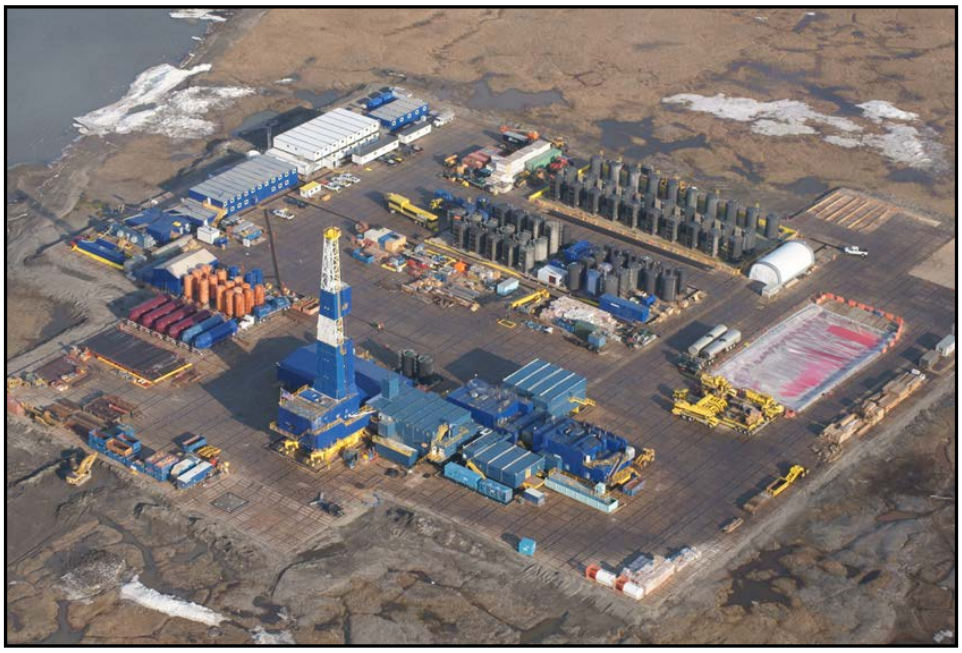
Appendix R

Human Health Impact Assessment

HEALTH IMPACT ASSESSMENT
Point Thomson Project



June 2011

Prepared for:

Point Thomson EIS

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State of Alaska HIA Program

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Signature page

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	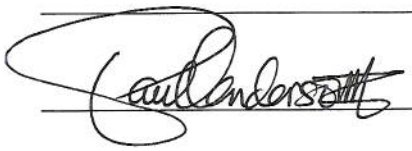
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ACRONYMS

ANWR	Arctic National Wildlife Refuge
ASNA	Arctic Slope Native Association
ATR	Alaska Trauma Registry
BMI	Body Mass Index
CDC	Centers for Disease Control
EIS	Environmental Impact Statement
ESRI	Environmental Sensitivities Research Institute
HIA	Health Impact Assessment
HEC	Health Effects Categories
IFC	International Finance Corporation
IPIECA	International Petroleum Industry Environmental Conservation Association
NCDs	Non-Communicable Diseases
NEPA	National Environmental Policy Act
NGOs	Non-Governmental Organizations
NSB	North Slope Borough
OPD	Outpatient Department
PACs	Potentially Affected Communities
PM	Particulate Matter
PTP	Point Thomson Project
SDH	Social Determinants of Health
SIA	Social Impact Assessment
STIs	Sexually Transmitted Infections
STP	Sewage Treatment Plants
WHO	World Health Organization

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EXECUTIVE SUMMARY

Project Background

This health impact assessment (HIA) aims to identify human health impacts associated with the proposed ExxonMobil development of the Thomson Sand reservoir (Figure 1). The project site is located approximately 60 miles east of Deadhorse on the Beaufort Sea coast, 60 miles west of Kaktovik, and just west of the Arctic National Wildlife Refuge, Alaska.

The U.S. Army Corps of Engineers (USACE) has not yet authorized this project which is currently in the National Environmental Policy Act (NEPA) Review/Environmental Impact Statement (EIS) process. This HIA is a standalone document that will be incorporated into the EIS as a technical appendix. Where appropriate, the HIA refers to detailed technical sections of the EIS which contain careful descriptions of the affected environment, project-specific engineering, and a comprehensive analysis of the PACs. Additionally, this HIA relies on information available as of June 2011 2010 that has been provided by (i) subject matter experts who worked on the EIS, (ii) the project proponent (*e.g.*, "Point Thomson Project Environmental Report, November 2009"), and (iii) tribal, federal and State of Alaska public health authorities.

HIA Background

HIA is an internationally used 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 negative health effects while maximizing the health benefits of a particular action.

In general, HIAs can be a) a very short desktop exercise that can be completed in a matter of weeks, b) a rapid assessment that requires in-depth analysis of baseline data, site visits, and literature review normally taking several months or c) a comprehensive HIA that meets all the requirements of a rapid assessment HIA but that also collects field data for health issues of concern. Comprehensive HIAs typically require a year or more for completion. During early screening meetings, stakeholders decided that the Pt. Thomson HIA should be a rapid assessment HIA since the health impacts from this project were expected to be few.

Limitations

This HIA has several important limitations. First, it does not address classic occupational health concerns (*e.g.* physical hazards or environmental hazards encountered while working), which are referred to as 'inside the fence' and are thoroughly addressed by federally mandated health and safety protocols. However, "cross-over" issues (*e.g.* health issues that arise as workers interact with local communities such as roadway traffic) are analyzed within the HIA. Second, this HIA does not evaluate the global implications of Alaskan development such as the contribution of the Pt. Thomson project to climate change. Third, this HIA was executed in the presence of data gaps, particularly related to human consumption of subsistence resources. As a result, the HIA reviewed subsistence reports from subject matter experts and predicted the nutritional changes for affected communities based on harvest

information. The rationale and assumptions involved in this exercise are described in detail below.

HIA Approach to Health

The Alaska Collaborative HIA Working Group, composed of federal, state, and tribal medical and public health professionals and organized by the Department of Health and Social Services HIA Program, developed an Alaska-specific list of Health Effect Categories (HECs) which allows HIA practitioners to combine their human health knowledge in a specific area (*e.g.* injury prevention) with their knowledge of project design features (*e.g.* road traffic patterns, road design) in order to identify likely health impacts. HECs analyzed for the Point Thomson Project include:

- Social Determinants of Health (SDH) including psychosocial, domestic violence and gender issues
- Accidents and Injuries
- Exposure to potentially hazardous materials
- Food, Nutrition, and Subsistence Activity
- Infectious Disease
- Water and Sanitation
- Non-communicable and Chronic Diseases
- Health Services Infrastructure and Capacity

To gather a variety of perspectives, the HIA Team hosted a panel on October 29, 2010, to consider the Point Thomson Project, its implications for human health, and to rank and rate those human health impacts. This panel was conducted in a focus group format in order to discuss a collection of impacts already identified by the HIA team. The focus group consisted of members of the HIA team, state public health professionals, state officials with excellent knowledge of the project, and international HIA experts.

ExxonMobil Design Alternatives, Impacts, Mitigations

ExxonMobil has proposed several alternative designs for the Pt. Thomson facility that contain both off-shore and onshore activities. They are:

- **Alternative A** – No action
- **Alternative B** – Applicant's proposed project
- **Alternative C** – Inland pads with gravel access road
- **Alternative D** – Inland pads with seasonal ice access road
- **Alternative E** – Coastal pads with seasonal ice roads.

Because these design alternatives propose changes to the position large linear features such as pipelines, roads and the size of the workforce needed, they have slightly different implications for human health. The impacts and mitigations unique to the various alternatives are presented below:

Alternative A

The No Action Alternative would result from the Army Corps of Engineers not issuing a permit for gravel fill and other construction activities regulated by the agency under Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act. Without a Corps permit, it is not foreseeable that any project leading to the production of the Point Thomson hydrocarbon resources could proceed. Two production wells (PTU-15 and PTU-16) were drilled and capped on the central pad. Protective wellhead covers approximately 16 feet tall and 8 feet in diameter were installed on PTU-15 and PTU-16 and rig mats remain onsite. All other equipment and camp structures were demobilized in 2011. If the No Action Alternative is selected, the wells would continue to be monitored in accordance with Alaska Oil and Gas Conservation Commission (AOGCC) regulations and prudent operator practices until the time that they are closed or brought into production in a future project. The monitoring will have zero to minimal impacts on public health. The area is remote from human habitation, and it is in the interest of public health and safety to continue the monitoring activities.

Alternative B

The Applicant's Proposed Action would configure the drilling and production facilities onto three gravel pads to facilitate evaluation of all hydrocarbon resources, and provide flexibility for future natural gas production should the currently-proposed project prove that larger-scale natural gas production was viable. This alternative would locate the onshore gravel pads near the coastline, incorporating portions of two existing gravel pads. To facilitate the transport of large facility modules to Point Thomson, a sealift facility composed of onshore bulkheads and offshore mooring dolphins would be constructed.

This alternative appears to present health challenges because it utilizes coastal locations that could change quantity and access for subsistence resources for residents of Kaktovik and Nuiqsut. ExxonMobil has already agreed to build the pipeline 7 feet above the tundra in order to facilitate the movement of caribou and agreed to cease barging activity during the Kaktovik whaling season. The HIA team noted that even with reduced harvests that there would be only a low impact on the composition of diet and food security because other sources of subsistence and manufactured food are available to make up for the potential loss of 1 pound of caribou per person.

Finally, incineration facilities at the central pad create the potential for emission of hazardous materials due to incomplete combustion. This feature is consistent for all alternatives and received a high rating because of the duration of the project. This impact can be mitigated through stack emissions monitoring.

Under all of the action alternatives operation of the Point Thomson facility would increase the size of dividends from the Alaska Permanent Fund to all qualified residents of Alaska. This effect would continue throughout the 30-year productive life of the facility. In addition, the development at Point Thomson is predicted to add approximately $1 billion to the actual and true property value of the North Slope Bureau. Increasing the tax revenue of the NSB may have cascading effects across the borough. The NSB provides most of the services and employment in the borough; it also funds most of the capital improvement projects in the region, including health care facilities.

Alternative C

The intent of the Inland Pads with Gravel Access Road alternative is to minimize impacts to coastal resources such as marine mammals, marine fish, subsistence activities, coastal processes, and to avoid potential impacts to the proposed project from coastal erosion. To minimize impacts, this alternative would move project components inland and as far away from the coast as feasible. To provide year-round access to Point Thomson, this alternative would also include the construction of an all-season gravel road from Point Thomson to the Endicott Spur Road where it would meet the Dalton Highway. Alternative C would not include barging or associated facilities for sea access to Point Thomson.

This alternative was designed to address concerns expressed about the coastal facility footprint by moving the facilities inland and eliminating the use of barges to the site. Under this alternative, materials and supplies would be barged into West Dock in Prudhoe Bay and then trucked to Point Thomson in between 17,000 and 18,500 trips during the extended construction and drilling phases of the project.

The HIA team ranked the potential for roadway accidents and injuries as high, especially during the construction and drilling phases when traffic volumes are high. While a roadway would be off limits to tourists, local residents would very likely have egress on these roads for snow machine and automobile travel. The combination of local resident travel and industrial truck traffic creates significant risk for accidents and injuries. ExxonMobil will require their drivers to follow internal transportation standards during the proposed construction schedule. If Alternative C is selected, local access to the roadways could be restricted until construction and drilling is completed and traffic volumes decrease. Seatbelt use and speed limit enforcement could also reduce the number and severity of injuries on roads constructed for these alternatives.

If roadway accidents and injuries increased, this would create an increased burden for local clinics in Prudhoe Bay and potentially Barrow. This impact can be mitigated through developing a written action plan to augment staff and facilities to meet this rising burden should it occur.

The Subsistence and Traditional Land Use Patterns section (Section 5.22) notes that Alternative C is expected to disrupt subsistence Caribou hunting for the residents of Kaktovik because the herds congregate along the shoreline during the summer months and that the noise and traffic could disrupt the herd during the long construction period. The Subsistence section estimates that the maximum potential effects on caribou harvests may include the loss of up to 10.8 percent of annual caribou harvests, accounting for approximately 13.3 pounds per capita of caribou per year or approximately or approximately 15,000 calories of energy from very lean meat. Impacts may not occur during all years but could exceed the maximum expected annual loss during certain years if caribou are unavailable elsewhere. Because this impact would potentially continue throughout the life of the project, ExxonMobil may want to consider doing some public health research regarding human consumption of subsistence resources (i.e. nutritional surveys).

Alternative D

The intent of Inland Pads with Seasonal Ice Access Road alternative is to minimize impacts to coastal resources such as marine mammals, marine fish, subsistence activities, coastal processes, and to reduce potential impacts to the proposed project from coastal erosion. To minimize impacts, this alternative would move the project components inland and as far away from the coast as feasible. This alternative is also characterized by access to and from Point Thomson occurring primarily via an inland seasonal ice road, running east from the Endicott Spur Road to the northern end of the Point Thomson project area.

This alternative was designed to address concerns expressed about the coastal facility footprint by moving the facilities inland and eliminating the use of barges to the site. Under this alternative, materials and supplies would be barged into West Dock in Prudhoe Bay and then trucked to Point Thomson in between 16,000 and 17,500 trips during the extended construction and drilling phases of the project.

The HIA team ranked the potential for roadway accidents and injuries as high due to high traffic volumes during the construction and drilling phases. While a roadway would be off limits to tourists, local residents would very likely have egress on these roads for snow machine and automobile travel. The combination of local resident travel and industrial truck traffic creates significant risk for accidents and injuries. ExxonMobil will require their drivers to follow internal transportation standards during the proposed construction schedule. If Alternative D is selected, local access to the roadways could be restricted until construction is completed and traffic volumes decrease. Seatbelt use and speed limit enforcement could also reduce the number and severity of injuries on roads constructed for these alternatives.

If roadway accidents and injuries increased, this would create an increased burden for local clinics in Prudhoe Bay and potentially Barrow. This impact can be mitigated through developing an action plan to augment staff and facilities to meet this rising burden should it occur.

Alternative D would have the same impact on subsistence as Alternative C.

Alternative E

The intent of Coastal Pads with Seasonal Ice Roads alternative is to minimize the development footprint to reduce impacts to wetlands and surrounding water resources. To minimize the development footprint, this alternative would reduce the amount of gravel fill needed for some of the project components. In particular, the footprints of the East and West Pads would be a combination of gravel and multiyear, multi-season ice pad extensions. During drilling, the gravel pad footprint would be expanded by ice to support other associated facilities. Over the long-term during operations, the ice pad footprint would be removed and only the gravel fill would remain to support the wellheads and associated required infrastructure. An expanded Central Pad incorporating both the central well and processing infrastructure would compensate for the two smaller ice/gravel combination pads. The gravel footprint would also be reduced by the use of ice roads as much of the infield road system.

This alternative presents the same potential loss of subsistence resources as Alternative B.

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Health Impact Assessment
Point Thomson Project

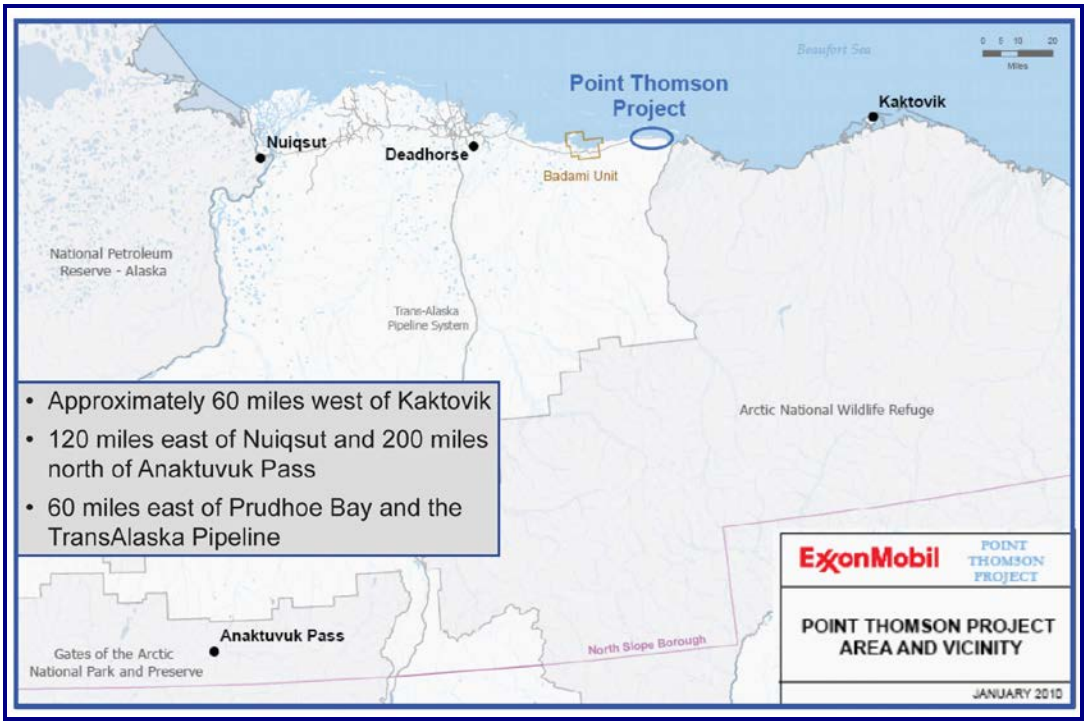
1.0 BASELINE CONDITIONS

This HIA aims to identify human health impacts associated with the proposed ExxonMobil development of the Thomson Sand reservoir (Figure 1). The project site is located approximately 60 miles east of Deadhorse on the Beaufort Sea coast, 60 miles west of Kaktovik, and just west of the Arctic National Wildlife Refuge, Alaska.

ExxonMobil operates two authorized production wells at an existing site, known as the Central Pad (CP). The proposed project recovers liquid condensate from natural gas, and may also extract crude oil. The Trans-Alaska Pipeline System would carry the extracted condensate and oil to market. Figure 2 and Figure 3 display additional maps of the project area and subsequent sections of the HIA identify potentially affected communities (PACs).

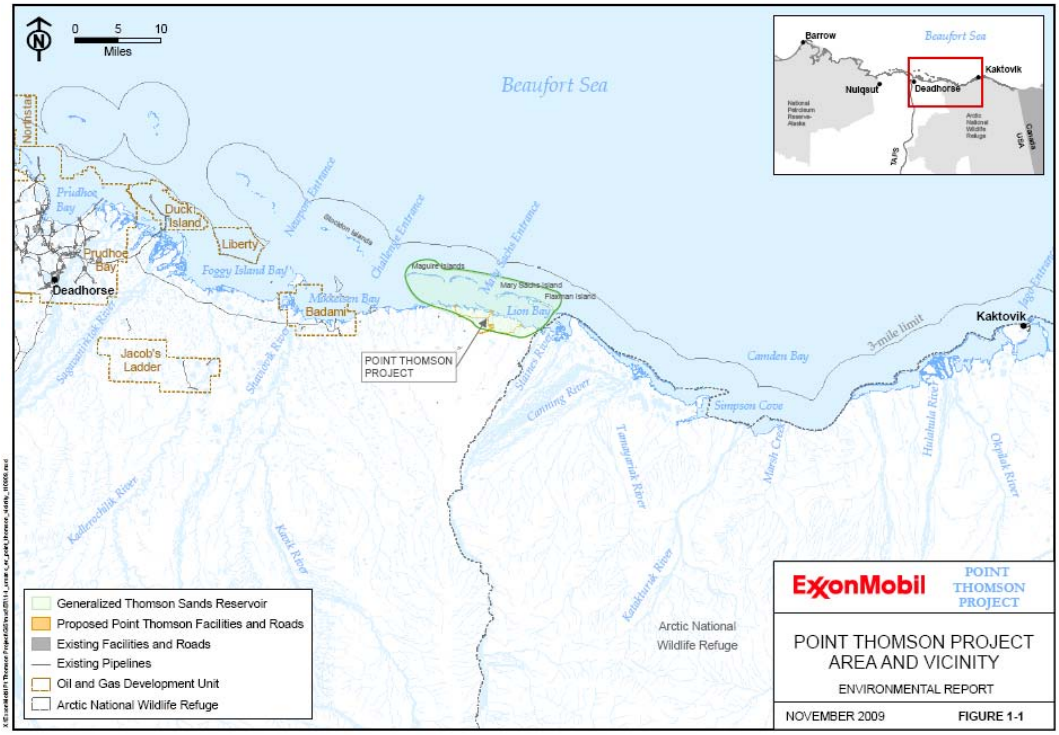
The U.S. Army Corps of Engineers (Corps) has not yet authorized this project which is currently in the National Environmental Policy Act (NEPA) Review/Environmental Impact Statement (EIS) process. This HIA is a standalone document that will be incorporated into the EIS as a technical appendix. Where appropriate, the HIA refers to detailed technical sections of the EIS which contain descriptions of the affected environment, project-specific engineering, and an analysis of the PACs. Additionally, this HIA relies on information available as of June 2011 that has been provided by (i) subject matter experts who worked on the EIS, (ii) the project proponent (*e.g.*, "Point Thomson Project Environmental Report, November 2009"), and (iii) tribal, federal and State of Alaska public health authorities.

Figure 1 Location Map Point Thomson Project



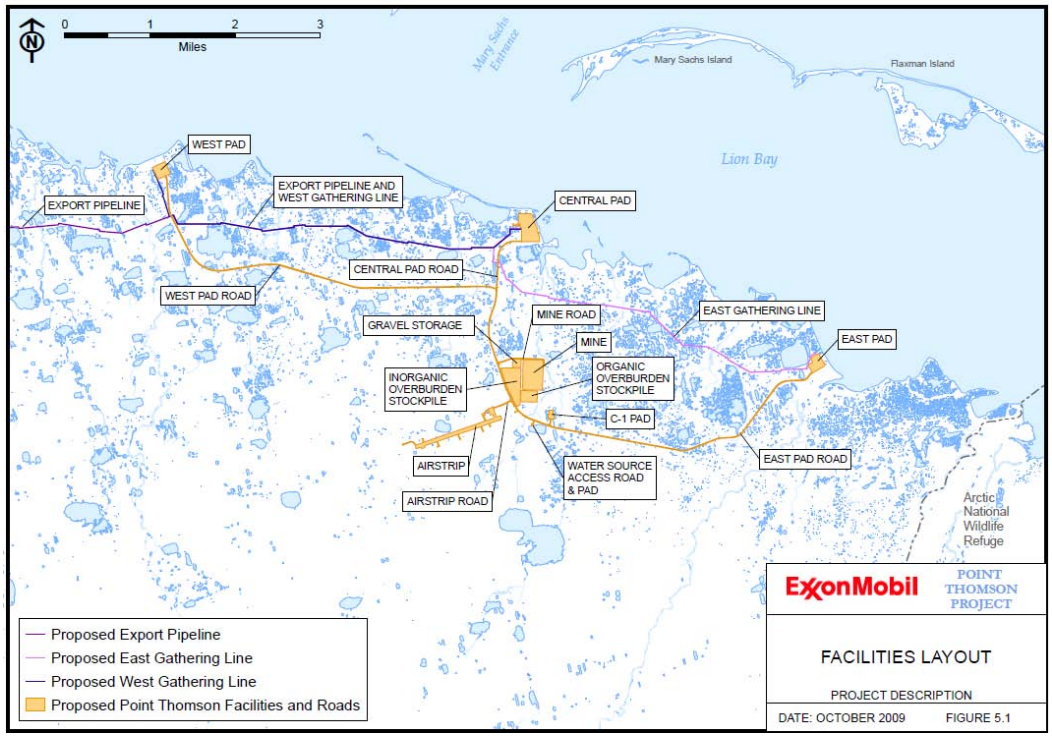
Source: ExxonMobil, 2009

Figure 2 Detailed Project Area and Vicinity



Source: ExxonMobil, 2009

Figure 3 Proponent's Proposed Facilities Layout



Source: ExxonMobil, 2009

1.1 Legal, Administrative and Legislative Framework

The State of Alaska does not currently require a formal HIA, but it has developed an HIA Toolkit to guide HIA efforts in the state. At the request of the lead federal agency, this HIA is included as part of the NEPA Review/EIS. The November 2009 Environmental Report describes the key authorizations, permits and r egulatory reviews required for construction and operation of the project. The Point Thomson Project HIA utilizes the approach described in the HIA Draft Toolkit but makes modifications unique to the setting of the project.

In addition to the Alaskan HIA Draft Toolkit, there are a variety of international guidelines (including performance standards from the International Finance Corporation (IFC)) that also inform this HIA. These international guidelines include:

- International Petroleum Industry Environmental Conservation Association (IPIECA) "Guidelines for Health Impact Assessment" (2005)
- IFC Performance Standard #4 "Community Health" (2006)
- IFC Good Practice Notes for Performance Standard #4 (2007)
- IFC "HIA Tool Kit" (2008).

1.2 HIA Framework and Methodology

HIA Definition

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 negative health effects while maximizing the health benefits of an action.

HIA Methods

- Analyze the sufficiency of baseline health data and highlight data gaps
- Select key health impacts and opportunities related to the project, policy, or program
- Conduct qualitative and/or quantitative data for analysis depending on available health information
- Provide a formal mechanism to engage the relevant stakeholders
- Facilitate careful discussion of key prevention issues and mitigation measures.

1.3 HIA Scope

The Point Thomson Project alternatives contain both off-shore and onshore activities. They are:

- **Alternative A** – No Action
- **Alternative B** – Applicant's Proposed Project
- **Alternative C** – Inland Pads with Gravel Access Road
- **Alternative D** – Inland Pads with Seasonal Ice Access Road
- **Alternative E** – Coastal Pads with Seasonal Ice Roads.

These alternatives are described in the EIS and summarized in the alternatives analysis section of the HIA. The specific methodology used to analyze potential health impacts is described in Section 2.2.

Areas outside the scope of the HIA

The study does not address classic occupational health concerns (*e.g.* physical hazards or environmental hazards encountered while working), which are referred to as 'inside the fence' and are thoroughly addressed by federally mandated health and safety protocols. However, "cross-over" issues (*e.g.* health issues that arise as workers interact with local communities) are analyzed within the HIA.

1.4 HIA within the NEPA Review/EIS

The HIA team performed (i) extensive literature and document reviews, (ii) close coordination with the EIS team, (iii) interviews with key project proponent staff, and (iv) limited field visits to the project area. In addition, the State of Alaska HIA Program collaborated with key tribal public health authorities to develop the critical risk analysis section of this HIA. The HIA Program reviewed and evaluated stakeholder concerns as presented in the scoping reports.

1.5 Impact Assessment Process

The available HIA guidance for impacts categorization is quite general and not consistent across published materials. For this HIA, the general risk rating system developed in the EIS has been modified and utilized. This categorization nomenclature is compatible and consistent with the terminology developed in the Draft Alaska HIA Guidance (HIA Toolkit 2011) and includes two primary components: (1) type of impact and (2) significance criteria in order to make reasonable and consistent analyses.

1.5.1 Impacts

Impacts include those effects resulting from the proposed project and project alternatives and these impacts may have beneficial or detrimental consequences to communities or individuals. Impacts are classified into three types:

Direct	caused by the action and occurring at the same time and place
Indirect	caused by the action and occurring later in time or farther removed in distance
Cumulative	incremental effects which when added to other past, present and reasonably foreseeable future actions are collectively significant over a period of time

A direct impact demonstrates a specific cause-and-effect relationship. For example, the presence of a project vehicle on roadway that subsequently has an accident in a local community would be a direct cause and effect situation.

Important indirect effects can include increases in community rates of communicable diseases that are associated with significant project triggered influx into local communities by job seekers. For example, the presence of a large project construction camp can temporarily attract a large number of job seekers and service workers into local communities, and this influx can significantly alter the spread and transmission of sexually transmitted infections (STIs).

Indirect effects are often of equal or greater significance than the more observable direct impacts that are related to accidents, injuries or sudden releases of potentially hazardous materials. The HIA analyzes both potential direct and indirect effects. Theoretically, one can imagine a vast number of hypothetical indirect effects and so, a set of most likely indirect effects was evaluated on the basis of past experiences at similar projects.

Cumulative effects health analysis is complex and often difficult to perform because the effects:

- May arise on a human receptor at any scale;
- Are triggered by multiple causes, *e.g.*, interaction of multiple health issues on one receptor (individual);
- Are generated by multiple impact pathways, *e.g.*, changes in access to key subsistence resources with subsequent changes in nutrition and community

cohesion (psychosocial) caused not just by a single project but all of the projects in an area.

Cumulative effects are an essential aspect of the NEPA process and are evaluated within the HIA for each of the alternatives.

1.5.2 Significance Criteria

To assess the beneficial and negative impacts each project, the HIA considers several critical elements which are further classified as low, medium, high, or very high:,

- Magnitude (intensity), which considers
  - Degree to which those affected will be able to adapt to the health impact and maintain pre-project level of health
  - Degree to which the potential effects on the quality of the human environment are likely to be controversial
  - Degree to which the possible effects on the human environment are highly uncertain or involve unique or unknown risks
  - Unique characteristics of a geographical/cultural setting which intensify impacts
  - Degree to which the action may establish a precedent for future actions with significant effects or represents a decision in principle about a future consideration

- Duration/Frequency, which considers the length of time a project or a project phase lasts and/or how often an event happens
  - Less than 1 month/happens rarely
  - Short-term, less than a year/low frequency
  - Medium-term, one to six years/ intermittent frequency
  - Long-term, more than six year, life of project/constant frequency

- Geographical extent, which examines where impacts might be experienced, including:
  - Project Area
    Local, small and limited
  - Extends beyond the local area
    - Regional/Statewide
    - National/Global

- Potential or Likelihood, which examines the chances that each impact will occur (IPCC 2007)

  - Exceptionally unlikely <1 percent probability
  - Very unlikely 1 to 10 percent probability
  - Unlikely 10 to 33 percent probability
  - About as likely as not 33 to 66 percent probability
  - Likely 66 to 90 percent probability
  - Very likely 90 to 99 percent probability
  - Virtually certain >99 percent probability of occurrence

Significance rating assigns a numerical score to each criteria to produce a cumulative score that can be low (0-3 points); medium (4-6 points), high (7-9 points) and very high (10-12 points) (Winkler 2010). The impact rating system used in this HIA will be described in greater detail in subsequent sections.

In general, HIAs are qualitative or semi-quantitative due to baseline data limitations, particularly if there are populations located in scattered communities. Therefore, significance is more broadly considered based on language developed within the NEPA process. Figure 4 illustrates the impact analysis scheme.

Figure 4 Impact Analyses/Significance Criteria

Project Phase	Magnitude (Low, Medium, High, Very High)	Duration / Frequency (less than a month, short-term, medium-term, long-term)	Extent (Project Area/ Local, Regional, State, Nation, Global)	Potential (Exceptionally Unlikely, Very Unlikely, Unlikely, About as Likely as Not, Likely, Very Likely, Virtually Certain)
Construction				
Drilling				
Operation				

Typically, there is a spectrum of impacts, positive and negative, that will be identified in the HIA. Many of the negative impacts can be reduced to baseline conditions if appropriate public health mitigation management plans are developed and rigorously implemented. A sufficiently robust monitoring and evaluation (M&E) system is essential so that early detection of significant indirect effects is possible.

1.5.3 Health Effects Categories (HECs)

Based on extensive international experience, the IPIECA developed a methodology (IPIECA, 2005; IFC, 2008) that reviews a standard set of health effects categories (HECs). The Alaska collaborative HIA working group consulted these published materials and developed an Alaska-specific set of HECs.

The HEC framework allows HIA practitioners to combine their human health knowledge in a specific area (*e.g.* injury prevention) with their knowledge of project design features (*e.g.* road traffic patterns, road design) in order to identify likely health impacts. This emphasis on predicting health impacts through knowledge of design, engineering and infrastructure is extremely important because experience indicates that

(i) primary prevention is a vastly more efficient and cost-effective strategy than post-construction attempts at mitigation and

(ii) the design of facilities, structures and workforce management (*e.g.*, work scheduling) are under the control of project proponents.

Predicting health impacts based on forecasted economic changes or anticipated changes in subsistence resource usage is more complex and typically mediated by personal choices at an individual and household level. Nevertheless, this framework

allows HIA practitioners to use HECs to reflect on project design features or projected socioeconomic changes in a systematic way.

The table below is taken from the HIA Toolkit and presents a list of health effects relevant for Alaskan resource development projects, including Point Thomson.

Table 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. ◆ 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 Limitations: While SDH are real and important, it is extremely difficult to establish direct causality between a change in a social determinants and a particular health outcome. The language used to communicate impacts related to social determinants should reflect that SDH influence health in complex ways.
Accidents and Injuries	This category includes impacts related to both fatal and non-fatal injury patterns for individuals and communities. Changed patterns of accidents and injuries may arise due to: ◆ Influx of non-resident personnel (increased traffic on roadways, rivers, air corridors ◆ Distance of travel required for successful subsistence. ◆ Project-related income and revenue used for improved infrastructure (e.g., roadways) and improved subsistence equipment/technology.

Health Effects Category	Pathway Description
Exposure to potentially hazardous materials	This category includes project emissions and discharges that lead to potential exposure. Exposure pathways include,: • Food. Quality changes in subsistence foods (risk based on analysis of foods or modeled environmental concentrations) • Drinking water • Air. Respiratory exposures to fugitive dusts, criteria pollutants, VOCs, mercury, and other substances. • Work. Secondary occupational exposure such as a family member's exposure to lead on a worker's clothing. • Indirect pathways, such as changing heating fuels/energy production fuels in communities
Food, Nutrition, and Subsistence Activity	This section depends on the subsistence analysis and nutritional surveys (if completed) and considers: • *Effect on Diet*: This pathway considers how changes in wildlife habitat, hunting patterns, and food choices will influence the diet of and cultural practices of local communities. While nutritional surveys are the most effective way to assess dietary intake, conclusions can be drawn if certain assumptions are accepted • *Effect on Food Security*: This discussion considers project-specific impacts that may limit or increase the availability of foods needed by local communities to survive in a mixed cash and subsistence economy present in rural Alaska.
Infectious Disease	This category includes the project's influence on patterns of infectious disease: The pathways include: • Influx of non-resident personnel from outside the region • Crowded or enclosed living & working conditions and the mixing of low and high prevalence populations due to influx can create an increased risk for transmission of STIs such as syphilis, HIV, and Chlamydia. • Changes to groundwater/wetlands can alter habitat for agents that transmit vector-borne diseases. This is not a likely scenario in Alaska, but with the cumulative effects of climate change it may become an issue of greater concern in the future.

Health Effects Category	Pathway Description
Water and Sanitation	This category includes the changes to access, quantity and quality of water supplies The pathways include: • Lack of adequate water service is linked to the high rates of lower respiratory infections observed in some regions, and to invasive skin infections. • Revenue from the project that supports construction and maintenance of water & sanitation facilities. • Increased demand on water and sanitation infrastructure secondary to influx of non-resident workers.
Non-communicable and Chronic Diseases	This category considers how the project might change patterns of chronic diseases. The pathways include: • Nutritional changes that could eventually produce obesity, impaired glucose tolerance, diabetes, cardiovascular disease. • Pulmonary exposures that lead to tobacco related chronic lung disease, asthma; in-home heat sources; local community air quality; clinic visits for respiratory illness • Cancer rates secondary to diet changes or environmental exposures • Increased rates of other disorders, specific to the contaminant(s) of concern
Health Services Infrastructure and Capacity	This category considers how the project will influence health services infrastructure and capacity. The pathways include: • Increased revenues can be used to support or bolster local/regional services and infrastructure • Increased demands on infrastructure and services by incoming non-resident employees or residents injured on the job, especially during construction phases.

Source: HIA Toolkit 2011

1.5.4 Social Determinants of Health (SDH) and Psychosocial Issues

SDH and psychosocial issues are very important in Alaska, particularly for small, remote villages. HIA seeks to disentangle the determinants of health and identify the individual, social, environmental, and institutional factors that produce direct, indirect, or cumulative health impacts. This exercise is complex because many individual and institutional factors interact with each other.

