Health Impact Assessment in Alaska:

General Guidance, Project Application, and Sustainable Mitigation

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This thesis represents my own work in accordance with University regulations.

Sincerely,

Alexa Glencer

Acknowledgments

This thesis represents the culmination of over a year spent conducting basic library-based background research, interning at the State of Alaska Department of Health and Social Services (ADHSS) Environmental Public Health Program (EPHP), and performing interviews at the site of the proposed Donlin Creek Project. I owe these opportunities to a variety of people who recognized my interest in the field of Alaska Native health and who truly went above and beyond what may have been asked of them to enable my study. During the spring of 2009, Burton Singer, my thesis adviser, introduced me to the concept of Health Impact Assessment (HIA) and collaborated with Lori Verbrugge, the ADHSS EPHP Manager, to arrange my summer internship placement. While working directly with Lori in Anchorage, I was granted unique exposure to the emerging field of HIA in the context of Alaskan natural resource development projects. The conversations that ensued at meetings held among governmental, tribal, and corporate agencies and my own participation in the data gathering process proved invaluable to my understanding of the power and limitations of the HIA tool and provided the foundation of my future thesis endeavors. In addition to Lori, I would like to thank Gary Krieger, Aaron Wernham, Jake Bell, Ed Fogels, and the entire Alaska HIA Working Group for allowing me to become so deeply involved.

In the late fall of 2009, I spoke with Lori and Gary with the intention of learning about any new HIA developments that had occurred in Alaska since my departure in August. During the conversation, Lori told me about a Donlin Creek presentation that she had just attended and advised me to speak with Mary Sattler, the Donlin Creek Manager of Community Relations and Sustainability. Gary advised me not just to speak

with Mary but to actually visit the Donlin Creek site in order to meet with people on the ground. Thus, I am greatly indebted to both Lori and Gary for helping me to restructure the nature of my thesis and for providing me with reason to return to Alaska. I would not have been able to return, however, were it not for the John Bonner Fund established at Princeton University, which covered the significant travel and outfitting expenses incurred in a winter trip to rural Alaska.

The interviews that I conducted at Donlin Creek allowed me to support my policy recommendations with a real-world model and to infuse a very human element into my thesis. Yet the interviews could never have been performed without the support of Mary and of Bill Bieber, the Operations Manager at Donlin Creek. While I am not aware of the precise details involved in the decision-making process, I feel confident in acknowledging that Bill made my trip to Donlin Creek possible. During the few days that I spent at Donlin, all of my (air) travel, housing, and meal expenses were covered, and Bill ensured that each of the employees on-site was available to speak with me. He also arranged for me to travel to the village of Crooked Creek in order to meet directly with Evelyn Thomas, the village chief. I feel incredibly privileged to have had the opportunity to speak with Evelyn and to have been able to visit her at her home. The knowledge that she shared was invaluable, and the dignity that she imparted gave my work a great sense of purpose. Her dignity, however, is not unique among the people of the Yukon-Kuskokwim Region; indeed, despite the tremendous burdens that they have borne historically and the hardships that they continue to face, they approach life with a remarkable sense of grace. The genuine kindness with which all of the Donlin Creek employees treated me and the honesty with which they responded to my questions has

taught me much more than what can be articulated in the context of this thesis. According to Lori and to Mary, the success of the Calista Shareholder Hire Program implemented at Donlin Creek was a special story that needed to be communicated to a wider audience. I hope that the final chapter of this thesis does just that.

I also hope that the entire thesis serves as a valuable and influential account of the evolving field of Alaskan HIA. I would like to thank my adviser, Burton Singer, for the invaluable suggestions and resources that he provided throughout the conceptualization, writing, and revision processes. In particular, I would like to thank him for pushing me to identify the purpose of my work, to articulate a clear synthesis, and to predict the future implications of currently unresolved HIA controversies.

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Introduction

Collectively referred to as Alaska Natives, the indigenous peoples residing in the state of Alaska belong to a diverse group of tribal nations, broadly classified as Aleuts, Indians (Tlingit, Athabascan, Tsimshian, Haida), and Eskimos (Yup'ik and Inupiat) (Jamison, Zegura, and Milan, 1978; Langdon, 1989). Representing approximately 19% of the total Alaskan population, Alaska Natives suffer a much greater share of mortality and morbidity than the national white population (Goldsmith et al., 2004). Primarily attributed to unintentional injury, homicide, and suicide, excess mortality experienced by the Alaska Native population is largely an indirect product of alcohol abuse (Day et al., 2006). In addition to its direct health impacts, alcohol abuse, which has plagued the Alaska Native community for decades, strongly influences patterns of social pathology. Among Alaska Natives, alcohol abuse is associated with elevated levels of suicide, violent death, child abuse, domestic violence, sexual assault, and incarceration (Goldsmith et al., 2004). However, alcohol abuse observed as a population phenomenon is rarely an expression of innate individual character flaws.

Over the past century, rapid sociocultural and economic changes in Alaska have transformed indigenous people's traditional community roles and family structures. Systematic campaigns designed to assimilate Alaska Natives into the growing white population continue to exert residual psychological effects today (Sullivan and Brems, 1997), and the transition from a subsistence- to a cash-based economy in rural areas has led to widespread unemployment and poverty (Wernham, 2007). Sociocultural alienation compounded by financial despair has generated a pervasive sense of hopelessness that encourages alcohol abuse and other related self-destructive behaviors (Segal, 1998).

Beyond its cultural and psychological impacts, the declining role of subsistence practices has also led to significant changes in Alaska Natives' dietary patterns. Substituting cheap store-bought goods high in saturated fats for subsistence resources rich in unsaturated fats and protein, Alaska Natives have experienced increased rates of a variety of metabolic disorders, including diabetes, hypertension, and obesity (Bersamin et al., 2008; Goldsmith et al., 2004). Other chronic diseases, most prominently cancer, have also become serious public health concerns (Goldsmith et al., 2004).

However, it is neither practically reasonable nor ethically right to prevent Alaska Native communities from being exposed to European-American ideas and economic markets. Instead, Alaska Natives should be provided with a responsive forum in which to voice their concerns and a mechanism designed to protect their interests. Given that large-scale industrial projects constitute the most significant contemporary threats to traditional Alaska Native lifestyles, the development of these projects should involve all stakeholders and should be predicated on a comprehensive consideration of broad social, economic, and environmental health determinants.

Currently, the National Environmental Protection Act (NEPA) mandates that all large-scale industrial project proposals include an Environmental Impact Statement (EIS). Consisting of detailed evaluations of all potential environmental effects associated with a given project, EISs serve as information documents that allow government decision-makers to weigh economic benefits against adverse environmental outcomes when determining if permits should be issued. Through the explicit provision of public comment periods and cooperating agency status, EISs incorporate substantial public input into the development process (Bhatia and Wernham, 2008). Yet despite the original

intent of NEPA, the environmental scope of most current EISs does not extend to considerations of human health (Wernham, 2007; Steinemann, 2000). Separate Health Impact Assessments (HIAs), regularly conducted by European nations, multinational companies, and International Finance Corporation (IFC) loan recipients, are not routinely conducted in the United States (Dannenberg et al., 2008). Although its application is different, HIA, like EIS, is intended to inform decision-makers, enlist public participation, and ultimately generate a set of recommendations. Thus, the integration of HIAs into the operational EIA framework is a logical means of ensuring that health concerns are adequately addressed and appropriate mitigation strategies constructed.

Recently, the State of Alaska has taken the initiative in incorporating the two impact assessment processes within the United States. In 2007, the Alaska Inter-Tribal Council (AITC) coordinated an effort among federal, State, and tribal regulatory and health agencies to complete three HIAs for proposed oil and gas pipeline projects in the North Slope region. All of these HIAs were included in the final EISs of their respective projects, and the Bureau of Land Management (BLM) has since introduced a measure requiring all North Slope developers to prepare formal HIAs for future projects. Within the past year, the Environmental Protection Agency (EPA), in collaboration with the U.S. Army Corps of Engineers (the Corps), the Alaska Department of Natural Resources (ADNR), and the tribal Maniilaq Association, also completed an HIA in association with the Supplemental Environmental Impact Statement (SEIS) prepared for a proposed site extension at the Red Dog Mine in northwestern Alaska. This HIA, which was embedded as a public health section in the SEIS, has established a number of important precedents that will inevitably influence future HIA practice within the State. Namely, it delineates

the pathways by which mining projects may impact psychosocial determinants of health, and it describes a variety of mitigation measures that, if implemented, may reduce the adverse public health consequences of mining activity in proximity to rural Alaska Native communities. Furthermore, it represents the first Alaskan HIA performed with the involvement of the State agencies that will be responsible for coordinating HIA evaluations in the future.

Over the past year and a half, an interagency team representing federal and State health and regulatory departments and tribal organizations has worked to develop general HIA guidance applicable to all large-scale resource extraction projects proposed within Alaska. Intended to function as a voluntary framework for implementing best-practice procedures, the guidance borrow from resource extraction HIA protocols established by the IFC but is careful to highlight unique Alaskan public health concerns. Specifically, it devotes significant consideration to the topic of project-related subsistence resource threats and their potential psychosomatic consequences. Reviewing the fundamental processes of screening, scoping, assessment, and mitigation shared between EIS and HIA, it also considers the unique role of monitoring and evaluation (M&E) within the HIA context. While the typical EIS is a predictive tool and M&E is therefore not mandated by any permitting agency, the working group concluded that its inclusion is valuable, for it may serve as an impetus for voluntary industry action. Indeed, the cost efficiencies conferred by mitigation measures implemented during the engineering project phase and subsequent verification strategies that identify which measures are effective and which can be discontinued are likely to appeal to corporate proponents.

Having resolved the relation of M&E to the HIA process, the working group issued a complete draft of the guidance document in the summer of 2009 and, following two rounds of revision, distributed it to each involved agency for the purpose of internal review. During the fall and winter, State agencies conducted a significant overhaul of the document. While the working group draft is largely process-oriented, the State-revised draft is much more methods-oriented. Catering to a corporate audience, it is intended to function as a strict technical tool. In order to avoid the costs associated with redundancy, it emphasizes coordination with the complementary environmental and social impact assessment processes. Ultimately, it intimates that HIA should not represent a radical departure from the well-established EIS process. The Guidance document should serve as a practical toolkit rather than as a discursive instruction manual.

As a toolkit, the guidance is intended to function as an aid to agencies responsible for conducting HIAs, but it does not claim to offer comprehensive solutions for project-specific challenges. Instead, early Alaskan HIA efforts will set important precedents, and subsequent projects will build upon past experience. Already, prior to the release of the guidance document, two projects, each anticipating the permitting stage, have requested that HIAs be performed in conjunction with their respective EIS processes.

