neonatal conjunctivitis and pneumonia. Untreated CT infections in men can cause epididymitis, Reiter syndrome, and infertility (Alaska Native Epidemiology Center 2009). The Alaska Department of Health and Social Services HIV/STD Program reports on STI prevalence data race for all Alaska Native Health Corporation regions.

Chlamydia

Alaska had the highest CT infection rate in the nation in 2010, and has consistently had the first or second highest rate in the nation since 2000 (ADHSS SOE 2013c).

A total of 6,026 cases of urogenital CT infection were reported to State Office of Epidemiology in 2010; Alaska's CT case rate was 849 per 100,000 persons (ADHSS SOE 2013c). This represents a 13 percent increase compared to 2009 and is more than twice the 2010 US rate of 417 per 100,000 persons. Alaskan women (66 percent of cases), adolescents and young adults (68 percent of cases); were disproportionately impacted by CT. In 2007, the CT rate reported for Alaska Native men was about 4 times greater than the rate for Alaska white men (Figure 5.2-9). The CT rate for Alaska Native women was about 7 times greater than for Alaska white women (Alaska Native Epidemiology Center 2011).

CT rates were highest in the Northern region (2250 cases per 100,000 persons), followed by the Southwest (1803 cases per 100,000 persons), the Interior (816 cases per 100,000 persons), Anchorage/Mat Su (806 cases per 100,000 persons), and Southeast (601 cases per 100,000 persons).

It should be noted that increases in CT rates and regional differences in rates may also, in part, reflect screening practices, availability of different diagnostic tests, consistency of reporting by providers and laboratories, and partner identification and testing practices.

Gonorrhea

Alaska is still experiencing a gonococcal infection (GC), or gonorrhea epidemic that started in 2008 and peaked in 2010 (ADHSS SOE 2013d). GC is an STI caused by the bacterium *Neisseria gonorrhoeae*, that when untreated or inadequately treated, can result in pre-term labor, PID, ectopic pregnancy, and infertility among women; epididymitis and infertility among men; and conjunctivitis in neonates. During 2012, Alaska's GC infection rate was 100 cases per 100,000 persons; representing a 26 percent decrease in reported cases and a 28 percent decrease in the GC incidence rate compared to 2011. This dramatic decline is attributed to a number of factors, including increased community/provider awareness through educational outreach efforts, disease intervention services, and EPT (ADHSS SOE 2013d).

Data from the Alaska Native Epidemiology Center for 2007 illustrates a much greater rate of GC among Alaska Natives as compared to whites in both males and females (Figure 5.2-10).

Expedited Partner Therapy

In 2011 the state of Alaska initiated the expedited partner therapy pharmacy pilot project (with funding through 2015) in effort to decrease chlamydia and gonorrhea. Under the program, pharmacy staff provide these services:

- An assessment of known allergies and contraindications for the prescribed medication(s), and information on adverse drug reactions;
- Referral to a health care provider for persons who have contraindications for EPT medications or are thought to have complicated infections;
- Treatment for persons infected with CT and/or GC who have no other resource for obtaining medications;
- Counseling on STI prevention and risk-reduction strategies; and

- Information on STIs, including a list of local health care providers who care for patients with STIs.

Syphilis

Syphilis is an STI cased by the bacterium *Treponema pallidum.* Syphilis is rare in Alaska, with the exception of three unrelated outbreaks that occurred in 2004 and 2011-2012. Both of these outbreaks primarily involved men who have sex with men (MSM) that were engaging in high-risk sexual behaviors (ADHSS SOE 2012b).

Human Immunodeficiency Virus (HIV)

HIV is the virus that can lead to acquired immunodeficiency syndrome, or AIDS. In Alaska, a cumulative total of 1,482 cases of HIV infection were reported between January 1, 1982 and December 31, 2012 (ADHSS SOE 2013e). A total of 51 cases of HIV infection were reported to SOE in 2012. Of these cases, 29 (57 percent) were initially diagnosed in Alaska in 2012. In 2012, the Alaska HIV/STD Program implemented a new intervention initiative called Linkage to Care, which serves to facilitate HIV-infected persons access medical care and provide supportive services.

5.2.6. HEC 6: Water and Sanitation

Adequate provision of water and sanitation services is a critical public health infrastructure. Sanitation infrastructure is provided to rural Alaskans by state and federally funded programs that have provided service first where the greatest number of homes could be served at the lowest cost (Hennessey et al. 2008). Providing in-home sanitation services is difficult in remote villages where small, isolated populations live in a harsh, cold climate. These difficulties can primarily be attributed to a combination of four factors:

- A harsh climate that results in high consumption of heating fuel and electricity and can damage mechanical systems;
- High costs for parts and consumables resulting from a lack of external road systems;
- A limited ability to pay for sanitation services because of underemployment or unemployment; and
- A reduced revenue base and limited labor pool because of small community populations (Eichelberger 2010, Ritter 2007).

Although many rural village homes lack in-home water service, nearly all villages have access to safe drinking water (ADEC 2000). Alaska village residents who live without pressurized in-home water service typically obtain water from a community-based water point and bring it home in 5-gallon plastic containers. Although water is available in centralized locations, some families must travel long distances or cross rivers to obtain safe water. This distribution method makes it difficult to obtain adequate amounts of water needed for basic consumption and hygiene practices. Alaska homes lacking pressurized in-home water service also lack flush toilets. Residents use outhouses or in-home waste containers commonly known as “honeybuckets” that require manual removal to a centralized waste disposal site or lagoon (Chambers et al. 2010).

In rural Alaska, lack of adequate water service is linked to the high rates of lower respiratory infections observed in some regions, and to invasive skin infections. Many small, rural, primarily Alaska Native communities lack any piped water and wastewater disposal services, and entire regions have service rates that remain below national standards. Gessner (2008) performed a community-level analysis including all 108 Alaskan communities with at least 15 children under two years of age enrolled in Medicaid during 1998-2003. This study found a strong association between modern water services in a community and outpatient LRI incidence rates among children less than two years of age. A weaker association was found for all inpatient (hospitalized) LRI incidence. Children living in communities with the lowest level of modern water service had LRI incidence three- to four-fold higher than those residing in communities with the highest levels of modern water services. This study found that a lack of modern water service in Alaska predicted increased LRI risk among young children.

A study conducted by Hennessey et al. (2008) among Native Alaskans living in rural villages found that regions with a lower proportion of home water service had significantly higher hospitalization rates for pneumonia and influenza, skin or soft tissue infection, and respiratory syncytial virus (among those younger than 5 years) than did higher-service regions. Within one region, infants from villages with less than 10 percent of homes having water service in-home had higher hospitalization rates for pneumonia and RSV than did infants from villages with more than 80 percent served (Hennessey et al. 2008). Outpatient Staphylococcus aureus infections (all ages) and skin infection hospitalizations (all ages) were higher in low-service than in high-service villages.

5.2.6.1. Households with Water and Sewer

According to the Alaska Department of Community and Regional Affairs Community Information Services, a housing unit is considered to have water and sewer service if it has water/sewer pipes or closed haul services. Table 5.2-14 presents information regarding the percentage of Alaska Native houses statewide that have indoor plumbing, obtained from the Alaska Native Epidemiology Center. Alaska Natives in the Mat-Su Borough are part of the Southcentral Foundation that had a regional rate of 89 percent with water and sewer service. The Project also includes PACs in the Copper River Native Association service area, which in 2008 had a regional rate of 86 percent of the population with services.

5.2.6.2. Drinking Water in Villages

"Safe water and adequate sanitation facilities have been public health priorities for decades in Alaska and have contributed significantly to the improvement of health in rural Alaska" (NSB 2012). ADEC Division of Environmental Health, Drinking Water Program, requires Public Water Systems (PWS) to be in compliance with the state drinking water regulations, in accordance with the Federal Safe Drinking Water Act (SDWA) and Amendments, for the public health protection of the residents and visitors to the State of Alaska. Regulated contaminants are divided into 6 categories: Bacteria/Viruses, Nitrate/Nitrites, Inorganic and Heavy Metals, Volatile Organics, Synthetic Organics, and Other Organics. Information on water quality for private wells and water sources is not publicly available.

Historically, there have been high rates of diseases associated with unsafe drinking water and lack of sanitation in Alaskan Native villages. In an attempt to address these public health problems, state and federal agencies were funded to design and build PWS in rural Alaska. There are now PWS in many villages that treat and distribute drinking water for public use. The water systems in each village are subject to the regulations enacted by the EPA under the SDWA and amendments.

There are several types of PWS configurations that may be considered for use in the villages. A system may be a watering point, which consists of a water treatment plant, storage facility, and a single watering point where villagers can collect water in containers. The PWS may be a piped distribution system, which consists of a water treatment plant, storage facility, and distribution lines that bring treated water directly to homes. A PWS may be a truck haul system, which consists of a water treatment plant and trucks used to deliver treated water to residential holding tanks. The type of PWS selected depends on the geographic conditions, especially the presence of permafrost, the population served, and the economic resources of the village (Christian 2007).

When violations occur, the ADEC Drinking Water Program responds with either compliance assistance or enforcement depending on the severity of the violations. Many villages cannot meet the requirements of all the regulations because:

- Lack of trained operators - Many Native speaking operators cannot pass the certification tests because they are only given in English. Often, operators are not paid by the village for their work and adequate support for the operator may not be available from the community.

- Lack of economic resources - Most villages have a subsistence lifestyle where there is little or no cash economy. Villagers may have trouble paying for utility services. Utilities have problems paying and training operators, and there is little money to pay for water testing, treatment chemicals and supplies.

- Geographic/climate extremes – Many villages are geographically remote. Many places in Alaska have no road system and the only access to the villages is by airplane or helicopter. It is difficult to get replacement parts for the PWS. Fuel and electricity to run the water treatment plant are expensive and water systems routinely freeze and distribution lines constantly break due to very cold temperatures. It is extremely difficult to get water samples to the lab on time, especially time dependent samples like total coliform bacteria.

- Lack of commitment in the village – Some villagers do not like the taste of chlorine or groundwater, which in Alaska has high levels of iron. The villagers prefer to use their traditional water sources for drinking water and the treated water for washing clothes (ADEC 2012).

The EPA maintains a database, “The Drinking Water Data Search in ECHO” which displays compliance information and violations that have occurred at public water systems (http://www.epa-echo.gov/cgi-bin/ideaotis.cgi). The database lists all sanitary surveys and site

visits that have occurred in the past 10 years, compliance summary data, and all violations and enforcement actions that have occurred in the previous 5 years for all PWS.

Information for this Section was taken directly from the Alaska Division of Community and Regional Affairs: Alaska Community Database, Custom Data Queries and Alaska Community Database Community Information Summaries (CIS) (http://www.commerce.state.ak.us/dca/commdb/CF_CIS.htm).

5.2.7. HEC 7: Chronic Non-communicable Disease

5.2.7.1. Cardiovascular Diseases

Cardiovascular disease is a category of disorders that includes blocked or narrowed blood vessels, e.g., coronary artery disease, other diseases of the heart, arteriosclerosis, hypertension, and cerebrovascular disease. Like many diseases, major risk factors for heart disease are smoking, age, diet, obesity, diabetes, high blood pressure, and cholesterol levels.

Table 5.2-15 presents the number and age-adjusted rates of death caused by major cardiovascular diseases between 2007 and 2009 in the Mat-Su, Denali, and Kenai Peninsula Boroughs; the Valdez-Cordova Census Area, and the State of Alaska. Diseases of the heart were the second most common cause of death due to major cardiovascular disease in the Mat-Su (149.6 deaths per 100,000 people) and Kenai Peninsula (172.4 deaths per 1000,000 people) Boroughs in 2009 and in Valdez-Cordova Census Area (163.2 deaths per 100,000) between 2007 and 2009. Age-adjusted rates of death due to major cardiovascular diseases were higher in the PAC boroughs than the State as a whole.

The most currently available data for average annual age-adjusted heart disease mortality rates among Alaska Natives by region are shown in Figure 5.2-11. For 2004 - 2007, the rate of heart disease mortality for Alaska Natives in the Anchorage/Mat-Su and Copper River/Prince William Sound Region (188.7 and 217.1 deaths, respectively per 100,000 population) was higher than the rate for all Alaska Natives and for Alaska whites and all U.S. whites. The rate of deaths from heart disease in the Interior Region was 138.6, which was less than the rate for all Alaska Natives, Alaska whites and U.S. whites.

5.2.7.2. Cerebrovascular Diseases

The age-adjusted death rate in the Mat-Su Borough for all races caused by cerebrovascular diseases between 2007 and 2009 was 40.1 deaths per 100,000 people. In the Valdez-Cordova Census Area for all races, the age-adjusted death rate was 80.8 deaths per 100,000 people between 2007 and 2009. The age-adjusted death rate in the Mat-Su Borough was lower than the state rate of 43.1 deaths per 100,000 people. The age-adjusted rate in the Valdez-Cordova Census Area was double the age-adjusted state rate, while the rate for the Kenai Peninsula was similar (37.0 deaths per 100,000 people). Sample sizes were too small to draw any meaningful comparisons for the Denali Borough. Figure 5.2-12 shows average annual age-adjusted cerebrovascular disease mortality rates by region from 2004 to 2007.