- Individual factors include genetic, biological, lifestyle or behaviors, and specific circumstances. Examples of individual determinants include gender, age, dietary intake, exercise, alcohol and tobacco use, educational attainment, and employment.
- Institutional factors include the capacity, capability, and coverage of public sector services such as health, schools, transportation, and communications.

The HIA considers psychosocial issues. Subsistence-based rural populations can suffer significant anxiety/stress associated with perceived changes in their autonomy, traditional lifestyle, and cultural stability. This reaction, however, is not necessarily uniform across the community since there may be a profound generational split. Even though the generational divide may be unrelated to the project it may be accentuated by the project. Important health outcomes including drug/alcohol usage, teen/unwed pregnancy, gender violence suicides, and depression are considered within this health effects category.

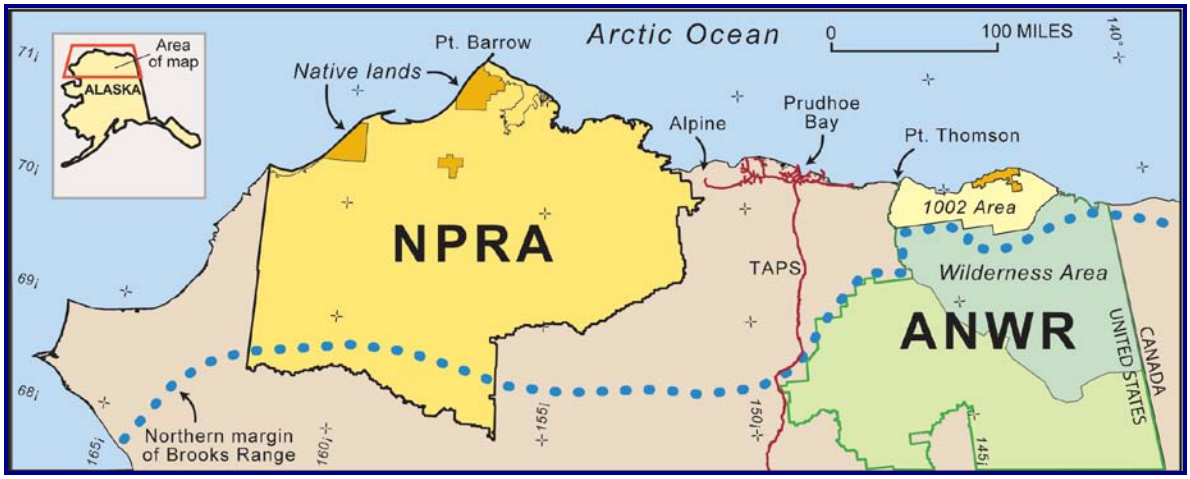
Within the SDH and psychosocial issues HEC, the Point Thomson HIA focuses on those alternative-specific potential impacts where there is a reasonable attribution of project effects.

1.5.5 Potentially Affected Communities (PACs)

A PAC is a defined community where project-related health impacts may reasonably be expected to occur. Both the ExxonMobil Environmental Report (ExxonMobil 2009) and the socioeconomics chapter of the EIS identified all communities in the North Slope Borough (NSB) as PACs.

A map of the geographical extent of the NSB is shown in Figure 5. Fewer than 7,000 people currently reside in the 88,800 square miles of the NSB–a population density of 0.08 persons per square mile. The population of the NSB decreased from 7,385 in 2000 to 6,706 residents in 2008, an annual average decline of 1.2 percent (See Table 2). Based on 2000 C ensus data, 83 percent of the population in the NSB is Alaska Native The communities with the greatest Alaska Native population are in Anaktuvuk Pass and Nuiqsut, both with about 90 percent Alaska Native.

Figure 5 Geographical Footprint of the NSB



Source: USGS http://energy.usgs.gov/images/alaska/NPRA_F1lg.gif

Table 2 NSB Population 1939-2008

North Slope Borough Population, 1939 - 2010								
Community	**Year**							
	1939	**1950**	**1980**	**1990**	**1998**	**2000**	**2005**	**2010**
Anaktuvuk Pass	*	66	203	259	314	282	307	324
Atqasuk	78	49	107	216	224	228	226	233
Barrow	363	951	2,267	3,469	4,641	4,581	4,174	4,212
Kaktovik	13	46	165	224	256	293	276	239
Nuiqsut	89	*	208	354	420	433	410	402
Point Hope	257	264	464	639	805	757	720	674
Point Lay	117	75	68	139	246	247	241	189
Wainwright	341	227	405	492	649	546	519	556
North Slope Borough Total	1,258	1,678	4,199	4925	7,555	7,385	6,886	6,902

Source: North Slope Bureau. http://www.co.north-slope.ak.us/nsb/gis/about_gis/about_index.htm.
Point Thomson EIS, 2011 Socio-economic Chapter (Section 3.12)

While the HIA recognizes the social, economic, and c ultural importance of all communities in the NSB, experience with HIA consistently demonstrates that the health-specific PAC footprint does not necessarily match the environmental and social PAC footprints. There are subtle but critical disciplinary differences that produce variations in the delineation of the PACs.

From an HIA perspective, the PACs have been divided into three zones based likelihood of significant health impacts from the Pt. Thomson project:

- **Zone 1** - Kaktovik and Nuiqsut
- **Zone 2** - Anaktuvuk Pass, Prudhoe Bay/Deadhorse, and Barrow
- **Zone 3** - Atqasuk, Wainwright, Point Lay, and Point Hope.

Figure 6 illustrates the location of eight primary NSB communities. The Point Thomson project (PTP) is located 60 miles west of Kaktovik, 120 miles east of Nuiqsut and 200 miles north of AP. Overall population figures for the PACs are shown in Table 3.

Figure 6 Point Thomson Project and Communities in the NSB

Source: NSB 2005

Zone 1 includes Kaktovik and Nuiqsut and the coastal area between Bullen Point and Point Demarcation where residents of both Kaktovik and Nuiqsut traditionally hunt and which are caribou herd use areas. Local workers may be hired for construction and/or operation of the Point Thomson Project from both Kaktovik and Nuiqsut.

Zone 2 PACs were selected because of the possibility of impacts on Anaktuvuk Pass (AP) which are related to potential changes in employment and income. The impacts on Prudhoe Bay and Deadhorse are related to barges docking at West Dock and transportation of personnel, supplies and equipment from that transport hub. Similarly the effects on Barrow are due to its position as the regional center for the NSB and the impact on health services from increased usage and taxes generated during Point Thomson operations.

Zone 3 includes communities that are remote from the Point Thomson project and that have minimal to no interaction with workers, materials, or products related to the project. These villages include Atqasuk, Wainwright, Point Lay, and Point Hope.

1.5.6 Community Profiles (Source NSB, 2005a)

- **Kaktovik** is located on the northern shore of Barter Island, facing Kaktovik Lagoon and the Beaufort Sea. The village is on the northern edge of the region that has become the Arctic National Wildlife Refuge (ANWR), only 90 miles from the Canadian border. It is the easternmost village in the North Slope Borough (NSB) (Figure 5 and Figure 6). The community has a young population, with a high ratio of dependents to wage earners. Historically, there have been high rates of unemployment and underemployment. The community has high levels of subsistence activities and use of subsistence resources. Kaktovik's infrastructure has had several upgrades in recent years. Water and sewer projects funded by the NSB have been completed. An electric utility is functional in the community, as well as telecommunications.

- **Nuiqsut** is located approximately 30 miles from the Beaufort Sea on the Nechelik channel of the Colville River delta (Figure 5 and Figure 6). This area has been used for centuries for subsistence activities, including hunting, fishing, gathering, and traditional celebrations. The growth and development of the community has been influenced by oil and gas development. Nuiqsut is located in the northeast section of the region that has become the National Petroleum Reserve–Alaska (NPRA). The community infrastructure has had several upgrades in recent years.

Water and sewer projects funded by the North Slope Borough (NSB) have been completed. An electric utility is functional in the community, as well as telecommunications. Surface transportation to Nuiqsut is often possible in the winter months, as ice roads associated with the nearby oil field projects are constructed. The ice roads connect to the Dalton Highway.

- **Anaktuvuk Pass (AP)** is the only remaining settlement of the inland northern Inupiat. Anaktuvuk Pass is situated at approximately 2,200 feet in elevation in the Endicott Mountains of the Brooks Range, within the region that has become Gates of the Arctic National Park and Preserve. The community is located about 250 miles southeast of Barrow (Figure 5 and Figure 6). AP has historically had high rates of unemployment and underemployment. Economic and employment opportunities are very limited in Anaktuvuk Pass. The North Slope Borough (NSB) and the school district provide most local jobs. City government and the village corporation are also important employers in the community. The community has high levels of subsistence activities and use of subsistence resources. Anaktuvuk Pass has a young population; average ages in Anaktuvuk Pass are less than in the state or nation. There is a high ratio of dependents to wage earners.

- **Prudhoe Bay** is a census-designated place (CDP) located in North Slope Borough. As of the 2000 census, the population of the CDP was 5 people; however, at any given time several thousand transient workers support the Prudhoe Bay oil field and associated activities. The airport, lodging, and general store are located at Deadhorse; the rigs and processing facilities are located on scattered gravel pads laid atop the tundra. It is only during winter that the surface is hard enough to support heavy equipment and new construction happens at that time.

- **Barrow** is the largest community in the NSB with a population of about 4,054 (about 60 per cent of the borough's population). It is the hub for regional government, transportation, communications, education, and economic development. The community is located on the northern edge of the Arctic Coastal plain, on the Chukchi Sea Coast (Figure 5 and Figure 6). Barrow's infrastructure is the most extensive of any North Slope community, and includes water, sewer, electric and telecommunication utilities. Demographically, Barrow has a 65 percent Alaska Native and 35 per cent non-native population mix. Barrow has a young population; average ages in Barrow are less than in the state or nation. There is a high ratio of dependents to wage earners. The Borough is the city's primary employer, providing approximately 50 percent of employment in the city.

- **Atqasuk** is located on the Meade River, 60 miles south of Barrow. The population of the community consisted of 228 people in 2000; 94 percent Alaska Native or part Native. Education and other government services provide the majority of full-time employment in Atqasuk. Subsistence activities are important to the lifestyle; the area has traditionally been hunted and fished by Inupiat Eskimos. The North Slope Borough provides the water, sewer, refuse, washeteria, landfill, and other public services. The majority of homes and

facilities and the school have running water and electricity There is one school located in the community, attended by 77 students. Local hospitals or health clinics include Atqasuk Clinic, a primary health care facility.

- **Wainwright** is located on the Chukchi Sea coast, 3 miles northeast of the Kuk River estuary. The region around Wainwright was traditionally well-populated, though the present village was not established until 1904, when the Alaska Native Service built a school and instituted medical and other services. The population of the community is 93 percent Alaska Native or part Native; most of whom are Inupiat Eskimos who practice a subsistence lifestyle. Economic opportunities in Wainwright are influenced by its proximity to Barrow and the fact that it is one of the older, more established villages. Most of the year-round positions are in borough services. Sale of local Eskimo arts and crafts supplement income. Bowhead and beluga whale, seal, walrus, caribou, polar bear, birds, and fish are harvested. The North Slope Borough provides all utilities in Wainwright. There is one school located in the community, attended by 158 students. Local hospitals or health clinics include Wainwright Health Clinic.

- **Point Hope** is located near the tip of Point Hope peninsula, a large gravel spit that forms the western-most extension of the northwest Alaska coast, 330 miles southwest of Barrow. Point Hope (Tikeraq) peninsula is one of the oldest continuously occupied Inupiat Eskimo areas in Alaska. Most full-time positions in Point Hope are with the city and borough governments. Residents manufacture whalebone masks, baleen baskets, ivory carvings, and Eskimo clothing. The population of the community is over 90 percent Alaska Native or part Native, principally Tikeraqmuit Inupiat Eskimos. The peninsula offers good access to marine mammals, and ice conditions allow easy boat launchings into open leads early in the spring whaling season which supports subsistence hunting and its strong cultural traditions. The North Slope Borough provides all utilities in Point Hope. There is one school located in the community, attended by 208 students. Local hospitals or health clinics include Point Hope Clinic.

Table 3 Population Demographics Point Thomson Area

Table 3.12-4: Demographics in the Point Thomson Area (2005-2009, 2010)										
Area	Anaktuvuk Pass		Barrow		Kaktovik		Nuiqsut		NSB Total	
General Characteristics	#	%	#	%	#	%	#	%	#	%
Total population	324		4,212		239		402		6,903	
Male	107 *(+/-35)*	46.3	2,183 *(+/-99)*	53.5	140 *(+/-41)*	53.8	18 *(+/-48)*	50.3	3,585 *(+/-73)*	53.4
Female	124 *(+/-44)*	53.7	1,895 *(+/-103)*	46.5	120 *(+/-38)*	46.2	182 *(+/-62)*	49.7	3,131 *(+/-73)*	46.6
Median age (years)	25.7 *(+/-1.5)*		28.2 *(+/-2.5)*		25.9 *(+/-6.9)*		19.2 *(+/-2.8)*		26 *(+/-0.8)*	
White	23	7.1	712	16.9	24	10.0	40	10.0	979	14.2
Black or African American	1	0.3	41	1.0	0	0.0	1	0.2	47	0.7
American Indian and Alaska Native	270	83.3	2,577	61.2	212	88.7	350	87.1	4,905	71.1
Asian	0	0.0	384	9.1	0	0.0	0	0.0	384	5.6
Native Hawaiian and Other Pacific Islander	1	0.3	99	2.4	0	0.0	0	0.0	101	1.5
Some other race	0	0.0	34	0.8	0	0.0	0	0.0	36	0.5
Two or more races	29	9.0	365	8.7	3	1.3	11	2.7	451	6.5
Hispanic or Latino (of any race)	7	2.2	131	3.1	0	0.0	0	0.0	156	2.3
Average household size	3.16 *(+/-0.82)*		3.03 *(+/-0.22)*		3.21 *(+/-0.71)*		4.02 *(+/-1.02)*		3.27 *(+/-0.16)*	

Source:Section 3.12 of the Point Thomson EIS

1.6 Baseline Introduction and Background

The HIA team performed a review of the available North Slope Borough baseline health data with data sources maintained by federal, state and tribal health authorities. Typically, Alaskan health data is reported by region or census area, which provides general health information for the HIA. Because these villages are very small, health information privacy concerns and problems with statistical validity limit the ability to analyze information at the village level. With the exception of Barrow, the PAC communities are extremely small, *i.e.*, total population levels less than 500 (see Table 3). Both state and tribal health authorities will not report an "observation" if they document fewer than six cases. Therefore, the data presented for villages in this baseline analysis are aggregated into zones and do not report at an individual village level. Experience indicates that village level data are consistent with the aggregated regional level data.

1.6.1 Sources of Information

The most current and comprehensive compendia of relevant NSB health information is the Alaska Native Epidemiology Center (AN EpiCenter) publication Alaska Native Health Status Report" (AN EpiCenter 2009a) and "Alaska native Regional Health Profile- Arctic Slope" (AN EpiCenter 2009b). The focus of this report is on the health of Alaskan Natives who account for the majority of the Arctic Slope's population. Despite this focus, the report provides sufficient mortality and morbidity data for Non-native Alaskans as well. In addition, the AN EpiCenter 2009b report accessed regional level data from a variety of key sources:

- National Patient Information Reporting System (NPIRS)
- State of Alaska Department of Labor (AK DOL)
- 1990 and 2000 U.S. Census
- Alaska Bureau of Vital Statistics (ABVS)
- Government Performance and Results Act (GPRA)
- Youth Risk Behavior Survey (YRBS)
- Alaska Trauma Registry (ATR)
- ANTHC Immunization Registry
- Alaska Area Diabetes Program
- ANTHC Department of Environmental Health and Engineering (DEHE)
- Alaska Native Tumor Registry.

In this report, the NSB fits the definition of the Arctic Slope Native Association (ASNA) service area with one exception, the community of Point Hope. Point Hope is a part of NSB but not part of the ASNA service area. Point Hope has an estimated 2009 population of 705, of which approximately 90 percent is Alaskan Natives. Much of the baseline data information utilizes ASNA as a geographical service area. The HIA team determined that the exclusion of Point Hope will not materially change the key baseline health observations that apply to the NSB geographical unit. For many outcome indicators "Arctic Slope" is defined as the NSB.

Mirroring the AN EpiCenter reports, the HIA baseline data are organized into five specific sections:

- Demographics
- Mortality and Morbidity
- Health Promotion
- Health Protection
- Preventive Services and Access to Health Care.

Cross references to how these data "fit" within the health effects categories (HECs) framework are also presented in each section. In addition, brief bulleted discussions of the key observations relevant to HIA impact analysis are also discussed.

1.6.2 Demographic Health Data

Table 2 and Table 3 presented the overall population data for the NSB and the specific Zone 1 & 2 PACs. Table 4 illustrates the population estimates by age group.

Table 5 Alaska Native Population by Age Group

Arctic Slope Service Area (2006)

	Male		Female		Total	
Age (years)	Number	%	Number	%	Number	%
0-4	297	6.2%	307	6.4%	604	12.6%
5-9	261	5.5%	220	4.6%	481	10.1%
10-14	272	5.7%	256	5.4%	528	11.0%
15-19	323	6.8%	324	6.8%	647	13.5%
20-24	198	4.1%	190	4.0%	388	8.1%
25-29	116	2.4%	122	2.6%	238	5.0%
30-34	103	2.2%	93	1.9%	196	4.1%
35-39	122	2.6%	117	2.4%	239	5.0%
40-44	172	3.6%	163	3.4%	335	7.0%
45-49	152	3.2%	137	2.9%	289	6.0%
50-54	124	2.6%	97	2.0%	221	4.6%
55-59	95	2.0%	67	1.4%	162	3.4%
60-64	68	1.4%	64	1.3%	132	2.8%
65+	150	3.1%	174	3.6%	324	6.8%
Total	2,453	51.3%	2,331	48.7%	4,784	100.0%

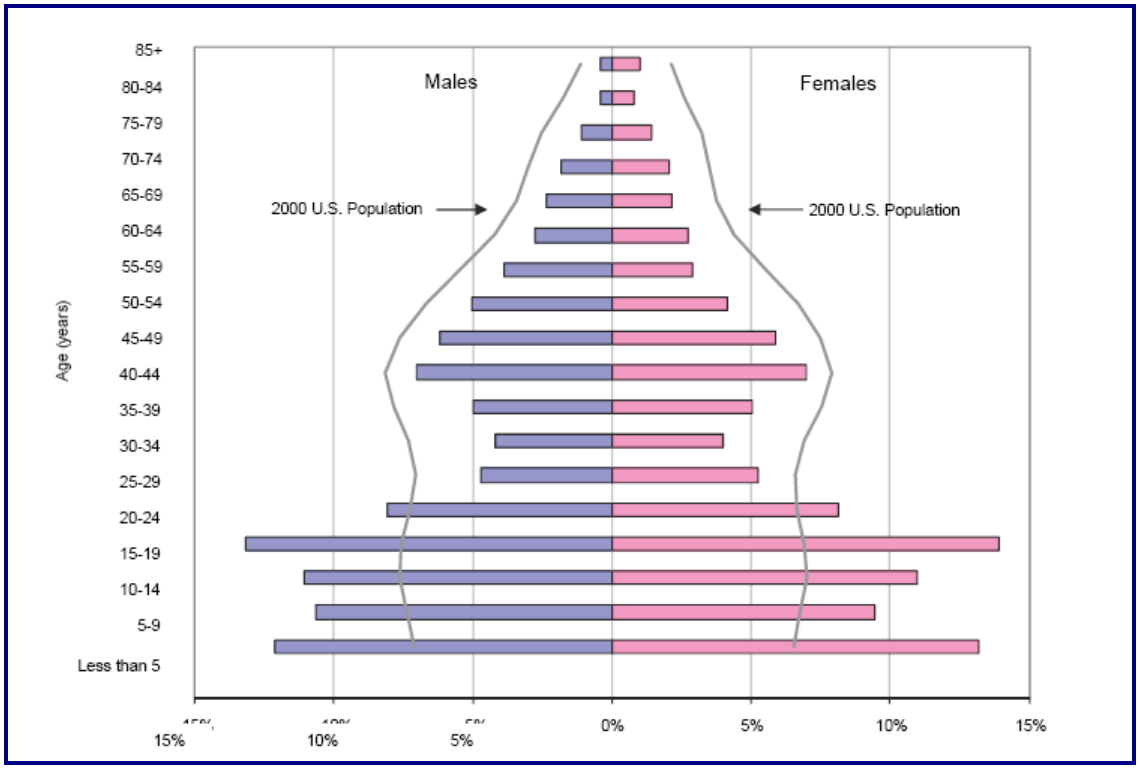
Source: AN EpiCenter 2009b

Figure 7 visually represents the population of NSB compared with the U.S. population. The grey line in the figure represents the U.S. population averages for a particular age group. The colored bars represent the relationship between U.S. averages and males (blue) and females (pink) by age category. As previously noted in the PAC overviews, the NSB communities have a significant percent (44 percent) of their native population under age 20, a much larger proportion as compared to the U.S. population. One in fifteen natives is over age 65.

The level of educational attainment in a household can influence community health. Figure 8 compares Arctic Slope Natives and the white population, not of Hispanic origin, of the U.S. based on 2000 US Census data. When compared to U.S. whites, these data demonstrate that Alaska Natives living in the Arctic Slope received an associate degree or higher at a rate five times lower (5 percent vs. 25 per cent) than U.S. whites. Internationally, highest level of household educational attainment positively correlates with improved overall family health status. In addition, household head educational attainment levels also predict challenges or opportunities that will occur in regards to local hiring programs. This is especially true in the oil and gas extraction industry where permanent positions may require significant technical skill sets.

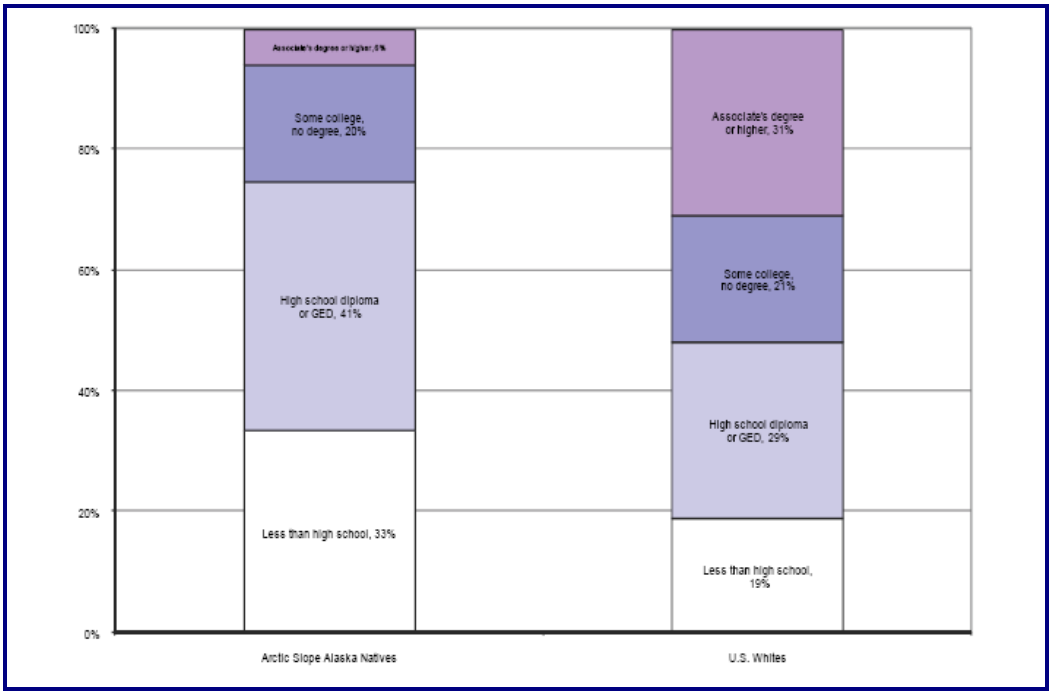
Employment is another key demographic factor that influences health. Despite the national economic recession, the NSB maintains a low unemployment rate relative to other regions in the state. The socio-economic section of the EIS provides greater detail and analysis of the employment situation in the NSB overall and for each PAC.

Figure 7 Alaska Native Population Pyramid, Arctic Slope Service Area (2006)



Source: AN EpiCenter 2009b

Figure 8 Highest Educational Attainment, 25 Years and Older



Source: AN EpiCenter 2009b

1.6.3 Mortality

In the Arctic Slope Service Area, the leading causes of death among Alaska Natives between 2000 - 2004 were cancer, unintentional injury and heart disease (Table 5).

Table 6: Leading Causes of Death Arctic Slope Service Area

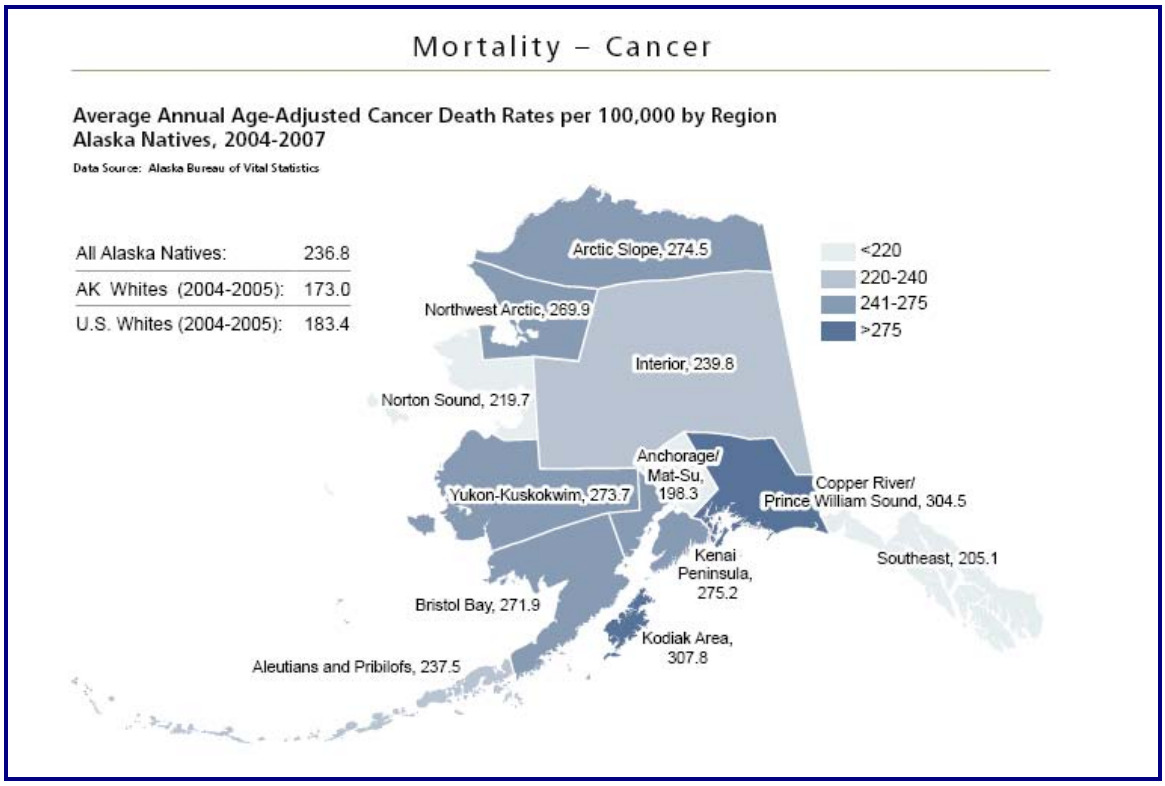
	Alaska Natives (AN) Arctic Slope service area	Number	% Deaths	U.S. Whites Rank	AN Statewide Rank
1	Cancer	36	22.1%	2	1
2	Unintentional Injury	27	16.6%	5	3
3	Heart Disease	19	11.7%	1	2
4	Suicide	15	9.2%	10	4
5	Chronic Obstructive Pulmonary Disease	11	6.7%	4	6
6	Cerebrovascular	7	4.3%	3	5
7	Pneumonia and Influenza	5	3.1%	7	7
	All other causes	43	26.4%		
	Total	163	100%		

Source: AN EpiCenter 2009b

1.6.3.1 Cancer

The cancer mortality rate has been analyzed over time. For the Arctic Slope Service Area, the cancer death rate increased by 33 percent between 1979-1983 and 1999-2003. In comparison, the US White cancer death rate decreased by 4 percent over a similar time frame. The explanation for these findings is complex and multi-factorial. Cause-specific cancer rates are strongly influenced by a variety of lifestyle behaviors including diet and smoking habits. The Alaska Native cancer rates vary by specific geographical region. These data are shown in Figure 9. Although there appears to be a difference between the Arctic-North Slope region and other regions, only the Anchorage/Mat-Su region has a statistically significant lower rate than all other regions.

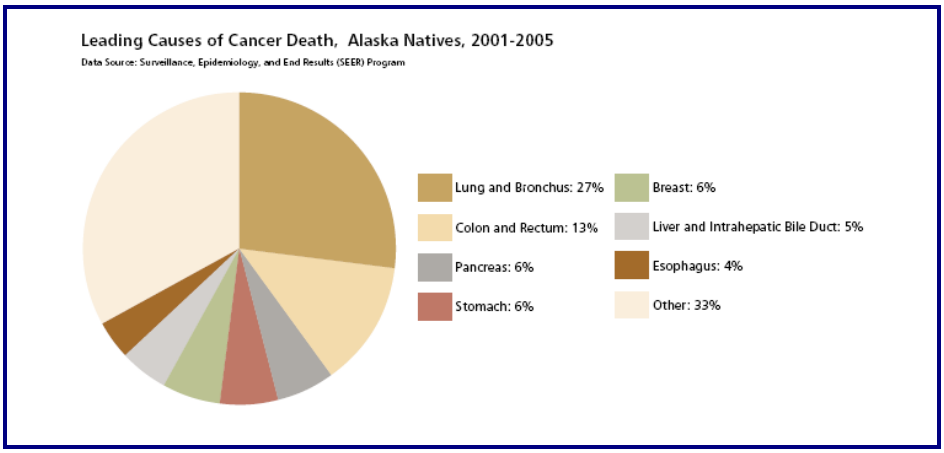
Figure 9 Alaska Native Age-Adjusted Cancer Death Rates



Source: AN EpiCenter 2009a

In addition to geographical variation, it is important to consider the types of cancers that are reported. Figure 10 presents the leading causes of cancer death for Alaska Natives from 2001 - 2005. The lung/bronchus cancer rates (Figure 10) are strongly related to the extremely high tobacco usage that occurs in Alaska Native populations. Smoking rates in Alaska Natives are significantly elevated versus US White populations. In the Arctic Slope Service Area, adult smoking rates over 90 percent have been reported (Section 1.6.4 Health Promotion).

Figure 10 Leading Causes of Cancer Death Alaska Natives

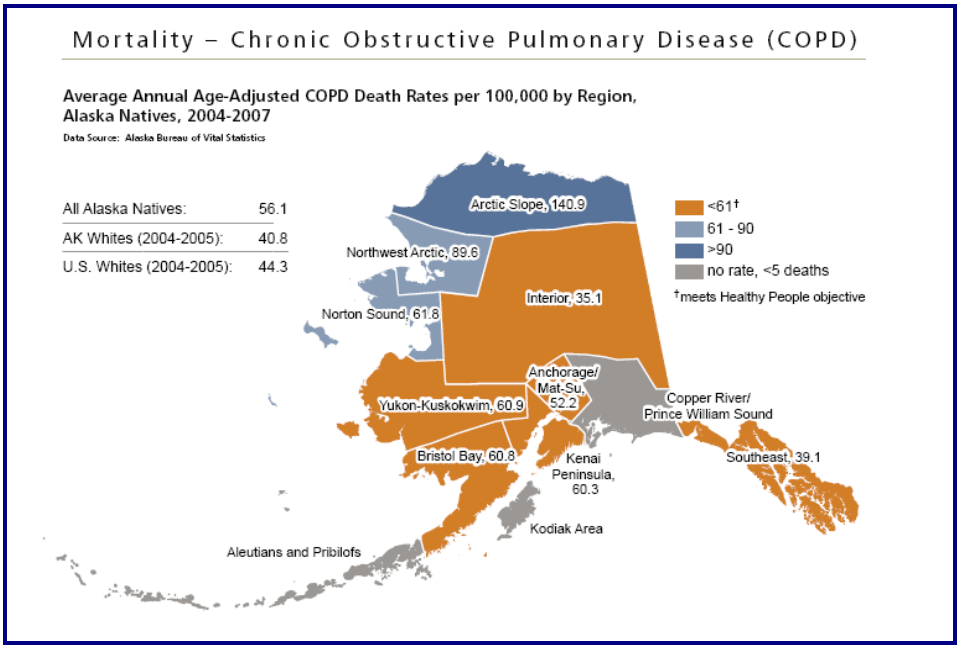


Source: AN EpiCenter 2009a

1.6.3.2 Chronic Obstructive Pulmonary Disease

High rates of chronic obstructive pulmonary disease (COPD) are seen in the Arctic Slope versus the other regions of Alaska (Figure 11). In this case, the death rate of residents of the Arctic Slope is significantly higher (p<.05) than the rate for all other regions (Figure 11). The Alaska Native COPD death rate has increased 92 percent since 1980 (p<.05). The rate peaked in 1994-1998 and appear s to be dec reasing. During 2004-2007, the Alaska Native COPD death rate was 40 percent higher than for Alaska Whites (p<.05) but not significantly different than for U.S. Whites. COPD rates are beginning to slowly decline in some regions potentially related to health promotion/prevention interventions.

Figure 11 Alaska Native Chronic Obstructive Pulmonary Disease

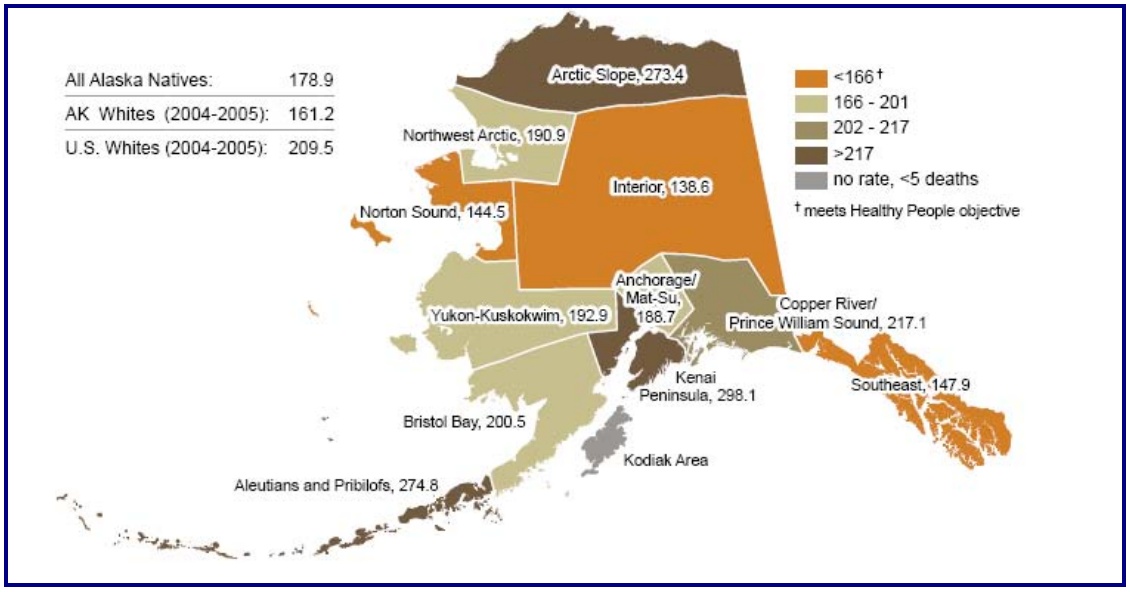


Source: AN EpiCenter 2009a

1.6.3.3 Cardiovascular Diseases

The data for cardiovascular diseases is complex. Although there appear to be variations between regions for heart disease death rates (Figure 12), only the rate in the Kodiak Area is significantly lower (p<.05) than the rate for all other regions. The rate in the Kenai Peninsula is significantly higher (p<.05) than the rate for all other regions. Interestingly, the Alaska Native heart disease death rate decreased by 43 percent between 1980 and 2007 (p<.05). Alaska Whites and U.S. Whites also experienced a similar decrease during this time period. During 2004-2007 there appear to be variations between the Alaska Native heart disease death rate and the U.S. and Alaska Whites rate; however, there is no significant difference between these populations.