The project that has advanced the farthest, the Chuitna Project, proposes to extract 300 million tons of ultra-low sulfur, sub-bituminous coal from a 5000-acre site within the Beluga Coal Field of south-central Alaska over the course of twenty-five years (ADNR, 2010; EPA, 2010). Over the summer, scoping meetings were held within local communities to provide updates, answer questions, and consider concerns. The most profound issues raised were related to the potential bioaccumulation of harmful

contaminants in subsistence resources and to the potential decline in abundance of these resources due to altered habitats and obstructed migration routes. Following these meetings, baseline health data was collected from various State agencies. It was proposed that a nutrition survey be conducted among local residents, but State regulatory agencies and the corporate project proponent each resisted. While State health agencies do not believe that a nutrition survey is critical at Chuitna, they worry about the future implications of its exclusion. That is, they would like to avoid creating a precedent that effectively prohibits nutrition surveys from being performed as a component of Alaskan HIAs.

These concerns are particularly salient, because the State health agencies strongly advocate for inclusion of a nutrition survey as an element of the HIA being conducted for the Donlin Creek Project, the other Alaskan resource extraction project involved in HIA negotiations within the past year. Located in southwestern Alaska, the Donlin Creek site is estimated to hold as much as 30 million ounces of gold. Proposed as a joint venture between a large multinational corporation and a Canadian mining company, Donlin Creek, would, if developed, become one of the largest gold mines in the world (Rothe, 2006). It is expected to operate for approximately twenty years and to process 50,000-60,000 tons of ore each day (Donlin Creek LLC, 2008).

Unlike the communities identified as potentially affected by the Chuitna Project, the communities identified as potentially affected by the Donlin Creek Project are largely receptive to industrial development. The particular region in which Donlin Creek is located, the Yukon-Kuskokwim region, is extremely economically depressed. Indeed, nearly 30% of the population falls below the federal poverty level, and about 70% of the

adult population is either unemployed or no longer seeking work (U.S. Census, 2000). Thus, the environmental hazards conferred by the mining project need to be weighed against the economic benefits that it would engender. These economic benefits are both direct and indirect; in addition to the creation of reliable wage-earning jobs, residents recognize in the Donlin Creek Project an opportunity to save capital and to develop infrastructure that could be used to stabilize the cash-based economy in the future. Furthermore, the Donlin Creek management team has established a program designed to prioritize local resident hiring and training. The training component of this program has provided employees with marketable skills and has helped them to cultivate a Western work ethic while still maintaining, and perhaps even enhancing, their traditional Yup'ik values and customs.

In conjunction with extensive community outreach efforts, the local hire program has significantly improved the lives of the people living in the ten villages in closest proximity to the mine site. It has allowed them to succeed in the mixed subsistence/ cash-based economy that increasingly characterizes rural Alaska and, in doing so, has helped to resolve endemic social distress. Yet the program also serves the business interests of Donlin Creek LLC, for it ensures provision of a reliable workforce in an inherently volatile industry. Thus, the local hire program suggests a model of corporate social responsibility that could benefit the entire Alaskan mining industry and affected Alaska Native communities.

The creation of formal HIA protocols is not intended to hinder local residents from benefiting from economic opportunities associated with industrial development. Instead, the objective of HIA is to inform the decision-making process and to empower,

not handicap, local communities. HIA does not force stakeholders to reject industrial development projects if adverse associated health consequences are identified; it merely gives them that option (as well as several other mitigation strategies) in the context of a well-informed cost-benefit analysis. Moreover, as the Donlin Creek management team proves, corporate project proponents may even choose to voluntarily implement measures that extend their burden of responsibility beyond typical standards of employee and community wellbeing.

The purpose of this thesis is (1) to identify the need for HIA as a standard component of the Alaskan resource extraction industry permitting process, (2) to describe HIA evolution to date within Alaska, (3) to identify persistent issues that impede formulation of a consistent HIA methodology within Alaska, and (4) to suggest strategies by which HIA could be best employed to resolve the tension between broad Alaskan public health concerns and corporate responsibility. The first chapter provides background information pertaining to the current health status of Alaska Natives, the HIA process, and successful examples of HIA application in the Alaskan resource extraction industry over the past three years. The second chapter describes formulation of general best-practice HIA guidelines intended for voluntary application within the State. These guidelines draw heavily upon those established by the IFC, but their emphasis differs by virtue of the unique data collection, health impact identification, and risk assessment considerations characteristic of rural Alaska. The third chapter examines HIA in relation to two mining projects preparing to enter the permitting stage; it identifies important methodological precedents set and contentious issues raised within the context of these projects' HIA negotiations. The most intransigent debates relate to corporate project

proponents' role in mitigating psychosocial health effects mediated by personal choice. The fourth chapter presents a potential remedy to these debates in the form of corporate social responsibility as practiced during exploration activities at the proposed Donlin Creek Project site. It details the creation and implementation of the Calista Shareholder Hire program, which privileges employment of local people in conjunction with training, counseling, and community outreach. Relying on direct testimony, it elucidates the value of the program as perceived by managers, hourly employees, and residents unaffiliated with the project. The chapter concludes by claiming that corporate social responsibility underlies voluntary HIA implementation but contends that the mental health benefits derived from reliable wage-earning job creation need to be measurable in order to be included within the HIA framework. Alternatively, the final chapter suggests that evaluation of broad social determinants of health, which are not easily quantified, may be better allocated to a novel impact assessment tool independent of HIA. In the future, in fact, it is highly likely that the HIA risk assessment process will rely upon a much more quantitative methodology. A matrix proposed within the scholarly literature is reviewed for potential application in the Alaskan context.

Chapter 1: Background*

Alaska Native Health Status

Health disparities between the American Indian/ Alaska Native (AI/AN) population and the United States national population have existed for more than 500 years (Jones, 2006). Today, in many cases, these health disparities are even more exacerbated among the Alaska Native population than among the AI/AN population as a whole. From 1999 to 2003, the Alaska Native all-cause mortality rate was 36% higher than that of the U.S. white population, and Alaska Natives demonstrated significantly higher mortality rates than U.S. whites for eight of the ten national leading causes of death (Day et al., 2006).

Unintentional injuries, homicides, and suicides, in particular, are three leading causes of excess mortality among the Alaska Native population (Day et al., 2006). Indeed, the proportion of deaths attributed to unintentional injuries among Alaska Natives is more than double that among the white Alaskan population (94.0 per 100,000 versus 46.1 per 100,000). Among individuals aged 19 years or less, this difference is even more striking. Alaska Native youth suffer from unintentional injury deaths at a rate nearly three times that of their white counterparts (51.5 per 100,000 versus 18.1 per 100,000). The homicide death rate among Alaska Natives of all ages is nearly four times greater than that among white Alaskans (13.0 per 100,000 versus 3.5 per 100,000), and the suicide death rate is more than twice as high (35.0 per 100,000 versus 16.7 per 100,000) (Healthy Alaskans 2010). Moreover, due to under-reporting, incorrect coding, and poor communication among government agencies, the true rate of suicide among Alaska

* This chapter incorporates a significant amount of content from the author's spring term Junior Paper, "Health Impacts of Large-Scale Industrial Development Projects on the Alaska Native Community: Identification and Mitigation."

Natives is likely to be even higher (Forbes and Van der Hyde 1988; Kettl and Bixler 1991). As is true of unintentional injury death rates, the discrepancy in suicide death rates among Alaska Natives and non-native Alaskans is even more pronounced among young individuals, especially men. Specifically, Alaska Native boys aged 10-14 years commit suicide at a rate six times that of their non-native counterparts, and Alaska Native girls aged 10-14 years commit suicide at a rate three times that of their non-native counterparts. Alaska Native boys aged 15-19 years commit suicide at a rate 5.6 times greater than their non-native counterparts, and Alaska Native girls aged 15-19 years commit suicide at a rate four times greater than their non-native counterparts (Goldsmith et al., 2004). Furthermore, in some Alaska Native communities, adolescent suicide is even more prevalent. Among Inupiat youth aged 15-19 years, for instance, the suicide rate is sixteen times greater than the national average (Wexler, 2006). Among all Alaska Natives aged 15-24 years, suicide is the leading cause of death, and suicides among individuals within this age group account for about half of all Alaska Native suicides each year. And, in contrast to the demographic distribution of suicides in the U.S. national population, suicide among Alaska Native elders (those over the age of sixty) is low to nonexistent (Wexler et al., 2008; Sullivan and Brems, 1997).

Both fatal and nonfatal suicide behaviors are associated with alcohol abuse, and "although heavy alcohol use in Alaska is not restricted to Alaska Natives, alcohol abuse and its consequences are disproportionately high among this group" (Segal, 1998). While 25% of all deaths in Alaska are alcohol-related, 66.6% of Alaska Native deaths are estimated to be alcohol-related, and the age-adjusted alcoholism death rate is 5.3 times higher among Alaska Natives than among the U.S. national population (Segal, 1998;

Abbot, 1998). Furthermore, in addition to its direct consequences and its association with suicide, alcohol abuse is linked to high rates of fetal alcohol spectrum disorder, child abuse, domestic violence, sexual assault, violent death, and incarceration (Goldsmith et al., 2004).

Fetal alcohol spectrum disorder (FASD) describes a variety of conditions, including mental retardation, growth deficiencies, and behavior disorders, that children can develop when exposed to alcohol in their mothers' wombs. Given that one-quarter to half of Alaskan alcoholics are women, it is not surprising that Alaska has the highest reported rate of FASD cases of any state in the country (Brems, 1995, 1996; Goldsmith et al., 2004). Yet of all Alaskan FASD cases, the vast majority, 89%, are found in the Alaska Native community. In the late 1990s, five out of every 1000 Alaska Native babies were diagnosed with FASD; moreover, only a small fraction of all Alaska Native children affected by pre-natal alcohol use are officially diagnosed with FASD (Goldsmith et al., 2004). In 1994, it was estimated that 39% of pregnant Alaska Native women were at risk for delivering a baby pre-natally exposed to alcohol or other drugs (Alaska Area Native Health Service, 1995).

Yet a far more widespread consequence of parental substance abuse is child abuse and neglect. It is estimated that approximately 80% of substantiated child abuse cases in Alaska are related to alcohol or drug abuse, and Alaska Native children are at significantly greater risk than other Alaskan children. Indeed, from 1997 to 2001, Alaska Native children represented more than half of all substantiated child abuse cases in Alaska despite making up only a quarter of the state's child population. More common than physical violence, however, is neglect. Among the Alaska Native child abuse cases

reported from 1997 to 2001, 72% were attributed to neglect rather than to physical abuse (Goldsmith et al., 2004).