The ADHSS, Division of Public Health gathers information on the percentage of adults of all races over 18 years of age who self-reported via the Behavioral Risk Factor Surveillance System

(BRFSS). In response to the question: "Has a doctor, nurse, or other health professional EVER told you had a stroke?" 2.2 percent of Mat-Su Borough residents surveyed said "Yes" while a mean of 2.4 percent of all Alaskans said "Yes" during the 2009–2011 survey period (ADHSS BRFSS 2013). No incidence data are available. In the Kenai Peninsula Borough, 3.3 percent of people had been told they had a stroke as compared to 0 percent in the Denali Borough, and 2.7 percent in the Valdez Cordova Census Area.

Chronic lower respiratory diseases, including asthma, chronic obstructive pulmonary disease, bronchitis, and emphysema, were among the top five leading causes of death in 2009 in the Mat-Su and Kenai Peninsula Boroughs and the Valdez Cordova Census Area 2007-2009, accounting for 22 deaths (both Boroughs) and 11 deaths, respectively. Chronic lower respiratory disease was not among the top five leading causes of death for 2005-2009 in the Denali Borough (ABVS 2013).

5.2.7.3. Asthma

In terms of lung-related health conditions, the ADHSS, Division of Public Health (BRFSS 2013) indicated that 16.9 percent of adults over the age of 18 answered "yes" to the following question: "Have you ever been told by a doctor, nurse, or other health professional that you had asthma?" The mean "yes" response for all Alaskans was 14.2 percent. The self-reported rate has increased since the question was tabulated in 2000–2002 when the mean Alaska response was 11.4 percent "yes,"and the "yes" response for residents of the Mat-Su Borough was 12.1 percent (BRFSS 2013). For the period of 2009-2011, the Denali Borough self-reported the lowest level of asthma at 6 percent, while the Kenai Peninsula Borough, Mat-Su Borough and the Valdez Cordova Census Area reported "yes" responses of 14.7, 14.0, and 10.4 percent, respectively.

5.2.7.4. Mental Health Disorders

Mental health, or behavioral health, is considered a critical component of overall health and is linked to physical health and well-being for persons of all ages. According to the state's BRFSS data base, from 2009 to 2011, Mat-Su Borough residents self reported approximately three days in the past 30 days in which their mental health was not good; 9.4 percent reported having periods of frequent mental distress (FMD: defined as 14 or more days of poor mental health; BRFSS 2013). In the Kenai Peninsula Borough, Denali Borough, and the Valdez Cordova Census Area residents reported that their mental health was not good over the past 30 days for a mean of 3.1, 2.4, and 2.8 days, respectively. Furthermore, 8.6 percent, 7.5 percent, and 8.9 percent of Kenai Peninsula Borough, Denali Borough, and Valdez Cordova Census Area residents reported FMD, respectively. These numbers were similar to the mean of all Alaska residents who self-reported 2.8 days in which their mental health was not good and 8.8 percent reported having periods of frequent mental distress.

5.2.7.5. Cancer

Cancer (malignant neoplasm) was the leading cause of death in the study area between 2007 and 2009 and throughout the previous decade (Table 5.2-16). Between 2007 and 2009, cancer accounted for 25.2 percent and 28.5 percent of all deaths in the Mat-Su and Kenai Peninsula Boroughs, respectively. In Valdez-Cordova Census Area, cancer accounted for 21.9 percent of

all deaths in the same time period. There were not enough cases of cancer in the Denali Borough to be statistically reliable. The percentage of deaths due to cancer for residents of the Mat-Su and Kenai Peninsula Boroughs and the Valdez-Cordova Census Area were similar as for Alaskans statewide (BVS 2013).

Table 5.2-17 presents the age-adjusted rates of cancer deaths in the study area by cancer type in 2007 to 2009. This data shows that cancer death rates were similar to those experienced statewide. Only the rate for the Kenai Peninsula Borough was higher than the statewide rate. Lung cancer was the most common type of cancer with 47.8, 59.3 and 43.9 deaths per 100,000 persons in the Mat-Su Borough, Kenai Peninsula Borough and the Valdez-Cordova Census Area, respectively, as compared to 55 deaths per 100,000 persons in the State of Alaska. Prostate cancers were also common. In the Mat-Su Borough and the Kenai Peninsula Borough the rate was 24.2 and 34.6 deaths, respectively, per 100,000 persons; as compared to the state rate of 21 deaths per 100,000 persons. There were no deaths due to prostate cancer in the Denali Borough and a rate was not reported for the Valdez-Cordova Census Area because there were fewer than 6 cases. These rates should be interpreted with caution due to the small number of occurrences (BVS 2013).

The Alaska Native age adjusted cancer rate deaths by region are shown in Figure 5.2-13. Although there appears to be a difference among the regions, only the Anchorage/Mat-Su region has a statistically significant lower rate than all other regions. The lung/bronchus cancer rates are strongly related to the extremely high tobacco usage that occurs in Alaska Native populations. Smoking rates among Alaska Natives are elevated versus U.S. white populations. Colon/rectal cancer is also a leading cause of cancer death.

5.2.7.6. Physical Activity Levels

Consistent physical activity is an important indicator of future non-communicable diseases risk, particularly cardiovascular disease 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, 3 times or more a week). In the BRFSS 2009 to 2011 data, 78.3 percent of Alaskans and 76.2 percent of residents of the Mat-Su Borough self-reported that they participate in leisure time physical activities (BRFSS 2013). The Denali Borough had the highest percentage of residents who self-reported participating in leisure time physical activities at 84.5 percent, followed by Valdez Cordova Census Area (80.5 percent), and the Kenai Peninsula Borough (78.4 percent; BRFSS 2013).

5.2.7.7. Tobacco Use

The County Health Rankings define smokers as the percentage of the adult population that currently smokes every day or most days and has smoked at least 100 cigarettes in their lifetime (Population Health Institute 2013). Of Alaska Native people in the Mat-Su Region 36.3 percent were smokers from 2007 to 2009. Of Alaska Native people in the Interior region 40.6% were smokers. This is similar to Alaska Natives Statewide (39.5%), but more than double Alaskan Non-Natives (17.1%).

The BRFSS report asks questions on the use of smokeless tobacco products such as chewing tobacco, snuff, Iq-mik or Blackbull. According to the 2009 to 2011 BRFSS data, 5.5 percent of Mat-Su Borough adults self-reported that they had used such products, very similar to the use of smokeless tobacco products by all Alaska adults (5.2 percent; BRFSS 2013). Prevalence of usage was highest in the Valdez Cordova Census Area (20.4 percent), followed by Denali (11.7 percent) and Kenai Peninsula (7.8 percent).

BRFSS also asks questions about people smoking cigarette, cigar, or pipes within their homes Over 14 percent of Mat-Su adults self-reported that they or someone else had smoked in their homes compared with just 9.9 percent of all Alaska adults (2009-2011; BRFSS 2013). The percentage of people reporting smoking within their homes was also higher than the state in the Kenai Peninsula Borough (12.6 percent), Valdez Cordova Census Area (15.5 percent), and highest in the Denali Borough (17.5).

Overall regional smoking rate data for Alaska Natives is shown in Figure 5.2-14. The smoking prevalence between 2005 and 2007 for Alaska Natives in the Anchorage/Mat-Su Region (37 percent), for Interior Region (38 percent) and Copper River/Prince William Sound Region (28 percent) which is less than the rate for all Alaska Natives (41 percent) but twice the rate of Alaska non-Natives and all races in the United States.

5.2.7.8. Chronic Obstructive Pulmonary Disease

COPD refers to a group of lung diseases where impact to airflow within the lungs is occurring. Main risk factors associated with COPD are tobacco smoking, indoor air pollution, outdoor air pollution, and respiratory diseases (Mayo Clinic definition 2013).

From 2004 to 2007, the rate of COPD among Alaska Natives in the Anchorage/Mat-Su Region was 52.2 cases per 100,000 persons, which was similar to the rate for all Alaska Natives, and Alaska whites (Figure 5.2-15). There was no reportable data for Copper River/Prince William Sound region at this time. The rate of COPD among Alaska Natives in the Interior Region was 35.1 cases per 100,000 persons, which was lower than the rate for all Alaska Natives and the rate for Alaska whites. The highest rate among PAC residents occurred in the Kenai Peninsula region (60.3 cases per 100,000 persons). The Alaska Native COPD mortality rate has increased 92 percent since 1980. The rate peaked between 1994 and 1998 and appears to be decreasing (Alaska Native Epidemiology Center 2009).

5.2.8. HEC 8: Health Services Infrastructure

Lack of health insurance coverage is a significant barrier to accessing needed health care. Examining insurance rates among non-elderly adults (or those ages 18-64 years) is a commonly utilized indicator because Medicare covers the preponderance of adults aged 65 years and older in the U.S. In 2010, the percentages of non-elderly adults lacking health insurance in the Mat-Su Borough, Denali Borough, Kenai Peninsula Borough and Valdez-Cordova Census Area were; 21 percent, 20 percent, 24 percent and 25 percent; respectively (Population Health Institute 2013). For Alaska as a whole, 21 percent of non-elderly adults lack health insurance, as do only 13 percent of all US residents. Alaska Natives can receive health care at Southcentral Foundation facilities, as described below.

Having access to care requires not only having financial coverage but also access to providers. Primary care providers include practicing physicians specializing in general practice medicine, family medicine, internal medicine, pediatrics, and obstetrics and gynecology. Table 5.2-18 displays the number of people per one provider for the PAC boroughs.

In 2010, the health care industry accounted for about nine percent of jobs in Alaska (Alaska Economic Trends 2011). During the past 10 years, health care has created more new jobs than any other sector of Alaska's economy. According to the Alaska Department of Labor and Workforce Development (2011) the industry added 10,000 jobs between 2001 and 2010, outpacing all other large industries. Changes due to new legislative changes in health care that may affect the Project area will be evaluated in the USR.

5.2.8.1. Health Service Providers

In Alaska, health services are provided by both private and public organizations for both Alaska Natives and non-natives by hospitals, clinics, and individual providers throughout the state. Health statistics for all borough residents are collected and analyzed by the Department of Health and Social Services and include Alaska Natives and non-natives in the totals. The Alaska Native Epidemiology Center maintains health statistics for all Alaska Native Tribal Regions.

5.2.8.2. Mat-Su Facilities and Services

In the Mat-Su Borough, the Sunshine Community Health Center located in Talkeetna services the residents of Talkeetna, Trapper Creek, Willow, and Chase. Valley Hospital is located in Palmer and is one of the closest major medical facility to the Project. The facility has 36 licensed beds and 109 staff members who provide a full range of emergency and surgical services (Advameg Inc. 2013). Emergency Services in the Mat-Su Borough have highway and air access and are within 30 minutes of a higher-level satellite health care facility. Emergency service is provided by 911 Telephone Service and volunteers. Auxiliary health care is provided by the Mat-Su Borough Fire/EMS and by volunteer Fire/EMS/Ambulance services in some of the smaller communities. Highway access is available at the 3 major medical facilities; and helicopter access is available to the Mat-Su Regional Medical Center.

The Mat-Su Regional Medical Center is located mid-way between Palmer and Wasilla with 74 licensed beds, a total staff of 660, of which 92 are physicians. Services include emergency, surgical, intensive care, medical, dental, laboratory, and pharmacy (Mat-Su Regional Medical Center 2011).

Providence Health & Services Alaska has family medicine, behavioral health and laboratory services available in a new building on the Parks Highway in Palmer. The clinic has 10 physicians on staff.

5.2.8.3. Denali Facilities and Services

There are three health facilities in the Denali Borough: the Cantwell Community Clinic in Cantwell, the Canyon Urgent Care Clinic and the Interior Community Health Clinic, both in Healy.

The closest major medical facility to the proposed "Denali" corridor (i.e. north-south) is Banner Memorial Hospital in Fairbanks. Fairbanks Memorial Hospital is a qualified acute care facility, which has 162 licensed beds and offers a full array of medical services including: Behavioral Health, Cancer Care, Diabetes, Emergency Care, Heart Care, Home Health, Long-term Care, Maternity Services, Medical Imaging, Orthopedics, Pain Management, Pediatrics, Rehabilitation, and Sleep Disorders.

Tanana Valley Clinic located in Fairbanks is a primary care clinic operated by Banner Health that offers these services: health promotion classes, family practice, internal medicine, OB/GYN, occupational medicine, pediatrics, osteopathic manipulation and sleep medicine (Banner Hospital 2012).

5.2.8.4. Valdez-Cordova Facilities and Services

The major medical facility serving the Valdez-Cordova Census Area is the Providence Valdez Medical Center that includes 24 hour emergency services. There are a number of private, public and Native run health facilities throughout the census area. Health care centers in the PACs are located in the communities: Cantwell, Chitina, Gakona, Glenallen, and Copper Center.