Figure 12 Alaska Native Heart Disease Rate

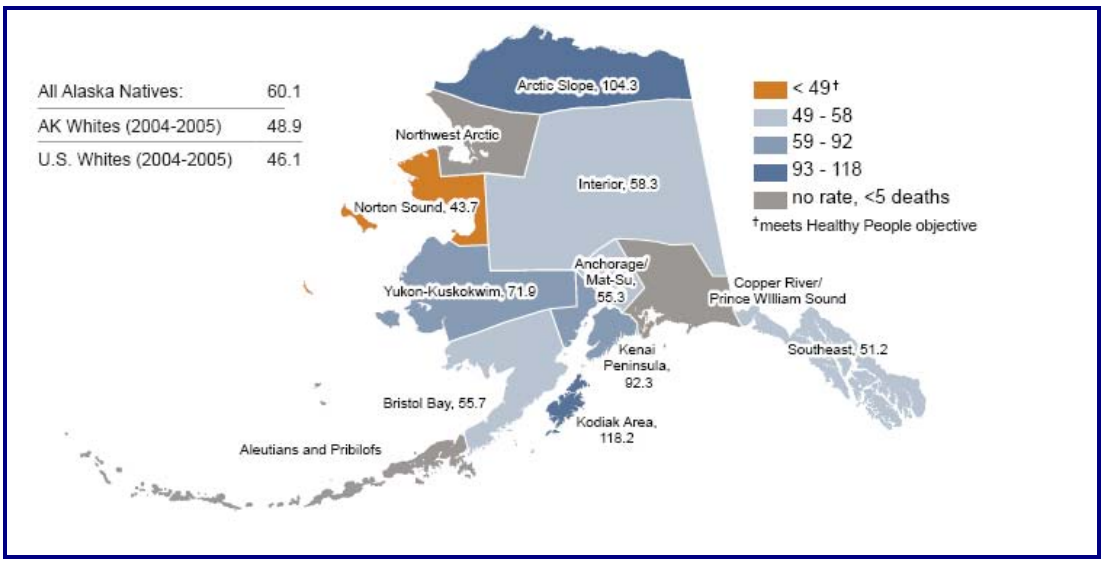


Source: AN EpiCenter 2009a

1.6.3.4 Cerebrovascular Diseases

Cerebrovascular diseases are another important cause of mortality in Alaska Natives. Although there appear to be variations between regions for cerebrovascular disease death rates (Figure 13), none of the regions were significantly different than all other regions combined. Cerebrovascular disease death rates have decreased among Alaska Native people; however, the decrease is not significant. During 2004-2007, the Alaska Native cerebrovascular disease death rate was 30 percent higher than for U.S. Whites ($p<.05$) but not significantly different than for Alaska Whites.

Figure 13 Alaska Native Cerebrovascular Disease Rate



Source: AN EpiCenter 2009a

1.6.3.5 Unintentional Injury

The overall leading causes of injury for Alaska Natives and Arctic Slope residents are shown in Table 6. Regional data are shown in Figure 14.

Table 7 Leading Causes of Injury All Alaska Natives and Arctic Slope

All Alaska Natives

Injury Death – Leading Causes

Leading Causes of Injury Death, Alaska Natives, 2005-2007

Rank	Cause	No. of Deaths	% of Total
1	Suicide	141	28.7%
2	Unintentional Poisoning	61	12.4%
3	Motor Vehicle Traffic	46	9.3%
4	Drowning	41	8.3%
5	Homicide	39	7.9%
6	Natural/Environmental	39	7.9%
7	ATV/Snowmachine	27	5.5%
8	Other Transport (Boat, etc.)	27	5.5%
9	Suffocation	19	3.9%
10	Fire/Flame	15	3.0%
11	Fall	7	1.4%
12	Pedestrian (Other)	6	1.2%
13	Firearm	3	0.6%
	Other	9	1.9%
	Not Specified	12	2.4%
	Total	492	100%

Arctic Slope Alaska Natives 1999-2005

Cause	No. of Deaths	% Total
1. Suicide	19	39%
2. Off Road Vehicle	9	18%
Other	21	43%
Total Injury	49	100%
Total Unintentional	28	57%

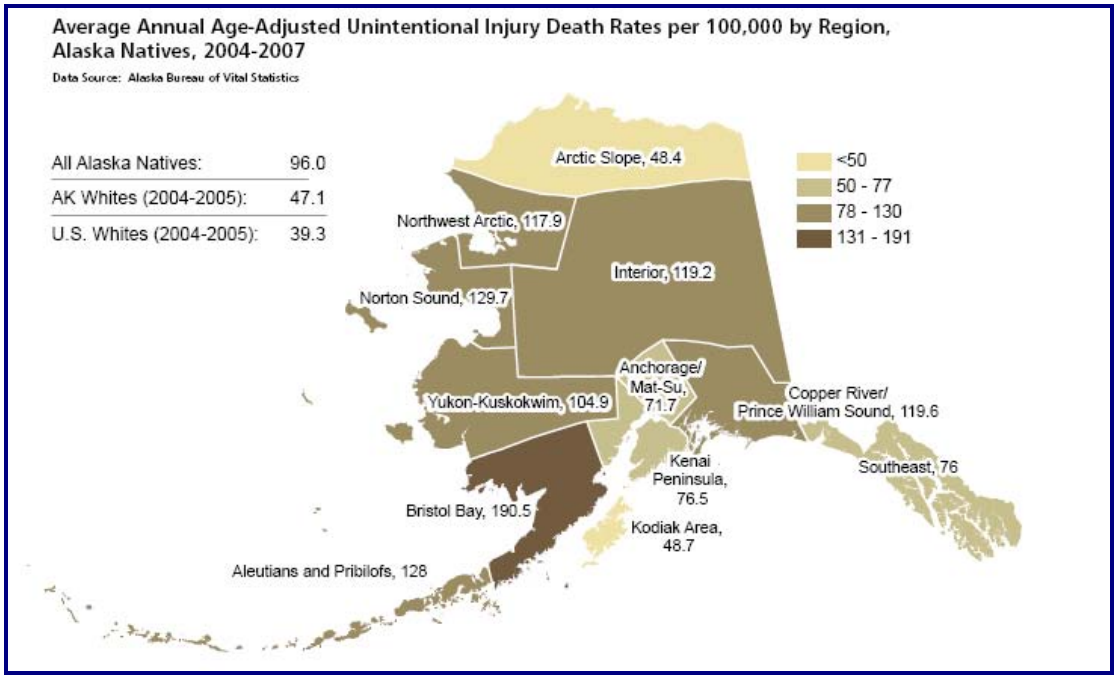
Data Source: Alaska Bureau of Vital Statistics [11]
Analysis Conducted by: AN EpiCenter

Source: AN EpiCenter 2009a

Between 1984-1988 and 1989-1993, there was a decrease in the unintentional injury death rate for Alaska Natives in the Arctic Slope Service Area, *i.e.*, 124 Alaska Natives in the Arctic Slope Service Area died as a result of an unintentional injury during 1989-1993; 71 fewer deaths than in 1984-1988. Although it appears that Arctic Slope and Kodiak's unintentional injury death rate is lower than the other regions (Figure 14), the number of deaths is too small to detect a significant difference across regions. Off road vehicles resulted in the deaths of 9 Alaska Natives in the Arctic Slope Service Area during 1999 - 2005.

Overall unintentional injury death rates for Alaska Natives are higher for men than women for all age groups. Unintentional injury death rates decreased 47 percent between 1980 and 2007 ($p<.05$). During 2004 - 2007, the Alaska Native unintentional injury death rate was 2.4 times greater than for U.S. Whites ($p<.05$) and 2.0 times greater than for Alaska Whites ($p<.05$).

Figure 14 Unintentional Injury Death Rates



Source: AN EpiCenter 2009a

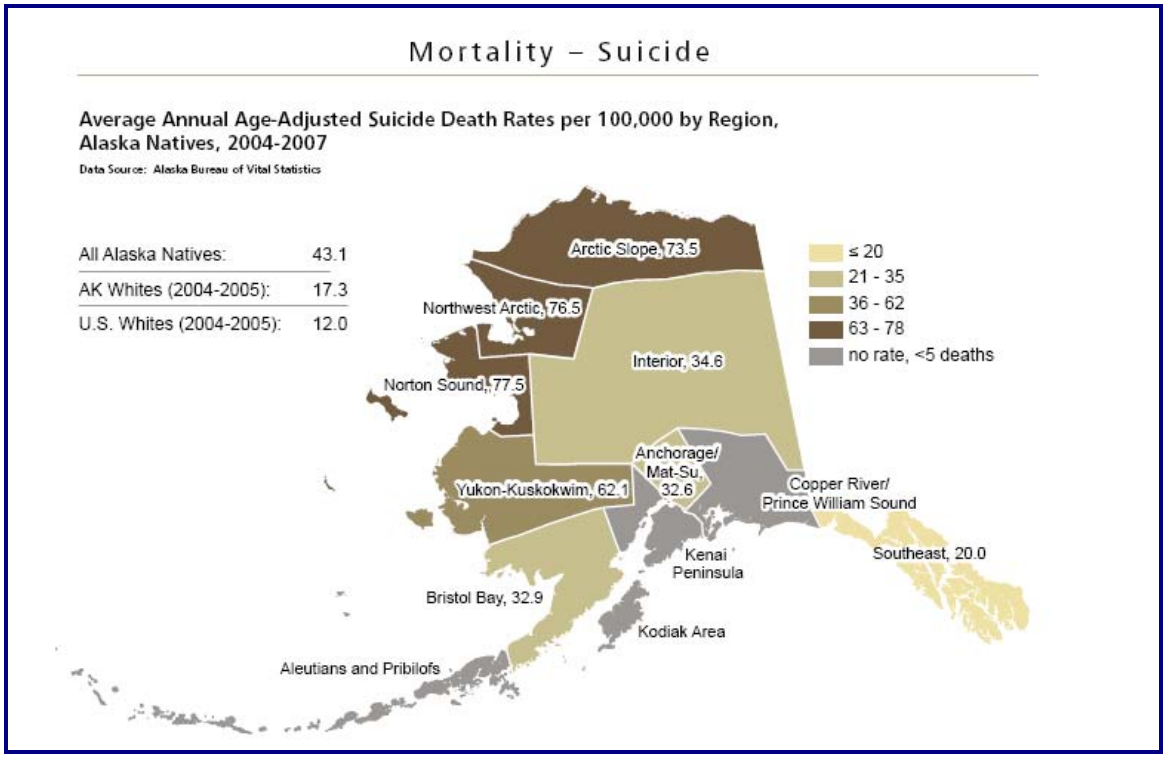
1.6.3.6 Suicide

Specific regional data are available for regional suicide rates. Although it appears that the suicide rate in the Arctic Slope (Figure 15) is higher, the number of deaths is too small to detect a s ignificant difference across regions. Suicide rates increased 49 percent in the Arctic Slope Service Area from 1984 t o 2003. Suicide was the leading cause of injury death (39 percent) in the Arctic Slope Service Area between 1999 - 2005.

The suicide death rate for the Yukon-Kuskokwim, Northwest Arctic and Norton Sound regions are significantly higher ($p<.05$) than for all other regions combined. The suicide death rate for Anchorage/Mat-Su is significantly lower than the rate for all other regions. The suicide rate for men is about 3 times that of women. Men aged 20-29 years had the highest suicide rate of any age group, male or female.

The suicide rate for Alaska Native people has not changed significantly since 1980; however, the U.S. White rate decreased by 8 percent ($p<.05$) since 1980. During 2004-2007, the Alaska Native suicide death rate was 3.6 times greater than for U.S. Whites ($p<.05$) and 2.5 times greater than for Alaska Whites ($p<.05$).

Figure 15 Suicide Death Rates by Region



Source: AN EpiCenter 2009a

1.6.3.7 Morbidity

Morbidity (illness) is tracked by following hospitalization and outpatient department data. Across all regions, (year 2007), the leading cause of hospitalizations for the Alaska Tribal Health System was childbirth and complications of pregnancy, The second leading cause was for diseases of the respiratory system, third was for injuries and poisoning and the fourth was for diseases of the digestive system. These four causes accounted for nearly 50 percent of all hospitalizations.

The leading cause of outpatient visits for the Alaska Tribal Health System during FY2007 was for diseases of the respiratory system (7.3 percent). The second leading cause was for mental health disorders (7.0 percent). During 2003 - 2005, falls were the leading cause of injury hospitalization, accounting for about one in every four (27.0 percent) injury hospitalizations. The second and third leading causes were suicide attempts (18.9 percent) and assaults (12.0 percent), respectively.

A similar pattern is seen for medical illnesses across the Arctic Slope (Table 7 through Table 9).

Table 8 Top 10 Hospital Discharges by Admission Diagnosis

All Ages, Fiscal Year 2006

Samuel Simmons Memorial Hospital			
Rank	Cause	Number	% Total
1	Complications of pregnancy/childbirth (630-677)	44	25.3%
2	Diseases of the respiratory system (460-519)	38	21.8%
3	Deliveries/childbirth (V01-V82)	38	21.8%
4	Disease of the digestive system (520-579)	10	5.7%
5	Diseases of the skin and subcutaneous tissue (680-709)	10	5.7%
6	Symptoms, signs and ill defined conditions (780-799)	8	4.6%
7	Endocrine, nutrition, metabolic, immunity disorders (240-279)	4	2.3%
8	Diseases of the nervous system and sense organs (320-389)	4	2.3%
9	Diseases of the circulatory system (390-459)	4	2.3%
10	Diseases of the muskuloskeletal system and connective tissue (710-739)	4	2.3%
	Total Discharges	**174**	

Data Source: I.H.S. NPIRS [8]

Source: AN EpiCenter 2009b

Table 9 Top 10 Inpatient by Admission Diagnosis

All Ages, Fiscal Year 2006

Samuel Simmons Memorial Hospital			
Rank	Cause	Number	% Total
1	Diseases of the respiratory system (460-519)	127	32.3%
2	Complications of pregnancy/childbirth (630-677)	76	19.3%
3	Deliveries/childbirth (V01-V82)	54	13.7%
4	Diseases of the skin and subcutaneous tissue (680-709)	34	8.7%
5	Disease of the digestive system (520-579)	23	5.9%
6	Symptoms, signs and ill defined conditions (780-799)	18	4.6%
7	Endocrine, nutrition, metabolic, immunity disorders (240-279)	13	3.3%
8	Diseases of the muskuloskeletal system and connective tissue (710-739)	12	3.1%
9	Diseases of the circulatory system (390-459)	10	2.5%
10	Diseases of the nervous system and sense organs (320-389)	8	2.0%
	Total Inpatient Days	**393**	

Data Source: I.H.S. NPIRS [8]

Source: AN EpiCenter 2009b

Table 10 Top 15 Outpatient Visits by ICD Recode*

All Ages, Fiscal Year 2005

Samuel Simmons Memorial Hospital

Rank	Cause	Number	% Total
1	Upper Respiratory Problems	718	11.9%
2	Accidents & Injuries	664	11.0%
3	Pregnancy, childbirth & puerperium	524	8.7%
4	Hospital Med/Surgical Follow-up	430	7.1%
5	Otitis Media	354	5.9%
6	Tests Only (Lab, X-Ray, Screening)	303	5.0%
7	Bone & Joint Disorders	249	4.1%
8	Assessment of Symptoms	243	4.0%
9	Hypertension	199	3.3%
10	Arthritis	158	2.6%
11	Musculoskeletal Disorder	146	2.4%
12	Eczema Urticaria/Skin Allergy	138	2.3%
13	Infected Skin & Abrasions	133	2.2%
14	Bronchitis, Emphysema	133	2.2%
15	Precordial & Abdominal Pain	123	2.0%
	Total Outpatient Visits	**6,046**	

Data Source: I.H.S. NPIRS [8]
* ICD Recode combines similar primary diagnoses into categories

Source: AN EpiCenter 2009b

1.6.3.8 Injury Hospitalizations

An injury hospitalization is defined as either an inpatient admission or transfer to an acute care facility due to injury. During 2000 - 2005, there were 728 injury hospitalizations to Alaska Natives in the Arctic Slope Service Area. Suicide and falls were the most common causes of injury hospitalization in the Arctic Slope Service Area; Suicide attempts accounted for 24 percent of all injury hospitalizations. Assault injury accounted for more than one out of every eight injury hospitalizations in the Arctic Slope Service Area. The Arctic Slope injury hospitalization rate is 119.4/10,000, significantly higher than for Alaska Natives statewide (99.8 per 100,000). Table 10 presents the Arctic Slope Non-Fatal Injury Hospitalization Data, 2000 - 2005.

Table 11 Arctic Slope Non-Fatal Injury Hospitalization Data, 2000-2005

Cause	No. of Hospitalizations	% Total
1. Suicide Attempts	174	23.9%
2. Falls	162	22.3%
3. Assault	104	14.3%
4. Snow machine	82	11.3%
5. ATV	55	7.6%
6. Unintentional Poisoning	15	2.1%
7. Accidentally Struck by Person or Object	13	1.8%
8. Bicycle	11	1.5%
9. Motor Vehicle Traffic Occupant	11	1.5%
10. Caught Between Objects	10	1.4%
Other	91	12.5%
Total	728	100.0%

Provided by: ANTHC Injury Prevention Program[12]
Data Source: Alaska Trauma Registry

Source: AN EpiCenter 2009b

1.6.4 Health Promotion

Health promotion data are focused on (i) rates of tobacco usage, (ii) substance abuse including binge drinking, (iii) obesity (adult)/overweight (children) status and (iv) physical activity of the Arctic Slope population.

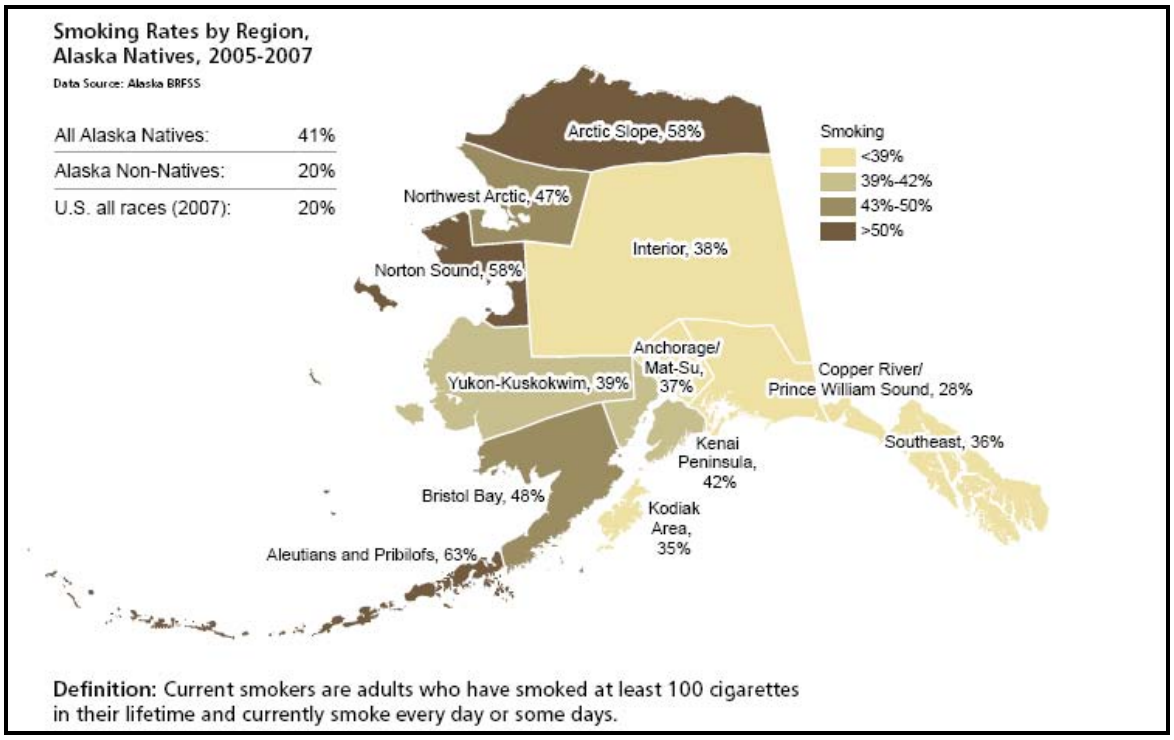
1.6.4.1 Tobacco Use

Overall regional smoking rate data are shown in Figure 16. The smoking prevalence in the Arctic Slope, Norton Sound and Aleutians and Pribilofs regions is significantly higher than for Alaska Natives statewide ($p<.05$).Younger adults are significantly more likely to smoke (49 percent) than older adults (17 percent of those age 65 and over, $p<.05$). Men are more likely to smoke than women ($p<.05$). Smoking prevalence among Alaska Native people has remained constant since the early 1990s, while among Alaska non-Natives it has declined slightly. During 2005 - 2007, more than twice as many Alaska Native people were estimated to be c urrent smokers than Alaska non-Natives (41 percent vs. 20 percent, $p<.05$).

Adolescent cigarette use is defined as having smoked one or more cigarettes on one or more of the past 30 days. In 2007, 31.7 percent of Alaska Native high school students smoked cigarettes on one or more of the past 30 days. This was a slightly higher rate than that of U.S. White adolescents in 2007. In 2007, the percentage of Alaska Native

high school students who had used chewing tobacco or snuff during the past 30 days was 16.6 percent. This was fifty percent higher than the rate of Alaska non-Natives.

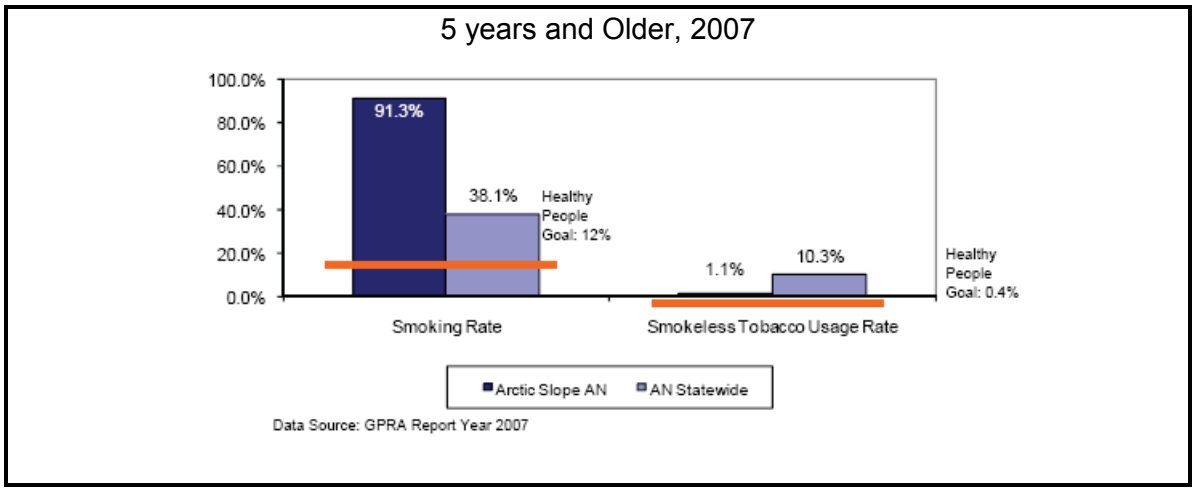
Figure 16 Tobacco Use



Source: AN EpiCenter 2009a

In the Arctic Slope, approximately 42 percent of patients were screened for tobacco use during 2007. More than 9 out of 10 (91.3 percent) Arctic Slope patients who were screened for tobacco use were smokers and 1. 1 percent of screened patients were smokeless tobacco users. These Arctic Slope specific data are shown in Figure 17 below.

Figure 17 Arctic Slope Tobacco and Smokeless Tobacco Usage Rates

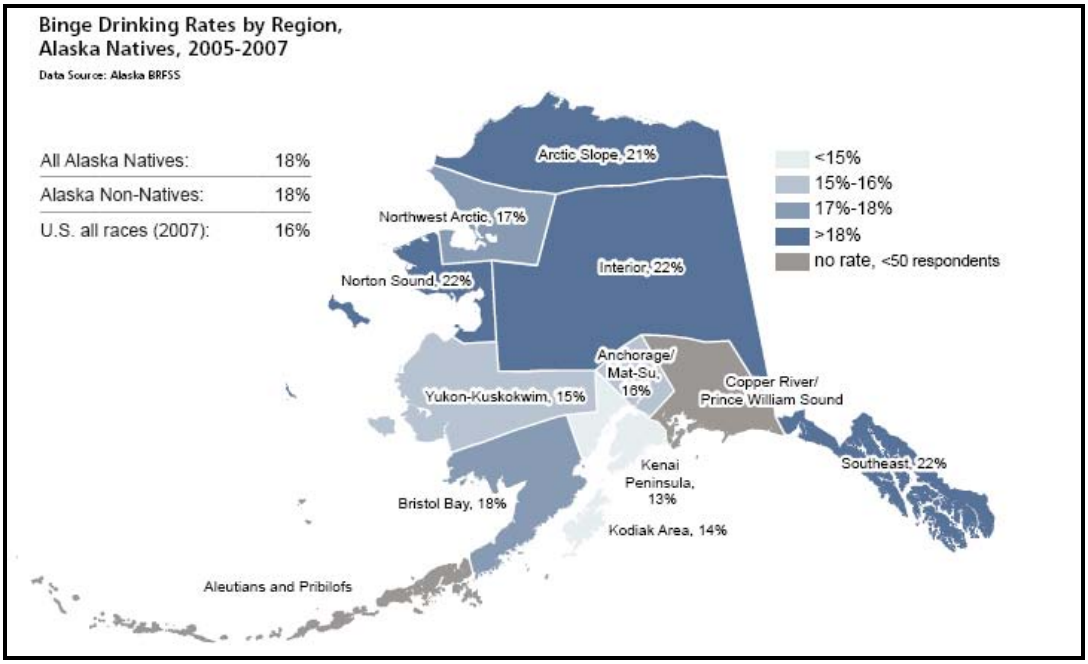


Source: AN EpiCenter 2009b

1.6.4.2 Substance Abuse

Substance abuse includes illegal drugs (*e.g.*, marijuana, cocaine) and binge drinking. 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. Overall Alaska Native regional data are shown in Figure 18.

Figure 18 Binge Drinking Rates by Region



Source: AN EpiCenter 2009a

Although there appears to be variations between regions, none of the region's rates of binge drinking are significantly different from Alaska Natives statewide. The prevalence of binge drinking among Alaska Native adults age 65 and older is significantly lower than for other adults ($p<.05$). Men are significantly more likely to binge drink than women (25 percent vs. 14 percent, $p<.05$). For Arctic Slope residents, the same male versus female trend is true, *i.e.*, self-reported rates of binge drinking of Arctic Slope males are more than double that for Arctic Slope females.

The prevalence of binge drinking has declined since the early 1990's, when it was estimated to be over 30 percent among Alaska Native people ($p<.05$). Binge drinking is equally prevalent among Alaska Natives and Alaska non-Natives at about 18 percent.

For adolescents (2007 survey data), the percent of Alaska Native high school students who report having at least one drink of alcohol on one or more of the past 30 days was less than for U.S. Whites (40.8 percent vs. 47.3 percent). Almost one-third (31.7 percent) of Alaska Native high school students report using marijuana during one or more of the past 30 days in 2007 compared to 19.9 percent of U.S. Whites. The percent of Alaska Native high school students who used any form of cocaine in the last month in 2007 was similar to that for U.S. Whites.

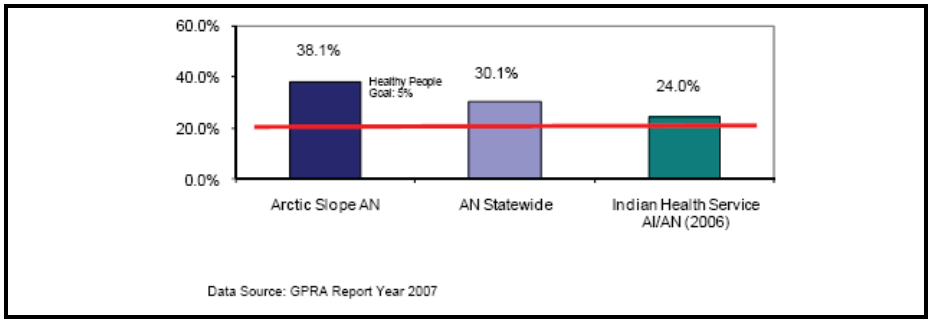
1.6.4.3 Obesity (adult) and Overweight (children)

Body mass index (BMI) is a critical indicator of obesity and overweight status. These terms are defined as:

- Obese (adults 19 – 74 years): Persons who have a current BMI assessment with a BMI of 30 or greater. Current BMI assessment requires that height and weight has been collected within the last five years or if over age 50, within the last two years.
- Overweight (children 18 and younger): Persons who have a current BMI assessment with a BMI greater than or equal to the 95th percentile using age-specific growth charts. Current BMI assessment requires that height and weight has been collected within the last year.

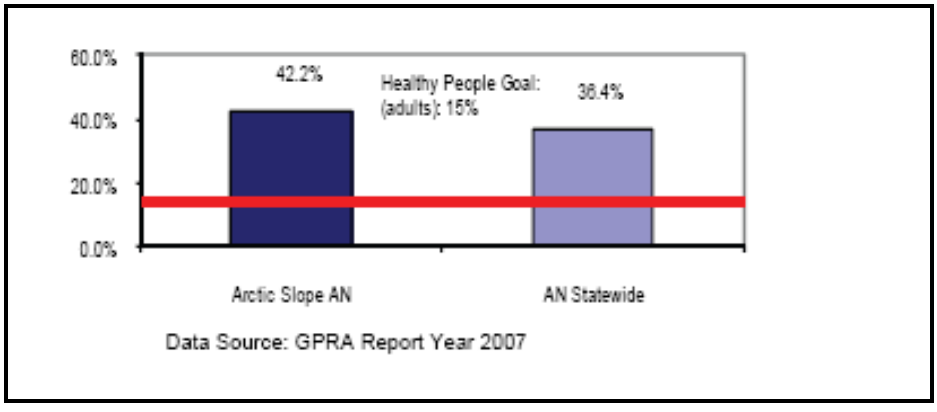
In the Arctic Slope Service Area, more than one out of every three (38.1 percent) Alaska Native children, 2-5 years meets the definition of overweight. Five out of every ten (51.6 percent) Arctic Slope patients have a current BMI assessment on record with Arctic Slope; 42 percent meet the definition of obese (>18 years) or overweight (≤18 years) as compared to 36 percent of Alaska Natives statewide. According to data from the 2007 Youth Risk Behavior Survey, 13.4 percent of Alaska Native high school students are overweight. This is slightly higher than the rate for Alaska Whites and U.S. Whites. These data are illustrated in Figure 19 and Figure 20.

Figure 19 Percent of Children who are Overweight 2-5 years, (2007 GPRA data)



Source: AN EpiCenter 2009b

Figure 20 Percent of Patients who are Obese 2-74 years, (2007 GPRA data)



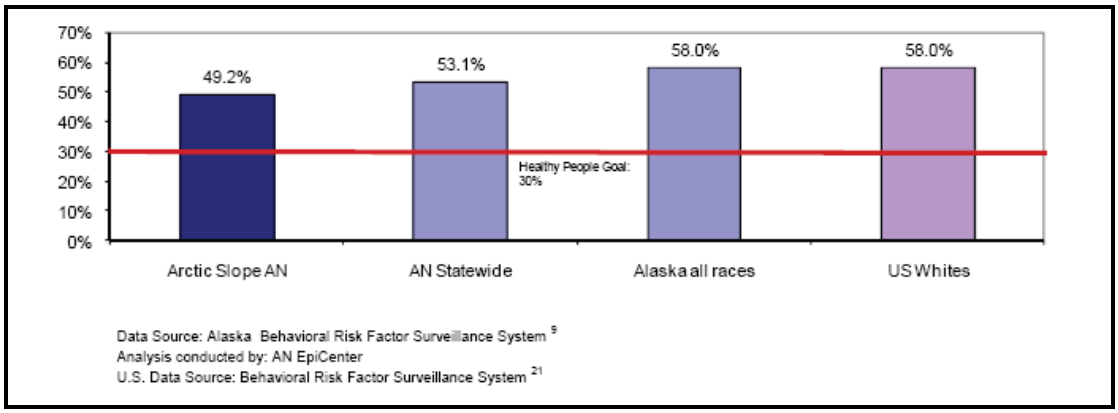
Source: AN EpiCenter 2009b

1.6.4.4 Physical Activity

Consistent physical activity is an important indicator of future cardiovascular risk. Moderate physical activity is defined as some activity that causes an increase in breathing or heart rate (30 or more minutes a day, 5 or more days per week). Vigorous physical activity is defined as some activity that causes a large increase in breathing or heart rate (20 or more minutes a day, 3 times or more a week).

The percent of Alaska Natives in the Arctic Slope service area who meet physical activity recommendations is about 4 percent less than for Alaska Natives statewide (Figure 21), and 32.1 percent of Alaska Native high school students engaged in recommended levels of physical activity. This was 15.0 percent less than Alaska non-Native students and 5.0 percent less than U.S. Whites.

Figure 21 Meets moderate or vigorous physical activity recommendations



Source: AN EpiCenter 2009b

1.6.5 Health Protection

Adequate provision of water and sanitation services is a critical public health infrastructure. A housing unit is considered to have water and sewer service if it has water/sewer pipes or closed haul services. As of 2008, 94 percent of the communities in the Arctic Slope region had water and sewer service, a level significantly higher than the majority of other Native Associations (Table 11).

Table 12 Water and Sewer Rates by Region, 2008

Regional Health Corporation	2008 Housing Units with Pipes or Close Haul	2008 Total Housing Units	% Served
Aleutian Pribilofs Islands Association (APIA)	271	324	84%
Arctic Slope Native Association (ASNA)	462	491	94%
Bristol Bay Area Health Corporation (BBAHC)	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	**13150**	**17332**	**76%**

Data Source: ANTHC DEHE [13]

Source: AN EpiCenter 2009b

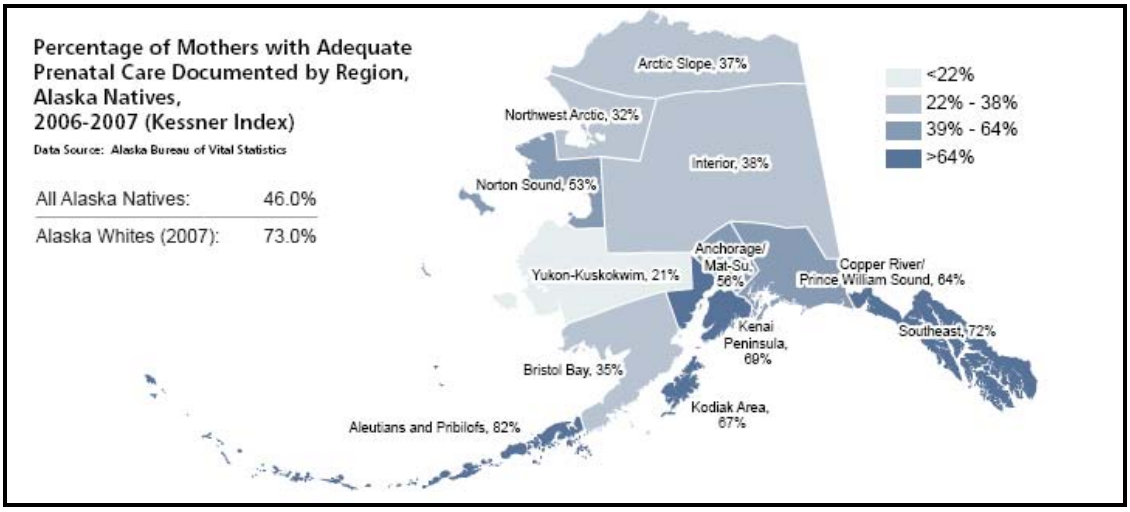
1.6.6 Preventive Services and Access to Health Care

This section includes summary information related to (i) maternal and child care (MCH), (ii) cancer screening, (iii) diabetes, (iv) immunizations, (v) family planning and (vi) infectious diseases including sexually transmitted infections (STIs).