But physical abuse directed towards Alaska Native women is a relatively frequent occurrence. Indeed, Alaska Native women are often victims of both domestic violence and sexual assault. From 2000 to 2003, Alaska Native women, accounting for less than 20% of the adult state population, represented 36% of all domestic violence victims and 44% of all sexual assault victims. And while the total number of sexual assault cases decreased during this period, the proportion of Alaska Native sexual assault cases increased. Moreover, experts argue that the actual incidences of both domestic violence and sexual assault among the Alaska Native population were each much greater due to underreporting. And, as is true of child abuse, domestic violence and sexual assault are also strongly linked to excessive alcohol use. In 85% of the domestic violence cases that were reported and 80% of the sexual assault cases that were reported among Alaska Natives, alcohol was determined to be a factor (Goldsmith et al., 2004). That is, the male aggressor was usually intoxicated. However, the gender pattern of alcohol abuse in the Alaska Native community (greater prevalence among Alaska Native women than among women in the national population) also supports research demonstrating a relationship between being victimized and drinking (Segal, 1998).

Yet despite the severity of alcohol abuse and its myriad effects within the Alaska Native community, other health conditions, notably chronic diseases, have recently emerged as equally serious threats. Indeed, cancer is currently the leading cause of death among Alaska Natives, and it is the third leading cause of excess mortality, following unintentional injury and suicide (Goldsmith et al., 2004; Day et al., 2006). The overall

cancer death rate among Alaska Natives is about 30% higher than among white Alaskans, the lung cancer incidence rate is about 30% higher among Alaska Natives than among white Alaskans, and the colorectal cancer death rate is more than two times higher among Alaska Natives than among white Alaskans (Healthy Alaskans 2010). The colorectal cancer death rate among Alaska Natives is, in fact, among the highest of any racial or ethnic group in the country (Brown, Lanier and Becker, 1998). The prevalence of tobacco use, strongly correlated with lung cancer, is also highest among Alaska Natives (CDC, 2004). From 1991 to 2002, 40-45% of Alaska Native adults smoked; in comparison, only 25% of non-Native adults smoked (Goldsmith et al., 2004). When the use of traditional "Iqmik" as well as cigarettes and smokeless tobacco is included in these estimates, the smoking prevalence among Alaska Native becomes even greater, possibly reaching as high as 60% (Lanier, Bulkow and Ireland, 1989). And, in addition to lung cancer, smoking has also contributed to the increasing incidence of pulmonary diseases like emphysema. Indeed, today, the prevalence of chronic obstructive pulmonary disease is much greater among Alaska Natives than among white Alaskans (50.8 per 100,000 versus 34.3 per 100,000) (Healthy Alaskans 2010).

While once rare, diabetes is now being reported with increasing frequency among the Alaska Native population. From 1985 to 1999, the diabetes rate among Alaska Natives increased by 100%, from a rate below the national average, 15.7 cases per 100,000 people, to a rate above the national average, 31.4 cases per 100,000 people (Goldsmith et al., 2004). Macrovascular complications of diabetes, including myocardial infarctions and strokes, are also occurring among Alaska Natives at rates comparable to those in other diabetic populations, and the prevalence of obesity increased from 18% of

the Alaska Native population in the early 1990s to 30% by the late 1990s (Schraer et al., 1997; Goldsmith et al., 2004). The corresponding increase in obesity prevalence rates among the white Alaskan population during this period was only from 12% to 20%. Largely related to the growing incidence of diabetes and obesity, heart disease, once extremely rare within the Alaska Native community, is now responsible for killing about as many Alaska Natives as white Alaskans (Goldsmith et al., 2004).

Health Determinants

Attributed to a variety of socio-psychological, cultural, and economic agents, the current health dilemma discernible in the Alaska Native community emerged in response to increasing interactions with European-American society. Beginning in the early nineteenth century, European-American missionaries, traders, and teachers imposed new customs, traditions, and economic systems on native peoples. From the 1950s to the 1970s, churches, schools, and government agencies intensified their attempts to destroy Alaska Native culture and to assimilate Alaska Natives into the white majority (Sullivan and Brems, 1997). During this period, Alaska Natives were encouraged to migrate into urban areas, and children were sent to far-away boarding schools. In addition, over the past 35-40 years, the development of the oil industry has dramatically accelerated the transition from reliance on traditional subsistence activities to reliance on a cash-based economy. Associated alterations in family roles and community functions have led to alienation, cultural disorientation, and loss of both self-control and identity, which, in turn, are channeled into the substance abuse and associated pathologies so problematic in Alaska Native villages today (Segal, 1998). As Sullivan and Brems argue, “alcohol and substance abuse, adolescent suicides, health crises, and interpersonal violence may

merely be the symptoms, not the causes, of the deterioration in the lifestyle of Native peoples across the state of Alaska" (1997).

Furthermore, the small size and remoteness of most Alaskan villages severely limit their economic potential. More than half of Alaska Natives live in rural areas, where they comprise more than 80% of the population (Goldsmith et al., 2004). Overall, per-capita income of Alaska Natives is about half that of non-natives, and in rural locations, energy, store-bought food, transportation, and communications are extremely high-priced due to isolation from the road system, low population densities, and extreme climatic conditions. Indeed, petroleum used for home heating in many rural Alaskan villages costs approximately $9 per gallon, and a gallon of milk from the grocery store costs nearly $11 (Stapleton, 2008). Having come to rely on commodities provided by a cash-based economy yet often unable to contribute to that economy, rural Alaska Natives suffer from much higher poverty and unemployment rates than their urban counterparts. Facing bleak prospects for career advancement and future financial stability, they have increasingly chosen to migrate into urban areas. If current migration trends continue, in fact, the Alaska Native population will soon be more concentrated in urban areas than in rural areas (Goldsmith et al., 2004). Among those without the means of migrating, substance abuse and associated suicide and violence represent responses to despair and hopelessness. Thus, the psychological and social pathologies so prevalent among the Alaska Native community are determined by growing economic disparities as well as rapid socio-cultural change and strain (Wernham, 2007).

The transition from subsistence to market activities has led to a breakdown in traditional kinship and community sharing networks and has impeded the transmission of

cultural axioms to youth; however, it has also dramatically changed dietary patterns (Wernham, 2007). Indeed, studies have demonstrated that the degree of modernization within a community is inversely correlated with the quantity of subsistence food consumed. And as subsistence food consumption decreases, the risk of developing metabolic disorders, such as diabetes, hypertension, and obesity, increases (Bjerregaard et al., 2004a; Bjerregaard et al., 2004b; Murphy et al., 1997; Murphy et al., 1995; Schraer, 1993; Young, 1992). Often, as is certainly the case in rural Alaska, the quality of food available in village stores is low, and the cost of choosing more healthful food options is prohibitive (Bersamin et al., 2006). While traditional Alaska Native diets were high in unsaturated fats known to reduce the risk of chronic disease, new commercial food products are often high in saturated fats, which have been hypothesized to mediate the relationship observed between high fat diets and chronic disease (Bersamin et al., 2008).

Breast, prostate, and colorectal cancers are each considered diseases of Western civilization and have been found to be associated with dietary fat. While colorectal cancer rates are significantly elevated among Alaska Natives, breast and prostate cancer still remain relatively low. However, studies demonstrate that colorectal cancer rates among migrants achieve those of a new country a generation ahead of breast and prostate cancer rates, and it is hypothesized that similar trends will hold true for cancer patterns observed among Alaska Natives (Lanier, 1989).

The distribution of diabetes prevalence within the Alaska Native population provides further evidence of the relationship between the replacement of traditional diets with Western diets and an increased disease burden. The Aleuts, who have had the longest contact with European-American migrants of any Alaska Native people, also

suffer from the highest diabetes prevalence rate; in contrast, Inupiats, who have had the least contact with European-Americans, demonstrate the lowest prevalence of diabetes. Since 1985, however, following the industrial development that emerged in northern Alaska in response to oil discoveries, the rate of diabetes among the Inupiat population has tripled (Goldsmith et al., 2004). Yet the health effects of large-scale oil and gas drilling on the Alaska Native community in this region have not been limited to an increase in diabetes incidence. Each of the poor health conditions that have become endemic in the Alaska Native population can be traced to the psychological, economic, and cultural health determinants described above. While not unique products of the particular demands of oil and gas development projects, these health determinants are, nevertheless, consistently evident in the context of North Slope resource exploration and industrial activities.

Health Effects of Oil and Gas Development Projects on Alaska's North Slope

Since the first North Slope oil discovery at Prudhoe Bay in 1967, the oil and gas industry has come to dominate the economy of this region. Over the past eight years, increasing pressure has been directed towards Alaska as a source of domestic petroleum, and, as a result, efforts have been made to expand oil and gas leasing to include most of the 24 million acre National Petroleum Reserve-Alaska (NPR-A) and the northern Outer Continental Shelf (OCS) (Wernham, 2007).

Eight Inupiat villages, ranging in population from 250 to more than 4,000, are located in the North Slope Borough (NSB). Due to the significant contribution of oil revenues to their economy, the residents of these villages have generally supported oil development as long as subsistence impacts have been minimal. Over the last fifteen

years, however, as industrial development has spread to within a few miles of the nearest village, local concerns have been raised regarding both direct human health impacts from chemical contaminants and indirect psychological, cultural, and dietary impacts generated from an influx of migratory workers and diminished subsistence species abundance and access (Wernham, 2007).

Fears of asthma and respiratory problems due to gas flaring and fears of cancer and thyroid disorders from polluted food sources are accompanied by fears of metabolic diseases and social problems resulting from the reduced availability of subsistence resources and shifting cultural norms that encourage consumption of store-bought foods (AITC, 2009). As voiced by a member of the Alaska Federation of Natives,

> Subsistence is a way of life in rural Alaska that is vital to the preservation of communities, tribal cultures, and economies. Subsistence resources have great nutritional, economical, cultural, and spiritual importance in the lives of rural Alaskans… Subsistence, being integral to our worldview and among the strongest remaining ties to our ancient cultures, is as much spiritual and cultural, as it is physical (BLM, 2005)

Thus, in addition to their dietary importance, subsistence activities, such as hunting, fishing, whaling, and berry gathering, also provide a foundation for Alaska Natives' social organization (Wernham, 2007). Exacerbated by the introduction of a cash economy unable to provide for all, the potential elimination of subsistence activities, a means by which all individuals can contribute to and, in turn, benefit from community prosperity, has profound psychological implications. Indeed, North Slope Inupiat communities consistently cite socioeconomic and cultural change, in addition to toxic chemical exposure from industrial effluents, as being responsible for producing a variety of negative physical and psychological health effects. Until recently, however, these

communities lacked a mechanism by which to translate their concerns into regulatory policy.