5.2.8.5. Kenai Peninsula Facilities and Services

Tyonek and Beluga are located on the west side of the Cook Inlet; the only access to hospital and emergency medical service is by air. The local health center includes Tyonek Health Clinic, a village clinic staffed by a two full time "community health aides" or (CHA). The Community Health Aide Program (CHAP) trains community members to provide basic medical services under distance supervision by a physician. In FY 2005, the Tyonek clinic recorded 372 patient encounters, a number that makes up around 1.5% of all recorded CHA visits in Alaska. This is comparable (though a little higher) to the percentage of Alaska natives statewide (estimated for year 2010) who live in Tyonek (≈1.22%; EPA 2010).

Along with the CHA program, a number of other health professionals visit Tyonek for specific health issues. There is a local behavioral health aide in Tyonek who provides continuing care to disabled citizens and works with a visiting Behavioral clinician who visits the village once a week and stays overnight. There is a rural alcohol advisor who visits the village once a week. Women's health clinicians visit annually to hold clinics. A dental aide or dental staff visits the village quarterly. Ophthalmology doctors or staff visit once a year. A public health nurse visits the village quarterly to provide such services as immunization and well-child visits. Senior citizens are cared for with lunch deliveries to their homes, and related child and senior welfare check-ups are undertaken by a community health representative (EPA 2010).

Emergency service is provided by volunteers and a health aide, and auxiliary health care is provided by Tyonek Volunteer Rescue Squad.

Beluga has no State or Tribal health services. Residents often undertake travel to Anchorage for medical services.

The eastern side of the Cook Inlet has more options for health care. Local hospitals or health clinics include the Central Peninsula General Hospital in Soldotna. The hospital is a qualified

acute care facility and provides critical care air ambulance service, family practice pediatrics, neurology, oncology, continuing care, and community health education programs. The hospital also manages the Kenai Health Center, a qualified Emergency Care Center.

5.2.8.6. Alaska Native Health Organizations

The Cook Inlet Region, Inc. (CIRI), the Chugach Alaska Corporation (CAC), and Ahtna, Incorporated (Ahtna) are the Alaska Native Corporations, which organize and manage services to Alaska Natives within the study area. Health services are provided via the Southcentral Foundation to the Anchorage Service Unit. The foundation recently broke ground on the Southcentral Valley Native Primary Care Center at the junction of Knik Goose Bay Road and the Palmer Wasilla Highway. This new facility will replace a clinic in Wasilla.

The Alaska Native Medical Center (ANMC), in Anchorage, is owned and managed by the CIRI Southcentral Foundation and the Alaska Native Tribal Health Consortium (ANTHC). The medical center is the state-wide referral center and gatekeeper for specialty care for Alaska Natives.

The Kenaitze Indian Tribe (KIT) operates the Dena'ina Health Clinic (DHC) in Kenai, which provides primary health services to eligible Alaska Natives and American Indians. Specialty services not available at the Clinic are referred to ANMC in Anchorage.

6. DISCUSSION

HIA baseline data collection is underway. Publicly available baseline data at the State, Borough (for the study area only), and Regional levels have been collected and compiled in this ISR. Additional baseline data will be included in the USR. Additional data sources include State and ANTHC database requests and baseline information collected by interdependent studies. In addition to baseline data gaps, there are also important gaps regarding project description that are relevant to the HIA.

6.1. HEC 1: Social Determinants of Health

6.1.1. Summary

- Alaska Natives have a lower life expectancy than Alaskans overall.
- In the Mat-Su Borough, 51.7 percent of the population was male and 5.5 percent of the population was Alaska Native in 2010.
- The Valdez-Cordova Census Area reported having a population that was 53.4 percent males and 13.6 percent Alaska Native in 2010.
- In the Denali Borough, 54.9 percent of the population was male and 3.6 percent was Alaska Native in 2010.

6.1.2. Data Gaps

- Community level demographics.
- Community level socioeconomics.
- Alaska Native infant mortality rates.
- Alaska Native prevalence of substance use during pregnancy.
- Project description information including:
    - Location of work camps and key infrastructure;
    - Location of transportation corridors;
    - Housing availability; and
    - Employment levels and hiring practices.

6.1.3. Interdependent Studies

The HIA will be informed by the Social Conditions and Public Services Study (Study 15.6). The HIA HEC 1 will use this study as a resource for establishing a social determinants baseline and for assessing potential impacts. The following data will inform the HIA:

- Hiring practices and work rotations,
- Potential for cultural change;
- Housing availability/inflation;
- Economy,
- Employment, and
- Education.

6.2. HEC 2: Accidents and Injury

6.2.1. Summary

- The leading cause of unintentional injury death for the: State of Alaska; the Mat-Su and Kenai Peninsula Boroughs and the Valdez Cordova Census Area was non-transport accidents; poisoning was the most frequent cause specified.
- The only cause of unintentional injury death for the Denali Borough was vehicle accident.
- The leading cause of non-transport related unintentional injury death in the Mat-Su and Kenai Peninsula Boroughs was poisoning and this rate was higher than that of the State.
- The most common cause of non-fatal injury requiring hospitalization in the Mat-Su Borough area was falls, followed by motor vehicle accidents, and suicide attempts, (in combination accounting for 60%).
- The leading cause of unintentional deaths among Alaska Natives between 2007-2009 was poisoning (i.e. alcohol).
- Unintentional injury deaths for Alaska Natives residing in the Interior and the Copper River/Prince William Sound Regions were more than twice that of Alaska Whites and U.S. Whites as a whole.
- The leading cause of intentional injury deaths among Alaska Natives in 2005 was suicide.

6.2.2. Data Gaps

- Updated accident and injury data from the ATR including any data for Denali Borough and the Valdez-Cordova Census Area.
- Crude non-fatal unintentional injury hospitalization rate by tribal health organization.
- Traffic and accident datasets from Transportation Resources Study (Study 15.7).

6.2.3. Interdependent Studies

- The HIA (HEC 2: Accidents and Injuries) will utilize traffic levels data (road, air, rail, river) generated by the Transportation Resources Study (Study 15.7) as a resource for establishing a traffic safety baseline in the PACs.
- Data generated by the traffic-forecasting portion of the study will inform the assessment of Project-driven accidents and injury risk posed by changes in baseline traffic.

6.3. HEC 3: Exposure to Potentially Hazardous Materials

6.3.1. Summary

- Results from surveys (Ware et al. 2013) showed that there is elevated potential for PM10/PM2.5 exposures in rural Alaska.
- Top indoor air quality concerns included mold, lack of ventilation or fresh air, and dust. A baseline burden of poor indoor air quality increases susceptibility to changes in outdoor air quality.
- Top outdoor air pollution concerns identified were open burning/smoke, road dust, and vehicle exhaust (e.g., snow machines, ATVs, etc.).
- The HIA does not have any Project area or community level data to examine at this time.

6.3.2. Data Gaps

- Community baseline data for air quality.
- Project baseline data for air, water, and soil.
- Project forecast and modeling data for air, water, and soil.

6.3.3. Interdependent Studies

Once available, data from the following interdependent studies will be examined under HEC3:

- Baseline Water Quality Study (Study 5.5);
- Mercury Assessment and Potential for Bioaccumulation Study (Study 5.7); and
- Air Quality Study (Study 15.9).

The HIA HEC3 Exposure to Potentially Hazardous Materials will utilize baseline data collected via these interdependent studies to establish a baseline of current levels of contaminants of human health concern present in fish and in water. These data will be compared to human health risk based screening levels. Similarly, the HIA will utilize data generated by the modeling

exercise portion of these studies in order to assess potential project impacts on contaminant levels in fish and water.

The HIA HEC3 Exposure to Potentially Hazardous Materials will utilize baseline data collected via the Water Quality Monitoring Study (Study 5.5) to locate domestic wells including private (homeowner) wells. In the risk assessment portion of the HIA, the HIA will use the groundwater vulnerability assessment in order to determine potential Project impacts on water availability for domestic well water users.

The HIA HEC3 Exposure to Potentially Hazardous Materials will also utilize baseline emissions data collected by the Air Quality and Transportation Studies (Studies 15.7 and 15.9) as a resource for determining baseline air quality in the PACs. Data generated by the future air emissions portion of the by Air Quality Study (Study 15.9) will inform the assessment of Project-driven risks to human health due to potential change in air quality.

6.4. HEC 4: Food, Nutrition, and Subsistence Activity

6.4.1. Summary

- Fishing and hunting for subsistence resources provide a reliable economic base for many rural regions. Subsistence is focused toward meeting the self-limiting needs of families and small communities (Wolfe and Walker 1987).
- While many residents in the communities engage in subsistence hunting, fishing, and gathering as a part of their diets, it is not yet known what percent of their food supply currently comes from subsistence activities.
- There are no community level data to examine at this time.

6.4.2. Data Gaps

- Some results of the TLK surveys are not yet available.
- Subsistence surveys and harvest data and analysis have not been completed and are not yet available.

6.4.3. Interdependent Studies

- The HIA HEC4 Food, Nutrition, and Subsistence will use the Subsistence Resources Study (Study 14.5) to identify subsistence resources currently used in Project area and as a resource to evaluate potential project impacts on identified subsistence uses in the PACs.

6.5. HEC 5: Infectious Disease

6.5.1. Summary

- Communicable diseases disproportionally affect poor populations and are exacerbated by unsanitary conditions, unsafe water, and inadequate personal hygiene.

- Reportable communicable diseases were not among the leading cause of death among all races in either the Mat-Su, Denali, or Kenai Peninsula Boroughs nor the Valdez-Cordova Census Area.
- Over the previous decade, deaths due to infectious and parasitic diseases have remained relatively stable, while the numbers of deaths due to pneumonia appear to be slightly decreasing.
- In 2011, Alaska had the highest incidence of TB in the nation and in contrast to the majority of newly identified TB cases in the U.S. which occur in the foreign-born population, most new TB cases in Alaska are locally-acquired, and occur primarily in the Alaska Native population.
- STIs among Alaska residents are disproportionately distributed by race, gender, and age.
    - Between 2007 and 2008, STIs comprised nearly 90 percent of all Alaska Native reportable infectious disease cases.
    - CT the most commonly reported infectious disease, accounting for 80 percent of all reported infectious diseases, followed by Gonorrhea.

6.5.2. Data Gaps

- Primary data sets from the BVS for the census area does not include years 2010 to 2013.
- Data from the Alaska Native Epidemiology Center do not include years 2007 to 2013.
- There is no information available at this time on admission codes for medical facilities in the Interior Region.
- Location of Project work camps and major infrastructure are unknown which has implications for the potential HEC 5 impacts due to population influx.

6.5.3. Interdependent Studies

- The HIA team does not anticipate receiving data from interdependent studies that would address existing data gaps; however pending database requests may able to address some of baseline data gaps.
- Communities potentially at risk for Project-driven changes in infectious disease prevalence will be identified once Project design, facilities, transportation routes, workforce plan are known.

6.6. HEC 6: Water and Sanitation

6.6.1. Summary

- Sanitation operations in rural Alaska are expensive and complex; small, economically limited communities have limited financial and technical capacity to support these operations.
- Many small, rural, primarily Alaska Native communities lack any piped water and wastewater disposal services, and entire regions have service rates that remain below national standards.
- In rural Alaska, lack of adequate water service is linked to the high rates of lower respiratory infections observed in some regions, and to invasive skin infections.

- There are approximately 220 Alaska Native villages that have a PWS. A significant number of these PWSs are on the EPA's Significant Non-Complier List due to noncompliance with the Drinking Water Regulations, mostly due to the village's lack of technical, managerial and financial capacity to properly run the water treatment plant.

6.6.2. Data Gaps

- The most current regional water and sanitation data collected by Native health service organizations are from 2008 and may not reflect current conditions.
- Community level water and sanitation service rates are unknown.
- Households to be included in the "Potential Impacts to Shallow Groundwater Users" portion of the Groundwater Monitoring Study are currently unknown.
- Location of Project work camps and major infrastructure are unknown which has implications for the potential overburdening of existing services due to population influx.
- Communities that may consume fish from the Study area.

6.6.3. Interdependent Studies

The HIA team is coordinating with the Groundwater Study (Study 7.5) lead to collect information regarding potential impacts to shallow groundwater users (i.e. private well users) in the Project area. The ground water study team sampled wells in 2013 in the following areas:

- Whiskers Slough
- Gold Creek
- Curry

The Groundwater Study team will be providing results in the next study season that will help determine which, if any, private well owners may need to be contacted for inclusion in the assessment.

6.7. HEC 7: Chronic Disease

6.7.1. Summary

- Major cardiovascular diseases age-adjusted mortality rates are higher in the Mat-Su and Kenai Peninsula Borough and the Valdez-Cordova Census Area than the state as a whole. The rate of deaths from heart disease in the Interior Region was less than the rate for all Alaska Natives, Alaska whites and U.S. whites.
- Cancer was the leading cause of death in the study area between 2007 and 2009, and throughout the previous decade.
- Lung/bronchus cancer rates are strongly related to the extremely high tobacco usage that occurs in Alaska Native populations.
    - Smoking rates in Alaska Natives are elevated versus U.S. white populations.
- Colon/rectal cancer is also a leading cause of cancer death among Alaska Natives.
- The rate of COPD among Alaska Natives in the Anchorage/Mat-Su Region was similar to the rate for all Alaska Natives, and Alaska whites. The rate of COPD among Alaska

Natives in the Interior Region was lower than for all Alaska Natives and for Alaska whites.