1.6.6.1 Maternal and Child Care (MCH)

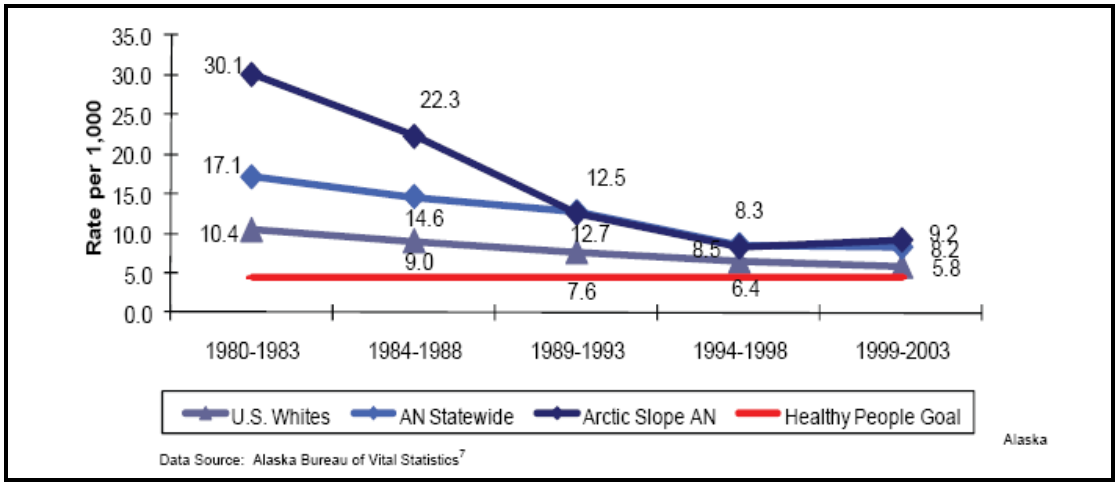
Adequate prenatal care is a critical key performance indicator. About 29 percent fewer Alaska Native mothers appear to have received adequate prenatal care as compared to Alaska White mothers ($p<.05$) (Figure 22). This may be due to prenatal care not being documented on birth certificate forms. In addition, the percent of Alaska Native mothers with documented adequate prenatal care has decreased 15 percent since 1996. The Bristol Bay, Interior, Northwest Arctic and Yukon-Kuskokwim regions had lower rates of documented adequate prenatal care than Alaska Natives statewide ($p<.05$). This suboptimal prenatal care performance is reflected in the Arctic Slope infant mortality rate (IMR) is 1.6 times greater than for U.S. Whites. However there is improvement as the Arctic Slope infant mortality rate decreased from 30.1 from 1980 - 1983 to 9.2 from 1999-2003 (Figure 23).

Figure 22 Percentage of Mothers with Adequate Prenatal Care, Regional Data 2006-7



Source: AN EpiCenter 2009a

Figure 23 IMR 5-year intervals 1980-2003



Source: AN EpiCenter 2009a

1.6.6.2 Cancer Screening

As previously discussed (Section 1.6.3.1), the most frequently diagnosed invasive cancers for Arctic Slope Alaska Native people during 1989 - 2003 were lung (41 cases), colon/rectum (32 cases) and breast (15 cases). These three cancers accounted for over half (56.4 percent) of all cancers diagnosed. The cancers most frequently diagnosed for Arctic Slope Alaska Natives were similar to the cancers most frequently diagnosed for all Alaska Natives statewide.

There is no significant difference in breast cancer incidence between Alaska Native and U.S. White women. In 2008, 58 percent of Alaska Native women age 52-64 years had a documented mammogram within the preceding two year period. The range for the facilities reporting was from 14.3 percent to 71.6 percent.

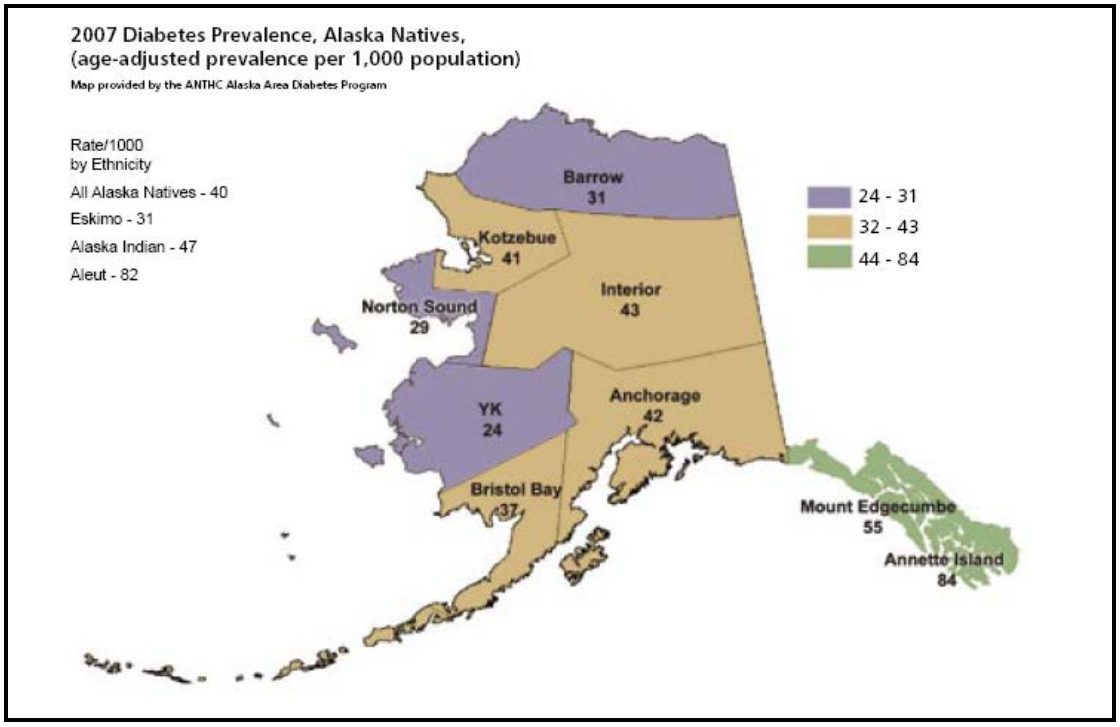
There is no significant difference in cervical cancer incidence between Alaska Native and U.S. White women. In 2008, 74 percent of Alaska Native women age 21-64 years had a documented Pap test within the preceding three-year period. The range for the facilities reporting was from 33.3 percent to 84.9 percent. More than six out of ten Arctic Slope Alaska Native women had received a pap smear within three years of the end of 2007. This is about 3 percent higher than that for all Indian Health Service (I.H.S) American Indians/Alaska Natives nationwide.

The Alaska Native colorectal cancer incidence rate is more than twice that for U.S. Whites (98.3 vs. 45.3, p<.05). In 2008, 50.1 percent of Alaska Native patients, age 51-80 years, had received colorectal cancer screening. The range for the facilities reporting was from 7.2 percent to 64 percent. Arctic Slope's Alaska Native people aged 51 to 80 years had lower colorectal cancer screenings (11.5 percent) when compared to Alaska Native people statewide (46.9 percent).

1.6.6.3 Diabetes

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

Figure 24 Diabetes Prevalence



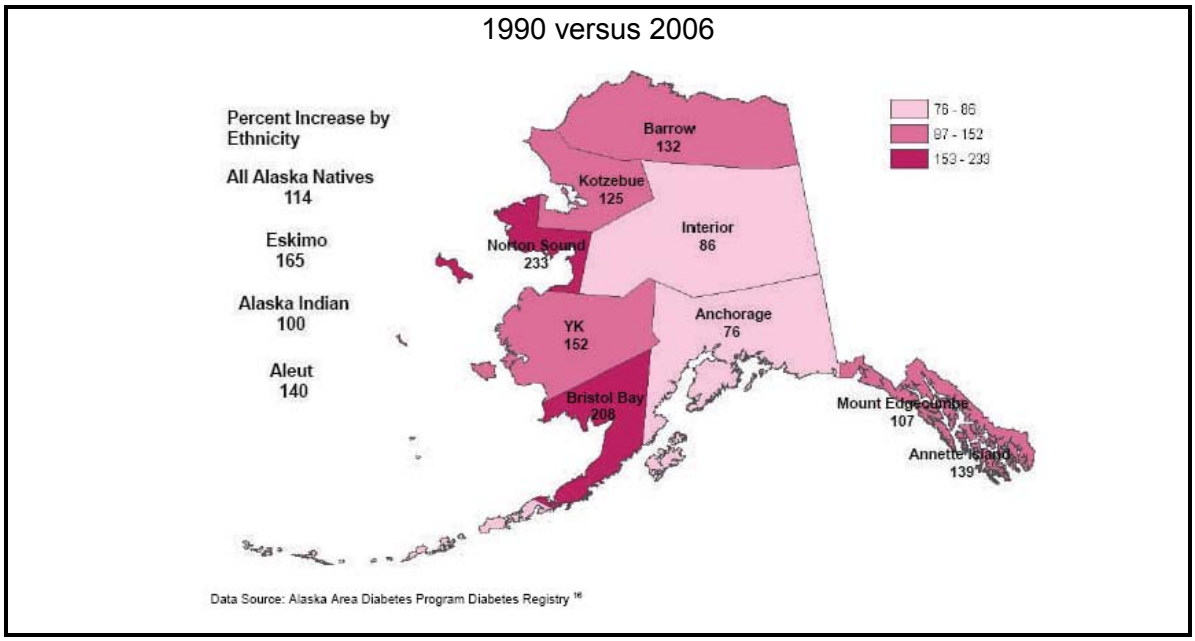
Source: AN EpiCenter 2009a

The prevalence of diagnosed diabetes among Alaska Native people for 2007 was 40 per 1,000 user population as compared to 66 per 1,000 non-Hispanic U.S. Whites (2004 - 2006). The prevalence ranged from 24 per 1,000 in the YK region to 84 per 1,000 in the Annette Island region (Figure 24). The prevalence of diabetes has increased in every

region of the state between 1990 and 2007. The rate of increase was the greatest in Norton Sound (201 percent) and Bristol Bay (200 percent).

The 2006 age-adjusted prevalence of diabetes among Alaska Natives in the Arctic Slope service area (labeled Barrow service unit) is 28/1,000 (81 cases). This is 30 percent lower than for Alaska Natives statewide. The rate of diabetes has increased by 132 percent from 1990 to 2006 among Alaska Natives in the Arctic Slope service area (Figure 25).

Figure 25 Percent Rate of Increase in Diabetes Prevalence Among Alaska Natives



Source: AN EpiCenter 2009a

1.6.6.4 Immunizations

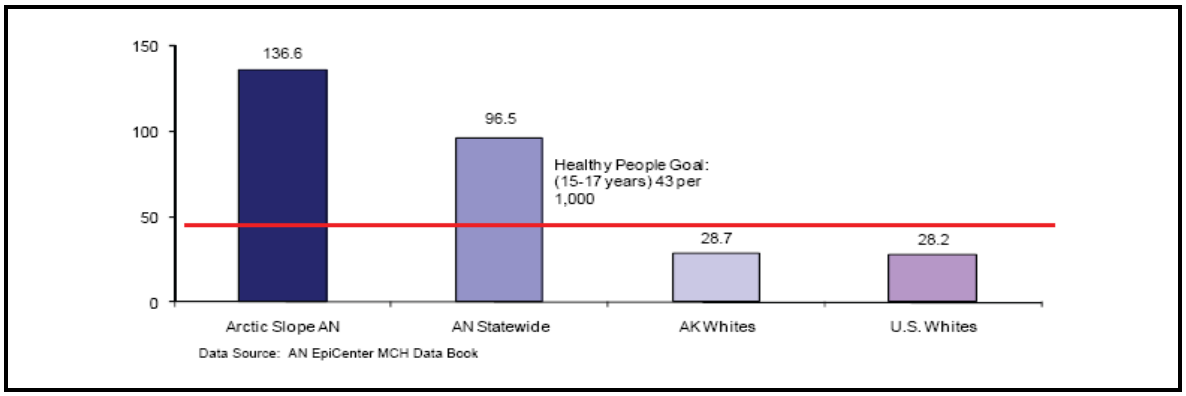
Immunization rates (greater than 80 percent coverage) for both children and adults are a critical performance indicator. By two years of age, it is recommended that all children should have received 4 doses of diphtheria-tetanus-pertussis (DTP), 3 doses of polio, 1 dose of measles-mumps-rubella (MMR), 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." As of December 2007, with 82 percent 4:3:1:3:3 coverage, the Arctic Slope service area attained the Healthy People objective of 80 percent coverage.

For adults aged 65 years and older, respiratory diseases are an extremely important source of observed mortality and morbidity. By June 2007, 46 percent of Arctic Slope users 65 years and older were vaccinated against influenza in the past year as compared to 71 percent of U.S. Whites. As of June 2007, 82 percent of Arctic Slope users 65 years and older had received a pneumococcal vaccine ever as compared to 69 percent of U.S. Whites.

1.6.6.5 Family Planning

Teen birth rates, defined as live births per 1,000 females age 15-19 years, are an important key performance indicator. The teen birth rate (15 - 19 years) for the Arctic Slope Service Area is higher than for Alaska Native people statewide and nearly 5 times the Alaska White rate (Figure 26). One-half of Alaska Native high school students are sexually active.

Figure 26 Teen Birth Rate (per 1,000 females 15-19 years), 2001-2005



Source: AN EpiCenter 2009b

1.6.6.6 Infectious Diseases including STIs

Reportable infectious diseases are an important performance indicator. Overall reportable infectious disease cases for Alaska Natives January 2007 - October 2008 are shown in Table 12.

Table 13 Reportable Infectious Diseases, Alaska Natives

Reportable Infectious Disease Cases,
Alaska Natives, January 1, 2007 - October 3, 2008
Data Source: Alaska Section of Epidemiology

Infectious Disease	Cases	%
Chlamydia	4103	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 Diseaes	10	0.2%
Total	**5177**	**100.0%**

Source: AN EpiCenter 2009b

Sexually Transmitted Infections (STI) comprised 89.4 percent of all Alaska Native reportable infectious disease cases. Chlamydia was by far the most commonly reported infectious disease, accounting for 80 percent of all reported infectious diseases. The Chlamydia rate reported for Alaska Native men is about 4 times greater than is reported for Alaska White men. The Chlamydia rate reported for Alaska Native women is about 7 times greater than is reported for Alaska White women.

The Chlamydia rate for Alaska Native people living in the Arctic Slope Service Area (1,317 per 100,000) is less than that of Alaska Natives statewide but double that of Alaska all races. The Arctic Slope gonorrhea rate of 20 per 100,000 is one-fifth that of all Alaskans.

1.6.7 Summary Arctic Slope

A summary of the key baseline data for the Arctic Slope is shown in Table 13.

Table 14 Arctic Slope Key Baseline Data

Leading Causes of Death (2004-2007)

	Cause of Death	Arctic Slope # Deaths	% of Deaths	Rate per 100,000	Rate Ratio: Arctic Slope vs. Alaska Natives
1	Cancer	25	23%	274.5	1.2
2	Heart Disease	17	15%	273.4	1.5
3	Suicide	12	11%	73.5	1.8
4	Unintentional Injury	8	7%	48.4	0.5
5	COPD	8	7%	140.9	2.6*
	Total- All Causes	111	100%	1350.5	1.3*

** significant difference, p<.05*

Adult Behaviors (2005-2007)

Measure	Arctic Slope	Lower CI[1]	Upper CI[1]	Alaska Natives Statewide	Alaska non-Natives Statewide
Obese (BMI 30+)	37%	28%	47%	31%	25%*
Current Smokers	58%	47%	68%	41%*	20%*
Smokeless Tobacco Users	4%	1%	13%	11%	4%
Meets Physical Activity Recommendations	NA	NA	NA	55%	61%
Binge Drinkers	21%	11%	36%	18%	18%

** significantly different from region, p<.05;* [1] *95% Confidence Interval*

Maternal and Child Health (2006-2007)

Measure	Arctic Slope	Alaska Natives Statewide	Alaska Whites
Low Birth Weight	6%	5%	6%
Adequate Prenatal Care	37%	46%	73%*
Smoking during Pregnancy	48%	29%*	10%*
Smokeless Tobacco during Pregnancy	1%	11%*	0%
Alcohol Consumption during Pregnancy	4%	3%	2%

** significantly different from region, p<.05*

Diabetes (2007)

Measure	Barrow Service Unit	Alaska Natives Statewide
Diabetes Prevalence per 1,000	31	40
% Rate of Increase since 1990	158%	117%

Environmental Health (2008)

Measure	Arctic Slope Native Assn.	AK Tribal Health System
Water and Sewer Service Rates	94%	76%

Source: AN EpiCenter 2009a

1.6.8 Data Gaps

As previously discussed, the databases for the Arctic Slope are quite comprehensive and detailed. These data are aggregated at the regional level. Disaggregating the data for the individual PACs is an extremely difficult task and probably unnecessary at this stage of the HIA process. There may be a rationale to evaluate disaggregating a few key performance indicators for future monitoring and evaluation (M&E) purposes. However, this will require additional feasibility discussions with the "holders" of the critical databases.

2.0 IMPACT ANALYSIS

2.1 Introduction

This section details the health impacts related to each of the five alternatives and also considers the construction, drilling, and operational phases of each alternative. The most significant positive and negative impacts are associated with

(i) Transportation corridors,
(ii) Exposures to hazardous materials
(iii) Local emergency medical services,
(iv) Continued evolution of subsistence and nutrition behaviors, and
(v) Psychosocial effects, particularly related to anxiety.

These positive and negative effects are centered in the Zone 1 communities of Kaktovik and Nuiqsut as well as the coastal hunting areas utilized by both communities (generally between Bullen Point and Point Demarcation). Local workers may be hired for construction and/or operation of the Point Thomson Project, but neither local employment quotas nor employment estimates exist.

The impacts on Anaktuvuk Pass (AP) relate to potential changes in employment and income. The impacts on Prudhoe Bay and Deadhorse relate to barge docking at West Dock and the transport of personnel, supplies and equipment to Point Thomson. Barrow is the regional center for NSB and the impact on health services arises from increased usage and revenues generated during Point Thomson operations which flow from the state to regional and local agencies.

Section 2.2 details the impact analysis methodology. Section 2.2 presents Impact Analysis and Section 2.4 presents the Mitigation Strategies and recommendations based on the impacts identified.

2.2 Impact Assessment Methodology

The methodology for analyzing potential impacts during an HIA has been presented in Section 1.5. The specific methodology utilized for the Point Thomson Project is presented below. Because the Point Thomson HIA was conducted as a rapid assessment HIA, new field research (*e.g.* nutritional surveys or in depth community interviews) was not gathered. Nevertheless, the HIA team travelled to Deadhorse/Prudhoe Bay and received a briefing on the facility and the surrounding area. Additionally, stakeholder engagement meetings conducted by the EIS team were reviewed in detail as well as sections of the EIS that relate to human health such as Transportation (e.g. accidents and injuries); Socioeconomic; Environmental Justice (e.g. psychosocial issues); and Subsistence and Traditional Land Use Patterns (e.g. subsistence foods community health, and dietary impacts). A specific analysis of the HECs based on applicable baseline data is presented below. An overall baseline health picture of the NSB was presented in Section 1.6. The development of an impact rating panel is presented and discussed below.

2.2.1 Heath Effects Categories

In addition to Health Effects Categories (HEC) developed for the State of Alaska HIA Draft Toolkit, as presented in Section 1.5., discrete issues specific to the Point Thomson Project were developed, as listed in Table 14, below.

Table 15 Health Effects Category and Discrete Point Thomson Project Issues

Health Effects Category	Overview
Social Determinants of Health (SDH) including psychosocial, domestic violence and gender issues <u>Discrete PTP issues:</u> • Change in maternal child health status • Change in depression/anxiety prevalence • Change in substance abuse rate • Change in suicide rate • Change in teen pregnancy rates • Change in domestic violence	**Description** ◆ Several important psychosocial issues related to drugs, alcohol, teenage pregnancy, family stress, domestic violence, are considered. Work rotation pattern/hiring practices and effects on family and subsistence can also be considered but duplicative analysis should be avoided. ◆ Economy and employment, cultural continuity (anxiety/stress regarding perceived threats to traditional ways of life), and environmental conditions are considered. The overall contribution of project-specific effects on economy, employment and the relationship to population health status are considered. **Baseline Situation** ◆ NSB suicide rates are elevated and is the leading cause of injury death; ◆ Injury rates (all causes) is higher than AN statewide; ◆ Tobacco usage rates are extremely high and above AN statewide; ◆ Binge drinking and drugs of abuse rates in NSB are typical for AN statewide; ◆ NSB maternal/child health (MCH) has improved and is consistent with statewide AN levels; ◆ Teen birth rate in NSB is significantly higher than AN statewide ◆ Unemployment in NSB is low relative to other areas; ◆ Project will use a 2 week FIFO system. **Analysis** ◆ Psychosocial issues are already present and a concern in NSB; ◆ FIFO likely to be keep Pt Thomson at parity with other existing projects; ◆ MCH is unlikely to be materially affected; ◆ Substance abuse issues a perceived concern (voiced village stakeholder concern) ◆ Project unlikely to materially change employment picture except for modest construction season “bump.” **Impact Analysis** ◆ Panel Ratings

Health Effects Category	Overview
Accidents and Injuries Discrete PTP issues: • Change in unintentional injury (*e.g.* drowning, falls, snow machine injury) rates • Change in roadway incidents and injuries due to service road access for hunters/ increased traffic from Prudhoe Bay • Changes to safety during subsistence activities	**Description** ◆ Concerns focus on potential influx of non-resident personnel (increased traffic on roadways and air corridors; Distance of travel required for successful subsistence. ◆ Will Project create new infrastructure (*e.g.* roadways) that increases traffic/usage, etc. ◆ Will project significantly increase number of vehicles on existing roadways. **Baseline Situation** ◆ Unintentional injury rates in NSB are consistent with AN and may be declining but absolute numbers are small; Off road accidents account for 18% of NSB unintentional injuries; Snow machine accidents are 11% of non-fatal injury hospitalizations. **Analysis** ◆ Unintentional injury rates are a significant contributor to the burden of disease in NSB; off road/snow machine accidents/injuries are important sources of morbidity and mortality for the NSB. **Impact Analysis** • Panel Ratings
Exposure to potentially hazardous materials Discrete PTP issues: • Changes in physiologic contaminant levels such as lead, methyl mercury, PCB, Dioxins, PM2.5 from incineration, drilling mud, or gas flaring. • Changed levels of the same substances in subsistence resources	**Description** Project emissions and discharges can lead to potential exposure. Exposure pathways include: • Quality changes in subsistence foods (risk based on analysis of foods or modeled environmental concentrations) • Drinking water • Respiratory (fugitive dust, criteria pollutants, persistent organic pollutants, volatile organics) • Secondary occupational exposure (exposure of home residents to dust/contaminants on worker clothing) • Indirect pathways could include changing heating fuels/energy production fuels in communities • Rates of disease endpoints, specific to the contaminant(s) of concern. **Baseline Situation** • Concern over exposure to potentially hazardous materials is frequently voiced in community meetings; • Distances from project facilities to physical communities is substantial such that anticipated concentrations are expected to be *de minimis;* • Exposure duration and frequency is likely to be minimal even during subsistence activities; • Project is expected to increase the number of operating incinerators,

Health Effects Category	Overview
	especially during construction. Currently incinerators are not covered by rigorous emission requirements; however, this is likely to change. **Analysis** • Stakeholder concerns are likely mismatched to actual physical exposures and potential received doses in the village setting; • Incinerators are a concern and are currently not covered by stringent emission requirements; • Different alternatives will have an impact on incinerator throughput and subsequent output. **Impact Analysis** • Panel Ratings
Food, Nutrition, and Subsistence Activity Discrete PTP issues: • Change in amount of dietary consumption of subsistence resources • Change in composition of diet • Change in food security	**Description** • *Effect on Diet*: Communities in rural Alaska continue to rely on subsistence resources to varying degrees. This pathway considers the effect of subsistence impacts on diet, in the context of other factors (such as income, personal choice work schedule/time off) that drive subsistence harvesting and food consumption patterns in Alaskan communities. Food security is considered; Project impacts on access, quantity, perceived (or actual quality) impacts and competition for resources are considered within the context of the effect of these potential impacts on diet and subsequent population level health. **Baseline Description** • Data are based on harvest surveys which use both historic data and some new survey information; • Nutritional survey data are not readily available; • Harvest data must be translated into population level potential effects; • Individual household vulnerability versus community-level must be differentiated. **Analysis** • Villages within the potential impact areas (Barrow, AP, Nuiqsut, Kaktovik) are not equivalent in terms of potential impacts; • Harvest data must be translated into potential household and community level effects; • Numerous confounding factors, *e.g.*, climate change, effects of income/food selection choices, purchasing power significantly complicate the analysis. **Impact Analysis** • Panel Ratings

Health Effects Category	Overview
Infectious Disease <u>Discrete PTP issues:</u> • Change in pediatric acute respiratory disease rates (RSV, pneumonias, asthma, Bronchiectasis) • Change in acute adult respiratory disease rates (TB, Bronchitis, Influenza) • Change in STD rates (esp. Chlamydia, Gonorrhea, HIV) • Change in gastrointestinal (GID) outbreaks	**Description** • Influx of non-resident personnel from outside the region, crowded or enclosed living & working conditions can facilitate the transmission of respiratory and gastrointestinal infections. • Antibiotic-resistant staph skin infections are prevalent in parts of Alaska, presenting a risk of transmission for non-resident workers (particularly in any setting involving shared hygiene facilities, living quarters, or equipment). • Influx of non-resident worker; mixing of low and high prevalence populations create a risk for transmission of STIs such as syphilis, HIV, and Chlamydia. • Vector-borne diseases (VBD) could be an issue if standing groundwater/wetlands changes resulted in altered distribution of insect vectors. With the cumulative effects of climate change, VBD may become an issue of greater concern in the future. **Baseline Situation** • Respiratory diseases (COPD, pneumonia and influenza) account for 10% of the NSB mortality profile • Respiratory diseases account for 21% of the NSB hospital discharges; • Respiratory diseases account for 32% of inpatient admissions and is the leading admission diagnosis in the NSB; • Respiratory diseases are the leading cause of outpatient visits (11.9%) • STIs, particularly Chlamydia, are a significant concern; however, the NSB rate is less than AN statewide; • Tobacco usage rates are over 90% in the NSB. • Vector diseases are slowly increasing northward move. **Analysis** • Burden of respiratory diseases is extremely high in the NSB and for AN statewide; • Tobacco usage rates are a major confounder • Alternatives that increase construction population and construction duration are a potential concern; • Project camps are closed and FIFO system drastically minimizes interaction with local communities. • Additional ponds created during construction will potentially increase breeding sites. **Impact Analysis** • Panel Ratings
Water and Sanitation	**Description** Access, quantity and quality of water supplies are considered. In rural Alaska, lack of adequate water service is linked to the high rates of

Health Effects Category	Overview
Discrete PTP issues: • Changes in potable water access • Change in water quantity • Change in water quality • Change in sanitation effectiveness, adequate settling pools, discharge	lower respiratory infections observed in some regions, and to invasive skin infections. P rojects can have potential ef fects on w ater and sanitation such as • Revenue from the project that supports construction and maintenance of water & sanitation facilities. • Increased demand on water and sanitation infrastructure secondary to influx of non-resident workers. **Baseline Situation** • NSB has extremely high levels of water/sewer services (94%) much greater than AN statewide averages **Analysis** • Project is unlikely to materially affect baseline **Impact Analysis** • Panel Ratings
Non-communicable and Chronic Diseases Discrete PTP issues: • Change in obesity prevalence • Change in average BMI • Change in Type 2 DM rates • Change in Hypertension • Change in lung cancer rates • Change in COPD rates	**Description** • Cardiovascular diseases including stroke; • Obesity, impaired glucose tolerance, and diabetes • Cancer rates • Exercise/fitness **Baseline Analysis** • Cancer is the leading cause of death in the NSB but the burden is not significantly different across other regions except for the ANC/Mat-Su region (lower) • Lung/bronchus is the leading cancer • Tobacco usage is extremely high in NSB • Heart disease is the number three cause of NSB mortality (11.7%); cerebrovascular (4.3%) • NSB cardiovascular and cerebrovascular disease rates are not significantly different than AN statewide; • NSB obesity rates are higher than statewide AN; • NSB physical activity rates are lower than AN statewide levels • NSB diabetes rates are rising; however, the overall NSB diabetes burden is 30% lower than AN statewide levels. **Analysis** • NSB non-communicable disease rates are evolving in complex ways and appear to be multi-factorial; • The Pt. Thomson project is small relative to the size and complexity of the NSB and is unlikely to materially affect population-level effects; • Subsistence effects are determined in the specific Subsistence HEC **Impact Analysis** • Panel Ratings

Health Effects Category	Overview
Health Services Infrastructure and Capacity Discrete PTP issues: • Change in number of clinics and staff • Change in quality of clinics and staff • Change in services offered (*e.g.* prenatal checks, x-ray, lab services) • Change in accessibility of health care • Change in utilization/clinic burden from non-resident influx	**Description** Projects can affect health services infrastructure and capacity, through: • Revenues used to support local/regional services and infrastructure • Increased demands on infrastructure and services by incoming non-resident employees or residents injured on the job. **Baseline Situation** • NSB has a fully functioning health system including in-patient , outpatient and public health services; **Analysis** • The FIFO system will significantly limit interaction and effects on local health systems; • Changes in accident/injury rates could cascade into the local emergency management systems; **Impact Analysis** • Panel Ratings

2.2.1.1 Risk Assessment Matrix

While there are numerical risk-based environmental standards that regulate biota, air, water and soil, there are no similar quantitative regulatory endpoints for public-health outcomes. Winkler 2010 proposes a risk assessment technique that ranks the significance of identified health impacts allowing health planners prioritize management actions. The entire rating is based on a modified Delphi approach (Rowe and Wright, 1999), a technique used in judgment and forecasting situations where pure model-based statistical methods are not practicable.

The HIA team performed this evaluation, as fully described in Winkler 2010 by drawing on

(i) Available health baseline data from the literature review;
(ii) Review of the project context, alternatives and developments;
(iii) Review of pertinent sections of the Point Thomson Project Environmental Impact Statement, particularly the Socioeconomic, Environmental Justice, Subsistence, and Transportation section; and
(iv) Information and recommendations generated by a panel of Alaskan medical and public health professionals.

The HIA team created a worksheet for each of the eight HECs and each of the five alternatives. Each of the 40 worksheets was divided into the project phases: construction, drilling, and operation. The health impact parameters consider:

- **Duration** – determines how long each phase will last; ranked from under a month to beyond the life of the project
- **Magnitude** – evaluates the intensity of the impact, particularly in light of existing baseline conditions
- **Extent** – identifies the localities where the projected impact will be experienced, *e.g.*, local or regional
- **Likelihood** – evaluates the probability that the impact will occur
- **Nature** – determines whether the impact is direct, indirect or cumulative
- **Impact** – evaluates whether the impact is positive or negative, *i.e.,* whether the impact will promote or progress, degrade or detract from the well-being of defined communities or populations
- **Scoring** – as described in Figure 27 and Figure 28 below.

For the risk analysis, a 4-step procedure was developed that is illustrated on the risk assessment matrix (Figure 27 and 28), as modified from Winkler 2010**,** and as presented below.

Figure 27 Step 1 of 4-Step Risk Assessment Matrix

Step 1				
	Consequences			
Impact Level (score)	**A – Health Effect**	**B- Duration**	**C-Magnitude**	**D- Extent**
Low (0)	Effect is not perceptible	Less than 1 month	Minor intensity	Local/Project Area
Medium (1)	Effect results in annoyance, minor injuries or illnesses that do not require intervention	Short-term: 1-12 months	Those impacted will be able to adapt to the impact with ease and maintain pre-impact level of health	Local/Zone 1: Kaktovik and Nuiqsut
High (2)	Effect resulting in moderate injury or illness that may require intervention	Medium-term: 1 to 6 years	Those impacted will be able to adapt to the health impact with some difficulty and will maintain pre-impact level of health with support	Zone 2: Prudhoe Bay/Deadhorse AP Barrow
Very high (3)	Effect resulting in loss of life, severe injuries or chronic illness that requires intervention	Long-term: more than 6 years/life of project and beyond	Those impacted will not be able to adapt to the health impact or to maintain pre-impact level of health	Rest of Alaska US Global

In Step 1, the extent of the four different consequences — (A) effect; (B) duration; (C) magnitude; and (D) extent—is rated according to the criteria set forth in Figure 28. The output of this rating is a score between 0 and 3 for each consequence, depending on the estimated impact level:

- Low (score = 0)
- Medium (score=1)
- High (score=2)
- Very high (score=3).

Figure 28 Steps 2, 3, and 4 of 4-Step Risk Assessment Matrix

Step 2	***Step 3***						
Severity Rating **(Magnitude + Duration + Geographic Extent + Health Effect)**	***Likelihood Rating***						
	Extremely Unlikely **< 1%**	**Very Unlikely** **1-10%**	**Unlikely** **10-33%**	**About as Likely as Not** **33-66%**	**Likely** **66-90%**	**Very Likely** **90-99%**	**Virtually Certain** **> 99%**
Low (0-3)	◆	◆	◆	◆	◆◆	◆◆	◆◆
Medium (4-6)	◆	◆	◆	◆◆	◆◆	◆◆	◆◆◆
High (7-9)	◆◆	◆◆	◆◆	◆◆◆	◆◆◆	◆◆◆	◆◆◆◆
Very high (10-12)	◆◆◆	◆◆◆	◆◆◆	◆◆◆◆	◆◆◆◆	◆◆◆◆	◆◆◆◆
Step 4	***Impact Rating***						
	Key: Low ◆ Medium ◆◆ High ◆◆◆ Very High ◆◆◆◆						

In Step 2, as shown in Figure 28, the scores of the consequences are summed up and based on the value the impact severity is assigned as follows:

- Low (0–3)
- Medium (4–6)
- High (7–9)
- Very high (10–12).

In Step 3 the likelihood of the impact to occur is assessed according to the following definitions, as presented in IPCC 2007:

- Exceptionally unlikely < 1 percent probability
- Very unlikely 1-10 percent probability

- Unlikely 10-33 percent probability
- About as likely as not: 33-66 percent probability
- Likely: 66-90 percent probability
- Very likely: 90-99 percent probability
- Virtually certain: > 99 percent probability.

Step 4 entails the final significance rating, which is identified through the intersection of the impact severity and the likelihood of the impact to occur, as shown in Figure 28.

A low significance indicates that the potential health impact is one where a negative effect may occur from the proposed activity; however, the impact magnitude is sufficiently small (with or without mitigation) and well within accepted levels, and/or the receptor has low sensitivity to the effect.

Impacts classified with a medium significance and above require action so that predicted negative health effects can be mitigated to as low as reasonably practicable (Winkler 2010). An impact with high or very high significance will affect the proposed activity, and without mitigation, may present an unacceptable risk. The significance is simply stated as positive (e.g. improvement of health services). If there is a negative accentuation of the health impact compared to the baseline condition, this is indicated in the risk assessment matrix by the use of a + sign to indicate a positive impact or a – sign to indicate a negative impact.

2.2.2 Expert Panel Review

Scientists and health professionals may have very different interpretations of "acceptability" or "significance." To gather a variety of perspectives, the HIA Team hosted a panel on October 29, 2010, to consider the Point Thomson Project, its implications for human health, and to rank and rate those human health impacts. This panel was conducted in a focus group format in order to discuss a collection of impacts already identified by the HIA team. The focus group consisted of members of the HIA team, state public health professionals, state officials with excellent knowledge of the project, and international HIA experts.

The Significance Scoring Tables prepared by the panel for each HEC and each alternative are presented in Annex 1.