Health Impact Assessments (HIAs)

Large-scale industrial development in the United States is regulated through the Environmental Impact Statement (EIS) process mandated by the National Environmental Policy Act (NEPA). Signed into law in January 1970, NEPA requires compliance from all federal agencies in the executive branch before final decisions are made about actions that may generate environmental effects. NEPA applies to federal construction projects, plans to manage and develop federally owned lands, and federal approvals of non-federal activities, such as grants, licenses, and permits (CEQ, 2007). Intended as an information document that allows governmental decision-makers to determine whether permits should be issued for proposed development projects, EISs must contain a description of the environment affected by a given project, an assessment of the direct and indirect environmental impacts of a proposed project, and an analysis of reasonable alternatives to the proposed project, including a "no-action" alternative (Yost, 2003). Suggestions of specific mitigation measures are also encouraged, and strong mechanisms are provided for incorporating public input into the review process. Indeed, NEPA mandates that public comment periods be held in order to allow for open and comprehensive discourse among all stakeholders. Agencies sponsoring development projects are required to respond to all substantive public input, either by altering the EIS or by justifying their original analysis. Furthermore, these agencies must solicit participation from potential cooperating agencies: state, local, or tribal governments and organizations with legal jurisdiction or relevant expertise (Bhatia and Wernham, 2008).

Yet while a typical EIS contains up to 3000 pages of detailed information addressing every aspect of the potential effects of a development project on the surrounding ecosystem, individual animal species, and air and water quality, its consideration of public health is largely absent (Wernham, 2007; Steinemann, 2000). Indeed, if an EIS does evaluate health impacts, "its focus is typically narrow: a single outcome (cancer), due to exposure to a single toxin, over a single lifetime, represented by a single number, calculated by a quantitative risk assessment methodology" (Steinemann, 2000). Such an approach is well-defined, relatively reliable, and legally defensible; consequently, agencies commissioning EISs rarely consider health impacts mediated by complex and often unpredictable social determinants or economic factors (Davies and Sadler, 1997). However, as Bhatia and Wernham note, "the inattention to health in EIS practice stands in direct contrast to the interdependence among environmental change, societal conditions, and human health" (2008). Due to their scale, projects regulated by NEPA significantly affect local economies, employment patterns, cultural values, and infrastructure, each of which contributes to a community's health profile (Wernham, 2007).

Furthermore, in contrast to the perception that NEPA does not require public health impacts to be evaluated or mitigation strategies developed, the Act's stated purpose is to "stimulate the health and welfare of man." The code governing NEPA's implementation explicitly defines public health as an effect that must be considered in any EIS, and it directs agencies to consider "the degree to which the proposed action affects public health or safety" when evaluating its "intensity." Additionally, separate from NEPA, Executive Order 12898 requires federal agencies to consider the health

effects of their actions on the AI/AN community and suggests that federal agencies consult with local public health agencies in addition to including health data in all environmental analyses (AITC, 2009). Yet despite these legal provisions as well as demonstrated need, formal Health Impact Assessments (HIAs) are not routinely conducted in Alaska or, indeed, anywhere in the United States (Dannenberg et al., 2008).

Widely employed internationally by many large lending institutions, such as the World Bank and the signatories to the Equator Principles, as well as a growing number of multinational corporations, such as Royal Dutch/ Shell and the International Association of Oil and Gas Producers, HIAs provide a systematic process by which the potential health consequences of a project or policy can be anticipated and altered in order to maximize benefits and minimize adverse outcomes (Bhatia and Wernham, 2008; Quigley et al., 2006). While its methodology is relatively new and still changing, HIA can generally be described by a six-step process first articulated by the World Health Organization (WHO) in 2007. This process includes the following components:

1) screening, in which a determination is made as to whether an HIA is necessary or likely to be useful for a given project;
2) scoping, in which the affected population and specific health problems are identified, and the methods and data sources to be used in the analysis are selected;
3) assessment, in which the likely impacts of a given project are determined based on a description of a population's baseline health status and the associations between project related disturbances, health determinants, and health outcomes;
4) mitigation, in which the predicted impacts of a project are used to inform the development of measures designed to maximize benefits and minimize adverse

impacts;

5) reporting, in which results are shared with stakeholders and, in some cases, formal public input contributes to a revised draft assessment;

6) monitoring and evaluation, in which select health outcomes likely to be sensitive and/or accurate indicators of predicted effects are monitored. This monitoring period is expected to last for the duration of the project, and it is intended to inform the process of "adaptive management," in which new observations may lead to the modification of predictions and mitigation measures (adapted by Wernham, 2007).

Adaptive management is a critical tool for ensuring the long-term sustainability of a project, for it has the power to improve forecasting methods and outcomes, to allow for an assessment of cumulative effects, and to "increase understanding of the interconnections among actions, impacts, environmental systems and human health" (Steinemann, 2000). Acknowledging that effective health interventions must involve contributions from all stakeholders and must address broad social, economic, and environmental health determinants, HIAs approach health from a cross-sectoral, holistic perspective (Bhatia and Wernham, 2008; Wernham, 2007). Like EISs, HIAs represent an attempt to inform decision-makers, enlist public participation, and, ultimately, generate a set of recommendations.

Yet despite the striking similarities between the two processes, nearly all of the limited number of U.S. HIAs completed thus far have been performed independently of EIS evaluations (Cole and Fielding, 2007). Given the growing domestic interest in HIAs, however, it is imperative that a systematic, enforceable mechanism be developed in order to guarantee their effective and widespread implementation. Such a mechanism is clearly

identified in the design of current EISs, and the provisions for public participation guaranteed under NEPA, namely official comment periods and cooperating agency status, provide a means by which to advocate for the inclusion of public health considerations in the form of an integrated EIS-HIA (Wernham, 2007).

Recently, the Alaska Inter-Tribal Council (AITC), a statewide, tribally-governed advocacy organization, partnered with the North Slope Borough (NSB) government and Aaron Wernham, at the time a fellow with the Columbia University Institute on Medicine as a Profession, to employ the NEPA framework as a means of conducting the first HIAs pertaining to oil and gas development on Alaska's North Slope. Arguing that prior NEPA analyses conducted in the region had failed to address public testimony, that health impacts were within the scope of NEPA, that appropriate public health data was available, and that HIA was an apt methodology, the team approached the relevant federal regulating agencies, the Bureau of Land Management (BLM) and the Minerals Management Service (MMS). Upon accepting that health should be included in the EISs performed for oil and gas development projects in the region, the BLM and MMS then asked Wernham to draft appropriate subsections pertaining to three active NEPA processes (Wernham, 2007). The overarching goal of these HIAs was to ensure that the physical, emotional, and spiritual health impacts of oil and gas exploration on the Inupiat community were adequately acknowledged and addressed in the planning, permitting, and regulatory stages of development (AITC, 2009).

Two of the HIAs, those pertaining to the Arctic Outer Continental Shelf Oil and Gas Leasing Program (AOCS) and the Chukchi Sea Oil and Gas Leasing Program, were rapidly performed and integrated into the environmental justice chapters of their

corresponding EISs. The third HIA, however, that pertaining to the National Petroleum Reserve-Alaska Oil Development Plan (NPR-A), was much more extensive. Working directly with BLM scientists, the AITC and NSB, acting as cooperating agencies, drafted a full HIA that included health-specific mitigation measures as well as identification of potential health impacts and alternative options. As it may serve as a prototype for other EISs conducted along the North Slope and beyond, the NPR-A HIA development process and the predictions and recommendations that it produced are detailed below.

NPR-A HIA Predictions

Anticipated project disturbances due to proposed oil and gas leasing in the 4.6 million acre NPR-A include the following:

- Seismic activity
- Increased ground and air traffic
- Construction of oil facilities (wells, processing plants)
- Construction of pipelines, roads, and staging areas
- Airborne discharge from flaring, exhaust, and volatile organics
- Oil and/ or other contaminant spills
- Influx of non-Native workers
- Creation of oil camps
- Local employment opportunities
- Increased revenue through taxes, Native corporation payments, and employment
- Employment decline at project termination

Having conducted public meetings, reviewed relevant sections of the ongoing EIS, and consulted with local public health professionals, wildlife experts, and BLM NEPA

analysts, members of the AITC and NSB then identified local health determinants and related these determinants to the anticipated project disturbances in order to predict health outcomes of oil and gas development on Inupiat communities in the NPR-A region (Wernham, 2007).

Perhaps most significant in magnitude are predicted psychological impacts and related social pathologies. Indeed, the arrival of non-Native workers and increasing reliance on a cash economy (at the expense of traditional subsistence activities) would almost certainly result in rapid cultural change, which is, in turn, strongly associated with substance abuse, depression, anxiety, child abuse, domestic violence, and suicide. Although alcohol is currently prohibited in most North Slope villages due to its role in perpetuating social pathologies and injuries, an increased flow of migrant workers and the establishment of new roads would be likely to increase Native access to both drugs and alcohol (Wernham, 2007). Even economic benefits derived from taxes paid to the local Native corporation (of which all villagers are shareholders) and new industrial employment opportunities could ultimately do more harm than good. In the short term, it has been suggested that increased employment could actually generate stress if subsistence activities are simultaneously marginalized (Martin, 2005). Yet regardless of whether or not this is a valid prediction, it is certainly true that unemployment and economic depression occurring during the project abandonment phase would lead to expressions of social pathology (Travis, 1984). Thus, as Wernham concluded in the text of the NPR-A HIA, the development of large-scale oil and gas industrial projects in an area of such significant local cultural and practical value inevitably imposes a high risk of adverse social effects (2007). While such effects could potentially be mitigated by

economic benefits, it is unlikely that they would be negated; moreover, any protective economic factors would ultimately be lost after the cessation of development activities.

Beyond its cultural repercussions, the decline in subsistence resources and/ or access is also predicted to contribute to increased injury rates, metabolic disorders, and food insecurity. Indeed, longer distances traveled to reach subsistence resources could increase the risk of injury, and, as discussed in detail earlier, greater reliance on store-bought foods could elevate diabetes, hypertension, and obesity prevalence. Furthermore, given that subsistence foods are estimated to account for about 50% of the Inuit population's caloric intake and that the monetary value of each annual subsistence harvest is estimated to be between $31 million and $51 million, replacing these harvests through cash-based purchases would exert a demanding economic toll, which could, in turn, generate food insecurity (Alaska Department of Fish and Game, 2000; Wernham, 2007).