6.7.2. Data Gaps

- Community level burden of chronic disease is unknown.
- Since the initial drafting of this report updated BRFSS data for Alaska Natives by Borough has become publicly available (2009-2011). The USR will include this updated data for chronic disease and risk factors among Alaska Natives:
    - Cerebrovascular disease
    - Cardiovascular disease
    - Cancer
    - Mental health
    - Asthma
    - COPD
    - Substance use
- Diabetes prevalence among Alaska Natives and Alaska Whites.
- Communities that may be sources of employment for the Project are currently unknown.

6.7.3. Interdependent Studies

- The HIA team may receive data from the Social Goods and Public Services Study (Study 15.6) and/or further Project description materials that would inform which local communities may serve as Project employment bases.
- The HIA will likely obtain anecdotal information regarding the burden of chronic disease in some of the PACs via the key informant interviews.

6.8. HEC 8: Health Infrastructure and Capacity

6.8.1. Summary

- Health services are provided by both private and public organizations for both Alaska Natives and non-natives by hospitals, clinics, and individual providers throughout Alaska.
- Valley Hospital in Palmer and is the closest major medical facility to the Project.
    - The facility has 36 licensed beds and 109 staff members who provide a full range of emergency and surgical services.
    - Emergency services in the Mat-Su Borough have highway and air access and are within 30 minutes of a higher-level satellite health care facility
- The closest major medical facility to the proposed "Denali" corridor (i.e. north-south) is Banner Memorial Hospital in Fairbanks.
- The major medical facility serving the Valdez-Cordova Census Area is the Providence Valdez Medical Center that includes 24 hour emergency services.
- Tyonek and Beluga are located on the west side of the Cook Inlet; the only access to hospital and emergency medical service is by air. Local health clinics include Tyonek

Health Clinic, a village clinic staffed by two fulltime "community health aides" or (CHA).

- Alaska Native Corporations which organize and manage services to Alaska Natives within the Study area include:
  - CIRI
  - CAC
  - Ahtna

6.8.2. Data Gaps

- Services and capabilities of health facilities in the Denali Borough PACs as well as true ratio of people to providers for the Borough are unknown.
- Services and capabilities of health facilities in the Valdez-Cordova Census Area PACs are unknown.

6.8.3. Interdependent Studies

- The HIA team does not anticipate receiving data relevant to HEC 8 from any of the other Project studies.
- Identified gaps will be filled through community observations conducted in coordination with ADF&G survey work, and telephone interviews with health management organizations and local health care practitioners.

7. COMPLETING THE STUDY

[Section 7 appears in the Part C section of this ISR.]

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9. TABLES

Table 4.4-1. Health Effects Categories

Health Effects Category	Pathway Description
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.
Accidents and Injuries	This category includes impacts related to both fatal and non-fatal injury patterns for individuals and communities.
Exposure to Potentially Hazardous Materials	This category includes project emissions and discharges that lead to potential exposure.
Food, Nutrition, and Subsistence Activity	This section depends on the subsistence analysis and nutritional surveys and the effect on diet and food security.
Infectious Disease	This category includes the project's influence on patterns of infectious disease.
Water and Sanitation	This category includes the changes to access, quantity and quality of water supplies.
Non-communicable and Chronic Diseases	This category considers how the project might change patterns of chronic diseases.
Health Services Infrastructure and Capacity	This category considers how the project will influence health services infrastructure and capacity.

ADHSS Technical Guidance for Health Impact Assessment (HIA) in Alaska, 2011

Table 4.5-1. HIA - Food Security, Nutrition Surveys and TLK Participation

Number	Community	ADF&G Surveys	HIA Data Gap Communities[1]	Community in Watershed	Use Area in Watershed
1	Beluga		X		x
2	Cantwell	X			x
3	Chase	X		X	No data
4	Chickaloon		X		x
5	Chistochina		X		
6	Chitina	X			
7	Copper Center		X		
8	Copperville	X			No data
9	Denali Hwy Households		X	X	No data
10	Eklutna		X		x
11	Gakona	X			x
12	Glennallen	X			x
13	Gulkana	X			x
14	Healy		X		x
15	Kenny Lake	X			x
16	Lake Louise	X		X	x
17	McCarthy	X			x
18	McKinley Park		X		x
19	Mendeltna	X		X	No data
20	Mentasta Lake		X		
21	Nabesna		X		
22	Nelchina	X			No data
23	Parks Hwy Households (Chulitna, Gold Creek, Hurricane/Broad Pass)		X		No data
24	Paxson	X			x
25	Petersville		X	X	No data
26	Skwentna	X		X	x
27	Slana		X		
28	Susitna	X		X	No data
29	Talkeetna	X		X	No data
30	Tazlina	X			No data
31	Tolsona	X			No data
32	Tonsina	X			x
33	Trapper Creek	X		X	No data
34	Tyonek		X		x

Number	Community	ADF&G Surveys	HIA Data Gap Communities[1]	Community in Watershed	Use Area in Watershed
35	**Wasilla**			X	No data
36	**Western Susitna Basin**		X		x
37	**Willow**		X	X	No data

Note:

1 For these communities there is no household level field work planned by the Subsistence Resources Study (Study 14.5) because existing data is sufficient.

Table 4.5-2 Overview of Potential Health Impacts Associated With The Susitna-Watana Hydroelectric Project

Health Effects Category	General Potential Impact
Social Determinants of Health (SDH)	Shift away from traditional lifestyle may cause familial and social discord, exacerbate generational gaps, which can lead to increased rates of domestic violence, mental illness, and suicide rates. Wages in the hands of locally sourced workers may increase spending on alcohol and drugs of abuse. In-migration of job seekers and worker family members may result in housing price inflation and housing shortages. Increased income can improve access to health services that may facilitate an overall improvement in health status. Increased purchasing power can in some cases allow families improved access to water and sanitation facilities.
Accidents and Injuries	The Project will operate vehicles that have the potential to interact with and potentially impact the PACs: (i) Road and rail traffic accidents (injury and possible fatality); and (ii) Releases/spills associated with road and rail traffic accidents. The primary potential sources for road and rail traffic are the project site, port, local materials sources and railroad headings. Geographically, the likelihood of an RTA will be greatest in the proposed roadway access corridors, particularly on north-south access corridor. Seasonal risks include increased tourism traffic during the summer and dangerous road conditions in the winter.
Exposure to Potentially Hazardous Materials	Reservoir construction can elevate levels of methyl mercury in fish tissue by three- to five-fold after flooding. As described in HEC2, transportation of Project hazardous materials on roadways, railways and waterways (e.g. fuel and waste materials) can result in an inadvertent release of potentially hazardous materials. The Project may improve local air quality by decreasing reliance on coal and diesel generators for electricity.
Food, Nutrition, and Subsistence Activity	Project driven landscape changes and associated infrastructure may affect the availability of subsistence resources via changes to habitat utilization, and fish and wildlife migration routes. Changes in wildlife habitat, hunting patterns, and food choices may influence the diet and cultural practices of local communities. In addition to direct impacts, indirect Project impacts to subsistence resources may occur as a result of population influx. Increased income may facilitate greater purchasing power and improved food security. Shift away from subsistence based diet may lead to purchase and consumption of less healthy foods
Infectious Disease	The presence of temporary "open" construction camps near communities could increase sexually transmitted infection rates and related diseases. International and domestic migrant workers could import bacterial and viral diseases endemic in other parts of the world or the contiguous 48 states. Improper disposal of kitchen wastes leads to congregation of wildlife (e.g. red fox), facilitating zoonotic outbreaks. Overcrowding in community homes to due influx of extended family leads to an increase in prevalence of respiratory infections such as influenza and TB.
Water and Sanitation	Overburdening existing services and systems due to community influx can lead to increases in water-born illness rates. Revenue from the project may support construction/maintenance of water and sanitation facilities that may create a positive impact.

Health Effects Category	General Potential Impact
Non-communicable and Chronic Diseases	Increased smoking at work camps may transmit to home environment. Changes in diet from life in work camps may result in adverse health outcomes (i.e. weight gain, cardiovascular disease, diabetes, etc.) Shift from high physical activity to sedentary lifestyles may contribute to increased obesity rates, cardiovascular disease rates and diabetes rates.) Improvement in air quality may lessen the burden of Chronic obstructive pulmonary disease (COPD).
Health Services Infrastructure and Capacity	Health care workers obtain jobs at project, which may reduce availability of local health care personnel. Workforce influx may increase demand on local health care infrastructure and services and reduce access for current residents. Increased revenues could be used to support or bolster local/regional health services

Table 5.2-1. Social Determinants of Health Susitna-Watana Hydroelectric Study Area Communities – Demographic Profile, 2010 Census

Location	Total Population	Median Age	Percent Male	Percent Alaska Native
State of Alaska	710,231	33.8	52.0	14.8
Denali Borough	1,826	NA	54.9	3.6
Cantwell	219	42.7	58.4	15.5
Healy	1,021	40.1	53.5	2.1
Mat-Su Borough	88,995	34.8	51.7	5.5
Chase	34	52.0	64.7	0.0
Chickaloon	272	48.8	52.2	6.3
Eklutna	ND	ND	ND	ND
Houston	1,912	35.4	53.5	6.7
Lake Louise	46	60.0	69.6	2.2
Skwentna	37	52.8	59.5	0.0
Susitna	18	58.0	55.6	0.0
Talkeetna	876	45.4	51.7	3.7
Trapper Creek	481	48.0	52.6	6.4
Valdez-Cordova Census Area	9,636	39.8	53.4	13.6
Chistochina	93	43.5	51.6	53.8
Chitina	126	28.0	48.4	19.8
Copperville	ND	ND	ND	ND
Copper Center	328	35.3	51.8	48.5
Gakona	218	40.7	52.3	19.7
Glennallen	483	35.8	50.7	7.7
Gulkana	119	26.3	51.3	76.5
Kenny Lake	355	44.5	52.4	8.2
McCarthy	28	48.0	71.4	0.0
Mendeltna	39	54.8	59.0	0.0
Nelchina	59	55.3	49.2	8.5
Paxson	40	54.0	67.5	0.0
Tazlina	297	38.5	50.2	33.7
Tolsona	30	52.3	53.3	0.0
Tonsina	78	49.3	56.4	9.0
Whittier/Portage	220	48	56.8	5.5
Kenai Peninsula Borough	55,400	40.6	52.4	7.4
Beluga	20	55.5	70.0	10.0
Tyonek	171	33.6	56.1	88.3

2010 Census SF1: Profile of General Population and Housing Characteristics

ND = Not Determined

Table 5.2-2. Infant Deaths and Infant Mortality Rates for Mat-Su Borough and Alaska, All Races, 2007 to 2009

Infant Deaths	Mat-Su Borough		Denali Borough*		Valdez-Cordova Census Area*		Kenai Peninsula Borough		State of Alaska
	Number of deaths	Rate per 1,000 live births	Number of deaths	Rate per 1,000 live births	Number of deaths	Rate per 1,000 live births	Number of deaths	Rate per 1,000 live births	Rate per 1,000 live births
Neonatal (infants less than 28 days of age)	6	1.6	0	0	2	**	3	**	2.6
Postneonatal (infants 28 days to 1 year of age)	15	3.9	0	0	3	**	5	**	3.6
Total Infant Deaths	21	5.5	0	0	5	**	8	3.9[a]	6.3

**Rates based on fewer than 6 occurrences are not reported

*Data is for the period 2005-2009

[a]Rates based on fewer than 20 occurrences are statistically unreliable and should be used with caution.