2.3 Impact Analysis

In all alternatives, workers would fly in and fly out (FIFO) of the site and would not be allowed outside of the project site without work authorization. Residents of Kaktovik and Nuiqsut would not be allowed inside the gate unless they were employees.

All of the action alternatives (B, C, D, and E) would require camps for construction, drilling, and operations. Temporary camp modules would be self-contained and include potable and wastewater systems. They would be located on gravel pads or single-season ice pads (ExxonMobil 2010zz). A permanent operations camp would be located on the pad with the Central Processing Facility. All camp modules would contain kitchens, laundry, recreational facilities, and sleeping quarters. A minimum of two infield construction camps would be required to house up to 600 construction crew members.

In the first construction season of each alternative, a temporary 140-bed export pipeline construction camp would be required; its location would depend upon the pipeline route in that alternative. In the second pipeline construction season, crew members would be housed at one of the two main construction camps (HDR 2011tt). These construction camps would demobilize with the construction crews and equipment. A temporary drilling camp would arrive onsite with the drill rig and would house the 140-person drilling staff, and would demobilize with the drill rig at the end of the drilling phase (HDR 2011tt).

The permanent operations camp would be designed to hold up to 140 staff members, though the average operations crew would be 80 personnel (HDR 2011aa) during standard operations. This camp would arrive with the facility modules in each alternative. Utility modules associated with the operations camp would include a potable water treatment system, potable water tanks, a wastewater treatment system; storage tanks for raw water and fire abatement; and water pumps for fire fighting.

The HIA team noted that during construction, drilling, and operation activities under all alternatives, the Point Thomson facility would be self-contained and workers would have no reason to travel to any of the NSB communities, other than Deadhorse for their FIFO rotations. The lack of physical connection between Point Thomson and the other communities reduces the interaction between the workers and the local community and therefore reduces the spread of infectious disease and reduces the potential for adverse human health effects to community characteristics or culture.

Because natural gas and oil production have occurred in the NSB for the past 35 years, the construction of the Point Thomson facility represents a familiar activity for the communities and the borough. In Alternative A, no condensate would be produced; in Alternatives B, C, D, and E, ExxonMobil expects to deliver condensate and any producible oil to Trans-Alaska Pipeline System Pump Station No. 1 at Prudhoe Bay for shipment to market. Initial average production of condensate is expected to be 10,000 barrels per day (bpd). If and when the wells on the East and West Pads are deemed viable, the production of hydrocarbon liquids (oil in addition to condensate) may increase, though the extent of the potential increase would be determined by reservoir delineation and evaluation activities.

The following eight tables summarize the impact analysis of each alternative for each Heath Effects Category/Health Issue (Table 15 through Table 22).

Table 16 Summary Scoring - HEC: Water and Sanitation

Health Issue	Alt A	Alt B	Alt C	Alt D	Alt E
Construction Phase					
Changes in potable water access	No activity	No impact	No impact	No impact	No impact
Change in water quantity	No activity	No impact	No impact	No impact I	No impact
Change in water quality	No activity	No impact	No impact	No impact It	No impact
Change in sanitation effectiveness, adequate settling pools, discharge	No activity	No impact	No impact	No impact I	No impact
Drilling Phase					
Changes in potable water access	No activity	No impact	No impact	No impact	No impact
Change in water quantity	No activity	No impact	No impact	No impact	No impact
Change in water quality	No activity	No impact	No impact	No impact	No impact
Change in sanitation effectiveness, adequate settling pools, discharge	No activity	No impact	No impact	No impact I	No impact
Operation Phase					
Changes in potable water access	No impact	No impact	No impact	No impact	No impact
Change in water quantity	No impact	No impact	No impact	No impact	No impact
Change in water quality	No impact	No impact	No impact	No impact I	No impact
Change in sanitation effectiveness, adequate settling pools, discharge	No impact	No impact	No impact	No impact	No impact

Table 17 Summary Scoring - HEC: Accidents and Injuries

Health Issue	Alt A	Alt B	Alt C	Alt D	Alt E
Construction Phase					
Change in unintentional injury (e.g. drowning, falls, snow machine injury) rates	No activity	-3 = Low	-3 = Low	-3 = Low	-3 = Low
Change in roadway incidents and injuries due to service road access for hunters / increased traffic from Prudhoe Bay	No activity	-3 = Low	-8 = High	-8 = High	-3 = Low
Changes to safety during subsistence activities	No activity	-3 = Low	-3 = Low	-3 = Low	-3 = Low
Drilling Phase					
Change in unintentional injury (e.g. drowning, falls, snow machine injury) rates	No activity	-3 = Low	-3 = Low	-3 = Low	-3 = Low
Change in roadway incidents and injuries due to service road access for hunters / Increased traffic from Prudhoe Bay	No activity	-3 = Low	-8 = High	-8 = High	-3 = Low
Changes to safety during subsistence activities	No activity	-3 = Low	-3 = Low	-3 = Low	-3 = Low
Operation Phase					
Change in unintentional injury (e.g. drowning, falls, snow machine injury) rates	No impact	-3 = Low	-3 = Low	-3 = Low	-3 = Low
Change in roadway incidents and injuries due to service road access for hunters / increased traffic from Prudhoe Bay and all–season road	No impact	-3 = Low	-6 = Medium	-6 = Medium	-3 = Low
Changes to safety during subsistence activities	No impact	-3 = Low	-3 = Low	-3 = Low	-3 = Low

Table 18 Summary Scoring - HEC: Exposure to Hazardous Materials

Health Issue	Alt A	Alt B	Alt C	Alt D	Alt E
Construction Phase					
Changes in physiologic contaminant levels such as lead, methyl mercury, PCB, Dioxins, PM2.5 from incineration, drilling mud, or gas flaring	No activity	-4 = Medium	-6 = Medium	-6 = Medium	-5 = Medium
Changed levels of the same substances in subsistence resources	No activity	-4 = Medium	-6 = Medium	-6 = Medium	-5 = Medium
Drilling Phase					
Changes in physiologic contaminant levels such as lead, methyl mercury, PCB, Dioxins, PM2.5 from incineration, drilling mud, or gas flaring	No activity	-4 = Medium	-5 = Medium	-5 = Medium	-5 = Medium
Changed levels of the same substances in subsistence resources	No activity	-4 = Medium	-5 = Medium	-5 = Medium	-5 = Medium
Operation Phase					
Changes in physiologic contaminant levels such as lead, methyl mercury, PCB, Dioxins, PM2.5 from incineration, drilling mud, or gas flaring	No impact	-4 = Medium	-5 = Medium	-5 = Medium	-5 = Medium
Changed levels of the same substances in subsistence resources	No impact	-4 = Medium	-5 = Medium	-5 = Medium	-5 = Medium

Table 19 Significance Scoring - HEC: Food, Nutrition, and Subsistence

Health Issue	Alt A	Alt B	Alt C	Alt D	Alt E
Construction Phase					
Change in amount of dietary consumption of subsistence resources	No activity	-3 =Low	-4 = Medium	-4 = Medium	-3 = Low
Change in composition of diet	No activity	-3 = Low	-3 = Low	-3 = Low	-3 = Low
Change in food security	No activity	-3 = Low	-3 = Low	-3 = Low	-3 = Low
Drilling Phase					
Change in amount of dietary consumption of subsistence resources	No activity	-3 = Low	-4 = Medium	-4 = Medium	-3 = Low
Change in composition of diet	No activity	-3 = Low	-3 = Low	-3 = Low	-3 = Low
Change in food security	No activity	-3 = Low	-3 = Low	-3 = Low	-3 = Low
Operation Phase					
Change in amount of dietary consumption of subsistence resources	No impact	-3 = Low	-4 = Medium	-4 = Medium	-3 = Low
Change in composition of diet	No impact	-3 = Low	-3 = Low	-3 = Low	-3 = Low
Change in food security	No impact	-3 = Low	-3 = Low	-3 = Low	-3 = Low

Table 20 Summary Scoring - HEC: Health Infrastructure/Delivery

Health Issue	Alt A	Alt B	Alt C	Alt D	Alt E
Construction Phase					
Change in number of clinics and staff	No activity	No impact	No impact	No impact	No impact
Change in quality of clinics and staff	No activity	No impact	No impact	No impact	No impact
Change in services offered (e.g. prenatal checks, x-ray, lab services)	No activity	No impact	No impact	No impact	No impact
Change in accessibility of health care	No activity	No impact	No impact	No impact	No impact
Change in utilization/clinic burden from non-resident influx	No activity	-3 = Low	-8 = High	-8 = High	-3 = Low
Drilling Phase					
Change in number of clinics and staff	No activity	No impact	No impact	No impact	No impact
Change in quality of clinics and staff	No activity	No impact	No impact	No impact	No impact
Change in services offered (e.g. prenatal checks, x-ray, lab services)	No activity	No impact	No impact	No impact	No impact
Change in accessibility of health care	No activity	No impact	No impact	No impact	No impact
Change in utilization/clinic burden from non-resident influx	No activity	-3 = Low	-8 = High	-8 = High	-3 = Low
Operation Phase					
Change in number of clinics and staff	No impact	+7 = High	+7 = High	+7 = High	+7 = High
Change in quality of clinics and staff	No impact	+7 = High	+7 = High	+7 = High	+7 = High
Change in services offered (e.g. prenatal checks, x-ray, lab services)	No impact	+7 = High	+7 = High	+7 = High	+7 = High
Change in accessibility of health care	No impact	+7 = High	+7 = High	+7 = High	+7 = High
Change in utilization/clinic burden from non-resident influx	No impact	-3 = Low	-3 = Low	-3 = Low	-3 = Low

Table 21 Summary Scoring - HEC: Infectious Disease

Health Issue	Alt A	Alt B	Alt C	Alt D	Alt E
Construction Phase					
Change in pediatric acute respiratory disease rates (RSV, pneumonias, asthma, Bronchiectasis)	No activity	No impact	No impact	No impact	No impact
Change in acute adult respiratory disease rates (TB, Bronchitis, Influenza)	No activity	No impact	No impact	No impact	No impact
Change in STD rates (esp. Chlamydia, Gonorrhea, HIV)	No activity	No impact	No impact	No impact	No impact
Change in GID outbreaks	No activity	No impact	No impact	No impact	No impact
Drilling Phase					
Change in pediatric acute respiratory disease rates (RSV, pneumonias, asthma, Bronchiectasis)	No activity	No impact	No impact	No impact	No impact
Change in acute adult respiratory disease rates (TB, Bronchitis, Influenza)	No activity	No impact	No impact	No impact	No impact
Change in STD rates (esp. Chlamydia, Gonorrhea, HIV)	No activity	No impact	No impact	No impact	No impact
Change in GID outbreaks	No activity	No impact	No impact	No impact	No impact
Operation Phase					
Change in pediatric acute respiratory disease rates (RSV, pneumonias, asthma, Bronchiectasis)	No impact	No impact	No impact	No impact	No impact
Change in acute adult respiratory disease rates (TB, Bronchitis, Influenza)	No impact	No impact	No impact	No impact	No impact
Change in STD rates (esp. Chlamydia, Gonorrhea, HIV)	No impact	No impact	No impact	No impact	No impact
Change in GID outbreaks	No activity	No impact	No impact	No impact	No impact

Table 22 Summary Scoring - HEC: Non-communicable Chronic Disease

Health Issue	Alt A	Alt B	Alt C	Alt D	Alt E
Construction Phase					
Change in obesity prevalence	No activity	-3 = Low	-3 = Low	-3 = Low	-3 = Low
Change in average BMI	No activity	-3 = Low	-3 = Low	-3 = Low	-3 = Low
Change in type 2 DM rates	No activity	-3 = Low	-3 = Low	-3 = Low	-3 = Low
Change in hypertension	No activity	No impact	No impact	No impact	No impact
Change in lung cancer rates	No activity	No impact	No impact	No impact	No impact
Change in COPD rates	No activity	No impact	No impact	No impact	No impact
Drilling Phase					
Change in obesity prevalence	No activity	-3 = Low	-3 = Low	-3 = Low	-3 = Low
Change in average BMI	No activity	-3 = Low	-3 = Low	-3 = Low	-3 = Low
Change in type 2 DM rates	No activity	-3 = Low	-3 = Low	-3 = Low	-3 = Low
Change in hypertension	No activity	No impact	No impact	No impact	No impact
Change in lung cancer rates	No activity	No impact	No impact	No impact	No impact
Change in COPD rates	No activity	No impact	No impact	No impact	No impact
Operation Phase					
Change in obesity prevalence	No impact	-3 = Low	-3 = Low	-3 = Low	-3 = Low
Change in average BMI	No impact	-3 = Low	-3 = Low	-3 = Low	-3 = Low
Change in type 2 DM rates	No impact	-3 = Low	-3 = Low	-3 = Low	-3 = Low
Change in hypertension	No impact	No impact	No impact	No impact	No impact
Change in lung cancer rates	No impact	No impact	No impact	No impact	No impact
Change in COPD rates	No impact	No impact	No impact	No impact	No impact

Table 23 Summary Scoring - HEC: Social Determinants of Health

Health Issue	Alt A	Alt B	Alt C	Alt D	Alt E
Construction Phase					
Change in maternal child health status	No activity	No impact	No impact	No impact	No impact
Change in depression/anxiety prevalence	No activity	-3 = Low	-3 = Low	-3 = Low	-3 = Low
Change in substance abuse rate	No activity	No impact	No impact	No impact	No impact
Change in suicide rate	No activity	-3 = Low	-3 = Low	-3 = Low	-3 = Low
Change in teen pregnancy rates	No impact	No impact	No impact	No impact	No impact
Change in domestic violence	No activity	No impact	No impact	No impact	No impact
Drilling Phase					
Change in maternal child health status	No activity	No impact	No impact	No impact	No impact
Change in depression/anxiety prevalence	No activity	-3 = Low	-3 = Low	-3 = Low	-3 = Low
Change in substance abuse rate	No activity	No impact	No impact	No impact	No impact
Change in suicide rate	No activity	-3 = Low	-3 = Low	-3 = Low	-3 = Low
Change in teen pregnancy rates	No activity	No impact	No impact	No impact	No impact
Change in domestic violence	No activity	No impact	No impact	No impact	No impact
Operation Phase					
Change in maternal child health status	No impact	-3 = Low	-3 = Low	-3 = Low	-3 = Low
Change in depression/anxiety prevalence	No impact	-4 = Medium	-4 = Medium	-4 = Medium	-4 = Medium
Change in substance abuse rate	No impact	-3 = Low	-3 = Low	-3 = Low	-3 = Low
Change in suicide rate	No impact	-3 = Low	-3 = Low	-3 = Low	-3 = Low
Change in teen pregnancy rates	No impact	-3 = Low	-3 = Low	-3 = Low	-3 = Low
Change in domestic violence	No impact	-3 = Low	-3 = Low	-3 = Low	-3 = Low

2.3.1 Alternative A - No-Action Alternative

Alternative A is the No Action Alternative which assumes that the project does not obtain a permit from the Corps to proceed and monitoring the project site is the only activity that would occur.

2.3.1.1 Construction

In the No Action Alternative, there is not construction activity.

2.3.1.2 Drilling

There is no activity in Phase 2 – Drilling.

2.3.1.2 Operation

Monitoring is the only activity in Phase 3 – Operation. If the No Action Alternative is selected, the wells would continue to be monitored in accordance with Alaska Oil and Gas Conservation Commission (AOGCC) regulations and prudent operator practices until the time that they are closed or brought into production in a future project.

2.3.1.3 Cumulative Effects

There are no cumulative health effects under Alternative A as the facility would not be developed. Under the No Action Alternative, the Applicant would suspend project engineering and planning activities for the evaluation of the Thomson Sand and other hydrocarbon resources at Point Thomson. Evaluating the resources is integral to development and would require onsite support infrastructure and processing facilities. The Applicant would investigate whether any options exist for resource delineation, evaluation, and development without filling wetlands. At this time, it is believed that there would be insufficient space on the existing Central Pad for processing facilities and related support infrastructure to make a viable project.

2.3.2 Alternative B – Applicants Proposed Action

Alternative B is the applicant's proposed action initiating the development of the Thomson Sand reservoir and hydrocarbon production facility. Alternative B takes advantage of nearly year-round access by using seasonal modes of travel, including barge access in the summer, ice roads in the winter, and helicopters and fixed-wing aircraft as weather permits. Alternative B would configure the drilling and production facilities onto three gravel pads to facilitate evaluation of all hydrocarbon resources, and provide flexibility for future natural gas production should the currently-proposed project prove that larger-scale natural gas production was viable. This alternative would locate the onshore gravel pads near the coastline, incorporating portions of two existing gravel pads. To facilitate the transport of large facility modules to Point Thomson, a sealift facility composed of onshore bulkheads and offshore mooring dolphins would be constructed.

2.3.2.1 Construction/Drilling

Construction and drilling in this alternative are simultaneous, because there is an existing central pad and both are anticipated to be complete within a three-year period. Facilities, including the pipeline and barging facilities, are located near the coast. Health issues related to construction of Alternative B include:

- Potential negative impacts on exposure to hazardous materials
- Potential negative impacts on reduced consumption of subsistence resources

Exposure to hazardous materials

The expert panel ranked exposure to hazardous materials as medium, primarily because of the presence of incinerators with no documented plan for monitoring stack emissions. While emissions will likely be rapidly diffused over a wide area, the health panel could not deny that certain byproducts of incomplete combustion would escape the stack and some potential for exposure of wildlife and humans could exist.

Food, Nutrition, and Subsistence Activities

According to Section 5.22, Subsistence and Traditional Land Use Patterns, under Alternative B, primary potential impacts could include the loss of high-use Kaktovik subsistence use areas for caribou due to project infrastructure (West, East, and Central Pads; gathering pipelines; gravel road; and a small percentage of the export pipeline); reduced resource availability to Kaktovik hunters for caribou due to displacement from infrastructure (e.g., pipelines) and noise/traffic; reduced resource availability and access to Nuiqsut hunters for bowhead whales due to noise/traffic; and reduced user access due to avoidance of coastal hunting areas in the project vicinity for caribou and fish (Dolly Varden and whitefish) resulting from project infrastructure, noise/traffic, contamination, and hunting regulations. These impacts would affect resources of major importance including caribou, fish (Dolly Varden and whitefish), and bowhead whale
The maximum potential harvest loss associated with the Point Thomson Project is between 0.8 percent (Bullen Point and Point Thomson) and 10.8 percent (Bullen Point to Brownlow Point/Canning River delta) annually (between 1 and 13. 3 pounds of caribou per capita)

According the Environmental Justice section (Chapter 4.16), if the proposed project reduces the quantity of caribou harvested by residents of Kaktovik, they would likely purchase more food from outside the area. In addition to increasing the reliance on the cash economy and the cost of living, Kaktovik residents could experience a change in diet as caribou become a less dominant part of their diet, which may result in nutritional deficiencies.

Changes to subsistence resource habitat and hunting areas cannot be directly converted into changes in human health status. Rather, changes to subsistence resource areas could negatively affect human health if one makes several interrelated assumptions. Besides assuming that complete avoidance of the area does in fact occur, one must then assume that

(a) Reduction in subsistence resource area equals a reduction in subsistence resource harvest,

(b) Reduction in subsistence harvest equals reduction in subsistence resource consumption and

(c) Residents choose to replace lost subsistence foods with less nutritious alternatives.

According to Section 5.22, less than 1 percent of the total caribou harvest may be affected by the activities described under Alternative B or 1 pound of caribou per person per year (or approximately 600 calories of very lean meat). When placed in the context of the overall subsistence harvest (including Bowhead whale harvest) this region (Bullen Point to Point Thomson) represents less than 1 percent of the overall harvest according to the data provided. It is possible that in some years residents could have successful hunts without accessing this remote region and that the actual harvest would not be materially affected. On the other hand, it is also the case that in some years, avoidance of this hunting ground may significantly challenge harvest efforts if herds are less present in other areas or if whale harvest does not occur.

Second, the reductions in subsistence resource areas could affect human health if one further assumes that a reduction in harvest produces an equal reduction in consumption of subsistence resources. Due to factors such as resource sharing and variable subsistence food consumption for different community groups (*e.g.* men vs. women, elderly vs. youth) it is difficult to know precisely to what extent a reduction in the resource affects consumption patterns in the community. For some individuals or household units with heavy reliance on traditional foods, the reduction in subsistence harvest may significantly reduce subsistence consumption. For others with different dietary habits, the reduction in harvest may have little impact.

Third, reduction in subsistence resource areas could possibly affect human health if one also assumes that residents will replace subsistence foods with less healthy alternatives. While residents will obviously replace subsistence foods using cash purchased foods, some may choose healthy replacement foods and some may not. Without current nutritional survey information for these villages, it is difficult to say precisely how a predicted reduction in subsistence resource area will ultimately affect human health. If, however, one makes all of the assumptions above and there is indeed a reduction in subsistence food consumption, this could lead to negative impacts on human health in the community. Based on the information provided in the subsistence report, the coastal region affected by the project yields a very small portion of the overall subsistence harvest for Kaktovik and would likely produce very small changes in consumption of traditional foods.

Subsistence activities are also an important component of the Nuiqsut economy and Iñupiat culture and identity. As in Kaktovik, subsistence resource harvesting continues to be the focus of life in Nuiqsut. Caribou are an important migratory resource that consistently ranks among the top two resources harvested by Nuiqsut residents. Although Nuiqsut's most recent (1995-2006) caribou use areas do not extend as far east as Point Thomson, caribou that migrate through the Point Thomson area may later be harvested by Nuiqsut hunters. Caribou use areas do extend to just east of Prudhoe Bay and cross the Dalton Highway which will experience a significant increase in traffic under Alternatives C and D.

Section 5.22 concludes by stating that given the Applicant's CAA with the AEWC, which restricts barge traffic during the Nuiqsut bowhead whaling season, Alternative B is not

expected to result in reduced harvests of bowhead whales. Impacts on fish harvesting would be unlikely to occur for Nuiqsut, but are possible for Kaktovik and primarily related to impacts from user avoidance; these impacts would be limited in extent. Waterfowl hunting impacts are unlikely.

Given the assumptions involved and the relatively small amount of meat potentially lost per capita, the panel rated the impact on (i) the amount of dietary consumption of subsistence resources, (ii) change in composition of diet and (iii) the change in food security as low. (see Table 18, Summary Scoring Table, HEC: Food, Nutrition and Subsistence for individual issues).

Social Determinants of Health (SDH)

Construction of Alternative B would be a multi-year project that generates employment within the NSB and the State of Alaska. Employment would peak in the fifth year of construction when an estimate of 950 workers would be employed in construction, and drilling (HDR 2011aa).

Construction and dr illing employees will be hou sed in six construction camps with a maximum capacity of 520 workers In addition, Alternative B includes a pioneer camp that would be transported to the project site by tundra-safe, low-pressure vehicles in late fall. This pioneer camp would be located on existing gravel, would house up to 160 personnel, and would be dem obilized in late fall of Year 2, once the construction camp modules arrived. Temporary camp modules would be self-contained and include potable and wastewater systems. They would be located on g ravel pads or single-season ice pads (ExxonMobil 2010zz) and access would be restricted..

ExxonMobil anticipates hiring local NSB residents as part of its construction crew or as employees of subsidiaries of the Native Corporations of Kaktovik, Kaktovik Iupiat Corporation and of Nuiqsut, Kuukpik Corporation. In 2009, 20 NSB residents were employed under these two contracts. Income in local NSB communities might also be positively impacted by the proposed seasonal hire of area residents for Marine Mammal Observers, Subsistence Advisors, and Polar Bear Monitors. Increased income is directly related to improved health (ExxonMobil 2009, ExxonMobil 2010).

The Subsistence and Traditional Land Use Patterns section (Chapter 4.13) notes that if harvests of subsistence resources (particularly caribou) decline because of the effects of infrastructure, noise/traffic, or contamination on resource availability, then there might be fewer opportunities to teach younger generations the skills necessary to hunt, harvest, and process subsistence resources, potentially weakening overall community wellbeing. The HIA team rated these potential impacts, a neg ative change to community cohesiveness, as low because the core subsistence areas near Kaktovik should not be affected by the Project.

2.3.2.2 Operation

Important health issues related to operation of Alternative B include:

- Potential negative impacts on exposure to hazardous materials
- Potential negative impacts on reduced consumption of subsistence resources

- Potential negative impacts on social determinants of health such as change in depression/anxiety prevalence
- Potential positive impact on the number and quality of health care clinics and staff, number of services available and accessibility to service providers.

Exposure to hazardous materials

The HIA expert panel ranked exposure to hazardous materials as medium, primarily because of the duration of the project. While the amount of incinerated waste would decrease after construction, there would still be no requirement for stack monitoring which precludes knowing if persistent organic pollutants are entering the atmosphere. The US Environmental Protection Agency is currently reviewing stack monitoring regulations which if enacted would change this rating.

Food, Nutrition, and Subsistence Activities

Even though hunters may avoid the Project Area for the duration of project operation, the HIA team determined that the potential impact on consumption of subsistence foods would remain low for Alternative B. This is due to the remote nature of the affected area and the relatively small contribution it makes to the subsistence caribou harvest for Kaktovik and Nuiqsut.

Social Determinants of Health

A total of 160 permanent employees are expected to work at the Point Thomson site during operation. It is unclear how many of these positions will be filled by NSB residents because of the required job skills needed during operations. Long – term (30 year) employment during operations requires facility operators, mechanical technicians, electrical technicians and instrument technicians. There will be limited positions open for less technical workers such as equipment operators, maintenance staff, and other direct support positions (ExxonMobil 2009, ExxonMobil 2010**).**

The Point Thomson facility is expected to have an operational life of 30 years and these jobs would continue throughout the life of the project. ExxonMobil has committed to continuing their local hiring program and encouraging independent contractors to “hire, train and retain” Native residents (ExxonMobil 2010). Given the fact that the NSB does not have a sufficiently developed industrial base to supply materials or other project related services, a direct hire program would be the primary method by which the NSB could benefit economically from the proposed project. Deadhorse would experience a minor increase in activity during operation of the Point Thomson facility and this would generate some minor indirect employment and income during the 30 years that the facility is expected to operate. As with the construction positions, operational jobs at Point Thomson would command premium pay due to the harsh Arctic conditions at the site, isolation, the relative scarcity of experienced or trained workers, and the commercial value of the end product. Income in local NSB communities may be positively impacted by the proposed seasonal hire of area residents for Marine Mammal Observers, Subsistence Advisors, and Polar Bear Monitors. Increased income, increased educational attainment and increased employment rates are directly related to improved health (ExxonMobil 2009, ExxonMobil 2010**).**

As with the construction activities, operation of the Point Thomson facility would be fully self-contained and workers would have no reason to travel to any of the NSB communities, other than Deadhorse. The lack of physical connection between Point

Thomson and the other communities would also reduce interaction between the workers and the local community. This lack of interaction is expected to reduce any potential for adverse effects to community characteristics or culture.

As noted previously, if harvests of subsistence resources (particularly caribou) decline because of the effects of infrastructure, noise/traffic, or contamination on resource availability, then there might be fewer opportunities to teach younger generations the skills necessary to hunt, harvest, and process subsistence resources, potentially weakening overall community wellbeing. The HIA team rated these potential effects as a negative change to community cohesiveness and possible increased anxiety/depression due to removal of historic hunting lands, as low since the majority of the core subsistence areas near Kaktovic and Nuiqsut will be unaffected.

The HIA team determined that local residents, especially of Kaktovik, might experience a modest change in their prevalence of depression and anxiety due to a low level but persistent fear of a catastrophic incident at the facility. Environmental disaster, in the Arctic, although it is not anticipated due to this project, is a real concern for local residents since it would have profound implications for their communities. This is an impact common to all action alternatives in the operations phase.

Health Infrastructure/Delivery

According to the Socioeconomics section of the EIS (Section 5.15), operation of the Point Thomson facility would increase the size of dividends from the Alaska Permanent Fund to all qualified residents of Alaska. This effect would continue throughout the 30-year productive life of the facility. In addition, the Point Thomson Project will be assessed by the Alaska Department of Revenue (AK DOR) based on the total capital investment in the project; costs related to drilling are exempt from taxation. The development at Point Thomson is predicted to add approximately $1 billion to the actual and true property value of the NSB. This would represent an increase of about 8 percent relative to the total NSB actual and true property value of $12.9 billion reported in 2009. Increasing the tax revenue of the NSB may have cascading effects across the borough. The NSB provides most of the services and employment in the borough; it also funds most of the capital improvement projects in the region, including health care facilities. This is an impact common to all action alternatives in the operations phase.

2.3.2.3 2.3.2.3 Cumulative Effects

The HIA team did not identify any cumulative health effects under Alternative B.

2.3.3 Alternative C – Inland Pads with Gravel Access Road

The intent of Alternative C is to minimize impacts to coastal resources such as marine mammals, marine fish, subsistence activities, coastal processes, and to avoid potential impacts to the proposed project from coastal erosion. To minimize potential impacts on the Caribou herd and coastal erosion, this alternative would move project components inland and as far away from the coast as practicable and feasible. To provide year-round access to Point Thomson, this alternative would also include the construction of an all-season gravel road from Point Thomson to the Endicott Spur Road where it would, connect to the Dalton Highway during construction and drilling. West Dock in Prudhoe Bay would be used for deliveries by barge; however, those materials would be transported to Point Thomson by truck. An airstrip would be built for air access.

Alternative C would not include barging or associated facilities for sea access to Point Thomson.

2.3.3.1 Construction

Construction and drilling of the Point Thomson facility would be complete and turned over in December of the eighth year, at the same time a separate all-season road would be completed. Under this alternative, materials and supplies would be barged into West Dock in Prudhoe Bay and then trucked to Point Thomson in between 17,000 and 18,500 trips during the extended construction and drilling phases of the project. Health issues related to construction of Alternative C include:

- Potential negative impacts on exposure to hazardous materials
- Potential negative impacts on reduced consumption of subsistence resources
- Potential negative impacts on traffic accidents and injuries
- Potential negative impacts on utilization/clinic burden from non-resident influx due to accidents and injuries.

Exposure to hazardous materials

The expert panel ranked exposure to hazardous materials as medium, primarily because of the need to incinerate waste and the lack of stack monitoring which precludes knowing if persistent organic pollutants are entering the atmosphere. This risk is higher than for Alternative B because the construction period is twice as long and because the amount of material for incineration increases with the size of the construction workforce.

Food, Nutrition, and Subsistence Activities

Alternative C places the facility, including the export pipeline, inland from the Beaufort Sea. Materials and supplies, including the modules will be delivered by barge to West Dock in Prudhoe Bay and trucked to the site on the Dalton Highway to Endicott Spur and into the site on a tundra ice road. While the impact to marine mammals may be less intense than under Alternative B, impacts to quantity of caribou are expected to be approximately the same as for Alternative B. The Subsistence and Traditional Land Use Patterns section (Chapter 5.22) notes that Alternative C is expected to disrupt subsistence Caribou hunting for the residents of Kaktovik because the herds congregate along the shoreline during the summer months and that the noise and traffic could disrupt the herd during the long construction period. The Subsistence section estimates that the maximum potential effects on caribou harvests may include the loss of up to 10.8 percent of annual caribou harvests, accounting for approximately 13.3 pounds per capita of caribou per year or approximately or approximately 15,000 calories of energy for very lean meat.. Impacts may not occur during all years but could exceed the maximum expected annual loss during certain years if caribou are unavailable elsewhere.

According the Environmental Justice section (Chapter 4.16), if the proposed project reduces the quantity of caribou harvested by residents of Kaktovik, they would likely purchase more food from outside the area. In addition to increasing the reliance on the cash economy and the cost of living, Kaktovik residents might experience a change in diet as caribou become a less dominant part of their diet, which may result in nutritional deficiencies.

The HIA team determined that the implications for subsistence, specifically on the amount of dietary consumption of subsistence resources, under this Alternative C are higher than Alternative B, given the substantial increase in traffic under Alternative C.

Nuiqsut's most recent (1995-2006) caribou use areas do extend to just east of Prudhoe Bay and cross the Dalton Highway which will experience a significant increase in traffic under Alternative C.

Similar to Alternative B, the panel ranked (see Table 18, Summary Scoring Table, HEC: Food, Nutrition and Subsistence for individual issues) the projected impacts on change in composition of diet and the change in food security were considered to be low.

Social Determinants of Health (SDH)

Construction employment under Alternative C could be as much as 50 percent greater than employment under Alternative B due to additional workforce needed to construct the all-season gravel road and to transport and assemble the facility modules from Deadhorse (Section 5.15, Socioeconomics). All of the construction materials needed under Alternative C would be transported overland and the size of each load would be restricted by the weight and width capacity of the transporters. The additional module assembly and commissioning would require between 8 and 10 months, rather than the 60-day to 120-day range estimated by the Applicant for Alternative B. Maximum total employment in Alternative C would peak in Year 6 at over 1,100 construction workers. Alternative C would have a total of six camps, five of which would demobilize with the construction and drilling crews.

Workforce hiring policies, security of work camps, and the ability to pass on traditional knowledge would remain the same as under Alternative B.

Accidents and Injuries / Health Infrastructure and Delivery

Alternative C relies upon trucking to transport all supplies and materials to the Point Thomson site. The Transportation section (Section 4.17) notes that the transport up the Dalton highway would be well within that road's capacity; however, because Alternative C would not use Point Thomson barging facilities, the 60 barges going into West Dock would require over 10,000 truck trips during the construction phase to deliver materials to the site. During Point Thomson's construction phase, a separate all season gravel road would be built by the applicant. The road for this alternative would start at Endicott Spur Road and end near Point Thomson. An all-season road could be used for drill rig demobilization at the end of the drilling phase. This road would likely be closed to the public and for Point Thomson only, and is not expected to have impacts to other road facilities. It is common, however, for local residents to have special access permits to major egress corridors to facilitate travel for hunting or other purposes.The HIA panel ranked the potential for increased roadway incidents and injuries as high with a cascading negative impact on the ability of the local emergency response and clinics to respond to such an increase.

2.3.3.2 7Drilling

Health issues related to the drilling phase of Alternative C include:

- Potential negative impacts on exposure to hazardous materials
- Potential negative impacts on reduced consumption of subsistence resources

- Potential negative impacts on traffic accidents and injuries
- Potential negative impacts on utilization/clinic burden from non-resident influx due to accidents and injuries.

Additional information on three of these potential impacts is discussed in the previous section, Construction. Accidents and injuries and the impact on the health care infrastructure are discussed below.

Accidents and Injuries / Health Infrastructure and Delivery

It is estimated that Alternative C would include between 6,850—8,200 truck trips during the last two years of drilling, which would pose a high risk for accidents and injuries and a high risk for the change in utilization/clinic burden from workers.

2.3.3.3 Operation

Important health issues related to operation of Alternative C include:

- Potential negative impacts on exposure to hazardous materials
- Potential negative impacts on reduced consumption of subsistence resources
- Potential negative impacts on social determinants of health such as a change in depression/anxiety prevalence
- Potential negative impacts on traffic accidents and injuries
- Potential positive impact on the number and quality of health care clinics and staff, the number of services available and accessibility to service providers.

The impacts expected during operation under Alternative C would be similar to the operation phase under Alternative B.

2.3.3.4 Cumulative Impacts

The Transportation section of the EIS (Section 4.17) notes that the construction of the all season road could potentially open the area up for additional oil and gas development. The Subsistence and Traditional Land Use section of the EIS (Section 4.13) confirms this possible cumulative effect and notes that by opening the area to further oil and gas development, the all-season gravel road proposed under Alternative C may cause greater disruption to caribou movement

2.3.4 Alternative D – Inland Pads with Seasonal Ice Access Road

The intent of Alternative D is to minimize impacts to coastal resources such as marine mammals, marine fish, subsistence activities, coastal processes, and to reduce potential impacts to the proposed project from coastal erosion. To minimize impacts, this alternative would move the project components inland and as far away from the coast as practicable and feasible. This alternative is also characterized by access to and from Point Thomson occurring primarily via an inland seasonal ice road, running east from the Endicott Spur Road (at its junction with the Dalton Highway) to the northern end of the Point Thomson project area.

Alternative D also minimizes impacts to coastal resources by moving all facilities inland, much like Alternative C. The main difference between Alternative C and D is there will

only be seasonal tundra ice road access in Alternative D; the all-season gravel road would not be built.