While large-scale oil and gas development projects typically release environmental contaminants into the air, soil, and water, the NPR-A HIA is less clear about the extent of health impacts related to pollution than it is about psychosocial health impacts. However, cited concerns include the emission of hazardous air pollutants (HAPs) and the release of polluted liquid-based effluents as byproducts of industrial production and processing (Wernham, 2007). HAPs such as sulfur and nitrogen oxides, carbon monoxide, and particulate matter are associated with pulmonary disease, exacerbated coronary artery disease, and excess mortality (EPA, 2007; Neher and Koenig, 1994). Polluted liquid-based effluents are associated with carcinogenesis, endocrine disruption, and neurodevelopmental delay (EPA, 2006a; AMAP, 2003). And many of these chemical

pollutants, both air- and liquid-based, bioaccumulate in mammals, such as caribou and whales, that the Inupiat people harvest as subsistence resources. However, as of yet, the oil and gas industry is not required to establish air or water quality monitoring processes. Thus, without sufficient data, the NPR-A HIA predicts that while localized episodic reductions in air quality are likely to occur near oil development facilities, the probability of incremental degradation in air quality near subsistence camps is uncertain. But given the observed disparities in cancer incidence, prevalence, and mortality between Alaska Natives and white Alaskans, the NPR-A HIA suggests that the health risks posed by the release of industrial toxins are particularly relevant (Wernham, 2007).

Finally, with regard to infectious disease, the NPR-A HIA notes that chlamydia, chronic pulmonary disease, and severe pulmonary infections are already highly prevalent on the North Slope (Alaska Department of Public Health, 2002, 2005, 2006). And increased contact between oil workers and previously isolated villages has the potential to augment the incidence of many additional infectious diseases, such as HIV and syphilis (Wernham, 2007).

NPR-A HIA Mitigation Measures

Having completed the assessment phase of the HIA, representatives from the AITC and NSB then drafted a series of health-based mitigation measures intended to serve as regulatory policy for oil and gas industrial development projects in the region. Foremost among these mitigation measures is the requirement that industrial development agencies fund baseline and continuous monitoring of selected health indicators. Recommended among these selected health indicators is a subsistence species count and measurements of identified contaminant levels in subsistence species as well as

in the environment. A Health Advisory Board, funded and organized by the BLM and composed of six professional public health members, would meet twice a year to review the data collected from this monitoring process as well as to review propositions for future HIA activities. After sufficient consideration, the Board would have the option of making management or mitigation recommendations. In the event of a large oil spill, the developer would be required to fund an independent review panel that would be responsible for monitoring related health impacts on the population and subsistence resources (Wernham, 2007).

In addition to the harvest study, which would be conducted as a means of determining subsistence species count, an intake study would be performed as a more sensitive method of measuring the dietary effects of shifting subsistence activity. Measures to support subsistence intake, such as financial support for community hunters, creation of community freezers, and a program to ensure adequate healthy food choices in village stores, would also be implemented (Wernham, 2007).

In order to address the direct impacts of the influx of migratory workers on the indigenous community, developers would also be required to fund the provision of additional police and emergency service personnel and would be responsible for creating a program, in collaboration with the community, to decrease the potential of drug and alcohol trafficking. In response to the increased risk of STIs, respiratory infections, and GI infections accompanying the arrival of migratory workers in previously isolated villages, employee health protocols, testing for communicable diseases, and infectious disease education programs would become mandatory (Wernham, 2007).

Finally, a sustainable development management plan, designed to address the anticipated sociocultural and economic changes generated by any large-scale industrial development project, would be implemented. Past examples of such a plan include sustainable savings and investment programs, economic diversification strategies, cultural stewardship/ preservation, subsistence hunter support programs, and education financing (Wernham, 2007).

In addition to including each of the above mitigation measures in the final EIS, BLM also introduced a measure requiring all developers in the North Slope region to work directly with appropriate health agencies and affected communities to design effective HIAs. Such a provision is an expression of a larger social movement that has borne witness to increased interest in HIAs in Alaska, even among other industries. Indeed, just this past fall, an HIA was included within the supplemental EIS (SEIS) issued for the proposed Aqqaluk Project at Red Dog Mine. In order to evaluate the significance and future implications of this measure, its context must first be elucidated.

Red Dog Mine: History of Development and Environmental Analyses

Mining is one of the fastest growing industries in Alaska, valued at more than $1 billion annually (Alaska DCED, 2009). As of 2006, 33 hard-rock or coal mines were in the operational, exploration, or developmental stage, providing 3,523 workers with full-time jobs (Alaska DGGS, 2006). However, mining operations frequently involve a great amount of environmental disturbance that can extend far beyond the mining area and can continue long after mining activities have ceased. Responsible for altering ecosystems and contaminating air, soil and water resources, mines typically exert adverse impacts on fish and wildlife populations, produce changes in groundwater and river regimes, and

render land unusable in the future. In addition, in Alaska, the economic benefits of mining within local communities and even at the State level may be offset by the risk that these large-scale projects pose to the fishing industry. Valued at $2.3 billion in 2001, Alaska's commercial fishing industry currently employs more than 14,000 people; an additional $657.6 million was collected from sport fisheries in the same year. Thus, the economic benefits derived from fishing activities significantly outweigh those derived from mining activities. Nevertheless, Alaska has borne witness to tremendous growth among industrial-scale mining operations and is faced with even more proposals (Rothe, 2006).

The Red Dog Mine, located in northwestern Alaska on the edge of the Brooks Range between Noatak National Preserve to the east and Cape Krusenstern National Monument to the west, is the world's largest zinc producer. In addition to zinc, the mine also refines a number of other metals, such as lead and cadmium. Operated by Teck Cominco, a Canadian company based in Vancouver, the mine is located on land owned by the Northwestern Alaska Native Association (NANA). In 1982, Teck Cominco reached an agreement with NANA to develop the 160 million ton ore deposit at the mine site, and in 1989, mining operations and production began. A 30-foot wide, 52-mile long all-weather road was built to link the mine to a shallow-water dock and offshore loading facility on the Chukchi Sea. Together, the corridor and port are known as the DeLong Mountain Regional Transportation System (DMTS) (ACAT, 2004) (Figure 1).

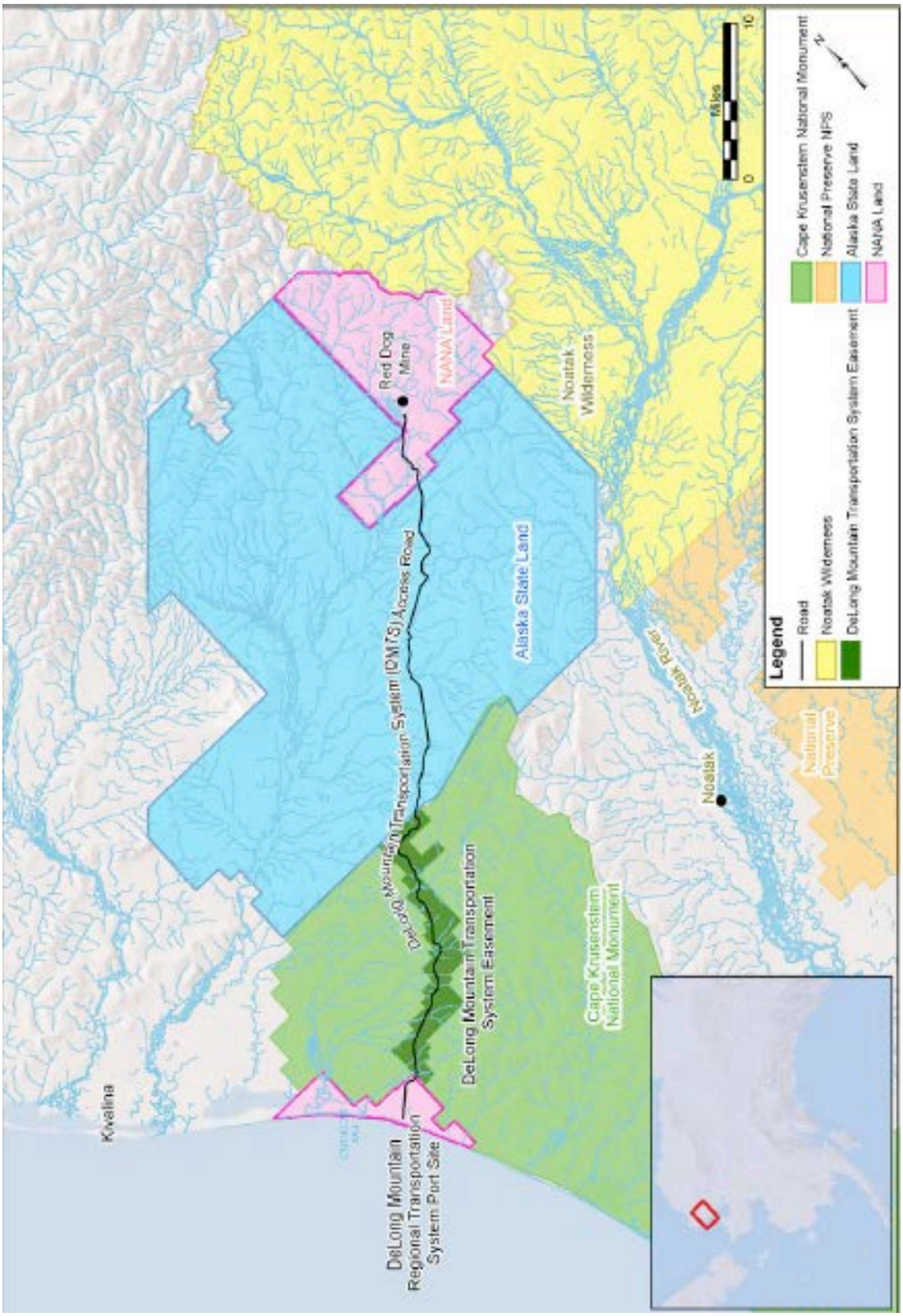

Figure 1 (Tetra Tech, 2009)

Each day, nearly 20,000 tons of ore concentrates and waste are generated, and trucks weighing 100 tons each when loaded leave the mine every 15 minutes (Figure 2). Upon reaching the port, the trucks unload ore either into storage facilities or onto small barges that traffic between the port and large ships anchored about three miles offshore (Figure 3). During this transportation process, ore dust is inadvertently released into the air, topsoil, and water along the road and at the port site. Furthermore, in addition to fugitive dust emissions, the EPA's Toxics Release Inventory (TRI) for the Red Dog Mine reports heavy-metal contamination of air, land, and water from waste rock and tailings solids, water treatment plant sludge, emissions from power generators and incinerators, and discharges from sewage treatment facilities. These releases, which amounted to 432 million pounds in 2001, account for approximately 83% of total toxic substance releases in Alaska each year (ACAT, 2004). In 2004, Red Dog Mine ranked first on the TRI list, having emitted the greatest level of toxic substances of any single source nationally (Rothe, 2006).