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Table 5.2-3. Adequacy of Prenatal Care for Females, by Race, 2009

Adequacy of Prenatal Care (APNCU Index)	ALL RACES		WHITE		ALASKA NATIVE	
	Births (No.)	Percent (%)	Births (No.)	Percent (%)	Births (No.)	Percent (%)
State of Alaska						
Adequate or better	**5,568**	**59.5**	**3,671**	**67.8**	**1,253**	**44.3**
Adequate plus	1,993	21.3	1,326	24.5	409	14.5
Adequate	3,575	38.2	2,345	43.3	844	29.8
Intermediate	2,178	23.3	1,148	21.2	797	28.2
Inadequate	1,605	17.2	602	11.1	780	27.6
Mat-Su Borough						
Adequate or better	**777**	**73.5**	**686**	**75.3**	**61**	**61.6**
Adequate plus	333	31.5	304	33.3	19	19.2
Adequate	444	42.0	384	42.0	42	42.4
Intermediate	140	13.2	112	12.3	21	21.2
Inadequate	141	13.3	114	12.5	17	17.2
Denali Borough						
Adequate or better	**11**	**52.4**	**	**	**	**
Adequate plus	3	14.3	**	**	**	**
Adequate	8	38.1	**	**	**	**
Intermediate	6	28.6	**	**	**	**
Inadequate	4	19.0	**	**	**	**
Valdez-Cordova Borough						
Adequate or better	**52**	**54.2**	**34**	**54**	**14**	**51.8**
Adequate plus	17	17.7	11	17.5	5	18.5
Adequate	35	36.5	23	36.5	9	33.3
Intermediate	28	29.2	17	27.0	9	33.3
Inadequate	16	16.7	12	19.0	4	14.8
Kenai Peninsula Borough						
Adequate or better	**461**	**69.1**	**398**	**70**	**50**	**61.7**
Adequate plus	142	21.3	125	22.0	12	14.8
Adequate	319	47.8	273	48.0	38	46.9
Intermediate	146	21.9	122	21.4	21	25.9
Inadequate	61	9.1	49	8.6	10	12.3

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Table 5.2-4. Infants Born to All Mothers Reporting Substance Use during Pregnancy, 2009

		Reported drinking	Reported smoking
Alaska	**Births (No.)**	340	1,744
	Percent (%)	3.1	15.6
Mat-Su Borough	**Births (No.)**	18	196
	Percent (%)	1.4	15.3
Denali Borough	**Births (No.)**	0	1
	Percent (%)	0	4.5
Valdez-Cordova Census Area	**Births (No.)**	3	22
	Percent (%)	2.5	18.0
Kenai Peninsula Borough	**Births (No.)**	16	96
	Percent (%)	2.3	14

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Table 5.2-5. Teen Birth Rates among Alaska Natives and All Mothers, 2009

	Births to Alaska Native mothers < 20 years (%)	Births to all mothers < 20 years (%)
Alaska	16.1	9.9
Mat-Su Borough	17.8	10.8
Denali Borough	**	3.8
Valdez-Cordova Census Area	18.8	8.9
Kenai Peninsula Borough	11	13

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Table 5.2-6. Potentially Affected Communities – Economic Indicators

Borough/Census Area	Median Household Income (2007-2011) ($)	Per Capita Income (2007-2011) ($)	Percent of People below Poverty Limit (2007-2011)	Percent Unemployed (July 2013)
United States	51,425	27,041	14.3	7.7
State of Alaska	69,014	31,944	9.5	5.9
Mat-Su Borough	66,052	24,906	9.7	6.7
Kenai Peninsula Borough	59,296	30,256	21.0	6.2
Denali Borough	82,898	38,804	9.1	3.6
Valdez Cordova Census Area	62,238	31,029	6.7	5.9

U.S. Bureau of Labor Statistics 2013. Not seasonally adjusted

2011 American Community Survey 2007-2011 5-year estimates

AK Dept of Labor and Workforce Development 2013

Table 5.2-7. Potentially Affected Communities – Education Indicators

Borough/Census Area	Educational attainment persons 25 years and older		High School Drop-out rate	Literacy Rate
	High School Grads or more (%)	Bachelor's degree or higher (%)		
United States	85.4	28.2	4.1	85.5
State of Alaska	91.4	27.2	7.3	91.0
Mat-Su Borough	92.3	20.9	NA	92.0[a]
Kenai Peninsula Borough	92.4	23.1	4.6	92
Denali Borough	90.8	24.2	NA	NA
Valdez Cordova Census Area	91.6	24.5	NA	NA

NA: Data not available

Educational Attainment: 2007-2011 American Community Survey 5-Year Estimates

National Center for Education Statistics, Public School Graduates and Dropouts 2007-2008, 2009 American Community Survey 3-Year Estimates

a 2003 National Assessment of Adult Literacy

Table 5.2-8. Potentially Affected Communities – Household Characteristics

Borough/Census Area	Number of Households	Average Household Size	Percent of Family Households	Female Households, No Husband Present (Percent of Family Households)	Two-Parent Households with own Children Present under 18 Years (Percent of Family Households)
United States	116,716,292	2.6	66.4	19.7	30.4
State of Alaska	258,058	2.7	66.2	16.2	34.3
Mat-Su Borough	31,824	2.8	70.9	12.3	36.9
Denali Borough	806	2.22	56.3	3.0	21.5
Valdez Cordova Census Area	3,966	2.38	60.9	8.2	19.7
Kenai Peninsula Borough	19,826	2.65	7.7	28.1	28.1

US Census 2010 (http://live.laborstats.alaska.gov/cen/dparea.cfm)

http://factfinder2.census.gov/faces/tableservices/jsf/pages/productview.xhtml?fpt=table

Table 5.2-9. Major Causes of Unintentional Injury Deaths, Mat-Su and Denali Boroughs, Valdez-Cordova Census Area, Kenai Peninsula Borough and State of Alaska, 2007 to 2009

Cause of Death	Mat-Su Borough		Denali Borough		Valdez-Cordova Census Area		Kenai Peninsula Borough		State of Alaska	
	Deaths	Age-Adjusted Rate[a]	Deaths	Age-Adjusted Rate[a]	Deaths	Age-Adjusted Rate[a]	Deaths	Age-Adjusted Rate[a]	Deaths	Age-Adjusted Rate[a]
Unintentional Injuries	117	50.4	1	**	21	77.1	105	70.4	1,025	55.3
Transport accidents	41	16.8	0	0	9	32.3[d]	45	28.8	310	15.5
Motor vehicle accidents	33	13.7	1	**	5	**	38	24.4	262	13.2
Snow machine[b]	3	**	0	0	0	0	3	**	48	2.5
ATV[c]	4	**	0	0	0	0	2	**	21	1
Water transport	0	0	0	0	3	**	1	**	16	8[d]
Air transport	7	2.8	0	0	1	**	6	3.7*	27	1.3
Other transport accidents	1	**	0	0	0	0	0	0	4	**
Non-transport accidents	76	33.6	1	**	12	44.8[d]	60	41.6	715	39.8
Falls	5	**	0	0	1	**	8	6.9*	73	5.6
Accidental discharge of firearms	0	0	0	0	0	0	0	0	6	3[d]
Drowning and submersion	3	**	0	0	3	**	7	5.3*	74	3.6
Smoke, fire and flame	3	**	0	0	2	**	8	5.2*	39	1.9
Poisoning	49	20	0	0	2	**	20	13.1	348	16.9

[a] Age-Adjusted rates are per 100,000 U.S. year 2000 standard population

[b] Deaths to an operator or passenger related to the use of a snow machine

[c] Deaths to an operator or passenger related to the use of an ATV

[d] 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

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Table 5.2-10. Leading Causes of Unintentional Injury Deaths among All Alaska Natives, 2005 to 2007

Cause	Rank	Number of Deaths	Percent of Total
Unintentional poisoning	1	61	19.6
Motor vehicle traffic	2	46	14.7
Drowning	3	41	13.1
Natural/environmental	4	39	12.5
ATV/Snowmachine	5	27	8.7
Other Transport (Boat, etc.)	6	27	8.7
Suffocation	7	19	6.1
Fire/Flame	8	15	4.8
Fall	9	7	2.2
Pedestrian (Other)	10	6	1.9
Firearm	11	3	1.0
Other		9	2.9
Not Specified		12	3.8
Total		**312**	**100**

Alaska Native Epidemiology Center 2009

Table 5.2-11. Leading Causes of Intentional Injury Deaths among All Alaska Natives, 2005 to 2007

Cause	Rank	Number of Deaths	Percent of Total
Suicide	1	141	78.3
Homicide	2	39	21.7
Total		**180**	**100**

Alaska Native Epidemiology Center 2009

Table 5.2-12. Deaths due to Infectious and Parasitic Disease in the State of Alaska, Mat-Su Borough, Valdez Cordova Census Area, Denali Borough, and the Kenai Peninsula Borough

Cause of Death	Alaska Age-adjusted rate	Mat-Su Borough Age-adjusted rate	Valdez-Cordova Census Area Age-adjusted rate	Denali Borough Age-adjusted rate	Kenai Peninsula Borough Age-adjusted rate
INFECTIOUS AND PARASITIC DISEASE (A00-B99)	14.1	11.6	**	0	15.2
Tuberculosis (A16-A19)	6*	**	0	0	0.0
Septicemia (A40-A41)	6.3	6.3*	**	0	**
Viral Hepatitis (B15-B19)	2.9	2.7*	**	0	2.8*
HIV Disease (B20-B24)	1.2	**	0	0	**
All Other Infectious Disease	3.1	**	0	0	7.7*
INFLUENZA AND PNEUMONIA (J10-J18)	12.5	**	**	0	6.9*
Influenza (J10-J11)	7*	0	0	0	0
Pneumonia (J12-J18)	11.8	10.4*	**	0	6.9*

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[a] 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.

Table 5.2-13. Reportable Infectious Disease Cases, Alaska Natives, January 1, 2007 to October 3, 2008

Infectious Disease	Cases	Percent of Total
Chlamydia	4,103	79.3
Gonorrhea	476	9.2
Hepatitis C	198	3.8
Pneumococcal invasive	135	2.6
Tuberculosis, Pulmonary	52	1.0
Chlamydia, PID	37	0.7
Pertussis	32	0.6
Salmonella	25	0.5
GAS invasive disease	24	0.5
GBS invasive disease	18	0.3
Chicken Pox	15	0.3
Botulism, Foodborne	13	0.3
Campylobacter	12	0.2
Gonorrhea, PID	9	0.2
Invasive H Flu, Not Meningitis	7	0.1
Giardia	5	0.1
Hepatitis B	3	0.1
Meningitis, Haemophilus	3	0.1
Other Infectious Diseases	10	0.2
Total	**5,177**	**100.0**

Alaska Native Epidemiology Center 2009

Table 5.2-14. Water and Sanitation Service Rates by Region, 2008

Regional Health Corporation	2008 Housing Units with Pipes or Close Haul	2008 Total Housing Units	Percent Served
Aleutian Pribilof Islands Association	271	324	84
Arctic Slope Native Association	462	491	94
Bristol Bay Area Health Corporation	1364	1572	87
Chugachmuit	179	189	95
Copper River Native Association	343	397	86
Eastern Aleutian Tribes	507	541	94
Kodiak Area Native Association	349	356	98
Maniilaq Association	865	1140	76
Norton Sound Health Corporation	970	1509	64
Southcentral Foundation	212	238	89
Southeast Alaska Regional Health Consortium	2288	2329	98
Tanana Chiefs Conference	1150	1930	60
Yukon-Kuskokwim Health Corporation	2753	4760	58
Independent	1437	1556	92
Total	13,150	17,332	76

Alaska Native Epidemiology Center 2011

Table 5.2-15. Major Cardiovascular Disease Deaths, Matanuska -Susitna Borough, Valdez-Cordova, Denali Borough, Kenai Peninsula Borough and the State of Alaska, 2007 to 2009

	Denali Borough		Mat-Su Borough		Valdez-Cordova Census Area		Kenai Peninsula Borough		State of Alaska	
Cause of Death	Deaths	Age-Adjusted Rate[a]	Deaths	Age-Adjusted Rate[a]	Deaths	Age-Adjusted Rate[a]	Deaths	Age-Adjusted Rate[a]	Deaths	Age-Adjusted Rate[a]
Major Cardiovascular Diseases	6	426.8*	306	219.4	45	235.2	285	224.6	2567	204.9
Heart disease	3	**	233	163.2	31	145.3	220	172.4	1945	151.2
Ischemic heart disease	2	**	132	89.4	19	89.6*	145	111.0	1152	87.6
Acute myocardial infarction	0	0	29	18.1	6	25.4*	22	18.0	232	19.2
Atherosclerotic cardiovascular disease	1	**	41	20.7	10	51.5*	77	55.0	484	31.0
All other ischemic heart disease	1	**	62	50.7	3	**	46	38.0	436	37.5
All other heart disease	1	**	101	73.8	12	55.8	75	61.4	793	63.5
Cerebrovascular disease	3	**	49	40.1	12	80.8*	44	37.0	488	43.1
All other cardiovascular diseases	0	0	24	16.2	2	**	22	15.2	134	10.7

Table 5.2-16. Top Leading Causes of Death in Alaska and the Susitna Watana Study Area, Age-adjusted Rates[a], 2007 to 2009

Cause of Death (ICD-10 Codes)	State of Alaska		Denali Borough		Mat-Su Borough		Kenai Peninsula Borough		Valdez-Cordova Census Area	
	Rank	Age-Adjusted Rate	Rank	Age-Adjusted Rate	Rank	Age-Adjusted Rate	Rank	Age-Adjusted Rate	Rank	Age-Adjusted Rate
Malignant Neoplasms (C00-C97)	1	184	1	**	1	174.9	1	228.5	1	157.0
Diseases of the Heart (I00-I09, I11, I13, I20-I51)	2	155.9	2	**	2	149.6	2	151.2	2	145.3
Unintentional Injuries (V01-X59, Y85-Y86)	3	54	2	**	3	42	3	74.7	3	77.1
Chronic Lower Respiratory Diseases (J40-J47)	4	49.2	-	-	4	44.1	4	46.7	5	71.5*
Cerebrovascular Diseases (I60-I69)	5	40.6	2	**	-	**	5	34.4*	4	80.8*
Intentional Self-Harm (Suicide) (X60-X84, Y87.0)	6	22.7	-		5	21.3*	-	-	-	-
Diabetes (E10-E14)	7	21.3	-	-	-	-	-		-	-
Chronic Liver Disease and Cirrhosis (K70, K73-K74)	8	11.7	-	-	-	-5	-	20.0	-	-
Influenza and Pneumonia (J10-J18)	9	12.5	-	-	-	-	-	-	-	-

Alaska Bureau of Vital Statistics

[a] 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.