2.3.4.1 Construction

Health issues related to construction of Alternative D include:

- Potential negative impacts on exposure to hazardous materials
- Potential negative impacts on reduced consumption of subsistence resources
- Potential negative impacts on traffic accidents and injuries
- Potential negative impacts on utilization/clinic burden from non-resident influx due to increase in accidents and injuries.

The impacts expected during construction under Alternative D would be similar to the construction under Alternative C with the following exceptions

- Truck traffic during the construction phase on the road from Prudhoe Bay will be decreased, theoretically decreasing the burden on local clinics and emergency services, and
- Fewer workers would be needed because Alternative D does not include the construction of a gravel road.

Neither of these exceptions changes the impact scoring between Alternatives C and D. Workforce hiring policies, security of work camps, and the ability to pass on traditional knowledge would remain the same as under Alternative B.

2.3.4.2 Drilling

Health issues unique to drilling under Alternative D are expected to be similar to the drilling phase of Alternative C, with the exception of increased truck traffic from Prudhoe Bay; please see that discussion for more information.

2.3.4.3 Operation

Major health issues related to operation of Alternative 3b include:

- Potential negative impacts on exposure to hazardous materials
- Potential negative impacts on consumption of subsistence resources
- Potential negative impacts on social determinants of health such as a change in depression/anxiety prevalence
- Potential positive impact on the number and quality of health care clinics and staff, the number of services available and accessibility to service providers.

The operation under Alternative D would be similar to the operation under Alternative C; please see that discussion for more information

2.3.4.4 Cumulative Effects

There are no cumulative effects under Alternative D because the all season road would not be built.

2.3.5 Alternative E – Coastal Pads with Seasonal Ice Roads

The intent of Alternative E is to minimize the development footprint to reduce impacts to wetlands and surrounding water resources. To minimize the development footprint, this alternative would reduce the amount of gravel fill needed for some of the project components. In particular, the footprints of the East and West Pads would be a combination of gravel and multiyear, multi-season ice pad extensions. Land transport numbers in construction and drilling include the overland transportation of large fuel tanks, modules, and the drill rig by way of the access ice road before barging would be established.

During drilling, the gravel pad footprint would be expanded by ice to support other associated facilities. Over the long-term during operations, the ice pad footprint would be removed and only the gravel fill would remain to support the wellheads and associated required infrastructure. An expanded Central Pad incorporating both the central well and processing infrastructure would compensate for the two smaller ice/gravel combination pads. The gravel footprint would also be reduced by the use of ice roads as much of the infield road system. Nine months of the year the site would be without ground transportation, except for a gravel road from the central production pad to the airport. This alternative has direct barge access with new barge bridge landing, bulkheads, and mooring dolphins.

2.3.5.1 Construction/Drilling

Construction and drilling would take place over nearly 10 years because of the need to use only seasonal tundra ice roads. Construction and drilling in this alternative are simultaneous, because there is an existing central pad. Facilities, including the pipeline and barging facilities, are located near the coast.

Health issues related to construction of Alternative E include:

- Potential negative impacts on exposure to hazardous materials
- Potential negative impacts on accidents and injuries

Impacts to subsistence resources and activities could be greater than in Alternative B as the increased use of helicopters has the potential to disturb wildlife in the project area. All construction and drilling impacts are expected to be lower than those experienced under Alternative C because of the lack of road transport; please see that discussion for more information. Workforce hiring policies, security of work camps, and the ability to pass on traditional knowledge would remain the same as under Alternative B.

2.3.5.2 Operation

Important health issues related to operation of Alternative E include:

- Potential negative impacts on exposure to hazardous materials
- Potential negative impacts on reduced consumption of subsistence resources
- Potential negative impacts on social determinants of health such as a change in depression/anxiety prevalence
- Potential positive impact on the number and quality of health care clinics and staff, the number of services available and accessibility to service providers.

Long term employment during operations in Alternative E is expected to be higher than in the other alternatives because an additional construction crew will be needed each winter to construct an ice road to the Point Thomson facility. Other impacts would be similar to the operation under Alternative B; please see that discussion for more information

2.3.5.3 Cumulative Effects

The HIA team did not identify any cumulative health effects under Alternative E.

2.4 Mitigation Strategies

2.4.1 Introduction

Mitigation refers to measures to avoid, minimize, or eliminate an adverse effect, or maximize a potential benefit (HIA Toolkit 2011). Although mitigation is presented as the final phase in an HIA, it should be viewed as an ongoing process, beginning as the project is being conceptualized and designed, and ending only when impacts from the project and decommission have concluded. Mitigations may be:

- **Required** by regulations,
- **Negotiated** commitments made by project proponents, or
- **Voluntary** contributions made to minimize potential detriments or maximize potential benefits.

The project can use the outcomes of the risk assessment step to establish actions that will potentially mitigate the identified impacts. Similarly, project proponents may wish to formally negotiate a series of specific commitments to affected communities, *e.g.*, participatory monitoring of certain impacts, subsistence resource access, quantity and quality. Some important considerations for mitigation strategies include:

- Types of health-protection processes that may be required, *e.g.*, primary versus secondary or tertiary prevention (discussed in the next sub-section)
- Availability of different mitigation strategies (*e.g.*, engineering intervention affecting water quantity, sanitation, etc.)
- Timelines of mitigation strategies
- Availability of interim measures or modifications
- Local capacity to absorb the proposed mitigation strategies
- Roles and responsibilities for the implementing the strategies.

The proposed community health mitigation strategies have been developed to monitor, evaluate and potentially mitigate potential health impacts identified within this HIA Potential impacts, both positive and negative, were developed based on the interaction between the Alaska-specific HECs and potentially affected communities (PACs), *e.g.*, communities along significant transportation corridors, project adjacent communities, etc. The overall opportunities are organized around two fundamental public health concepts, (i) health promotion and (ii) disease prevention.

Health promotion/education

- Any intervention that seeks to eliminate or reduce exposure to harmful factors by modifying human behaviors
- Any combination of health education and related organizational, political and economic interventions designed to facilitate behavioral and environmental adaptations that will improve or protect health.

Disease prevention

- Any intervention that seeks to reduce or eliminate diagnosable conditions
- An intervention that may be applied at the individual level, as in immunization, or the community level, as in the chlorination of the water supply.

Disease prevention is often illustrated by the prevention pyramid, Figure 29, which is composed of:

- Primary - the base of the pyramid which covers population oriented actions designed before health problems develop
- Secondary - the second level covering clinical preventive services for populations at high risk, where interventions are designed to prevent a condition for those at risk of disease
- Tertiary - top of the pyramid covering treatment intervention or rehabilitation for existing, serious disease symptoms.

Figure 29 Prevention Pyramid

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The mitigations developed in an HIA are primary preventions and belong at the base of the prevention pyramid. This is significant because of:

- Its focus on all of the people as recipients
- Its broad, long-lasting impact on health
- Its role in defining and facilitating the whole system to work.

Because of the geographical size and contractual complexity of the projects, a combination of health promotion/education and primary prevention is the most efficient and cost-effective method of managing potential impacts. Therefore, the mitigation strategies propose a series of practical biological/medical approaches that are scientifically defensible but should be compatible with existing administrative and national health directives.

The overall strategies should be capable of detecting both “acute” and “chronic”, positive and negative changes in health within the defined PACs. Acute changes are those that can be manifested within weeks to months, *e.g.*, acute disease rate changes for respiratory infections. In contrast, chronic non-communicable disease rate changes for cardiovascular disorders or diabetes evolve over a much longer period of time, particularly at a community level.

Finally, the broad strategies should also consider that a variety of *positive* community-level impacts will occur. For example, rapid changes and alleviation of “income poverty”

may likely produce significant improvement in overall population-level health status. Therefore, the monitoring and mitigation system should be capable of capturing a variety of positive and negative trends across the community over different time scales.

Monitoring and mitigation strategies do not neatly fall into "internal project" and "external community" categories. The project workforce is both a separate inside the fence line community but also simultaneously part of the wider external rural/urban (most workers will live in Anchorage and Fairbanks and fly in-fly out) environment surrounding the project. Therefore, many of the proposed strategies originate inside the fence line and extend into specific project affected areas. Outreach activities, whether directed towards workers, family members or the general community, should be carefully assessed and tied to appropriate outcome indicators.

2.5 Mitigation Recommendations

This section presents a series of mitigation strategies for each HEC. It is important to tie the mitigation to specific potential impacts identified in the risk analysis.

2.5.1 Alternative Impact Summary

Alternative A: The monitoring activities will have **zero to minimal impacts** on public health. The area is remote from human habitation, and it is in the interest of public health to continue to monitor the existing infrastructure to ensure compliance with environmental regulations.

The impacts and mitigations unique to each action alternative are presented below.

Alternative B: The Proposed Project presents some challenges to health because it utilizes coastal resources which could change the quantity of and access to subsistence resources for residents of Kaktovik and Nuiqsut. ExxonMobil has already agreed to build the pipeline 7 feet above the tundra in order to facilitate the movement of caribou and to cease barging activity during the Kaktovik whaling season. The HIA team noted that even with reduced harvests that there would be only a **low** impact on the composition of diet and food security because other sources of subsistence and manufactured food are available to make up for the potential loss of 1 pound of caribou per person.

Impacts to off-site accidents and injuries are expected to be **low,** and ExxonMobil has existing procedures for safe driving.

The potential for increases in contaminants from unmonitored stack emissions is expected to be **low** and can be mitigated by following EPA proposed regulations on stack emissions.

Alternative C: This alternative was designed to mitigate the impact of coastal oriented facilities on subsistence resources by moving the facilities inland and eliminating the use of barges to the site. The alternative would barge materials and supplies into West Dock in Prudhoe Bay and truck the materials and supplies to Point Thomson in over 19,500 truck trips on an all season road during the a four-year construction and drilling phases of the project.

The HIA team ranked the potential for roadway accidents and injuries as **high,** especially during the construction phase when traffic volumes are high, potentially resulting in a **high** impact to local clinics and emergency services. While a roadway would be off limits to tourists, local residents would very likely have egress on these

roads for snow machine and automobile travel. The combination of local resident travel and heavy truck traffic creates significant risk of increases in accidents and injuries. Besides requiring the drivers to follow all of the ExxonMobil transportation standards, local access to the roadway could be restricted until construction is completed and traffic volumes decrease. ExxonMobil could also impose strict enforcement of seatbelt use and speed limits, and regular patrols on the roads during construction. To prepare for an increased burden of visits to local health facilities, an action plan for increased coverage and resources could be developed an put in place if demand for local health services increased under these alternatives.

Alternative C presents some challenges to health because of the length of time the area will be disturbed for subsistence resources during construction and drilling. The HIA team noted that even with reduced harvests that there would be only a **medium** impact on the composition of diet and food security because other sources of subsistence and manufactured food are available to replace the 13 pounds per year of caribou potentially lost. Because this impact would potentially continue throughout the life of the project, ExxonMobil may want to consider doing some public health research on nutritional and dietary consumption in these villages.

The potential for increases in contaminants from unmonitored stack emissions is expected to be **medium** and can be mitigated by following EPA proposed regulations on stack emissions.

Alternative D: This alternative was designed to mitigate the impact of coastal oriented facilities on subsistence resources by moving the facilities inland and eliminating the use of barges to the site. The alternative would barge materials and supplies into West Dock in Prudhoe Bay and truck the materials and supplies to Point Thomson in an estimated 17,500 trips per year during an extended (8 year) construction and drilling phases of the project.

The HIA team ranked the potential for roadway accidents and injuries as **high**, especially during the construction and drilling phases when traffic volumes are high, potentially resulting in a **high** impact to local clinics and emergency services. While a roadway would be off limits to tourists, local residents would very likely have egress on these roads for snow machine and automobile travel. The combination of local resident travel and heavy truck traffic creates a **high** risk of increases in accidents and injuries. Besides requiring the drivers to follow all of the ExxonMobil transportation standards, local access to the roadway could be restricted until construction is completed and traffic volumes decrease. ExxonMobil could also impose strict enforcement of seatbelt use and speed limits, and regular patrols on the roads during construction. To prepare for an increased burden of visits to local health facilities, an action plan for increased coverage and resources could be developed an put in place if demand for local health services increased under these alternatives.

Alternative D presents some challenges to health because of the length of time the area will be disturbed for subsistence resources during construction and drilling. The HIA team noted that even with reduced harvests that there would be only a **medium** impact on the composition of diet and food security because other sources of subsistence and manufactured food are available to replace the 13 pounds of caribou potentially lost. Because this impact would potentially continue throughout the life of the project,

ExxonMobil may want to consider doing some public health research on nutritional and dietary consumption in these villages.

The potential for increases in contaminants from unmonitored stack emissions is expected to be **medium** and can be mitigated by following EPA proposed regulations on stack emissions.

Alternative E: The minimized development footprint alternative with seasonal ice roads presents some challenges to health because it utilizes coastal resources which could change the quantity of and access to subsistence resources for residents of Kaktovik and Nuiqsut. ExxonMobil has already agreed to build the pipeline 7 feet above the tundra in order to facilitate the movement of caribou and to cease barging activity during the Kaktovik whaling season. The HIA team noted that even with reduced harvests that there would be only a **low** impact on the composition of diet and food security because other sources of subsistence and manufactured food are available to replace the 1 pound of caribou per person potentially lost.

The potential for increases in contaminants from unmonitored stack emissions is expected to be **low** and can be mitigated by following EPA proposed regulations on stack emissions.

Impacts to off-site accidents and injuries are expected to be **low,** and ExxonMobil has existing procedures for safe driving.

2.5.2 Impact Mitigation Summary

Table 23 presents health impacts, mitigation strategies and recommendations which have been developed in response to the negative impacts identified at levels above 3 (medium to high impact). Low impacts may be low in intensity but have long duration as is found in the operations phase or medium in intensity but of very short duration as is common during the construction or drilling phases (see Figures 27 – and 28, Steps in the Risk Assessment Matrix).

In many situations, important public health issues surface as part of the analysis; however, it is very difficult to disaggregate causation between a project and large trends that are already occurring across populations/communities, *e.g.*, changes in non-communicable disease rates such as diabetes. In this situation, the HIA analysis tries to delineate those affects that can be

(i) Causally linked to the proposed project

(ii) Are amenable to specific project mitigations.

It may be difficult to casually tie to a specific project; nevertheless, such a prediction may be important for future government health planning. The HIA analysis differentiates mitigations that are tied to the project from those that more appropriately fall under a government role and responsibility.

This Impact Mitigation Summary is intended to provide a brief synopsis of the data presented in the sections above for those potential impacts rated at negative or positive 4 or above (medium to very high risk). This information should serve as input into the project including specific actions, responsibilities, timing, potential collaborators and performance indicators. Many of the mitigation measures require collaboration with local community members and agencies and should be very carefully planned and

coordinated with the project's community affairs group in order to maximize communication, cultural sensitivity and awareness.

Any critical data gaps can be closed either by the project collecting specific data sets or by collaborating with local health officials. For example, data sets such as incinerator emissions characterization require specialized equipment that is unlikely to be available within local health departments; hence, these types of collection exercises should be directed and managed by the project and/or its key contractors. These data collection efforts are referred to as 'Project." For small communities, disaggregated data are generally not publically available; however, the overall NSB database is likely to be sufficient and applicable. If there is a need for addition household surveys, the effort is best managed as a c ollaborative effort with the relevant local and national health authorities.

Table 24 Negative Impact Mitigation Summary

Health Effects Category	Health Impact	Mitigation	Key information gaps
Alternative A – Monitoring			
No impacts			
Alternative B Construction/Drilling			
Exposure to Hazardous Materials	Potential for increases in physiologic contaminant levels from unmonitored stack emissions	Follow proposed EPA regulation on stack emissions	**Project** - Baseline stack monitoring data during construction
	Potential for increases in contaminant levels in subsistence resources from unmonitored stack emissions	Follow proposed EPA regulation on stack emissions	**Project** - Baseline stack monitoring data during operation
Alternative B Operation			
Exposure to Hazardous Materials	Potential for increases in physiologic contaminant levels from unmonitored stack emissions	Follow proposed EPA regulation on stack emissions	**Project** - Baseline stack monitoring data during construction
	Potential for increases in contaminant levels in subsistence resources from unmonitored stack emissions	Follow proposed EPA regulation on stack emissions	**Project** - Baseline stack monitoring data during operation
Social Determinants of Health	Potential for increase in depression and anxiety prevalence	Applicant should increase community education about safety measures in place for arctic projects	**Project and NSB Health Corporation** - Ongoing community engagement regarding disaster planning and potential with the people in Kaktovik and Nuiqsut who may have these fears.
Alternative C - Construction			
Exposure to Hazardous Materials	Potential for increases in physiologic contaminant levels unmonitored stack emissions	Follow proposed EPA regulation on stack emissions	**Project** - Baseline stack monitoring data during construction
	Potential for increases in contaminant levels in subsistence resources from unmonitored stack emissions	Follow proposed EPA regulation on stack emissions	**Project** - Baseline stack monitoring data during operation

Health Effects Category	Health Impact	Mitigation	Key information gaps
Food, Nutrition, and Subsistence	Potential for decrease in consumption of subsistence resource (caribou)		**Project -** Baseline nutritional surveys with ongoing monitoring
Accidents and Injuries	Potential increases in roadway accidents and injuries due to increased traffic	Restricted access, increased security and safety patrols, speed enforcement, seatbelt requirements	
Health Infrastructure and Delivery	Potential increased burden on local emergency response and clinics	Response plan for augmentation of existing health care infrastructure in local clinics	
Alternative C - Drilling			
Exposure to Hazardous Materials	Potential for increases in physiologic contaminant levels from unmonitored stack emissions	Follow proposed EPA regulation on stack emissions	**Project** - Baseline stack monitoring data during construction
	Potential for increases in contaminant levels in subsistence resources from unmonitored stack emissions	Follow proposed EPA regulation on stack emissions	**Project** - Baseline stack monitoring data during operation
Food, Nutrition, and Subsistence	Potential for decrease in consumption of subsistence resource (caribou)		**Project -** Baseline nutritional surveys with ongoing monitoring
Accidents and Injuries	Potential increases in roadway accidents and injuries due to increased traffic	Restricted access, increased security and safety patrols, speed enforcement, seatbelt requirements	
Health Infrastructure and Delivery	Potential increased burden on local emergency response and clinics	Response plan for augmentation of existing health care infrastructure in local clinics	
Alternative C - Operation			
Exposure to Hazardous Materials	Potential for increases in physiologic contaminant levels from unmonitored stack emissions	Follow proposed EPA regulation on stack emissions	**Project** - Baseline stack monitoring data during construction
	Potential for increases in contaminant levels in subsistence resources from unmonitored stack emissions	Follow proposed EPA regulation on stack emissions	**Project** - Baseline stack monitoring data during operation

Health Effects Category	Health Impact	Mitigation	Key information gaps
Food, Nutrition, and Subsistence	Potential for decrease in consumption of subsistence foods (caribou)		**Project -** Baseline nutritional surveys with ongoing monitoring
Social Determinants of Health	Potential for increase in depression and anxiety prevalence	Applicant should increase community education about safety measures in place for arctic projects	**Project and NSB Health Corporation –** Ongoing community engagement regarding disaster planning and potential with people in Kaktovik and Nuiqsut who may have these fears.
Accidents and Injuries	Potential increases in roadway accidents and injuries due to increased traffic	Restricted access, increased security and safety patrols, speed enforcement, seatbelt requirements	
Health Infrastructure and Delivery	Potential increased burden on local emergency response and clinics	Response plan for augmentation of existing health care infrastructure in local clinics	
Alternative D Construction			
Exposure to Hazardous Materials	Potential for increases in physiologic contaminant levels from unmonitored stack emissions	Follow proposed EPA regulation on stack emissions	**Project** - Baseline stack monitoring data during construction
	Potential for increases in contaminant levels in subsistence resources from unmonitored stack emissions	Follow proposed EPA regulation on stack emissions	**Project** - Baseline stack monitoring data during operation
Food, Nutrition, and Subsistence	Potential for decrease in consumption of subsistence resource (caribou)	.	**Project -** Baseline nutritional surveys with ongoing monitoring
Accidents and Injuries	Potential increases in roadway accidents and injuries	Restrict access, increase security and safety patrols, speed enforcement, seatbelt requirements	
Health Infrastructure and Delivery	Potential increased burden on local emergency response and clinics	Response plan for augmentation of existing health care infrastructure in local clinics	

Health Effects Category	Health Impact	Mitigation	Key information gaps
Alternative D - Drilling			
Exposure to Hazardous Materials	Potential for increases in physiologic contaminant levels from unmonitored stack emissions	Follow proposed EPA regulation on stack emissions	**Project** - Baseline stack monitoring data during construction
	Potential for increases in contaminant levels in subsistence resources from unmonitored stack emissions	Follow proposed EPA regulation on stack emissions	**Project** - Baseline stack monitoring data during operation
Accidents and Injuries	Potential increases in roadway accidents and injuries	Restrict access, increase security and safety patrols, speed enforcement, seatbelt requirements	
Health Infrastructure and Delivery	Potential increased burden on local emergency response and clinics	Response plan for augmentation of existing health care infrastructure in local clinics	
Alternative D - Operation			
Exposure to Hazardous Materials	Potential for increases in physiologic contaminant levels from unmonitored stack emissions	Follow proposed EPA regulation on stack emissions	**Project** - Baseline stack monitoring data during construction
	Potential for increases in contaminant levels in subsistence resources from unmonitored stack emissions	Follow proposed EPA regulation on stack emissions	**Project** - Baseline stack monitoring data during operation
Food, Nutrition, and Subsistence	Potential for decrease in consumption of subsistence resource (caribou)	.	**Project -** Baseline nutritional surveys with ongoing monitoring
Social Determinants of Health	Potential for increase in depression and anxiety prevalence	Applicant should increase community education about safety measures in place for arctic projects	**Project and NSB Health Corporation -** Ongoing community engagement regarding disaster planning and potential with people in Kaktovik and Nuiqsut who may have these fears.
Accidents and Injuries	Potential increases in roadway accidents and injuries	Restrict access, increase security and safety patrols, speed	

Health Effects Category	Health Impact	Mitigation	Key information gaps
		enforcement, seatbelt requirements	
Health Infrastructure and Delivery	Potential increased burden on local emergency response and clinics	Response plan for augmentation of existing health care infrastructure in local clinics	
Alternative E Construction/Drilling			
Exposure to Hazardous Materials	Potential for increases in physiologic contaminant levels from unmonitored stack emissions	Follow proposed EPA regulation on stack emissions	**Project** - Baseline stack monitoring data during construction
	Potential for increases in contaminant levels in subsistence resources from unmonitored stack emissions	Follow proposed EPA regulation on stack emissions	**Project** - Baseline stack monitoring data during operation
Alternative E Operation			
Exposure to Hazardous Materials	Potential for increases in physiologic contaminant levels from unmonitored stack emissions	Follow proposed EPA regulation on stack emissions	**Project** - Baseline stack monitoring data during construction
	Potential for increases in contaminant levels in subsistence resources from unmonitored stack emissions	Follow proposed EPA regulation on stack emissions	**Project** - Baseline stack monitoring data during operation
Social Determinants of Health	Potential for increase in depression and anxiety prevalence	Applicant should increase community education about safety measures in place for arctic projects	**Project and NSB Health Corporation –** Ongoing community engagement regarding disaster planning and potential with people in Kaktovik and Nuiqsut who may have these fears.

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ANNEX 1

Health Impact Analysis

Alternative A

Health Effects Category / Issues	Duration (Months, Seasons, Years)	Magnitude (Low, Medium, High, Very High)	Extent (Local, Regional, State, Nation, Global)	Potential (Exceptionally Unlikely, Very Unlikely, Unlikely, About as Likely as Not, Likely, Very Likely, Virtually Certain)	Nature (Direct, Indirect, Cumulative)	Impact (Positive, Negative)	Scoring
Water and Sanitation – Construction - Demobilization and Well Capping							
Changes in potable water access							**No impact**
Change in water quantity							**No impact**
Change in water quality							**No impact**
Change in sanitation effectiveness, adequate settling pools, discharge							**No impact**
Water and Sanitation – Drilling – No Activity							
Water and Sanitation – Operation – No Activity							

Health Impact Analysis

Alternative A

Health Effects Category / Issue	Duration (Months, Seasons, Years)	Magnitude (Low, Medium, High, Very High)	Extent (Local, Regional, State, Nation, Global)	Potential ((Exceptionally Unlikely, Very Unlikely, Unlikely, About as Likely as Not, Likely, Very Likely, Virtually Certain)	Nature (Direct, Indirect, Cumulative)	Impact (Positive, Negative)	Scoring
Accidents and Injuries – Construction - Demobilization and Well Capping							
Change in unintentional injury (e.g. drowning, falls, snow machine injury) rates							**No impact**
Change in roadway incidents and injuries due to service road access for hunters/increased traffic from Prudhoe Bay	3 years	Low - Rig and equipment over ice road	Local	About as Likely as Not	Direct	Negative	**3 = Low**
Changes to safety during subsistence activities	3 years	Low - Personnel and supplies by existing coastal barge and helicopter	Local	About as Likely as Not	Direct	Negative	**3 = Low**
Accidents and Injuries – Drilling – No Activity							
Accidents and Injuries – Operation – No Activity							

Health Impact Analysis

Alternative A

Health Effects Category / Issue	Duration (Months, Seasons, Years)	Magnitude (Low, Medium, High, Very High	Extent (Local, Regional, State, Nation, Global)	Potential (Exceptionally Unlikely, Very Unlikely, Unlikely, About as Likely as Not, Likely, Very Likely, Virtually Certain)	Nature (Direct, Indirect, Cumulative)	Impact (Positive, Negative)	Scoring
Exposure to Hazardous Materials – Construction - Demobilization and Well Capping							
Changes in physiologic contaminant levels such as lead, methyl mercury, PCB, Dioxins, PM2.5 from incineration, drilling mud, or gas flaring	3 years	Low	Local	About as Likely as Not	Direct	Negative	**3 = Low**
Changed levels of the same substances in subsistence resources	3 years	Low	Local	About as Likely as Not	Direct	Negative	**3 = Low**
Exposure to Hazardous Materials – Drilling – No Activity							
Exposure to Hazardous Materials – Operation – No Activity							

Health Impact Analysis Alternative A							
Health Effects Category /Issue	**Duration** (Months, Seasons, Years)	**Magnitude** (Low, Medium, High, Very High)	**Extent** (Local, Regional, State, Nation, Global)	**Potential** (Exceptionally Unlikely, Very Unlikely, Unlikely, About as Likely as Not, Likely, Very Likely, Virtually Certain)	**Nature** (Direct, Indirect, Cumulative)	**Impact** (Positive, Negative)	**Scoring**
Food, Nutrition, Subsistence – Construction - Demobilization and Well Capping							
Change in amount of dietary consumption of subsistence resources	3 years	Low	Local	About as Likely as Not	Direct	Negative	**3 = Low**
Change in composition of diet	3 years	Low	Local	About as Likely as Not	Direct	Negative	**3 = Low**
Change in food security							**No impact**
Food, Nutrition, Subsistence – Drilling – No Activity							
Food, Nutrition, Subsistence – Drilling – No Activity							

Health Impact Analysis

Alternative A

Health Effects Category / Issue	Duration (Months, Seasons, Years)	Magnitude (Low, Medium, High, Very High	Extent (Local, Regional, State, Nation, Global)	Potential (Exceptionally Unlikely, Very Unlikely, Unlikely, About as Likely as Not, Likely, Very Likely, Virtually Certain)	Nature (Direct, Indirect, Cumulative)	Impact (Positive, Negative)	Scoring
Health Infrastructure/Delivery – Construction - Demobilization and Well Capping							
Change in number of clinics and staff							**No impact**
Change in quality of clinics and staff							**No impact**
Change in services offered (e.g. prenatal checks, x-ray, lab services)							**No impact**
Change in accessibility of health care							**No impact**
Change in utilization/clinic burden from non-resident influx							**No impact**
Health Infrastructure/Delivery – Drilling – No Activity							
Health Infrastructure/Delivery – Operation – No Activity							

Health Impact Analysis

Alternative A

Health Effects Category / Issue	Duration (Months, Seasons, Years)	Magnitude (Low, Medium, High, Very High)	Extent (Local, Regional, State, Nation, Global)	Potential (Exceptionally Unlikely, Very Unlikely, Unlikely, About as Likely as Not, Likely, Very Likely, Virtually Certain)	Nature (Direct, Indirect, Cumulative)	Impact (Positive, Negative)	Scoring
Infectious Diseases – Construction - Demobilization and Well Capping							
Change in pediatric acute respiratory disease rates (RSV, pneumonias, asthma, Bronchiectasis)							**No impact**
Change in acute adult respiratory disease rates (TB, Bronchitis, Influenza)							**No impact**
Change in STD rates (esp. Chlamydia, Gonorrhea, HIV)							**No impact**
Change in GID outbreaks							**No impact**
Infectious Diseases – Drilling – No Activity							
Infectious Diseases – Operation – No Activity							

Health Impact Analysis

Alternative A

Health Effects Category / Issue	Duration (Months, Seasons, Years)	Magnitude (Low, Medium, High, Very High	Extent (Local, Regional, State, Nation, Global)	Potential (Exceptionally Unlikely, Very Unlikely, Unlikely, About as Likely as Not, Likely, Very Likely, Virtually Certain)	Nature (Direct, Indirect, Cumulative)	Impact (Positive, Negative)	Scoring
Non-communicable Chronic Disease – Construction - Demobilization and Well Capping							
Change in obesity prevalence							**No impact**
Change in average BMI							**No impact**
Change in type 2 DM rates							**No impact**
Change in hypertension							**No impact**
Change in lung cancer rates							**No impact**
Change in COPD rates							**No impact**
Non-communicable Chronic Disease – Drilling – No Activity							
Non-communicable Chronic Disease – Drilling – No Activity							

Health Impact Analysis

Alternative A

Health Effects Category / Issue	Duration (Months, Seasons, Years)	Magnitude (Low, Medium, High, Very High	Extent (Local, Regional, State, Nation, Global)	Potential (Exceptionally Unlikely, Very Unlikely, Unlikely, About as Likely as Not, Likely, Very Likely, Virtually Certain)	Nature (Direct, Indirect, Cumulative)	Impact (Positive, Negative)	Scoring
Social Determinants of Health – Construction – Demobilization and Well Capping							
Change in maternal child health status							**No impact**
Change in depression/anxiety prevalence							**No impact**
Change in substance abuse rate							**No impact**
Change in suicide rate							**No impact**
Change in teen pregnancy rates							**No impact**
Change in domestic violence							**No impact**
Social Determinants of Health – Drilling – No Activity							
Social Determinants of Health – Operation – No Activity							

Health Impact Analysis
Alternative B

Health Effects Category / Issues	Duration (Months, Seasons, Years)	Magnitude (Low, Medium, High, Very High)	Extent (Local, Regional, State, Nation, Global)	Potential (Exceptionally Unlikely, Very Unlikely, Unlikely, About as Likely as Not, Likely, Very Likely, Virtually Certain)	Nature (Direct, Indirect, Cumulative)	Impact (Positive, Negative)	Scoring
Water and Sanitation – Construction/Drilling							
Changes in potable water access							**No impact**
Change in water quantity							**No impact**
Change in water quality							**No impact**
Change in sanitation effectiveness, adequate settling pools, discharge							**No impact**
Water and Sanitation - Operation							
Changes in potable water access							**No impact**
Change in water quantity							**No impact**
Change in water quality							**No impact**
Change in sanitation effectiveness, adequate							**No impact**

settling pools, discharge							

Health Impact Analysis Alternative B							
Health Effects Category / Issue	**Duration** (Months, Seasons, Years)	**Magnitude** (Low, Medium, High, Very High)	**Extent** (Local, Regional, State, Nation, Global)	**Potential** (Exceptionally Unlikely, Very Unlikely, Unlikely, About as Likely as Not, Likely, Very Likely, Virtually Certain)	**Nature** (Direct, Indirect, Cumulative)	**Impact** (Positive, Negative)	**Scoring**
Accidents and Injuries – Construction/Drilling							
Change in unintentional injury (e.g. drowning, falls, snow machine injury) rates	3 years	Low	Local	About as Likely as Not	Direct	Negative	**3 = Low**
Change in roadway incidents and injuries due to service road access for hunters/increased traffic from Prudhoe Bay	3 years	Low (Dalton Highway access from Deadhorse; ice road between Endicott Spur and PTP for VSM and supplies; modules shipped by barge – roads can handle traffic)	Local	About as Likely as Not	Direct	Negative	**3 = Low**
Changes to safety during subsistence activities	3 years	Low	Local	About as Likely as Not	Direct	Negative	**3 = Low**

Health Impact Analysis Alternative B							
Health Effects Category / Issue	**Duration** (Months, Seasons, Years)	**Magnitude** (Low, Medium, High, Very High)	**Extent** (Local, Regional, State, Nation, Global)	**Potential** (Exceptionally Unlikely, Very Unlikely, Unlikely, About as Likely as Not, Likely, Very Likely, Virtually Certain)	**Nature** (Direct, Indirect, Cumulative)	**Impact** (Positive, Negative)	**Scoring**
Accidents and Injuries - Operation							
Change in unintentional injury (e.g. drowning, falls, snow machine injury) rates	30 years	Low – no impact from project	Local	Unlikely	Direct	Negative	**3 = Low**
Change in roadway incidents and injuries due to service road access for hunters/increased traffic from Prudhoe Bay	30 years	Low – Road access will be well established	Local	Unlikely	Direct	Negative	**3 = Low**
Changes to safety during subsistence activities	30 years	Low	Local	Unlikely	Direct	Negative	**3 = Low**

Health Impact Analysis
Alternative B

Health Effects Category / Issue	Duration (Months, Seasons, Years)	Magnitude (Low, Medium, High, Very High	Extent (Local, Regional, State, Nation, Global)	Potential (Exceptionally Unlikely, Very Unlikely, Unlikely, About as Likely as Not, Likely, Very Likely, Virtually Certain)	Nature (Direct, Indirect, Cumulative)	Impact (Positive, Negative)	Scoring
Exposure to Hazardous Materials – Construction/Drilling							
Changes in physiologic contaminant levels such as lead, methyl mercury, PCB, Dioxins, PM2.5 from incineration, drilling mud, or gas flaring	3 years	High – due to increased number of incinerations and stack throughput and the lack of stack testing and analysis (EPA regulations)	Local - limited exposure because the nearest settlement is 60 miles west	Unlikely it would leave the site	Direct	Negative	**4 = Medium**
Changed levels of the same substances in subsistence resources	3 years	High - due to increased number of incinerations	Local	Unlikely it would leave the site	Indirect (food source)	Negative	**4 = Medium**
Exposure to Hazardous Materials – Operation							
Changes in physiologic contaminant levels such as lead, methyl mercury, PCB, Dioxins, PM2.5 from incineration, drilling mud, or gas flaring	30 years	Medium – incinerations decrease during operations	Local	About as Likely as Not	Direct	Negative	**4 = Medium**
Changed levels of the same substances in subsistence resources	30 years	Medium - incinerations decrease during operations	Local	About as Likely as Not	Indirect (food source)	Negative	**4 = Medium**

Health Impact Analysis Alternative B							
Health Effects Category /Issue	**Duration** (Months, Seasons, Years)	**Magnitude** (Low, Medium, High, Very High)	**Extent** (Local, Regional, State, Nation, Global)	**Potential** ((Exceptionally Unlikely, Very Unlikely, Unlikely, About as Likely as Not, Likely, Very Likely, Virtually Certain)	**Nature** (Direct, Indirect, Cumulative)	**Impact** (Positive, Negative)	**Scoring**
Food, Nutrition, Subsistence – Construction/Drilling							
Change in amount of dietary consumption of subsistence resources	3 years	Low - average annual loss of between 2 and 17 pounds of caribou; barging ceases during whale season	Local	Likely	Direct	Negative	**4= Medium**
Change in composition of diet	3 years	Low - residents eat other subsistence resources although caribou are very important	Local	About as Likely as Not	Direct	Negative	**3 = Low**
Change in food security	3 years	Low - residents have access to cash and stores; other subsistence resources are available	Local	Unlikely	Direct	Negative	**3 = Low**