Figure 2 (EPA, 2010)

Figure 3 (EPA, 2010)

Due to their proximity to the mine and their reliance on a subsistence-based diet and economy, the residents of three nearby Inupiat villages have repeatedly expressed

concern about the potential human health effects of the mine's chemical releases. These concerns, which are primarily based upon the environmental toxicity of lead and cadmium, are well warranted. Indeed, in 1996, a monitoring survey found soil surface lead concentrations at the port to be greater than 27,000 mg/kg, or 27 times higher than the EPA industrial soil cleanup standard (Hasselbach et al., 2004). Since then, a number of studies have been performed to assess the levels of lead and cadmium deposits both near the port site and along the haul road (ACAT, 2004).

The earliest of these studies, conducted by the National Park Service (NPS) in 2000, sought to quantify the concentrations of heavy metals in *Hylocomium splendans* moss and soil samples along six transects within the transportation corridor. Given that moss does not absorb minerals from the soil and groundwater as rapidly as vascular plants do, NPS researchers were able to distinguish between heavy metal concentrations occurring naturally in the soil and concentrations that were influenced by the release of fugitive dust particles along the haul road. They found that mosses and soil containing the highest levels of lead and cadmium were those located nearest to the road and that these concentrations declined with increasing distance from the road. However, even heavy metal concentrations in samples taken a mile from the haul road were discovered to "exceed medians (and in most cases maxima) from all 28 countries in the Nordic moss monitoring program, including many of the most polluted countries in Central and Eastern Europe, and all areas of Western Russia." While *H. splendans* samples with lead concentrations exceeding 60-80 mg/kg are characteristic of highly polluted areas, lead levels near the haul road were found to be greater than 400 mg/kg. And even at a mile's

distance, lead levels remained relatively high, consistently above 30 mg/kg (Ford and Hasselbach, 2001).

In the following year, at the request of local residents, a study designed to analyze the heavy metal concentrations of three traditional subsistence plants, sourdock, salmonberry, and blackberry, was conducted. Under contract to the Alaska Department of Environmental Conservation (ADEC), the consulting firm, Ecology and Environment (E&E), determined that each of the three subsistence plants, sampled from an area including the traditional subsistence harvest sites of indigenous people, was contaminated by high concentrations of lead and cadmium. Moreover, rinsing the plants did nothing to lower heavy metal exposure (E&E, 2002).

In the same year, the consulting firm, Exponent, under contract to Teck Cominco, conducted a study similar to that performed by the NPS. Like the NPS, Exponent found that both lead and cadmium moss concentrations along the haul road and at the port site were higher than background levels reported in northern Alaska. Also like the NPS, Exponent reported that these concentrations decreased with increasing distance from the road and port. This independently confirmed observation lent further credibility to the conclusion that the source of heavy metal contamination was most likely to be fugitive dust deposited by ore trucks (Exponent, 2002). In response to the unambiguous study results, Teck Cominco replaced its open-top trucks with a new fleet of trucks outfitted with hydraulically sealed cargo covers and side-dumping features (E&E, 2002). Over the course of the next three years, the company spent an estimated $11 million on facilities upgrades to control fugitive dust and $4 million on fugitive dust studies and risk assessment (DEC, 2009).

However, a second NPS study performed in 2004 found that heavy metal levels had, in fact, doubled in the area adjacent to the haul road since the first NPS study had been conducted four years earlier. Indeed, lead concentrations, previously reported to be greater than 400 mg/kg, were now observed to be greater than 900 mg/kg. Similarly, cadmium levels, previously reported to be greater than 12 mg/kg, were now observed to be greater than 24 mg/kg. As in the original study, these levels decreased with increasing distance from the haul road and port site, and an analysis of the subsurface soil suggested that these patterns were not attributable to subsurface lithology. Furthermore, by extending the sample area beyond that of the original study, it was found that heavy metal contamination reached significantly farther than previously believed. While cadmium deposits were detected as far as 12 km to the north and 3 km to the south (the wind blows from south to north) of the haul road, lead deposits were detected as far as 25 km to the north of the haul road, in an area beyond the Wulik River (Hasselbach et al., 2004).

Thus, it is clear that lead and cadmium levels are elevated in the vegetation and soil surrounding the Red Dog mine, haul road, and port and that the mine is responsible. What is less clear, however, is the extent of such contamination on human health. Given that their traditional subsistence hunting and harvesting grounds lie within the same watershed as the mine, the people of Kivalina, a village of 377 about 50 miles southwest of the mine, are concerned that they will inadvertently ingest toxic chemicals that have bioaccumulated in the tissues of subsistence species. Furthermore, the Red Dog Creek, which flows through the mine site, is a tributary of the Wulik River, which supplies the village with its drinking water (ACAT, 2004).

After the release of the original NPS study, the Alaska Department of Health and Human Services' Environmental Public Health Program (EPHP) conducted an investigation to determine if the mine was exposing local residents to heavy metal-related health risks. A comprehensive review of relevant data was performed. In addition to data from the NPS, Ecology and Environment, and Exponent studies, data was also obtained from Teck Cominco's records of employee blood lead levels (BLL). Water samples were collected from the Wulik River and Kivalina's village water tanks, and heavy metal concentrations measured in the tissues of caribou and fish were retrieved from records collected by the Alaska Department of Fish and Game. After a collective analysis of this data, a determination was finally made as to whether pathways existed by which residents could be exposed to heavy metal contaminants released by mining activities. Arguing that heavy metal concentrations in the village drinking water supply, caribou tissue, fish, and berries were each low, that lead produced by the mine had low bioavailability, and that villagers had limited access to the mine, port, and haul road, the agency concluded that no exposure pathways existed from the Red Dog mine to the residents of Kivalina or another nearby Inupiat village, Noatak. While it recommended that water samples from drinking water sources be regularly collected and analyzed, the agency made no recommendation for further blood lead level testing. In fact, the study instead urged Kivalina and Noatak residents to "continue the unrestricted harvest and consumption of subsistence resources in the area" (EPHP, 2001).

However, insufficiencies and inconsistencies in the data and assumptions of this report prompted the Alaska Community Action on Toxics (ACAT) to sponsor an independent analysis of the available data. Conducted by Dr. Fred Youngs, an

occupational and environmental research chemist at the University of Massachusetts, Lowell, the analysis investigated alleged weaknesses of the EPHP's bioavailability assessment and Teck Cominco's village BLL data. As the analysis revealed, bioavailability conclusions were based on results extrapolated from a study performed on rats in Skagway, AK (ACAT, 2004). In this study, lead did not accumulate in the rats' blood, but it did build up in bone and kidney tissue (Dieter, 1993). More concerning, however, is the evidence from other studies that indicates that rats are poor human models in an analysis of lead effects; indeed, in addition to different anatomy and physiology, rats also excrete lead at a higher rate than humans (Weis and LaVelle, 1991). As suggested by Dr. Youngs, young swine, whose digestive tracts are anatomically similar to those of young children, would be a much more appropriate choice of laboratory animal in a study designed to evaluate heavy metal bioavailability among humans. Furthermore, the claim that low village BLLs are evidence of low lead bioavailability is seriously flawed, for the only comprehensive BLL data that exists was collected in 1990, less than a year after mining production began. Given the expansion in mining operations that occurred in 1998 and again in 2001, the independent analysis recommended that more recent BLL testing be conducted among large samples of both Kivalina and Noatak residents. It is hoped that this BLL testing would be accompanied by a new study designed to assess the bioavailability of Red Dog lead, rather than Skagway lead, in young swine, rather than rats (ACAT, 2004).

Until results from updated studies are reported, however, the independent analysis recommended that the state advise villagers to limit their harvest of subsistence foods along the haul road and near the port site. Furthermore, in addition to monitoring heavy

metal concentrations in drinking water, the state should be responsible for monitoring heavy metal concentrations in plants and tissues of subsistence fish and mammals. Finally, the state and Teck Cominco should engage independent scientists, academics, and local experts to perform an environmental and health assessment of Red Dog mining activities; such an assessment would also include a mechanism by which public input could be integrated into mining operation decisions, or, at the very least, in the design and review of monitoring programs, the issuing of mining permits, and the evaluation of proposed mining expansions (ACAT, 2004).

Today, environmental assessments of this nature are routinely conducted at Red Dog. In November 2007, the consulting firm, Exponent, under contract to Teck Cominco, released the "DMTS Fugitive Dust Risk Assessment" for public review and comment. This assessment was then submitted to the Alaska Department of Environmental Conservation (DEC) for approval, and in August 2008, a draft of the "DMTS Fugitive Dust Risk Management Plan" was reviewed during a public comment period (DEC, 2009). However, like company-commissioned studies of the past, neither of these reports acknowledged that health risks, particularly those associated with subsistence harvesting, are beyond acceptable public health limits. Relying on flawed data and a narrow definition of health determinants, these reports failed to address the concerns expressed by local people.

As a result, local people began to explore other possible forums in which to voice their concerns. In 2004, a number of Kivalina residents, frustrated by the apparent lack of response elicited by their health questions, decided to file a lawsuit against Teck Cominco. Arguing that the company had violated 2,400 permits issued under the Clean

Air Act, the villagers hoped that the legal system would provide them with an effective channel by which to articulate their position and demand concessions. Yet while the case was ultimately settled four years later, conflicting evidence continues to prevent a definitive judgment from being made about the human health risks perpetuated by Red Dog mining activity (Bluemink, 2008). Within the past year, however, an HIA performed in association with the SEIS conducted by the EPA in response to Teck's proposal for mining activity expansion has offered a much more comprehensive evaluation of human health risks associated with continued mining activity.

Red Dog Mine Extension: Aqqaluk Project

Given that the Red Dog main deposit is expected to be mined out between 2011 and 2012, Teck has proposed extending mining activities to the adjacent Aqqaluk Deposit in order to ensure continued operations until 2031 (Figure 4). In order to begin mining at this new site, Teck must apply for re-issuance of its Clean Water Act Section 401 National Pollutant Discharge Elimination System (NPDES) permit and for a new Clean Water Act Section 404 Wetlands Dredge and Fill Permit. The NPDES permit, which was granted by the EPA, authorizes discharge of treated wastewater from the tailings impoundment to Red Dog Creek, and the Wetlands Dredge and Fill Permit, which is granted by the U.S. Army Corps of Engineers (the Corps), would authorize Aqqaluk Project fill placement to a designated location.