Table 5.2-17. Cancer Deaths by Type, Matanuska-Susitna, Denali, Valdez-Cordova Census Area, Kenai Peninsula Borough, and the State of Alaska, 2007 to 2009

	Denali Borough		Mat-Su Borough		Valdez-Cordova Census Area		Kenai Peninsula Borough		State of Alaska	
Cause of Death	Deaths	Age-Adjusted Rate[a]	Deaths	Age-Adjusted Rate[a]	Deaths	Age-Adjusted Rate[a]	Deaths	Age-Adjusted Rate[a]	Deaths	Age-Adjusted Rate[a]
Malignant Neoplasms	1	**	301	175.3	36	157.0	285	200.5	2583	182.8
Colon, rectum and anus	0	0	25	13.6	2	**	26	19.5	236	17.5
Liver and intrahepatic bile ducts	0	0	8	4.2[c]	1	**	11	5.8*	94	5.7
Lung	1	**	82	47.8	10	43.9	82	59.3	770	55.0
Breast [b]	0	0	20	22.5	1	**	29	39.5	187	24.0
Prostate [b]	0	0	14	24.2[c]	2	**	16	34.6*	104	21.0
Lymphoid & hematopoietic	0	0	27	13.6	4	**	17	12.7*	209	15.5
Non-Hodgkin's lymphoma	0	0	8	3.4[c]	0	0.0	9	6.6*	83	6.3
Leukemia	0	0	14	8.1[c]	3	**	6	4.4*	88	6.4
All other lymphoid & hematopoietic	0	0	5	**	1	**	2	**	38	2.8
All other malignant neoplasms	0	0	125	73.9	16	66.1	104	68.9	983	67.6

Table 5.2-18. Ratio of People to Providers

Location	Number of People Per One Primary Care Provider
United States	1,067 to 1
Alaska	1,206 to 1
Matanuska-Susitna Borough	1,293 to 1
Denali Borough	1,835 to 0
Valdez-Cordova Census Area	1,384 to 1
Kenai Peninsula Borough	1,235 to 1

Population Health Institute 2013

10. FIGURES

Figure 5-1. HIA Study Area

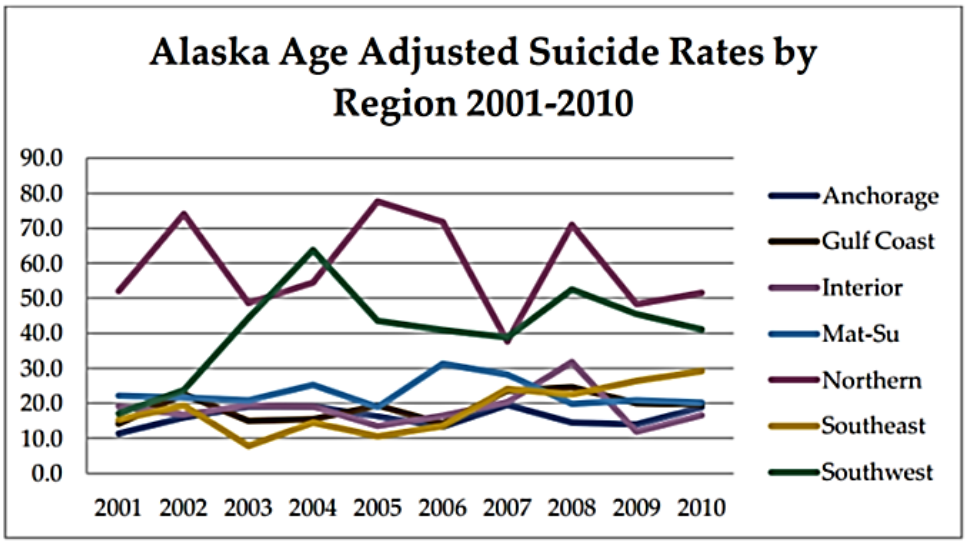

Figure 5.2-1. Alaska Age-adjusted Suicide Rates over Time by Region 2001 – 2010. Source: ADHSS Suicide Prevention Council 2012.

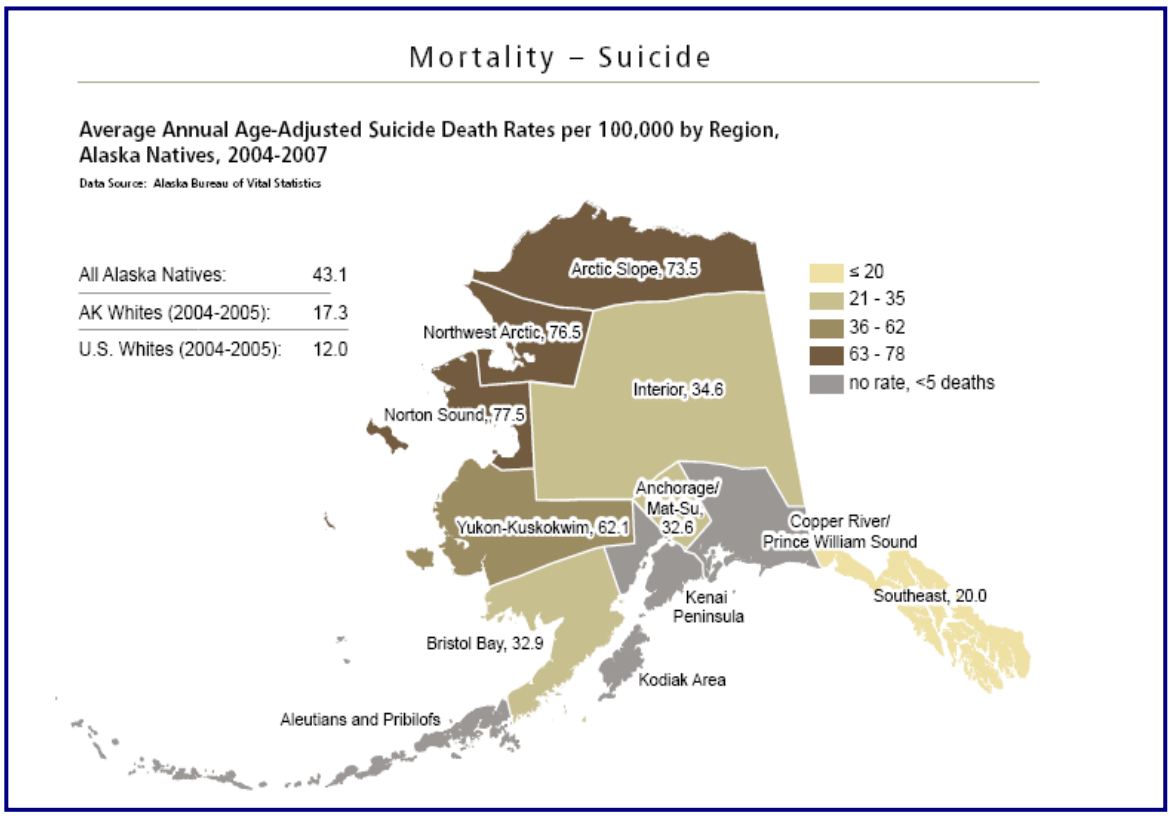

Figure 5.2-2. Suicide Death Rates by Region. Source: Alaska Native Epidemiology Center 2009.

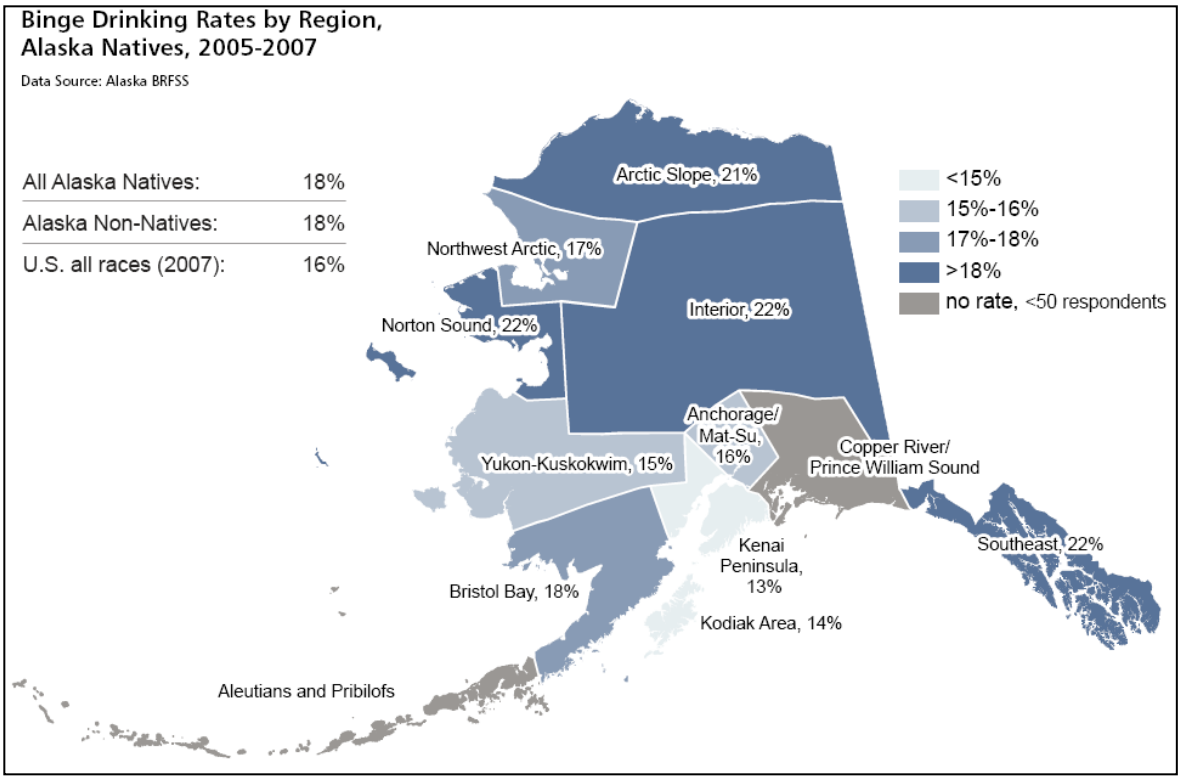

Figure 5.2-3. Binge Drinking Rates by Region. Source: Alaska Native Epidemiology Center 2009.

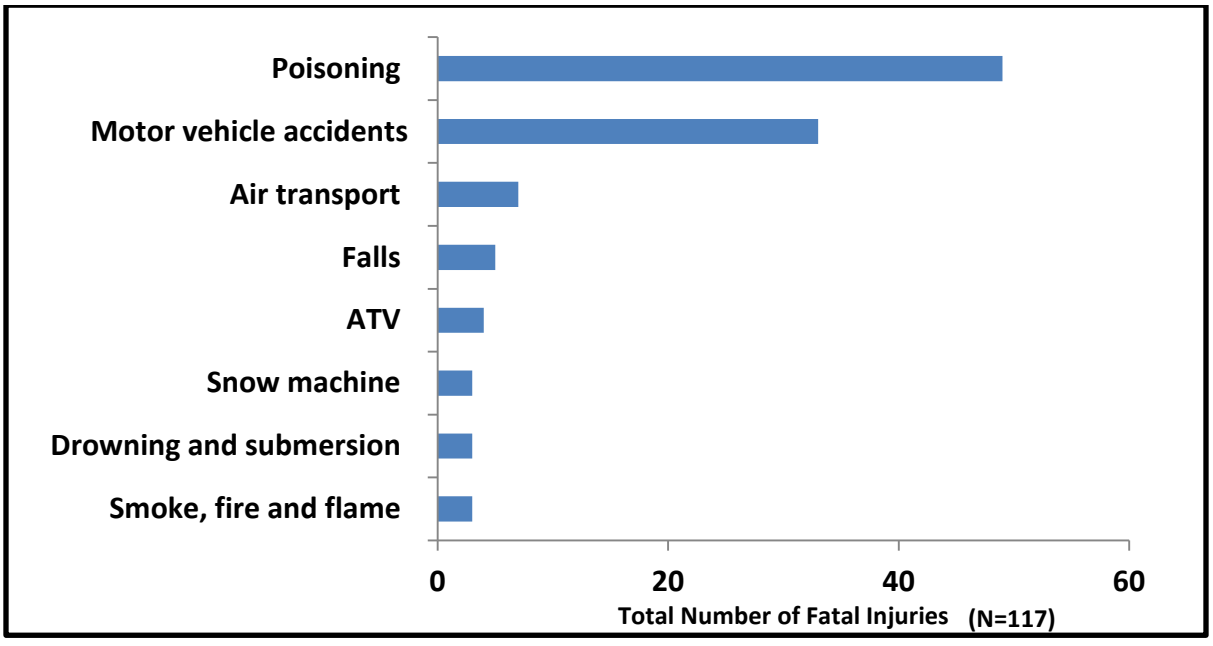

Figure 5.2-4. Number of Fatal Injuries in the Matanuska Susitna Borough, 2007 – 2009. Source: Alaska Trauma Registry 2011.