Health Impact Analysis Alternative B							
Health Effects Category /Issue	**Duration** (Months, Seasons, Years)	**Magnitude** (Low, Medium, High, Very High)	**Extent** (Local, Regional, State, Nation, Global)	**Potential** ((Exceptionally Unlikely, Very Unlikely, Unlikely, About as Likely as Not, Likely, Very Likely, Virtually Certain)	**Nature** (Direct, Indirect, Cumulative)	**Impact** (Positive, Negative)	**Scoring**
Food, Nutrition, Subsistence – Operation							
Change in amount of dietary consumption of subsistence resources	30 years	Medium - size of the caribou herd in 5 years is unknown	Local	Likely	Direct	Negative	**4 = Medium**
Change in composition of diet	30 years	Medium - (size of the caribou herd in 5 years is unknown	Local	About as Likely as Not	Direct	Negative	**3 = Low**
Change in food security	30 years	Low -residents have access to cash and stores; other subsistence resources are available	Local	Unlikely	Direct	Negative	**3 = Low**

Health Impact Analysis Alternative B							
Health Effects Category / Issue	**Duration** (Months, Seasons, Years)	**Magnitude** (Low, Medium, High, Very High	**Extent** (Local, Regional, State, Nation, Global)	**Potential** (Exceptionally Unlikely, Very Unlikely, Unlikely, About as Likely as Not, Likely, Very Likely, Virtually Certain)	**Nature** (Direct, Indirect, Cumulative)	**Impact** (Positive, Negative)	**Scoring**
Health Infrastructure/Delivery – Construction/Drilling							
Change in number of clinics and staff							**No impact**
Change in quality of clinics and staff							**No impact**
Change in services offered (e.g. prenatal checks, x-ray, lab services)							**No impact**
Change in accessibility of health care							**No impact**
Change in utilization/clinic burden from non-resident influx	3 years	Medium	Local	About as Likely as Not	Indirect	Negative	**3 = Low**

Health Impact Analysis
Alternative B

Health Effects Category / Issue	Duration (Months, Seasons, Years)	Magnitude (Low, Medium, High, Very High	Extent (Local, Regional, State, Nation, Global)	Potential (Exceptionally Unlikely, Very Unlikely, Unlikely, About as Likely as Not, Likely, Very Likely, Virtually Certain)	Nature (Direct, Indirect, Cumulative)	Impact (Positive, Negative)	Scoring
Health Infrastructure/Delivery - Operation							
Change in number of clinics and staff	30 years	Medium – depends on amount of tax revenues from operation	Regional	Virtually Certain	Indirect	Positive	**7 = High**
Change in quality of clinics and staff	30 years	Medium – depends on amount of tax revenues from operation	Regional	Virtually Certain	Indirect	Positive	**7 = High**
Change in services offered (e.g. prenatal checks, x-ray, lab services)	30 years	Medium – depends on amount of tax revenues from operation	Regional	Virtually Certain	Indirect	Positive	**7 = High**
Change in accessibility of health care	30 years	Medium – depends on amount of tax revenues from operation	Regional	Virtually Certain	Indirect	Positive	**7 = High**
Change in utilization/clinic burden from non-resident influx	30 years	Low – accidents tend to decrease during operations	Regional	Likely	Indirect	Negative	**3 = Low**

Health Impact Analysis Alternative B							
Health Effects Category / Issue	**Duration** (Months, Seasons, Years)	**Magnitude** (Low, Medium, High, Very High)	**Extent** (Local, Regional, State, Nation, Global)	**Potential** (Exceptionally Unlikely, Very Unlikely, Unlikely, About as Likely as Not, Likely, Very Likely, Virtually Certain)	**Nature** (Direct, Indirect, Cumulative)	**Impact** (Positive, Negative)	**Scoring**
Infectious Diseases – Construction/Drilling							
Change in pediatric acute respiratory disease rates (RSV, pneumonias, asthma, Bronchiectasis)							**No impact**
Change in acute adult respiratory disease rates (TB, Bronchitis, Influenza)*							**No impact**
Change in STD rates (esp. Chlamydia, Gonorrhea, HIV)							**No impact**
Change in GID outbreaks							**No impact**

Health Impact Analysis Alternative B							
Health Effects Category / Issue	**Duration** (Months, Seasons, Years)	**Magnitude** (Low, Medium, High, Very High)	**Extent** (Local, Regional, State, Nation, Global)	**Potential** (Exceptionally Unlikely, Very Unlikely, Unlikely, About as Likely as Not, Likely, Very Likely, Virtually Certain)	**Nature** (Direct, Indirect, Cumulative)	**Impact** (Positive, Negative)	**Scoring**
Infectious Diseases - Operation							
Change in pediatric acute respiratory disease rates (RSV, pneumonias, asthma, Bronchiectasis)							**No impact**
Change in acute adult respiratory disease rates (TB, Bronchitis, Influenza)*							**No impact**
Change in STD rates (esp. Chlamydia, Gonorrhea, HIV)							**No impact**
Change in GID outbreaks							**No impact**

*Panel notes that the project may bring more RSV to local communities depending on the number of local employees – an unknown number to date

Health Impact Analysis Alternative B							
Health Effects Category / Issue	**Duration** (Months, Seasons, Years)	**Magnitude** (Low, Medium, High, Very High	**Extent** (Local, Regional, State, Nation, Global)	**Potential** (Exceptionally Unlikely, Very Unlikely, Unlikely, About as Likely as Not, Likely, Very Likely, Virtually Certain)	**Nature** (Direct, Indirect, Cumulative)	**Impact** (Positive, Negative)	**Scoring**
Non-communicable Chronic Disease – Construction/Drilling							
Change in obesity prevalence	3 years	Low (changes to diet due to loss of subsistence resources might lead to increased obesity)	Local	About as Likely as Not	Indirect	Negative	**3 = Low**
Change in average BMI	3 years	Low (changes to diet due to loss of subsistence resources would lead to increased BMI)	Local	About as Likely as Not	Indirect	Negative	**3 = Low**
Change in type 2 DM rates	3 years	Low (changes to diet due to loss of subsistence resources would lead to increased 2DM rates)	Local	About as Likely as Not	Indirect	Negative	**3 = Low**
Change in hypertension							**No impact**
Change in lung cancer rates							**No impact**
Change in COPD rates							**No impact**

Health Impact Analysis

Alternative B

Health Effects Category / Issue	Duration (Months, Seasons, Years)	Magnitude (Low, Medium, High, Very High	Extent (Local, Regional, State, Nation, Global)	Potential (Exceptionally Unlikely, Very Unlikely, Unlikely, About as Likely as Not, Likely, Very Likely, Virtually Certain)	Nature (Direct, Indirect, Cumulative)	Impact (Positive, Negative)	Scoring
Non-communicable Chronic Disease - Operation							
Change in obesity prevalence	30 years	Low (changes to diet due to loss of subsistence resources might lead to increased obesity)	Local	About as Likely as Not	Indirect	Negative	**3 = Low**
Change in average BMI	30 years	Low (changes to diet due to loss of subsistence resources would lead to increased BMI)	Local	About as Likely as Not	Indirect	Negative	**3 = Low**
Change in type 2 DM rates	30 years	Low (changes to diet due to loss of subsistence resources would lead to increased 2 DM rates)	Local	About as Likely as Not	Indirect	Negative	**3 = Low**
Change in hypertension							**No impact**
Change in lung cancer rates							**No impact**
Change in COPD rates							**No impact**

Health Impact Analysis Alternative B							
Health Effects Category / Issue	**Duration** (Months, Seasons, Years)	**Magnitude** (Low, Medium, High, Very High	**Extent** (Local, Regional, State, Nation, Global)	**Potential** (Exceptionally Unlikely, Very Unlikely, Unlikely, About as Likely as Not, Likely, Very Likely, Virtually Certain)	**Nature** (Direct, Indirect, Cumulative)	**Impact** (Positive, Negative)	**Scoring**
Social Determinants of Health – Construction/Drilling							
Change in maternal child health status							**No impact**
Change in depression/anxiety prevalence**	3 years	Medium	Local	About as Likely as Not	Direct	Negative	**4 = Medium**
Change in substance abuse rate							**No impact**
Change in suicide rate***	3 years	Low	Local	About as Likely as Not	Direct	Negative	**3 = Low**
Change in teen pregnancy rates***							**No impact**
Change in domestic violence							**No impact**
Change in domestic violence							**No impact**

Health Impact Analysis

Alternative B

Health Effects Category / Issue	Duration (Months, Seasons, Years)	Magnitude (Low, Medium, High, Very High	Extent (Local, Regional, State, Nation, Global)	Potential (Exceptionally Unlikely, Very Unlikely, Unlikely, About as Likely as Not, Likely, Very Likely, Virtually Certain)	Nature (Direct, Indirect, Cumulative)	Impact (Positive, Negative)	Scoring
Social Determinants of Health - Operation							
Change in maternal child health status	30 years	Low	Local	Unknown	Direct	Negative	**3 = Low**
Change in depression/anxiety prevalence*	30 years	Medium	Local	About as Likely as Not	Direct	Negative	**4 = Medium**
Change in substance abuse rate	30 years	Low	Local	Unknown	Direct	Negative	**3 = Low**
Change in suicide rate**	30 years	Low	Local	About as Likely as Not	Direct	Negative	**3 = Low**
Change in teen pregnancy rates***	30 years	Low	Local	Unknown	Direct	Negative	**3 = Low**
Change in domestic violence	30 years	Low	Local	Unknown	Direct	Negative	**3 = Low**

*Panel notes that local residents may fear an incident like the BP spill in the Gulf which would severely impact marine resources (see EIS)

** Panel notes that rates are already high and might be reduced if youth were targeted for employment

*** Panel notes that rates are already high and would not be affected because there is so little opportunity for employees to interact with local residents

Health Impact Analysis Alternative C							
Health Effects Category / Issues	**Duration** (Months, Seasons, Years)	**Magnitude** (Low, Medium, High, Very High)	**Extent** (Local, Regional, State, Nation, Global)	**Potential** (Exceptionally Unlikely, Very Unlikely, Unlikely, About as Likely as Not, Likely, Very Likely, Virtually Certain)	**Nature** (Direct, Indirect, Cumulative)	**Impact** (Positive, Negative)	**Scoring**
Water and Sanitation - Construction							
Changes in potable water access							**No Impact**
Change in water quantity							**No Impact**
Change in water quality							**No Impact**
Change in sanitation effectiveness, adequate settling pools, discharge							**No Impact**
Water and Sanitation - Drilling							
Changes in potable water access							**No Impact**
Change in water quantity							**No Impact**
Change in water quality							**No Impact**
Change in sanitation effectiveness, adequate							**No Impact**

Health Impact Analysis Alternative C							
Health Effects Category / Issues	**Duration** (Months, Seasons, Years)	**Magnitude** (Low, Medium, High, Very High)	**Extent** (Local, Regional, State, Nation, Global)	**Potential** (Exceptionally Unlikely, Very Unlikely, Unlikely, About as Likely as Not, Likely, Very Likely, Virtually Certain)	**Nature** (Direct, Indirect, Cumulative)	**Impact** (Positive, Negative)	**Scoring**
settling pools, discharge							
Water and Sanitation - Operation							
Changes in potable water access							**No Impact**
Change in water quantity							**No Impact**
Change in water quality							**No Impact**
Change in sanitation effectiveness, adequate settling pools, discharge							**No Impact**

Health Impact Analysis Alternative C							
Health Effects Category / Issue	**Duration** (Months, Seasons, Years)	**Magnitude** (Low, Medium, High, Very High)	**Extent** (Local, Regional, State, Nation, Global)	**Potential** (Exceptionally Unlikely, Very Unlikely, Unlikely, About as Likely as Not, Likely, Very Likely, Virtually Certain)	**Nature** (Direct, Indirect, Cumulative)	**Impact** (Positive, Negative)	**Scoring**
Accidents and Injuries - Construction							
Change in unintentional injury (e.g. drowning, falls, snow machine injury) rates	5 years	Low	Local	About as Likely as Not	Direct	Negative	**3 = Low**
Change in roadway incidents and injuries due to service road access for hunters/increased traffic from Prudhoe Bay	5 years	Very high – road traffic from Prudhoe Bay will increase to approximately 6,400 trips per year, cascading impacts from accidents and injuries	Local, regional	Virtually Certain	Indirect	Negative	**8 = High**
Changes to safety during subsistence activities	5 years	Low	Local	About as Likely as Not	Direct	Negative	**3 = Low**

Health Impact Analysis Alternative C							
Health Effects Category / Issue	**Duration** (Months, Seasons, Years)	**Magnitude** (Low, Medium, High, Very High)	**Extent** (Local, Regional, State, Nation, Global)	**Potential** (Exceptionally Unlikely, Very Unlikely, Unlikely, About as Likely as Not, Likely, Very Likely, Virtually Certain)	**Nature** (Direct, Indirect, Cumulative)	**Impact** (Positive, Negative)	**Scoring**
Accidents and Injuries - Drilling							
Change in unintentional injury (e.g. drowning, falls, snow machine injury) rates	2 years	Low	Local	About as Likely as Not	Direct	Negative	**3 = Low**
Change in roadway incidents and injuries due to service road access for hunters/increased traffic from Prudhoe Bay	2 years	Very high – road traffic from Prudhoe Bay will increase to approximately 6,400 trips per year, cascading impacts from accidents and injuries	Local, regional	Virtually Certain	Indirect	Negative	**8 = High**
Changes to safety during subsistence activities	2 years	Low	Local	About as Likely as Not	Direct	Negative	**3 = Low**

Health Impact Analysis Alternative C							
Health Effects Category / Issue	**Duration** (Months, Seasons, Years)	**Magnitude** (Low, Medium, High, Very High)	**Extent** (Local, Regional, State, Nation, Global)	**Potential** (Exceptionally Unlikely, Very Unlikely, Unlikely, About as Likely as Not, Likely, Very Likely, Virtually Certain)	**Nature** (Direct, Indirect, Cumulative)	**Impact** (Positive, Negative)	**Scoring**
Accidents and Injuries - Operation							
Change in unintentional injury (e.g. drowning, falls, snow machine injury) rates	30 years	Low	Local	Unlikely	Direct	Negative	**3 = Low**
Change in roadway incidents and injuries due to service road access for hunters/increased traffic from Prudhoe Bay	30 years	High – accidents from Prudhoe Bay will decrease as construction traffic levels decrease during operations, but new all season road will permanently increase traffic	Local	Unlikely	Direct	Negative	**7 = High**
Changes to safety during subsistence activities	30 years	Low	Local	Unlikely	Direct	Negative	**3 = Low**

Health Impact Analysis
Alternative C

Health Effects Category / Issue	Duration (Months, Seasons, Years)	Magnitude (Low, Medium, High, Very High	Extent (Local, Regional, State, Nation, Global)	Potential (Exceptionally Unlikely, Very Unlikely, Unlikely, About as Likely as Not, Likely, Very Likely, Virtually Certain)	Nature (Direct, Indirect, Cumulative)	Impact (Positive, Negative)	Scoring
Exposure to Hazardous Materials – Construction							
Changes in physiologic contaminant levels such as lead, methyl mercury, PCB, Dioxins, PM2.5 from incineration, drilling mud, or gas flaring	5 years	Very high – due to increased number of incinerations and stack throughput and the lack of stack testing and analysis (EPA regulations) and increased construction period	Local - limited exposure because the nearest settlement is 60 miles west	Unlikely it would leave the site	Direct	Negative	**6 = Medium**
Changed levels of the same substances in subsistence resources	5 years	Very high - due to increased number of incinerations	Local	Unlikely it would leave the site	Indirect (food source)	Negative	**6 = Medium**
Exposure to Hazardous Materials – Drilling							
Changes in physiologic contaminant levels such as lead, methyl mercury, PCB, Dioxins, PM2.5 from incineration, drilling mud, or gas flaring	2 years	High - increased number of incinerations, and the lack of stack testing and analysis	Local	Unlikely it would leave the site	Direct	Negative	**5 = Medium**
Changed levels of the same substances in subsistence resources	2 years	High - increased number of incinerations	Local	Unlikely it would leave the site	Indirect (food source)	Negative	**5 = Medium**

Health Impact Analysis Alternative C							
Health Effects Category / Issue	**Duration** (Months, Seasons, Years)	**Magnitude** (Low, Medium, High, Very High	**Extent** (Local, Regional, State, Nation, Global)	**Potential** (Exceptionally Unlikely, Very Unlikely, Unlikely, About as Likely as Not, Likely, Very Likely, Virtually Certain)	**Nature** (Direct, Indirect, Cumulative)	**Impact** (Positive, Negative)	**Scoring**
Exposure to Hazardous Materials – Operation							
Changes in physiologic contaminant levels such as lead, methyl mercury, PCB, Dioxins, PM2.5 from incineration, drilling mud, or gas flaring	30 years	Medium – incinerations decrease during operations	Local	About as Likely as Not	Direct	Negative	**5 = Medium**
Changed levels of the same substances in subsistence resources	30 years	Medium - incinerations decrease during operations	Local	About as Likely as Not	Indirect (food source)	Negative	**5 = Medium**

Health Impact Analysis

Alternative C

Health Effects Category /Issue	Duration (Months, Seasons, Years)	Magnitude (Low, Medium, High, Very High)	Extent (Local, Regional, State, Nation, Global)	Potential (Exceptionally Unlikely, Very Unlikely, Unlikely, About as Likely as Not, Likely, Very Likely, Virtually Certain)	Nature (Direct, Indirect, Cumulative)	Impact (Positive, Negative)	Scoring
Food, Nutrition, Subsistence – Construction							
Change in amount of dietary consumption of subsistence resources	5 years	Low - average annual loss of between 2 and 17 pounds of caribou; no impact on marine mammals	Local	Likely	Direct	Negative	**4 =Medium**
Change in composition of diet*	5 years	Low - residents eat other subsistence resources although caribou are very important)	Local	About as Likely as Not	Direct	Negative	**3 = Low**
Change in food security	5 years	Low - residents have access to cash and stores; other subsistence resources are available	Local	Unlikely	Direct	Negative	**3 = Low**

Health Impact Analysis

Alternative C

Health Effects Category /Issue	Duration (Months, Seasons, Years)	Magnitude (Low, Medium, High, Very High)	Extent (Local, Regional, State, Nation, Global)	Potential (Exceptionally Unlikely, Very Unlikely, Unlikely, About as Likely as Not, Likely, Very Likely, Virtually Certain)	Nature (Direct, Indirect, Cumulative)	Impact (Positive, Negative)	Scoring
Food, Nutrition, Subsistence – Drilling							
Change in amount of dietary consumption of subsistence resources	2 years	Low - average annual loss of between 2 and 17 pounds of caribou	Local	Likely	Direct	Negative	**4 =Medium**
Change in composition of diet	2.5 years	Low - residents eat other subsistence resources although caribou are very important	Local	About as Likely as Not	Direct	Negative	**3 = Low**
Change in food security	2 years	Low - residents have access to cash and stores; other subsistence resources are available	Local	Unlikely	Direct	Negative	**3 = Low**
Food, Nutrition, Subsistence – Operation							
Change in amount of dietary consumption of subsistence resources	30 years	Low - size of the caribou herd after construction and drilling is unknown	Local	Likely	Direct	Negative	**4 = Medium**
Change in composition of diet	30 years	Low - size of the caribou herd after construction and drilling is unknown	Local	About as Likely as Not	Direct	Negative	**3 = Low**
Change in food security	30 years	Low - residents have access to cash and stores; other subsistence resources are available	Local	Unlikely	Direct	Negative	**3 = Low**

*Panel asks if increased income would replace nutritional value of caribou?

Health Impact Analysis Alternative C							
Health Effects Category / Issue	**Duration** (Months, Seasons, Years)	**Magnitude** (Low, Medium, High, Very High	**Extent** (Local, Regional, State, Nation, Global)	**Potential** (Exceptionally Unlikely, Very Unlikely, Unlikely, About as Likely as Not, Likely, Very Likely, Virtually Certain)	**Nature** (Direct, Indirect, Cumulative)	**Impact** (Positive, Negative)	**Scoring**
Health Infrastructure/Delivery - Construction							
Change in number of clinics and staff							**No impact**
Change in quality of clinics and staff							**No impact**
Change in services offered (e.g. prenatal checks, x-ray, lab services)							**No impact**
Change in accessibility of health care							**No impact**
Change in utilization/clinic burden from non-resident influx*	5 years	Very high – road traffic from Prudhoe Bay will increase to approximately 6,400 trips per year, cascading impacts from accidents and injuries	Local, regional	Virtually Certain	Indirect	Negative	**8 = High**

Health Impact Analysis Alternative C							
Health Effects Category / Issue	**Duration** (Months, Seasons, Years)	**Magnitude** (Low, Medium, High, Very High	**Extent** (Local, Regional, State, Nation, Global)	**Potential** (Exceptionally Unlikely, Very Unlikely, Unlikely, About as Likely as Not, Likely, Very Likely, Virtually Certain)	**Nature** (Direct, Indirect, Cumulative)	**Impact** (Positive, Negative)	**Scoring**
Health Infrastructure/Delivery - Drilling							
Change in number of clinics and staff							**No impact**
Change in quality of clinics and staff							**No impact**
Change in services offered (e.g. prenatal checks, x-ray, lab services)							**No impact**
Change in accessibility of health care							**No impact**
Change in utilization/clinic burden from non-resident influx*	2 years	Very high – road traffic from Prudhoe Bay will increase to approximately 6,400 trips per year, cascading impacts from accidents and injuries	Local, regional	Virtually Certain	Indirect	Negative	**8 = High**

Health Impact Analysis

Alternative C

Health Effects Category / Issue	Duration (Months, Seasons, Years)	Magnitude (Low, Medium, High, Very High	Extent (Local, Regional, State, Nation, Global)	Potential (Exceptionally Unlikely, Very Unlikely, Unlikely, About as Likely as Not, Likely, Very Likely, Virtually Certain)	Nature (Direct, Indirect, Cumulative)	Impact (Positive, Negative)	Scoring
Health Infrastructure/Delivery - Operation							
Change in number of clinics and staff	30 years	Medium – depends on amount of tax revenues from operation	Regional	Virtually Certain	Indirect	Positive	**7 = High**
Change in quality of clinics and staff	30 years	Medium – depends on amount of tax revenues from operation	Regional	Virtually Certain	Indirect	Positive	**7 = High**
Change in services offered (e.g. prenatal checks, x-ray, lab services)	30 years	Medium – depends on amount of tax revenues from operation	Regional	Virtually Certain	Indirect	Positive	**7 = High**
Change in accessibility of health care	30 years	Medium – depends on amount of tax revenues from operation	Regional	Virtually Certain	Indirect	Positive	**7 = High**
Change in utilization/clinic burden from non-resident influx*	30 years	Low – accidents will decrease as construction traffic levels decrease during operations	Local, regional	Likely	Indirect	Negative	**3 = Low**

*Panel notes that there may be impact from construction accidents on site

Health Impact Analysis Alternative C							
Health Effects Category / Issue	**Duration** (Months, Seasons, Years)	**Magnitude** (Low, Medium, High, Very High)	**Extent** (Local, Regional, State, Nation, Global)	**Potential** (Exceptionally Unlikely, Very Unlikely, Unlikely, About as Likely as Not, Likely, Very Likely, Virtually Certain)	**Nature** (Direct, Indirect, Cumulative)	**Impact** (Positive, Negative)	**Scoring**
Infectious Diseases - Construction							
Change in pediatric acute respiratory disease rates (RSV, pneumonias, asthma, Bronchiectasis)							**No impact**
Change in acute adult respiratory disease rates (TB, Bronchitis, Influenza)*							**No impact**
Change in STD rates (esp. Chlamydia, Gonorrhea, HIV)							**No impact**
Change in GID outbreaks							**No impact**

Health Impact Analysis Alternative C							
Health Effects Category / Issue	**Duration** (Months, Seasons, Years)	**Magnitude** (Low, Medium, High, Very High)	**Extent** (Local, Regional, State, Nation, Global)	**Potential** (Exceptionally Unlikely, Very Unlikely, Unlikely, About as Likely as Not, Likely, Very Likely, Virtually Certain)	**Nature** (Direct, Indirect, Cumulative)	**Impact** (Positive, Negative)	**Scoring**
Infectious Diseases - Drilling							
Change in pediatric acute respiratory disease rates (RSV, pneumonias, asthma, Bronchiectasis)							**No impact**
Change in acute adult respiratory disease rates (TB, Bronchitis, Influenza)*							**No impact**
Change in STD rates (esp. Chlamydia, Gonorrhea, HIV)							**No impact**
Change in GID outbreaks							**No impact**

Health Impact Analysis Alternative C							
Health Effects Category / Issue	**Duration** (Months, Seasons, Years)	**Magnitude** (Low, Medium, High, Very High)	**Extent** (Local, Regional, State, Nation, Global)	**Potential** (Exceptionally Unlikely, Very Unlikely, Unlikely, About as Likely as Not, Likely, Very Likely, Virtually Certain)	**Nature** (Direct, Indirect, Cumulative)	**Impact** (Positive, Negative)	**Scoring**
Infectious Diseases - Operation							
Change in pediatric acute respiratory disease rates (RSV, pneumonias, asthma, Bronchiectasis)							**No impact**
Change in acute adult respiratory disease rates (TB, Bronchitis, Influenza) *							**No impact**
Change in STD rates (esp. Chlamydia, Gonorrhea, HIV)							**No impact**
Change in GID outbreaks							**No impact**

*Panel notes that the project may bring more RSV to local communities depending on the number of local employees – an unknown number to date

Health Impact Analysis Alternative C							
Health Effects Category / Issue	**Duration** (Months, Seasons, Years)	**Magnitude** (Low, Medium, High, Very High	**Extent** (Local, Regional, State, Nation, Global)	**Potential** (Exceptionally Unlikely, Very Unlikely, Unlikely, About as Likely as Not, Likely, Very Likely, Virtually Certain)	**Nature** (Direct, Indirect, Cumulative)	**Impact** (Positive, Negative)	**Scoring**
Non-communicable Chronic Disease - Construction							
Change in obesity prevalence	5 years	Low - changes to diet due to loss of subsistence resources might lead to increased obesity	Local	About as Likely as Not	Indirect	Negative	**3 = Low**
Change in average BMI	5 years	Low - changes to diet due to loss of subsistence resources would lead to increased BMI	Local	About as Likely as Not	Indirect	Negative	**3 = Low**
Change in type 2 DM rates	5 years	Low -changes to diet due to loss of subsistence resources would lead to increased 2DM rates	Local	About as Likely as Not	Indirect	Negative	**3 = Low**
Change in hypertension							**No impact**
Change in lung cancer rates							**No impact**
Change in COPD rates							**No impact**

Health Impact Analysis

Alternative C

Health Effects Category / Issue	Duration (Months, Seasons, Years)	Magnitude (Low, Medium, High, Very High	Extent (Local, Regional, State, Nation, Global)	Potential (Exceptionally Unlikely, Very Unlikely, Unlikely, About as Likely as Not, Likely, Very Likely, Virtually Certain)	Nature (Direct, Indirect, Cumulative)	Impact (Positive, Negative)	Scoring
Non-communicable Chronic Disease - Drilling							
Change in obesity prevalence	2 years	Low - changes to diet due to loss of subsistence resources might lead to increased obesity	Local	About as Likely as Not	Indirect	Negative	**3 = Low**
Change in average BMI	2 years	Low - changes to diet due to loss of subsistence resources would lead to increased BMI	Local	About as Likely as Not	Indirect	Negative	**3 = Low**
Change in type 2 DM rates	2 years	Low - changes to diet due to loss of subsistence resources would lead to increased 2DM rates	Local	About as Likely as Not	Indirect	Negative	**3 = Low**
Change in hypertension							**No impact**
Change in lung cancer rates							**No impact**
Change in COPD rates							**No impact**

Health Impact Analysis Alternative C							
Health Effects Category / Issue	**Duration** (Months, Seasons, Years)	**Magnitude** (Low, Medium, High, Very High	**Extent** (Local, Regional, State, Nation, Global)	**Potential** (Exceptionally Unlikely, Very Unlikely, Unlikely, About as Likely as Not, Likely, Very Likely, Virtually Certain)	**Nature** (Direct, Indirect, Cumulative)	**Impact** (Positive, Negative)	**Scoring**
Non-communicable Chronic Disease - Operation							
Change in obesity prevalence	30 years	Low - changes to diet due to loss of subsistence resources might lead to increased obesity	Local	About as Likely as Not	Indirect	Negative	**3 = Low**
Change in average BMI	30 years	Low - changes to diet due to loss of subsistence resources would lead to increased BMI	Local	About as Likely as Not	Indirect	Negative	**3 = Low**
Change in type 2 DM rates	30 years	Low - changes to diet due to loss of subsistence resources would lead to increased 2DM rates	Local	About as Likely as Not	Indirect	Negative	**3 = Low**
Change in hypertension							**No impact**
Change in lung cancer rates							**No impact**
Change in COPD rates							**No impact**

Health Impact Analysis Alternative C							
Health Effects Category / Issue	**Duration** (Months, Seasons, Years)	**Magnitude** (Low, Medium, High, Very High	**Extent** (Local, Regional, State, Nation, Global)	**Potential** (Exceptionally Unlikely, Very Unlikely, Unlikely, About as Likely as Not, Likely, Very Likely, Virtually Certain)	**Nature** (Direct, Indirect, Cumulative)	**Impact** (Positive, Negative)	**Scoring**
Social Determinants of Health - Construction							
Change in maternal child health status							**No impact**
Change in depression/anxiety prevalence*	5 years	Medium	Local	About as Likely as Not	Direct	Negative	**4 = Medium**
Change in substance abuse rate							**No impact**
Change in suicide rate**	5years	Low	Local	About as Likely as Not	Direct	Negative	**3 = Low**
Change in teen pregnancy rates***							**No impact**
Change in domestic violence							**No impact**

Health Impact Analysis

Alternative C

Health Effects Category / Issue	Duration (Months, Seasons, Years)	Magnitude (Low, Medium, High, Very High	Extent (Local, Regional, State, Nation, Global)	Potential (Exceptionally Unlikely, Very Unlikely, Unlikely, About as Likely as Not, Likely, Very Likely, Virtually Certain)	Nature (Direct, Indirect, Cumulative)	Impact (Positive, Negative)	Scoring
Social Determinants of Health - Drilling							
Change in maternal child health status							**No impact**
Change in depression/anxiety prevalence*	2 years	Medium	Local	About as Likely as Not	Direct	Negative	**4 = Medium**
Change in substance abuse rate							**No impact**
Change in suicide rate**	2 years	Low	Local	About as Likely as Not	Direct	Negative	**3 = Low**
Change in teen pregnancy rates***							**No impact**
Change in domestic violence							**No impact**

Health Impact Analysis

Alternative C

Health Effects Category / Issue	Duration (Months, Seasons, Years)	Magnitude (Low, Medium, High, Very High	Extent (Local, Regional, State, Nation, Global)	Potential (Exceptionally Unlikely, Very Unlikely, Unlikely, About as Likely as Not, Likely, Very Likely, Virtually Certain)	Nature (Direct, Indirect, Cumulative)	Impact (Positive, Negative)	Scoring
Social Determinants of Health - Operation							
Change in maternal child health status	30 years	Low	Local	Unknown	Direct	Negative	**3 = Low**
Change in depression/anxiety prevalence*	30 years	Medium	Local	About as Likely as Not	Direct	Negative	**4 = Medium**
Change in substance abuse rate	30 years	Low	Local	Unknown	Direct	Negative	**3 = Low**
Change in suicide rate**	30 years	Low	Local	About as Likely as Not	Direct	Negative	**3 = Low**
Change in teen pregnancy rates***	30 years	Low	Local	Unknown	Direct	Negative	**3 = Low**
Change in domestic violence	30 years	Low	Local	Unknown	Direct	Negative	**3 = Low**

*Panel notes that local residents may fear an incident like the BP spill in the Gulf which would severely impact marine resources (see EIS)

**Panel notes that rates are already high and might be reduced if youth were targeted for employment

***Panel notes that rates are already high and would not be affected because there is so little opportunity for employees to interact with local residents

Health Impact Analysis Alternative D							
Health Effects Category / Issues	**Duration** (Months, Seasons, Years)	**Magnitude** (Low, Medium, High, Very High)	**Extent** (Local, Regional, State, Nation, Global)	**Potential** (Exceptionally Unlikely, Very Unlikely, Unlikely, About as Likely as Not, Likely, Very Likely, Virtually Certain)	**Nature** (Direct, Indirect, Cumulative)	**Impact** (Positive, Negative)	**Scoring**
Water and Sanitation - Construction							
Changes in potable water access							**No impact**
Change in water quantity							**No impact**
Change in water quality							**No impact**
Change in sanitation effectiveness, adequate settling pools, discharge							**No impact**
Water and Sanitation - Drilling							
Changes in potable water access							**No impact**
Change in water quantity							**No impact**
Change in water quality							**No impact**
Change in sanitation effectiveness, adequate							**No impact**

Health Impact Analysis Alternative D							
Health Effects Category / Issues	**Duration** (Months, Seasons, Years)	**Magnitude** (Low, Medium, High, Very High)	**Extent** (Local, Regional, State, Nation, Global)	**Potential** (Exceptionally Unlikely, Very Unlikely, Unlikely, About as Likely as Not, Likely, Very Likely, Virtually Certain)	**Nature** (Direct, Indirect, Cumulative)	**Impact** (Positive, Negative)	**Scoring**
settling pools, discharge							
Water and Sanitation - Operation							
Changes in potable water access							**No impact**
Change in water quantity							**No impact**
Change in water quality							**No impact**
Change in sanitation effectiveness, adequate settling pools, discharge							**No impact**

Health Impact Analysis Alternative D							
Health Effects Category / Issue	**Duration** (Months, Seasons, Years)	**Magnitude** (Low, Medium, High, Very High)	**Extent** (Local, Regional, State, Nation, Global)	**Potential** (Exceptionally Unlikely, Very Unlikely, Unlikely, About as Likely as Not, Likely, Very Likely, Virtually Certain)	**Nature** (Direct, Indirect, Cumulative)	**Impact** (Positive, Negative)	**Scoring**
Accidents and Injuries - Construction							
Change in unintentional injury (e.g. drowning, falls, snow machine injury) rates	5 years	Low	Local	About as Likely as Not	Direct	Negative	**3 = Low**
Change in roadway incidents and injuries due to service road access for hunters/increased traffic from Prudhoe Bay	5 years	Very high – road traffic from Prudhoe Bay will increase to approximately 6,400 trips per year, cascading impacts from accidents and injuries	Local, regional	Virtually Certain	Indirect	Negative	**8 = High**
Changes to safety during subsistence activities	5 years	Low	Local	About as Likely as Not	Direct	Negative	**3 = Low**

Health Impact Analysis

Alternative D

Health Effects Category / Issue	Duration (Months, Seasons, Years)	Magnitude (Low, Medium, High, Very High)	Extent (Local, Regional, State, Nation, Global)	Potential (Exceptionally Unlikely, Very Unlikely, Unlikely, About as Likely as Not, Likely, Very Likely, Virtually Certain)	Nature (Direct, Indirect, Cumulative)	Impact (Positive, Negative)	Scoring
Accidents and Injuries - Drilling							
Change in unintentional injury (e.g. drowning, falls, snow machine injury) rates	2 years	Low	Local	About as Likely as Not	Direct	Negative	**3 = Low**
Change in roadway incidents and injuries due to service road access for hunters/increased traffic from Prudhoe Bay	2 years	Very high – road traffic from Prudhoe Bay will increase to approximately 6,400 trips per year, cascading impacts from accidents and injuries	Local, regional	Virtually Certain	Indirect	Negative	**8 = High**
Changes to safety during subsistence activities	2 years	Low	Local	About as Likely as Not	Direct	Negative	**3 = Low**
Accidents and Injuries - Operation							
Change in unintentional injury (e.g. drowning, falls, snow machine injury) rates	30 years	Low	Local	Unlikely	Direct	Negative	**3 = Low**
Change in roadway incidents and injuries due to service road access for hunters/increased traffic from Prudhoe Bay	30 years	Low – accidents will decrease as construction traffic levels decrease during operations	Local	Unlikely	Direct	Negative	**3 = Low**