As was true when Teck filed for its original NPDES, the EPA requires that an EIS be performed in conjunction with the Aqqaluk Project NPDES. This secondary EIS, released in October 2009, supplements the 1984 EIS completed by the EPA and the U.S. Department of the Interior. Serving as the lead agency, the EPA enlisted the help of the

Corps, the National Park Service, the Alaska Department of Natural Resources (ADNR), and Maniilaq Association, a non-profit tribal consortium representing the governments of the nine locally affected communities, as cooperating agencies. While the first EIS was restricted to a discussion of environmental contaminants, the supplemental EIS (SEIS) includes a health section (Tetra Tech, 2009).

Taxed with determining the effects of Red Dog Mine operations on both the public health of local residents and the industrial health of employees and contractors, this health section addresses each category independently. However, it is the public health evaluation that represents the embedded HIA. This evaluation describes baseline health conditions, provides an assessment of possible environmental health effects of each alternative action, and suggests potential mitigation measures designed to enhance positive and reduce negative health effects. The analysis of health effects was based upon public testimony collected during SEIS scoping hearings, published peer-reviewed public health data, information derived from public health databases and monitoring programs, a subsistence and cultural study performed by the Alaska Department of Fish and Game (ADF&G) and Tetra Tech for the SEIS, interviews with stakeholders, professional opinion, and environmental contaminant data collected by Teck as part of its Fugitive Dust Risk Assessment (Tetra Tech, 2009).

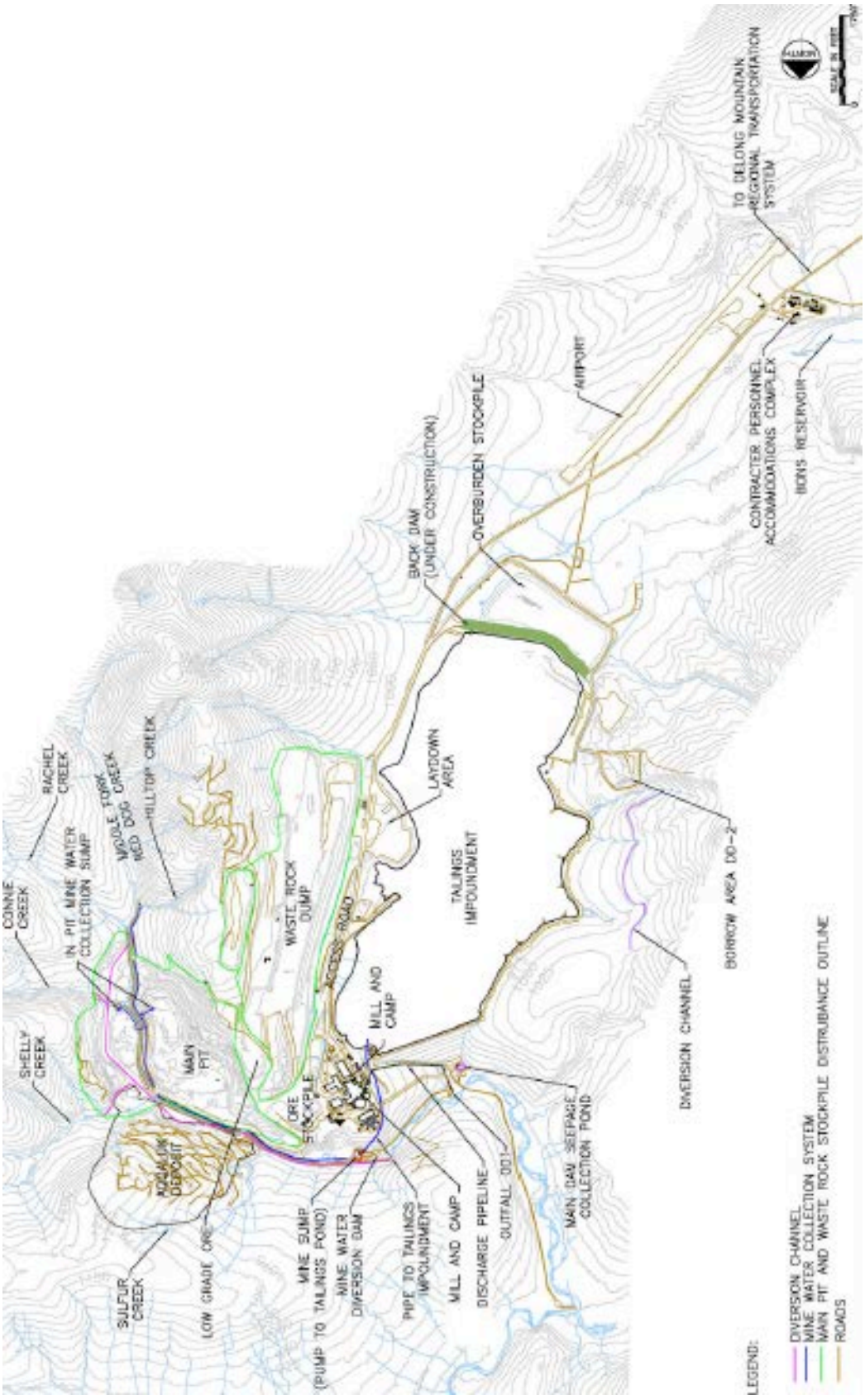

Figure 4 (Tetra Tech, 2009)

The HIA team, directed by Aaron Wernham of AITC, included representatives of the Maniilaq Association, the Alaska Native Tribal Health Consortium (ANTHC), the federal Center for Disease Control and Prevention (CDC), CDC's National Center for Environmental Health (NCEH), the Alaska Department of Health and Social Services (ADHSS), and the Alaska Toxic Substances and Disease Registry (ATSDR). This group determined the scope of health effects analyzed by evaluating 1) prevalent illnesses, health disparities, and vulnerabilities in the Northwest Arctic Borough (NWAB) population; 2) project impacts (socioeconomic, community infrastructure and services, subsistence, air quality, water quality) on resources that may impact health; 3) public testimony; and 4) accepted mechanisms of disease transmission. The health effects categories generated from this process, which were constructed to be relevant to the NEPA process and which are certainly not mutually exclusive, include 1) general health; 2) subsistence, nutrition, and diet-related diseases; 3) social and psychological health; 4) injury; 5) cancer; 6) pulmonary disease; and 7) environmental contaminants. Employing a logic framework, potential pathways between mine-related impacts and health outcomes included within these categories were then delineated. These pathways were studied to a greater extent through the synthesis of available public health data, literature from analogous populations, and accepted mechanisms of disease transmission. Methodological limitations acknowledged in the final SEIS included:

- the lack of prevalence data at the village and regional level
- the lack of studies directly investigating potential health effects related to mining activity

- the difficulty of determining the relative contribution of mining versus non-mining impacts to a given health problem
- the inability to perform statistically significant data analyses given small population sizes of villages within the affected area
- restriction of health effects to those cognizable by NEPA (TetraTech, 2009)

Nevertheless, despite these limitations, the HIA team was able to develop an understanding of public health conditions in the pre-mining environment, to evaluate current baseline health status, to attempt to elucidate the health effects of existing operations, and to compare anticipated effects under each alternative. These assessments, subdivided by health effect category, are described below.

General Health

Since 1989, Alaska Native life expectancy has improved significantly and has been correlated with a decline in injury rates. However, the HIA acknowledges that the decline in overall mortality rates should not be construed as an indicator of universal health improvement. Indeed, as mortality rates from injury and infectious disease have decreased, new health problems have emerged in the form of dramatic increases in cancer incidence, COPD, and diabetes. Cultural changes are identified as influencing both psychosocial health and health behaviors, such as diet composition, exercise, and smoking. Socioeconomic factors are recognized for their contribution to the physical, mental, and social health of individuals and communities. Specifically, greater income is associated with health outcome improvements, but increased dependence on the cash economy may be a source of social strain within subsistence-based Alaska Native communities. Rapid economic growth within indigenous communities is associated with

alcohol and drug abuse, tobacco use, less reliance on subsistence diets, increased reliance on store-bought diets, and physical inactivity. These latter two behavior changes contribute, in turn, to an increased risk for chronic illnesses, such as diabetes, high blood pressure, obesity, and heart disease. Thus, the HIA concludes that "the broad economic benefits received by NANA and the NWAB have not necessarily translated into improvements in the public health infrastructure at the local level" (Tetra Tech, 2009, p. 241).

Subsistence, Nutrition, and Diet-Related Diseases

Acknowledging the fundamental role of subsistence practices in local Alaska Native culture, social structure, and economy, the HIA accepts that subsistence provides a wide range of protective health benefits. In particular, subsistence diets are associated with lower cumulative risks of nutritionally mediated health problems, and subsistence activities serve as a source of social cohesion and psychological wellbeing. However, among a variety of arctic subsistence communities, increased employment and higher incomes have been found to enable and promote market food purchases at the expense of subsistence resources. According to the HIA, the same effect is already evident at Red Dog. Indeed, the total per capita harvest of subsistence resources is declining in each of the three study areas (Noatak, Kotzebue, and Kivalina). In particular, mining activities have contributed to decreased caribou and beluga harvests in Kivalina. Yet in order to definitively evaluate the effect of reduced harvests on diet and, thus, of mining operations on local community nutrition, the HIA recommends that a dietary survey be conducted in Kivalina for the purpose of quantifying the contribution of subsistence resource harvest to dietary intake (Tetra Tech, 2009).

Social and Psychological Health

The HIA clearly states that high rates of anxiety, depression, suicide, drug and alcohol abuse, and domestic violence predate mining activities in the NWAB. However, these health issues are assessed within the HIA because their link to socioeconomic and demographic changes is well-recognized among other arctic populations. A discussion of both the adverse and beneficial means by which the mine may influence these psychosocial determinants of health is included within the HIA. Specifically, the increased availability of discretionary income may result in greater tobacco, alcohol, and illicit drug purchases. The increased income of a fraction of the local population may exacerbate economic disparity within the villages, which may alter the sharing network values that are integral to the subsistence socio-cultural system. Long work shifts away from home (Red Dog operates on a two weeks on/ two weeks off schedule) may produce marital discord and family dysfunction (Tetra Tech, 2009).