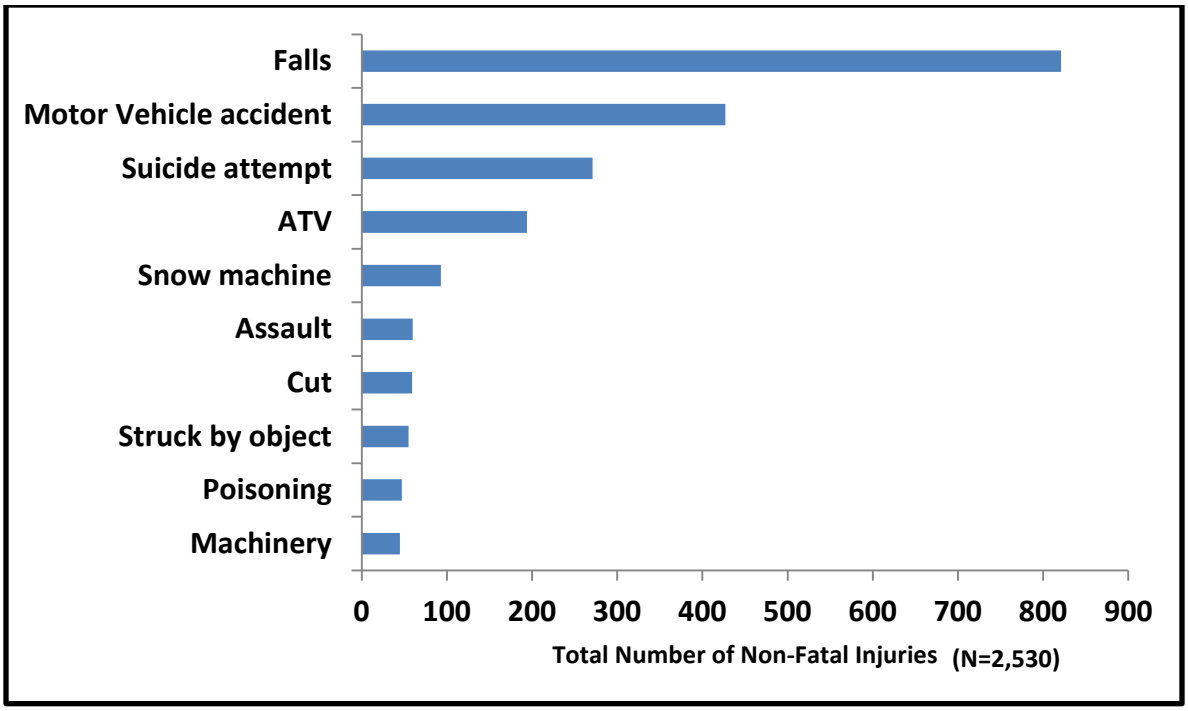

Figure 5.2-5. Leading Causes of Non-Fatal Injury in the Matanuska Susitna Borough, 2004 – 2008. Source: Alaska Trauma Registry 2011

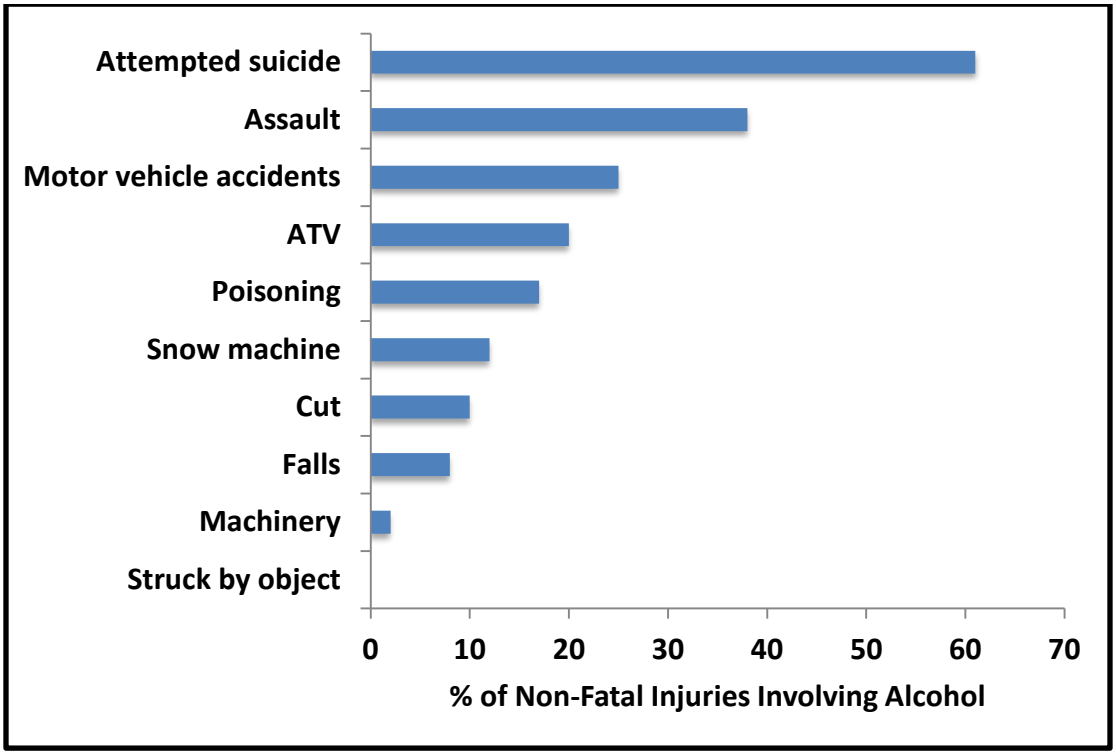

Figure 5.2-6. Non-fatal injuries by Percentage Involving Alcohol: 2004 – 2008 Matanuska Susitna Borough, Alaska. Source: Alaska Trauma Registry 2011.

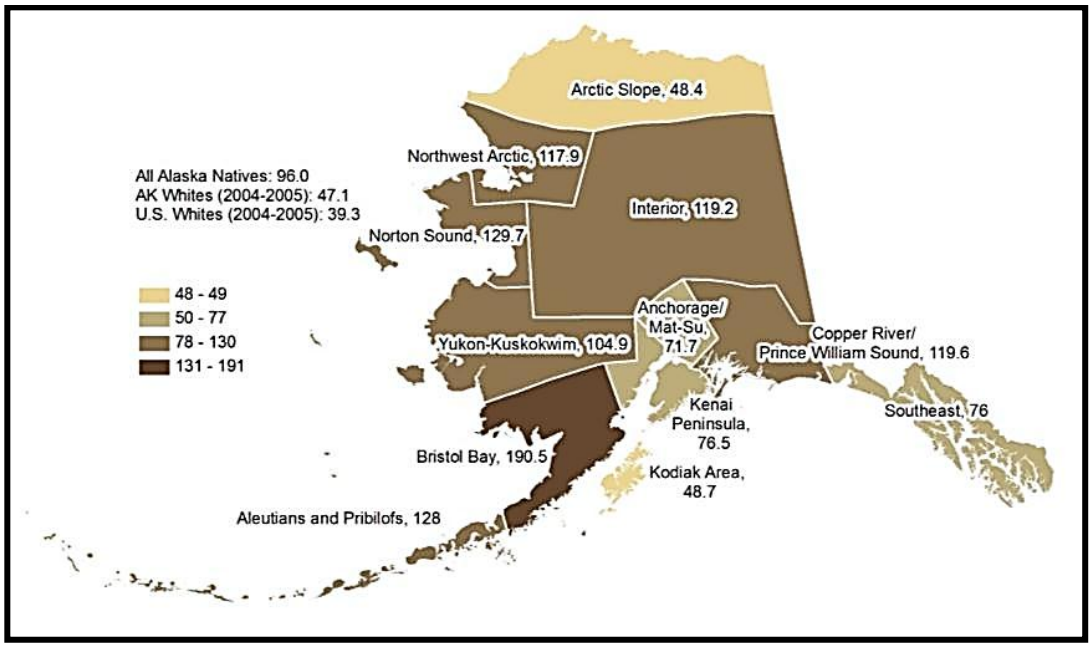

Figure 5.2-7. Average Annual Age-adjusted Unintentional Injury Death Rates per 100,000 by Region, Alaska Natives, 2004 – 2007. Source: Alaska Trauma Registry 2011.

Figure 5.2-8. Regions in Alaska Where Rabies is Enzootic Among Foxes. Source: ADHSS SOE 2013b.

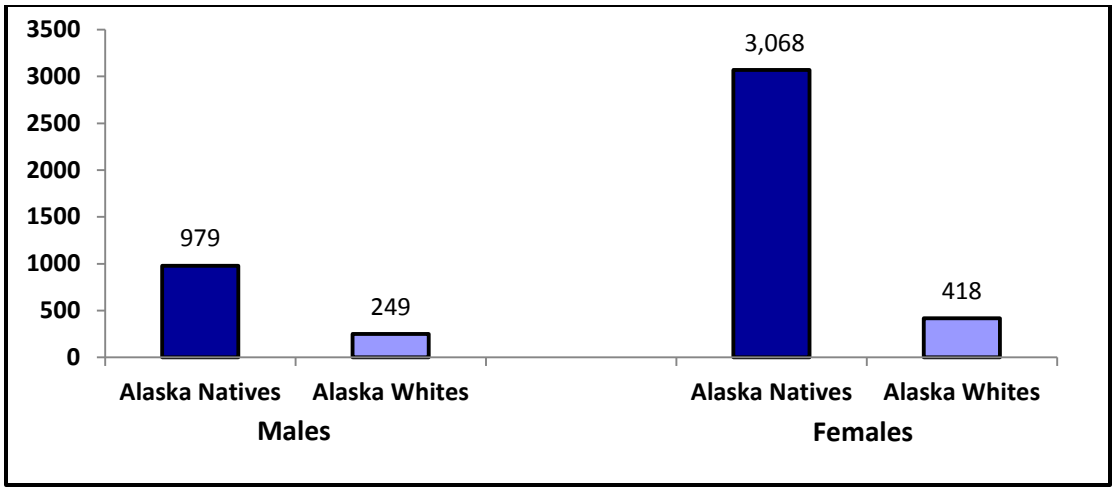

Figure 5.2-9. Chlamydia Rate per 100,000 Population, Alaska Natives Statewide, 2007. Source: Alaska Native Epidemiology Center 2011.

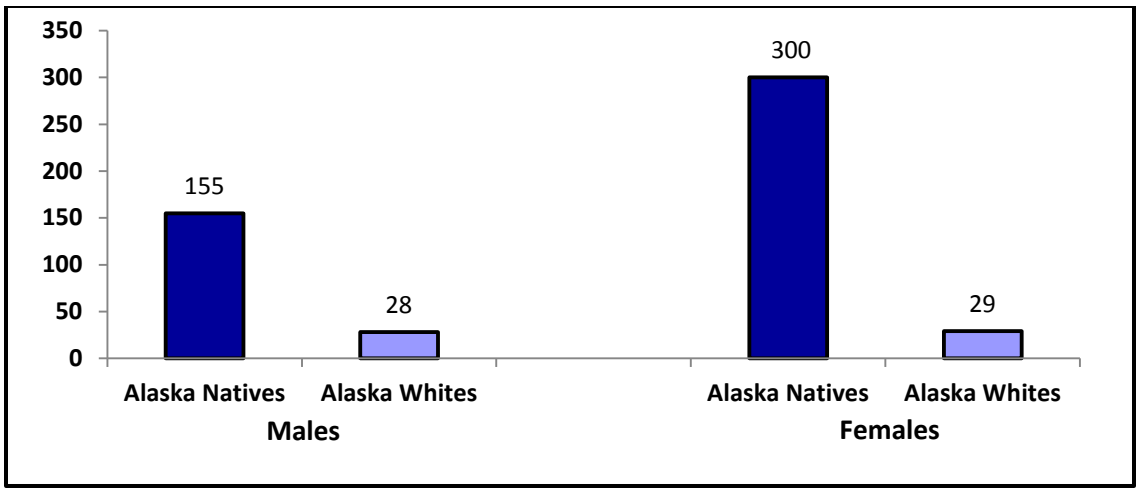

Figure 5.2-10. Gonorrhea Rate per 100,000 Population, Alaska Natives Statewide, 2007. Source: Alaska Native Epidemiology Center 2011.