Health Impact Analysis Alternative D							
Health Effects Category / Issue	**Duration** (Months, Seasons, Years)	**Magnitude** (Low, Medium, High, Very High)	**Extent** (Local, Regional, State, Nation, Global)	**Potential** (Exceptionally Unlikely, Very Unlikely, Unlikely, About as Likely as Not, Likely, Very Likely, Virtually Certain)	**Nature** (Direct, Indirect, Cumulative)	**Impact** (Positive, Negative)	**Scoring**
Changes to safety during subsistence activities	30 years	Low	Local	Unlikely	Direct	Negative	**3 = Low**

Health Impact Analysis

Alternative D

Health Effects Category / Issue	Duration (Months, Seasons, Years)	Magnitude (Low, Medium, High, Very High	Extent (Local, Regional, State, Nation, Global)	Potential (Exceptionally Unlikely, Very Unlikely, Unlikely, About as Likely as Not, Likely, Very Likely, Virtually Certain)	Nature (Direct, Indirect, Cumulative)	Impact (Positive, Negative)	Scoring
Exposure to Hazardous Materials – Construction							
Changes in physiologic contaminant levels such as lead, methyl mercury, PCB, Dioxins, PM2.5 from incineration, drilling mud, or gas flaring	5 years	Very high – due to increased number of incinerations and stack throughput and the lack of stack testing and analysis (EPA regulations) and increased construction period	Local - limited exposure because the nearest settlement is 60 miles west	Unlikely it would leave the site	Direct	Negative	**6 = Medium**
Changed levels of the same substances in subsistence resources	5 years	Very high - due to increased number of incinerations	Local	Unlikely it would leave the site	Indirect (food source)	Negative	**6 = Medium**
Exposure to Hazardous Materials – Drilling							
Changes in physiologic contaminant levels such as lead, methyl mercury, PCB, Dioxins, PM2.5 from incineration, drilling mud, or gas flaring	2 years	High - increased number of incinerations and the lack of stack testing and analysis	Local	Unlikely it would leave the site	Direct	Negative	**5 = Medium**
Changed levels of the same substances in	2 years	High - increased number of incinerations	Local	Unlikely it would leave the site	Indirect (food	Negative	**5 = Medium**

Health Impact Analysis Alternative D							
Health Effects Category / Issue	**Duration** (Months, Seasons, Years)	**Magnitude** (Low, Medium, High, Very High	**Extent** (Local, Regional, State, Nation, Global)	**Potential** (Exceptionally Unlikely, Very Unlikely, Unlikely, About as Likely as Not, Likely, Very Likely, Virtually Certain)	**Nature** (Direct, Indirect, Cumulative)	**Impact** (Positive, Negative)	**Scoring**
subsistence resources					source)		
Exposure to Hazardous Materials – Operation							
Changes in physiologic contaminant levels such as lead, methyl mercury, PCB, Dioxins, PM2.5 from incineration, drilling mud, or gas flaring	30 years	Medium – incinerations decrease during operations	Local	About as Likely as Not	Direct	Negative	**5 = Medium**
Changed levels of the same substances in subsistence resources	30 years	Medium - incinerations decrease during operations	Local	About as Likely as Not	Indirect (food source)	Negative	**5 = Medium**

Health Impact Analysis Alternative D							
Health Effects Category /Issue	**Duration** (Months, Seasons, Years)	**Magnitude** (Low, Medium, High, Very High)	**Extent** (Local, Regional, State, Nation, Global)	**Potential** (Exceptionally Unlikely, Very Unlikely, Unlikely, About as Likely as Not, Likely, Very Likely, Virtually Certain)	**Nature** (Direct, Indirect, Cumulative)	**Impact** (Positive, Negative)	**Scoring**
Food, Nutrition, Subsistence – Construction							
Change in amount of dietary consumption of subsistence resources	5 years	Low - average annual loss of between 2 and 17 pounds of caribou; no impact on marine mammals	Local	Likely	Direct	Negative	**4 = Medium**
Change in composition of diet*	5 years	Low - residents eat other subsistence resources although caribou are very important)	Local	About as Likely as Not	Direct	Negative	**3 = Low**
Change in food security	5 years	Low - residents have access to cash and stores; other subsistence resources are available	Local	Unlikely	Direct	Negative	**3 = Low**

Health Impact Analysis

Alternative D

Health Effects Category /Issue	Duration (Months, Seasons, Years)	Magnitude (Low, Medium, High, Very High)	Extent (Local, Regional, State, Nation, Global)	Potential (Exceptionally Unlikely, Very Unlikely, Unlikely, About as Likely as Not, Likely, Very Likely, Virtually Certain)	Nature (Direct, Indirect, Cumulative)	Impact (Positive, Negative)	Scoring
Food, Nutrition, Subsistence – Drilling							
Change in amount of dietary consumption of subsistence resources	2 years	Low - average annual loss of between 2 and 17 pounds of caribou	Local	Likely	Direct	Negative	**4 = Medium**
Change in composition of diet*	2 years	Low - residents eat other subsistence resources although caribou are very important	Local	About as Likely as Not	Direct	Negative	**3 = Low**
Change in food security	2 years	Low - residents have access to cash and stores; other subsistence resources are available	Local	Unlikely	Direct	Negative	**3 = Low**
Food, Nutrition, Subsistence – Operation							
Change in amount of dietary consumption of subsistence resources	30 years	Low - size of the caribou herd after construction and drilling is unknown	Local	Likely	Direct	Negative	**4 = Medium**
Change in composition of diet*	30 years	Low - size of the caribou herd after construction and drilling is unknown	Local	About as Likely as Not	Direct	Negative	**3 = Low**
Change in food security	30 years	Low - residents have access to cash and stores; other subsistence resources are available	Local	Unlikely	Direct	Negative	**3 = Low**

*Panel asks if increased income could replace nutritional value of caribou?

Health Impact Analysis Alternative D							
Health Effects Category / Issue	**Duration** (Months, Seasons, Years)	**Magnitude** (Low, Medium, High, Very High	**Extent** (Local, Regional, State, Nation, Global)	**Potential** (Exceptionally Unlikely, Very Unlikely, Unlikely, About as Likely as Not, Likely, Very Likely, Virtually Certain)	**Nature** (Direct, Indirect, Cumulative)	**Impact** (Positive, Negative)	**Scoring**
Health Infrastructure/Delivery - Construction							
Change in number of clinics and staff							**No impact**
Change in quality of clinics and staff							**No impact**
Change in services offered (e.g. prenatal checks, x-ray, lab services)							**No impact**
Change in accessibility of health care							**No impact**
Change in utilization/clinic burden from non-resident influx*	5 years	Very high – road traffic from Prudhoe Bay will increase to approximately 6,400 trips per year, cascading impacts from accidents and injuries	Local, regional	Virtually Certain	Indirect	Negative	**8 = High**

Health Impact Analysis Alternative D							
Health Effects Category / Issue	**Duration** (Months, Seasons, Years)	**Magnitude** (Low, Medium, High, Very High	**Extent** (Local, Regional, State, Nation, Global)	**Potential** (Exceptionally Unlikely, Very Unlikely, Unlikely, About as Likely as Not, Likely, Very Likely, Virtually Certain)	**Nature** (Direct, Indirect, Cumulative)	**Impact** (Positive, Negative)	**Scoring**
Health Infrastructure/Delivery - Drilling							
Change in number of clinics and staff							**No impact**
Change in quality of clinics and staff							**No impact**
Change in services offered (e.g. prenatal checks, x-ray, lab services)							**No impact**
Change in accessibility of health care							**No impact**
Change in utilization/clinic burden from non-resident influx*	3 years	Very high – road traffic from Prudhoe Bay will increase to approximately 6,400 trips per year, cascading impacts from accidents and injuries	Local, regional	Virtually Certain	Indirect	Negative	**8 = High**

Health Impact Analysis

Alternative D

Health Effects Category / Issue	Duration (Months, Seasons, Years)	Magnitude (Low, Medium, High, Very High	Extent (Local, Regional, State, Nation, Global)	Potential (Exceptionally Unlikely, Very Unlikely, Unlikely, About as Likely as Not, Likely, Very Likely, Virtually Certain)	Nature (Direct, Indirect, Cumulative)	Impact (Positive, Negative)	Scoring
Health Infrastructure/Delivery - Operation							
Change in number of clinics and staff	30 years	Medium – depends on amount of tax revenues from operation	Regional	Virtually Certain	Indirect	Positive	**7 = High**
Change in quality of clinics and staff	30 years	Medium – depends on amount of tax revenues from operation	Regional	Virtually Certain	Indirect	Positive	**7 = High**
Change in services offered (e.g. prenatal checks, x-ray, lab services)	30 years	Medium – depends on amount of tax revenues from operation	Regional	Virtually Certain	Indirect	Positive	**7 = High**
Change in accessibility of health care	30 years	Medium – depends on amount of tax revenues from operation	Regional	Virtually Certain	Indirect	Positive	**7 = High**
Change in utilization/clinic burden from non-resident influx*	30 years	Low – accidents will decrease as construction traffic levels decrease during operations	Local, regional	Likely	Indirect	Negative	**3 = Low**

*Panel notes that there may be impact from construction accidents on site

Health Impact Analysis Alternative D							
Health Effects Category / Issue	**Duration** (Months, Seasons, Years)	**Magnitude** (Low, Medium, High, Very High)	**Extent** (Local, Regional, State, Nation, Global)	**Potential** (Exceptionally Unlikely, Very Unlikely, Unlikely, About as Likely as Not, Likely, Very Likely, Virtually Certain)	**Nature** (Direct, Indirect, Cumulative)	**Impact** (Positive, Negative)	**Scoring**
Infectious Diseases - Construction							
Change in pediatric acute respiratory disease rates (RSV, pneumonias, asthma, Bronchiectasis)							**No impact**
Change in acute adult respiratory disease rates (TB, Bronchitis, Influenza)*							**No impact**
Change in STD rates (esp. Chlamydia, Gonorrhea, HIV)							**No impact**
Change in GID outbreaks							**No impact**

Health Impact Analysis Alternative D							
Health Effects Category / Issue	**Duration** (Months, Seasons, Years)	**Magnitude** (Low, Medium, High, Very High)	**Extent** (Local, Regional, State, Nation, Global)	**Potential** (Exceptionally Unlikely, Very Unlikely, Unlikely, About as Likely as Not, Likely, Very Likely, Virtually Certain)	**Nature** (Direct, Indirect, Cumulative)	**Impact** (Positive, Negative)	**Scoring**
Infectious Diseases - Drilling							
Change in pediatric acute respiratory disease rates (RSV, pneumonias, asthma, Bronchiectasis)							**No impact**
Change in acute adult respiratory disease rates (TB, Bronchitis, Influenza)*							**No impact**
Change in STD rates (esp. Chlamydia, Gonorrhea, HIV)							**No impact**
Change in GI outbreaks							**No impact**

Health Impact Analysis Alternative D							
Health Effects Category / Issue	**Duration** (Months, Seasons, Years)	**Magnitude** (Low, Medium, High, Very High)	**Extent** (Local, Regional, State, Nation, Global)	**Potential** (Exceptionally Unlikely, Very Unlikely, Unlikely, About as Likely as Not, Likely, Very Likely, Virtually Certain)	**Nature** (Direct, Indirect, Cumulative)	**Impact** (Positive, Negative)	**Scoring**
Infectious Diseases - Operation							
Change in pediatric acute respiratory disease rates (RSV, pneumonias, asthma, Bronchiectasis)							**No impact**
Change in acute adult respiratory disease rates (TB, Bronchitis, Influenza)*							**No impact**
Change in STD rates (esp. Chlamydia, Gonorrhea, HIV)							**No impact**
Change in GID outbreaks							**No impact**

*Panel notes that the project may bring more RSV to local communities depending on t he number of local employees – an unknown number to date

Health Impact Analysis Alternative D							
Health Effects Category / Issue	**Duration** (Months, Seasons, Years)	**Magnitude** (Low, Medium, High, Very High	**Extent** (Local, Regional, State, Nation, Global)	**Potential** (Exceptionally Unlikely, Very Unlikely, Unlikely, About as Likely as Not, Likely, Very Likely, Virtually Certain)	**Nature** (Direct, Indirect, Cumulative)	**Impact** (Positive, Negative)	**Scoring**
Non-communicable Chronic Disease - Construction							
Change in obesity prevalence	5 years	Low - changes to diet due to loss of subsistence resources might lead to increased obesity	Local	About as Likely as Not	Indirect	Negative	**3 = Low**
Change in average BMI	5 years	Low - changes to diet due to loss of subsistence resources would lead to increased BMI	Local	About as Likely as Not	Indirect	Negative	**3 = Low**
Change in type 2 DM rates	5 years	Low -changes to diet due to loss of subsistence resources would lead to increased 2DM rates	Local	About as Likely as Not	Indirect	Negative	**3 = Low**
Change in hypertension							**No impact**
Change in lung cancer rates							**No impact**
Change in COPD rates							**No impact**

Health Impact Analysis Alternative D							
Health Effects Category / Issue	**Duration** (Months, Seasons, Years)	**Magnitude** (Low, Medium, High, Very High	**Extent** (Local, Regional, State, Nation, Global)	**Potential** (Exceptionally Unlikely, Very Unlikely, Unlikely, About as Likely as Not, Likely, Very Likely, Virtually Certain)	**Nature** (Direct, Indirect, Cumulative)	**Impact** (Positive, Negative)	**Scoring**
Non-communicable Chronic Disease - Drilling							
Change in obesity prevalence	2 years	Low - changes to diet due to loss of subsistence resources might lead to increased obesity	Local	About as Likely as Not	Indirect	Negative	**3 = Low**
Change in average BMI	2 years	Low - changes to diet due to loss of subsistence resources would lead to increased BMI	Local	About as Likely as Not	Indirect	Negative	**3 = Low**
Change in type 2 DM rates	2 years	Low - changes to diet due to loss of subsistence resources would lead to increased 2DM rates	Local	About as Likely as Not	Indirect	Negative	**3 = Low**
Change in hypertension							**No impact**
Change in lung cancer rates							**No impact**
Change in COPD rates							**No impact**

Health Impact Analysis Alternative D							
Health Effects Category / Issue	**Duration** (Months, Seasons, Years)	**Magnitude** (Low, Medium, High, Very High	**Extent** (Local, Regional, State, Nation, Global)	**Potential** (Exceptionally Unlikely, Very Unlikely, Unlikely, About as Likely as Not, Likely, Very Likely, Virtually Certain)	**Nature** (Direct, Indirect, Cumulative)	**Impact** (Positive, Negative)	**Scoring**
Non-communicable Chronic Disease - Operation							
Change in obesity prevalence	30 years	Low - changes to diet due to loss of subsistence resources might lead to increased obesity	Local	About as Likely as Not	Indirect	Negative	**3 = Low**
Change in average BMI	30 years	Low - changes to diet due to loss of subsistence resources would lead to increased BMI	Local	About as Likely as Not	Indirect	Negative	**3 = Low**
Change in type 2 DM rates	30 years	Low - changes to diet due to loss of subsistence resources would lead to increased 2DM rates	Local	About as Likely as Not	Indirect	Negative	**3 = Low**
Change in hypertension							**No impact**
Change in lung cancer rates							**No impact**
Change in COPD rates							**No impact**

Health Impact Analysis Alternative D							
Health Effects Category / Issue	**Duration** (Months, Seasons, Years)	**Magnitude** (Low, Medium, High, Very High	**Extent** (Local, Regional, State, Nation, Global)	**Potential** (Exceptionally Unlikely, Very Unlikely, Unlikely, About as Likely as Not, Likely, Very Likely, Virtually Certain)	**Nature** (Direct, Indirect, Cumulative)	**Impact** (Positive, Negative)	**Scoring**
Social Determinants of Health - Construction							
Change in maternal child health status							**No impact**
Change in depression/anxiety prevalence*	5 years	Medium	Local	About as Likely as Not	Direct	Negative	**4 = Medium**
Change in substance abuse rate							**No impact**
Change in suicide rate**	5 years	Low	Local	About as Likely as Not	Direct	Negative	**3 = Low**
Change in teen pregnancy rates***							**No impact**
Change in domestic violence							**No impact**

Health Impact Analysis Alternative D							
Health Effects Category / Issue	**Duration** (Months, Seasons, Years)	**Magnitude** (Low, Medium, High, Very High	**Extent** (Local, Regional, State, Nation, Global)	**Potential** (Exceptionally Unlikely, Very Unlikely, Unlikely, About as Likely as Not, Likely, Very Likely, Virtually Certain)	**Nature** (Direct, Indirect, Cumulative)	**Impact** (Positive, Negative)	**Scoring**
Social Determinants of Health - Drilling							
Change in maternal child health status							**No impact**
Change in depression/anxiety prevalence*	2 years	Medium	Local	About as Likely as Not	Direct	Negative	**4 = Medium**
Change in substance abuse rate							**No impact**
Change in suicide rate**	2 years	Low	Local	About as Likely as Not	Direct	Negative	**3 = Low**
Change in teen pregnancy rates***							**No impact**
Change in domestic violence							**No impact**

Health Impact Analysis

Alternative D

Health Effects Category / Issue	Duration (Months, Seasons, Years)	Magnitude (Low, Medium, High, Very High	Extent (Local, Regional, State, Nation, Global)	Potential (Exceptionally Unlikely, Very Unlikely, Unlikely, About as Likely as Not, Likely, Very Likely, Virtually Certain)	Nature (Direct, Indirect, Cumulative)	Impact (Positive, Negative)	Scoring
Social Determinants of Health - Operation							
Change in maternal child health status	30 years	Low	Local	Unknown	Direct	Negative	**3 = Low**
Change in depression/anxiety prevalence*	30 years	Medium	Local	About as Likely as Not	Direct	Negative	**4 = Medium**
Change in substance abuse rate	30 years	Low	Local	Unknown	Direct	Negative	**3 = Low**
Change in suicide rate*	30 years	Low	Local	About as Likely as Not	Direct	Negative	**3 = Low**
Change in teen pregnancy rates***	30 years	Low	Local	Unknown	Direct	Negative	**3 = Low**
Change in domestic violence	30 years	Low	Local	Unknown	Direct	Negative	**3 = Low**

*Panel notes that local residents may fear an incident like the BP spill in the Gulf which would severely impact marine resources (see EIS)

**Panel notes that rates are already high and might be reduced if youth were targeted for employment

***Panel notes that rates are already high and would not be affected because there is so little opportunity for employees to interact with local residents

Health Impact Analysis

Alternative E

Health Effects Category / Issues	Duration (Months, Seasons, Years)	Magnitude (Low, Medium, High, Very High)	Extent (Local, Regional, State, Nation, Global)	Potential (Exceptionally Unlikely, Very Unlikely, Unlikely, About as Likely as Not, Likely, Very Likely, Virtually Certain)	Nature (Direct, Indirect, Cumulative)	Impact (Positive, Negative)	Scoring
Water and Sanitation - Construction							
Changes in potable water access							**No impact**
Change in water quantity							**No impact**
Change in water quality							**No impact**
Change in sanitation effectiveness, adequate settling pools, discharge							**No impact**
Water and Sanitation - Drilling							
Changes in potable water access							**No impact**
Change in water quantity							**No impact**
Change in water quality							**No impact**
Change in sanitation effectiveness, adequate							**No impact**

Health Impact Analysis Alternative E							
Health Effects Category / Issues	**Duration** (Months, Seasons, Years)	**Magnitude** (Low, Medium, High, Very High)	**Extent** (Local, Regional, State, Nation, Global)	**Potential** (Exceptionally Unlikely, Very Unlikely, Unlikely, About as Likely as Not, Likely, Very Likely, Virtually Certain)	**Nature** (Direct, Indirect, Cumulative)	**Impact** (Positive, Negative)	**Scoring**
settling pools, discharge							
Water and Sanitation - Operation							
Changes in potable water access							**No impact**
Change in water quantity							**No impact**
Change in water quality							**No impact**
Change in sanitation effectiveness, adequate settling pools, discharge							**No impact**

Health Impact Analysis Alternative E							
Health Effects Category / Issue	**Duration** (Months, Seasons, Years)	**Magnitude** (Low, Medium, High, Very High)	**Extent** (Local, Regional, State, Nation, Global)	**Potential** (Exceptionally Unlikely, Very Unlikely, Unlikely, About as Likely as Not, Likely, Very Likely, Virtually Certain)	**Nature** (Direct, Indirect, Cumulative)	**Impact** (Positive, Negative)	**Scoring**
Accidents and Injuries - Construction							
Change in unintentional injury (e.g. drowning, falls, snow machine injury) rates	3 years	Low	Local	About as Likely as Not	Direct	Negative	**3 = Low**
Change in roadway incidents and injuries due to service road access for hunters/increased traffic from Prudhoe Bay	3 years	Low (Dalton Highway access from Deadhorse, ice road between Endicott Spur and PTP for VSM and supplies; modules shipped by barge – roads can handle traffic)	Local, Regional, State	About as Likely as Not	Direct	Negative	**3 = Low**
Changes to safety during subsistence activities	3 years	Low	Local	About as Likely as Not	Direct	Negative	**3 = Low**

Health Impact Analysis Alternative E							
Health Effects Category / Issue	**Duration** (Months, Seasons, Years)	**Magnitude** (Low, Medium, High, Very High)	**Extent** (Local, Regional, State, Nation, Global)	**Potential** (Exceptionally Unlikely, Very Unlikely, Unlikely, About as Likely as Not, Likely, Very Likely, Virtually Certain)	**Nature** (Direct, Indirect, Cumulative)	**Impact** (Positive, Negative)	**Scoring**
Accidents and Injuries - Drilling							
Change in unintentional injury (e.g. drowning, falls, snow machine injury) rates	2 years	Low	Local	About as Likely as Not	Direct	Negative	**3 = Low**
Change in roadway incidents and injuries due to service road access for hunters/increased traffic from Prudhoe Bay	2 years	Low (Dalton Highway access from Deadhorse, ice road between Endicott Spur and PTP for VSM and supplies (roads can handle traffic)	Local, regional	About as Likely as Not	Direct	Negative	**3 = Low**
Changes to safety during subsistence activities	2 years	Low	Local	About as Likely as Not	Direct	Negative	**3 = Low**

Health Impact Analysis Alternative E							
Health Effects Category / Issue	**Duration** (Months, Seasons, Years)	**Magnitude** (Low, Medium, High, Very High)	**Extent** (Local, Regional, State, Nation, Global)	**Potential** (Exceptionally Unlikely, Very Unlikely, Unlikely, About as Likely as Not, Likely, Very Likely, Virtually Certain)	**Nature** (Direct, Indirect, Cumulative)	**Impact** (Positive, Negative)	**Scoring**
Accidents and Injuries - Operation							
Change in unintentional injury (e.g. drowning, falls, snow machine injury) rates	30 years	Low – no impact from project	Local	Unlikely	Direct	Negative	**3 = Low**
Change in roadway incidents and injuries due to service road access for hunters/increased traffic from Prudhoe Bay	30 years	Low - No trips on Dalton Road or from the Endicott Spur are anticipated	Local	Unlikely	Direct	Negative	**3 = Low**
Changes to safety during subsistence activities	30 years	Low	Local	Unlikely	Direct	Negative	**3 = Low**

Health Impact Analysis
Alternative E

Health Effects Category / Issue	Duration (Months, Seasons, Years)	Magnitude (Low, Medium, High, Very High	Extent (Local, Regional, State, Nation, Global)	Potential (Exceptionally Unlikely, Very Unlikely, Unlikely, About as Likely as Not, Likely, Very Likely, Virtually Certain)	Nature (Direct, Indirect, Cumulative)	Impact (Positive, Negative)	Scoring
Exposure to Hazardous Materials – Construction							
Changes in physiologic contaminant levels such as lead, methyl mercury, PCB, Dioxins, PM2.5 from incineration, drilling mud, or gas flaring	3 years	High – due to increased number of incinerations and stack throughput and the lack of stack testing and analysis (EPA regulations)	Local - limited exposure because the nearest settlement is 60 miles west	Very Unlikely it would leave the site	Direct	Negative	**5 = Medium**
Changed levels of the same substances in subsistence resources	3 years	High - due to increased number of incinerations	Local	Very Unlikely it would leave the site	Indirect (food source)	Negative	**5 = Medium**
Exposure to Hazardous Materials – Drilling							
Changes in physiologic contaminant levels such as lead, methyl mercury, PCB, Dioxins, PM2.5 from incineration, drilling mud, or gas flaring	2 years	High - increased number of incinerations and the lack of stack testing and analysis	Local	Very Unlikely it would leave the site	Direct	Negative	**5 = Medium**
Changed levels of the same substances in	2 years	High - increased number of	Local	Very Unlikely it would	Indirect (food	Negative	**5 =**

Health Impact Analysis Alternative E							
Health Effects Category / Issue	**Duration** (Months, Seasons, Years)	**Magnitude** (Low, Medium, High, Very High	**Extent** (Local, Regional, State, Nation, Global)	**Potential** (Exceptionally Unlikely, Very Unlikely, Unlikely, About as Likely as Not, Likely, Very Likely, Virtually Certain)	**Nature** (Direct, Indirect, Cumulative)	**Impact** (Positive, Negative)	**Scoring**
subsistence resources		incinerations		leave the site	source)		**Medium**
Exposure to Hazardous Materials – Operation							
Changes in physiologic contaminant levels such as lead, methyl mercury, PCB, Dioxins, PM2.5 from incineration, drilling mud, or gas flaring	30 years	Medium – incinerations decrease during operations	Local	About as Likely as Not	Direct	Negative	**5 = Medium**
Changed levels of the same substances in subsistence resources	30 years	Medium - incinerations decrease during operations	Local	About as Likely as Not	Indirect (food source)	Negative	**5 = Medium**

Health Impact Analysis Alternative E							
Health Effects Category /Issue	**Duration** (Months, Seasons, Years)	**Magnitude** (Low, Medium, High, Very High)	**Extent** (Local, Regional, State, Nation, Global)	**Potential** (Exceptionally Unlikely, Very Unlikely, Unlikely, About as Likely as Not, Likely, Very Likely, Virtually Certain)	**Nature** (Direct, Indirect, Cumulative)	**Impact** (Positive, Negative)	**Scoring**
Food, Nutrition, Subsistence – Construction							
Change in amount of dietary consumption of subsistence resources	3 years	Low (average annual loss of between 2 and 17 pounds of caribou; barging ceases during whale season)	Local	Likely	Direct	Negative	**4 = Medium**
Change in composition of diet*	3 years	Low (residents eat other subsistence resources although caribou are very important)	Local	About as Likely as Not	Direct	Negative	**3 = Low**
Change in food security	3 years	Low (residents have access to cash and stores; other subsistence resources are available)	Local	Unlikely	Direct	Negative	**3 = Low**

Health Impact Analysis

Alternative E

Health Effects Category /Issue	Duration (Months, Seasons, Years)	Magnitude (Low, Medium, High, Very High)	Extent (Local, Regional, State, Nation, Global)	Potential (Exceptionally Unlikely, Very Unlikely, Unlikely, About as Likely as Not, Likely, Very Likely, Virtually Certain)	Nature (Direct, Indirect, Cumulative)	Impact (Positive, Negative)	Scoring
Food, Nutrition, Subsistence – Drilling							
Change in amount of dietary consumption of subsistence resources	2 years	Low (average annual loss of between 2 and 17 pounds of caribou; barging ceases during whale season)	Local	Likely	Direct	Negative	**4 = Medium**
Change in composition of diet*	2.5 years	Low (residents eat other subsistence resources although caribou are very important)	Local	About as Likely as Not	Direct	Negative	**3 = Low**
Change in food security	2 years	Low (residents have access to cash and stores; other subsistence resources are available)	Local	Unlikely	Direct	Negative	**3 = Low**
Food, Nutrition, Subsistence – Operation							
Change in amount of dietary consumption of subsistence resources	30 years	Medium (size of the caribou herd in 5 years is unknown)	Local	Likely	Direct	Negative	**4 = Medium**
Change in composition of diet*	30 years	Medium (size of the caribou herd in 5 years is unknown)	Local	About as Likely as Not	Direct	Negative	**3 = Low**
Change in food security	30 years	Low (residents have access to cash and stores; other subsistence resources are available)	Local	Unlikely	Direct	Negative	**3 = Low**

*Panel asks if increased income would replace nutritional value of caribou?

Health Impact Analysis

Alternative E

Health Effects Category / Issue	Duration (Months, Seasons, Years)	Magnitude (Low, Medium, High, Very High	Extent (Local, Regional, State, Nation, Global)	Potential (Exceptionally Unlikely, Very Unlikely, Unlikely, About as Likely as Not, Likely, Very Likely, Virtually Certain)	Nature (Direct, Indirect, Cumulative)	Impact (Positive, Negative)	Scoring
Health Infrastructure/Delivery - Construction							
Change in number of clinics and staff							**No impact**
Change in quality of clinics and staff							**No impact**
Change in services offered (e.g. prenatal checks, x-ray, lab services)							**No impact**
Change in accessibility of health care							**No impact**
Change in utilization/clinic burden from non-resident influx*	3 years	Medium	Local	About as Likely as Not	Indirect	Negative	**3 = Low**

Health Impact Analysis Alternative E							
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Health Infrastructure/Delivery - Drilling							
Change in number of clinics and staff							**No impact**
Change in quality of clinics and staff							**No impact**
Change in services offered (e.g. prenatal checks, x-ray, lab services)							**No impact**
Change in accessibility of health care							**No impact**
Change in utilization/clinic burden from non-resident influx*	3 years	Medium	Regional	About as Likely as Not	Indirect	Negative	**3 = Low**

Health Impact Analysis
Alternative E

Health Effects Category / Issue	Duration (Months, Seasons, Years)	Magnitude (Low, Medium, High, Very High	Extent (Local, Regional, State, Nation, Global)	Potential (Exceptionally Unlikely, Very Unlikely, Unlikely, About as Likely as Not, Likely, Very Likely, Virtually Certain)	Nature (Direct, Indirect, Cumulative)	Impact (Positive, Negative)	Scoring
Health Infrastructure/Delivery - Operation							
Change in number of clinics and staff	30 years	Medium – depends on amount of tax revenues from operation	Regional	Virtually Certain	Indirect	Positive	**7 = High**
Change in quality of clinics and staff	30 years	Medium – depends on amount of tax revenues from operation	Regional	Virtually Certain	Indirect	Positive	**7 = High**
Change in services offered (e.g. prenatal checks, x-ray, lab services)	30 years	Medium – depends on amount of tax revenues from operation	Regional	Virtually Certain	Indirect	Positive	**7 = High**
Change in accessibility of health care	30 years	Medium – depends on amount of tax revenues from operation	Regional	Virtually Certain	Indirect	Positive	**7 = High**
Change in utilization/clinic burden from non-resident influx*	30 years	Low – accidents tend to decrease during operations	Regional	Likely	Indirect	Negative	**3 = Low**

*Panel notes that there may be impact from construction accidents on site

Health Impact Analysis Alternative E							
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Infectious Diseases - Construction							
Change in pediatric acute respiratory disease rates (RSV, pneumonias, asthma, Bronchiectasis)							**No impact**
Change in acute adult respiratory disease rates (TB, Bronchitis, Influenza)*							**No impact**
Change in STD rates (esp. Chlamydia, Gonorrhea, HIV)							**No impact**
Change in GID outbreaks							**No impact**

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Infectious Diseases - Drilling							
Change in pediatric acute respiratory disease rates (RSV, pneumonias, asthma, Bronchiectasis)							**No impact**
Change in acute adult respiratory disease rates (TB, Bronchitis, Influenza)*							**No impact**
Change in STD rates (esp. Chlamydia, Gonorrhea, HIV)							**No impact**
Change in GID outbreaks							**No impact**

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Infectious Diseases - Operation							
Change in pediatric acute respiratory disease rates (RSV, pneumonias, asthma, Bronchiectasis)							**No impact**
Change in acute adult respiratory disease rates (TB, Bronchitis, Influenza)*							**No impact**
Change in STD rates (esp. Chlamydia, Gonorrhea, HIV)							**No impact**
Change in GID outbreaks							**No impact**

*Panel notes that the project may bring more RSV to local communities depending on the number of local employees – an unknown number to date

Health Impact Analysis

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Non-communicable Chronic Disease - Construction							
Change in obesity prevalence	3 years	Low (changes to diet due to loss of subsistence resources might lead to increased obesity)	Local	About as Likely as Not	Indirect	Negative	**3 = Low**
Change in average BMI	3 years	Low (changes to diet due to loss of subsistence resources would lead to increased BMI)	Local	About as Likely as Not	Indirect	Negative	**3 = Low**
Change in type 2 DM rates	3 years	Low (changes to diet due to loss of subsistence resources would lead to increased 2DM rates)	Local	About as Likely as Not	Indirect	Negative	**3 = Low**
Change in hypertension							**No impact**
Change in lung cancer rates							**No impact**
Change in COPD rates							**No impact**

Health Impact Analysis

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Non-communicable Chronic Disease - Drilling							
Change in obesity prevalence	2 years	Low (changes to diet due to loss of subsistence resources might lead to increased obesity)	Local	About as Likely as Not	Indirect	Negative	**3 = Low**
Change in average BMI	2 years	Low (changes to diet due to loss of subsistence resources would lead to increased BMI)	Local	About as Likely as Not	Indirect	Negative	**3 = Low**
Change in type 2 DM rates	2 years	Low (changes to diet due to loss of subsistence resources would lead to increased 2DM rates)	Local	About as Likely as Not	Indirect	Negative	**3 = Low**
Change in hypertension							**No impact**
Change in lung cancer rates							**No impact**
Change in COPD rates							**No impact**

Health Impact Analysis

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Change in hypertension							**No impact**
Change in lung cancer rates							**No impact**
Change in COPD rates							**No impact**

Health Impact Analysis
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Health Effects Category / Issue	Duration (Months, Seasons, Years)	Magnitude (Low, Medium, High, Very High	Extent (Local, Regional, State, Nation, Global)	Potential (Exceptionally Unlikely, Very Unlikely, Unlikely, About as Likely as Not, Likely, Very Likely, Virtually Certain)	Nature (Direct, Indirect, Cumulative)	Impact (Positive, Negative)	Scoring
Social Determinants of Health - Construction							
Change in maternal child health status							**No impact**
Change in depression/anxiety prevalence*	3 years	Medium	Local	About as Likely as Not	Direct	Negative	**4 = Medium**
Change in substance abuse rate							**No impact**
Change in suicide rate**	3 years	Low	Local	About as Likely as Not	Direct	Negative	**3 = Low**
Change in teen pregnancy rates***							**No impact**
Change in domestic violence							**No impact**

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Social Determinants of Health - Drilling							
Change in maternal child health status							**No impact**
Change in depression/anxiety prevalence*	2 years	Medium	Local	About as Likely as Not	Direct	Negative	**4 = Medium**
Change in substance abuse rate							**No impact**
Change in suicide rate**	2 years	Low	Local	About as Likely as Not	Direct	Negative	**3 = Low**
Change in teen pregnancy rates***							**No impact**
Change in domestic violence							**No impact**

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Social Determinants of Health - Operation							
Change in maternal child health status	30 years	Low	Local	Unknown	Direct	Negative	**3 = Low**
Change in depression/anxiety prevalence*	30 years	Medium	Local	About as Likely as Not	Direct	Negative	**4 = Medium**
Change in substance abuse rate	30 years	Low	Local	Unknown	Direct	Negative	**3 = Low**
Change in suicide rate**	30 years	Low	Local	About as Likely as Not	Direct	Negative	**3 = Low**
Change in teen pregnancy rates***	30 years	Low	Local	Unknown	Direct	Negative	**3 = Low**
Change in domestic violence	30 years	Low	Local	Unknown	Direct	Negative	**3 = Low**

*Panel notes that local residents may fear an incident like the BP spill in the Gulf which would severely impact marine resources (see EIS)

**Panel notes that rates are already high and might be reduced if youth were targeted for employment

***Panel notes that rates are already high and would not be affected because there is so little opportunity for employees to interact with local residents