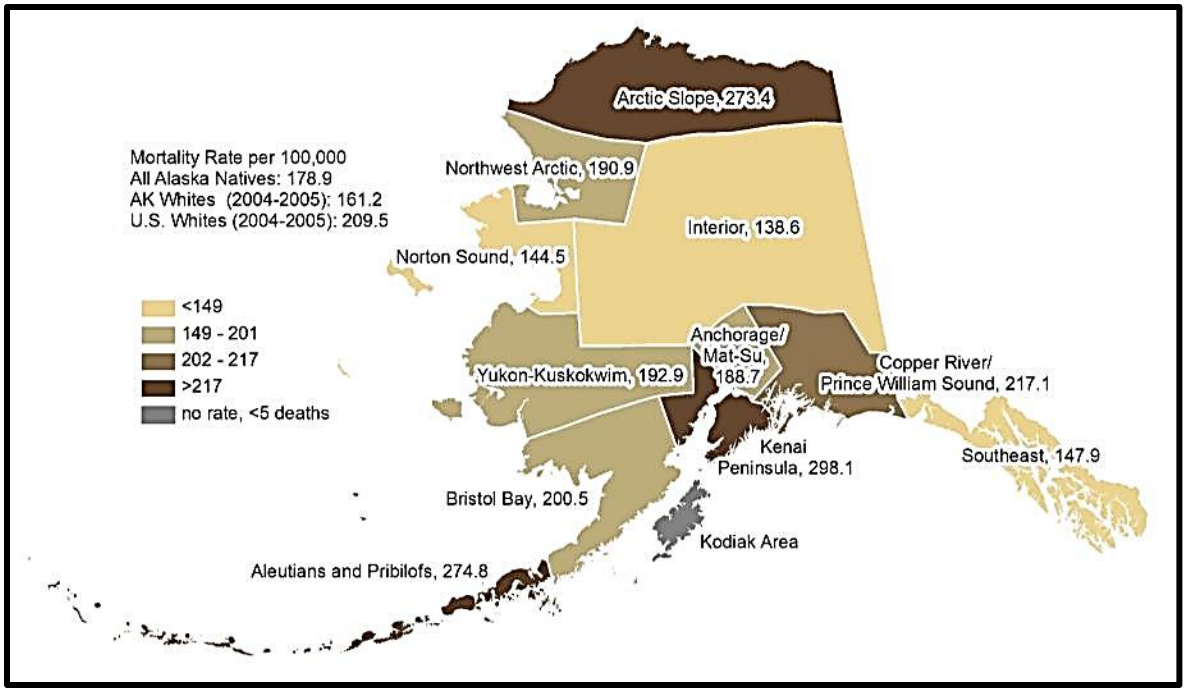

Figure 5.2-11. Average Annual Age-adjusted Heart Disease Mortality Rates per 100,000 by Region Alaska Natives, 2004 to 2007. Source: Alaska Native Epidemiology Center 2011.

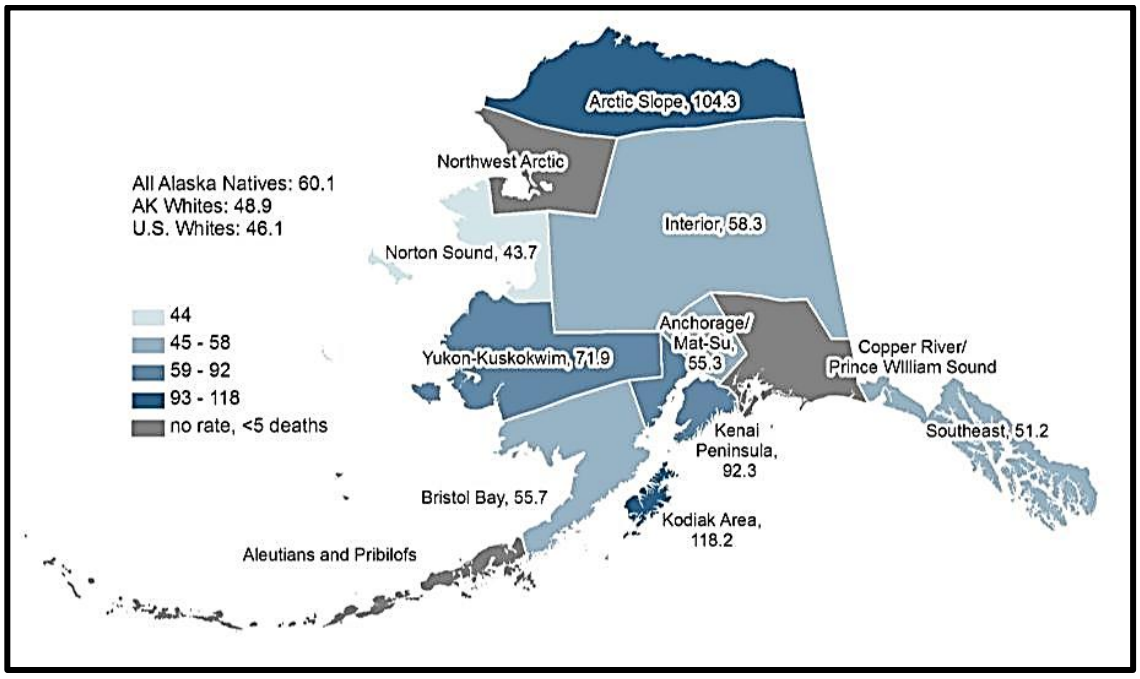

Figure 5.2-12. Average Annual Age-adjusted Cerebrovascular Disease Mortality Rates per 100,000 by Region Alaska Natives, 2004 to 2007. Source: Alaska Native Epidemiology Center 2011.

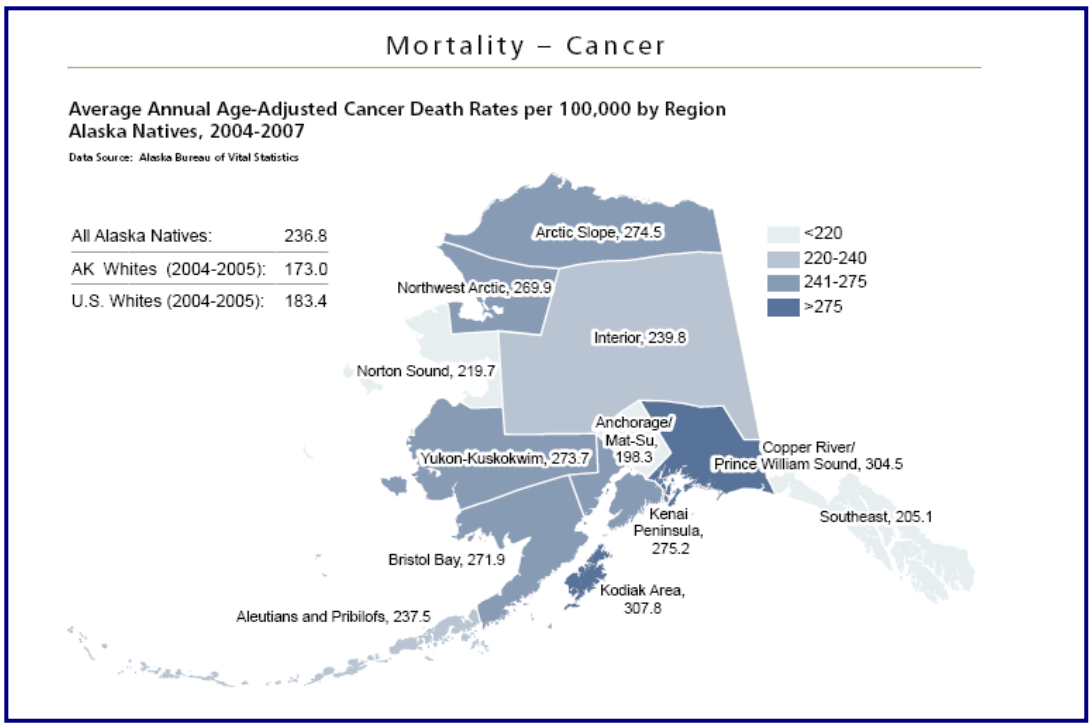

Figure 5.2-13. Alaska Native Age-Adjusted Cancer Death Rates. Source: Alaska Native Epidemiology Center 2009.

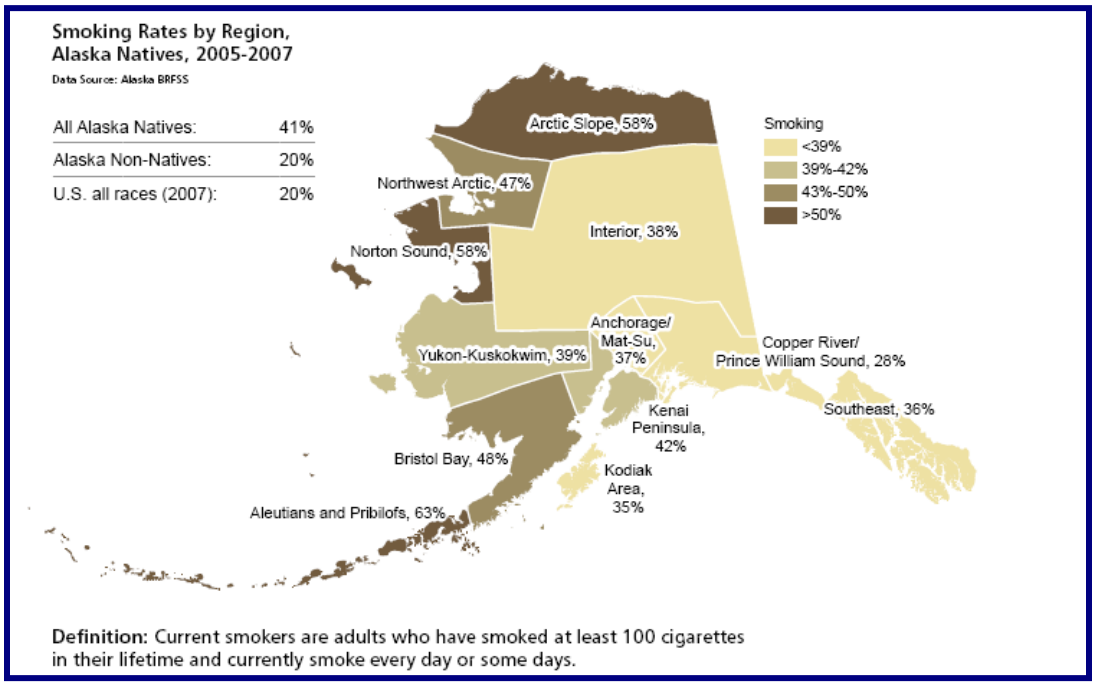

Figure 5.2-14. Tobacco Use. Source: Alaska Native Epidemiology Center 2009.

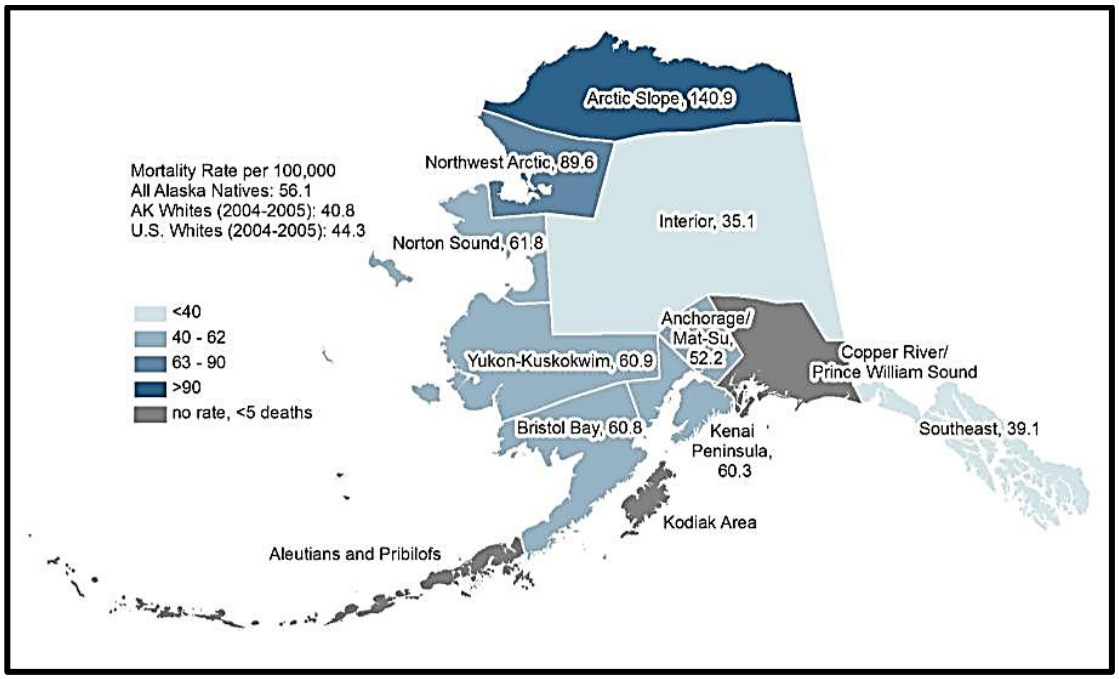

Figure 5.2-15. Alaska Native Chronic Obstructive Pulmonary Disease, 2004 – 2007. Source: Alaska Native Epidemiology Center 2009.