Injury

Since injury rates correlate strongly with social and psychological problems, the HIA finds that the potential effects of mining activity on social and psychological health could exert indirect positive or negative effects on regional injury patterns. In particular, alcohol abuse contributes to elevated rates of unintentional injury. In terms of intentional injury, the Maniilaq Service Area was found to have the highest suicide attempt rate of all Alaskan service areas from 2000-2005; during the same period, the NWAB claimed the second highest suicide death rate of any borough statewide. The HIA concludes that available evidence supports economic depression as the source of such troubling suicide

statistics (Tetra Tech, 2009). Thus, the dramatic decline in economic stability that would accompany Red Dog Mine closure threatens to even further exacerbate suicide behavior within local villages.

Cancer

Addressed largely in response to public concern, the potential link between regional cancer rates and contaminants released by the mine was evaluated through review of baseline cancer rates in the NWAB and their change over time in comparison to those of other regions within the State. Although it alleges the difficulty of controlling for the confounding factors of tobacco use and diet, the HIA concludes that no evidence exists to link local cancer rates to Red Dog mining activities. Moreover, the cancer trends within the NWAB do not differ significantly from those within other regions of the State, and no unusual environmentally related cancer cases have been reported among Red Dog Mine employees (Tetra Tech, 2009).

Pulmonary Disease

While the HIA states that tobacco smoking is a major risk factor for pulmonary disease and that 77% of Maniilaq residents smoke, the focus of the evaluation is on whether mine-related effects contribute to the pulmonary disease burden. Thus, the HIA investigates the contributions of vehicle emissions, diesel and heating oil combustion, and dust derived from dirt roads to air pollution. Referencing recent air quality analyses, it concludes that air quality at and near the mine are well within regulatory guidelines (Tetra Tech, 2009).

Environmental Contaminants

Establishing the primary sources of Red Dog environmental contamination as wastewater discharges and fugitive and point source air emissions, the HIA relies on the cadmium and lead biomonitoring studies performed among Kivalina and Noatak residents as well as the human health component of the DMTS risk assessment to conclude that the cadmium risk is still uncertain but that lead does not pose an unacceptable risk to either adults or children within local communities (Tetra Tech, 2009).

Aqqaluk Project Alternative Actions

As required by NEPA, the SEIS performed for the Aqqaluk Project describes and evaluates a number of alternative actions in addition to Teck's development proposal. The first alternative, referred to as Alternative A, simply represents no action. That is, under Alternative A, the EPA will not re-issue its NPDES permit, and the Army Corps of Engineers will not issue Section 404 wetland permits. Mining will continue in the main pit until the projected closure date in 2011 or 2012. The wastewater treatment system will be modified, but wastewater will continue to be discharged into Red Dog Creek. Under Alternative B, which represents Teck's proposed action, the NPDES and wetland permits will be re-issued, extending the projected closure date to 2031 and continuing to allow wastewater discharge into Red Dog Creek. Alternative C, like Alternative B, proposes that mining activity be extended to 2031; however, Alternative C differs from Alternative B in that it proposes that zinc and lead concentrate be transported from the on-site mill to the port through a 52-mile slurry pipeline rather than by haul trucks. A second pipeline would transport wastewater from the tailings impoundment water

treatment facility to the port. The concentrate and tailings wastewater would be combined and filtered at the port site and then released into the Chukchi Sea. A third pipeline would carry diesel fuel from the port to the mine. All three pipelines would be buried in a berm adjacent to the DMTS road. Alternative D, designed to enhance dust control and to address subsistence concerns, combines some components of Alternatives B and C with novel suggestions. Like Alternative C, Alternative D requires that wastewater from the tailings impoundment be discharged to the Chukchi Sea rather than to Red Dog Creek. But unlike Alternative C, Alternative D still relies on haul trucks to carry concentrate from the mine to the port. However, Alternative D stipulates that year-round truck washes would be added at each end of the road to reduce fugitive dust release, that the DMTS road would be closed during the autumn caribou migration, and that the port would only be opened in the summer following the June beluga whale migration (Tetra Tech, 2009).

Health Effects Predicted Under Each Alternative Action

Although each alternative is associated with its own unique set of health implications, certain effects can be identified as common to some or all of the alternatives. Thus, the following analysis does not present the health effects of each alternative separately but, instead, groups anticipated effects within the context of the health effect categories generated during the scoping stage. Summaries of the positive and negative impacts predicted under each alternative are included in Tables 1-4.

General Health

Mine closure, whether in 2011 or in 2031, will inevitably result in the abrupt loss of personal and community income and is, thus, likely to be associated with substantial adverse health effects among residents of the NWAB. Indeed, given that Red Dog employment represents approximately 30 percent of non-government jobs in the NANA region, that 290 of 510 jobs at Red Dog are held by NANA shareholders, and that Red Dog is the only taxpayer in the NWAB, paying an average of $6 million in property taxes annually, cessation of mining operations would be accompanied by a significant loss of individual and community economic stability (Rothe, 2006). The loss of revenue could reduce the ability of village and regional authorities to provide essential services, such as school systems and public safety, and to maintain and renovate critical infrastructure, such as water and sewer systems. Job loss and economic depression are also strongly associated with greater mortality from heart disease, increased social problems, and higher injury rates. While these issues cannot be avoided indefinitely, delayed mine closure, as proposed under Alternatives B, C, and D, would provide the NWAB, NANA, and individuals with an opportunity to make long-term plans to lessen the severity of economic decline following discontinuation of mining activities. It would offer them time to develop and institute measures designed to diversify and stabilize the regional economic base (Tetra Tech, 2009).

Subsistence, Nutrition, and Diet-Related Health Problems

As demonstrated during baseline studies, mining activities have already contributed to reduced caribou and beluga harvests and have raised community concerns about the effects of dust contamination on other subsistence resources. As acknowledged

by the HIA, continued mining operations could lead to further caribou displacement given that their migration route crosses the DMTS road. Further displacement could reduce harvests even more, which could contribute to a greater reliance on nutritionally-poor store-bought goods and a greater incidence of related metabolic disorders. Again, the HIA urges that a dietary survey be conducted to elucidate the relationship between subsistence resource harvest changes and diet. At the very least, even if harvests do not decline, it is expected that residents' subsistence concerns will continue and possibly worsen throughout the duration of mining operations (Tetra Tech, 2009).

Immediate mine closure, as outlined under Alternative A, would drastically reduce DMTS traffic, which could contribute to improved caribou harvests and a corresponding improvement in nutrition. However, mine closure would result in individual loss of income from employment, NANA dividends, and subsidies, which would decrease the disposable income available to support household expenses, including subsistence activities. As discussed previously, immediate mine closure would provide substantially less time to design measures intended to ameliorate economic decline. However, Alternatives C and D offer means of reducing traffic on the DMTS road while also preserving the economic benefits derived from the mine. By closing the port, Alternative D would also allow for greater beluga harvests (Tetra Tech, 2009).

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Social and Psychological Health

The risk of social and psychological problems is likely to increase with the abrupt loss of income and decline in infrastructure that would inevitably accompany mine closure. Under Alternative A, the social strain fostered by long absences from home would be reduced in duration, but increased counseling services would likely to be

required in order to combat the adverse psychological effects of unemployment in the absence of other economic opportunities. The enhanced availability of subsistence resources likely under Alternatives A, C, or D could positively impact social and psychological health within affected communities; however, under Alternatives C and D, this effect would not be muted by job loss concerns (Tetra Tech, 2009).

Injury

Given that injury rates in the NWAB parallel social and psychological health, the HIA predicts that injury rates will increase following mine closure. However, continuation of mining operations until 2031, as proposed under Alternatives B, C, and D, would allow greater planning time to develop measures designed to mitigate the social and psychological trauma accompanying unemployment. The social and psychological benefits associated with greater subsistence harvests suggest that Alternatives C and D also have the potential to decrease current injury rates (Tetra Tech, 2009).

Environmental Contaminants and Health

Based on the DMTS Fugitive Dust human health risk assessment, the HIA concludes that exposure to carcinogens derived from Red Dog mining activity appears to be low and, therefore, that there is no evidence to suggest that any of the Aqqaluk Project alternatives would affect cancer rates within the NWAB. Furthermore, given that air quality at the mine site currently meets or exceeds Clean Air Act standards, continued mining activity is unlikely to contribute to deteriorating air quality within local villages. However, while the HIA alleges that potential exposure to carcinogens and environmental contaminants is unlikely to produce effects under any proposed

alternative, it also acknowledges that the duration of time during which local residents would be exposed to fugitive dust released by haul trucks traveling along the DMTS road would be significantly truncated under Alternative A. Under Alternative C, elimination of concentrate-carrying trucks would concomitantly eliminate the major source of fugitive dust release, and the truck washes stipulated by Alternative D would reduce the contributions of lead and zinc concentrates to total fugitive dust release. While the HIA claims that changes in physical health risks would be limited regardless of alternative action selected, community concerns about airborne pollution and its impact on the safe consumption of subsistence resources would certainly be allayed to a greater extent under Alternatives A, C, and D. Similarly, drinking water and subsistence fishing safety concerns related to wastewater discharge into Red Dog Creek could be ameliorated if Alternative A, C, or D was enacted. However, under Alternatives C and D, these concerns about waterborne contamination in Red Dog Creek could simply be transformed into concerns about waterborne contamination in the Chukchi Sea (Tetra Tech 2009).

Table 1: Summary of the Potential Public Health Effects of Alternative A (Tetra Tech, 2009)

HEALTH FOCUS	PUBLIC HEALTH EFFECTS
Subsistence and Nutrition	(+) decreased traffic on haul road (+) decreased fugitive dust emissions (+) improved subsistence hunting locally (-) loss of income leading to: a) difficulty purchasing subsistence fuel and equipment b) purchase of low-quality, inexpensive foods in village stores
Social and Psychological Health	(+) less impact to subsistence resources from traffic on haul road (-) sudden loss of income leading to poverty, stress, social dysfunction (-) loss of income leading to: a) difficulty purchasing subsistence fuel and equipment b) purchase of low-quality, inexpensive foods in village stores (-) social unrest related to financial stress/unemployment (-) deteriorating infrastructure
Environmental Contaminants and Health	no effect anticipated on cancer rates, respiratory illness, or cardiovascular disease (+) lower emissions of fugitive dust, TDS, and metals from mine

Table 2: Summary of the Potential Public Health Effects of Alternative B (Tetra Tech, 2009)

HEALTH FOCUS	PUBLIC HEALTH EFFECTS
Subsistence and Nutrition	(+) continued income from mining supporting purchase of subsistence fuel and equipment (-) continued traffic on haul road which may disrupt caribou (-) continued fugitive dust emissions
Social and Psychological Health	(+) continued employment and income, stabilizing socioeconomics across region (-) mine workers absent from families, creating potential stressors for family functioning; continued impacts on subsistence resources (+) stabilization of current socioeconomic conditions through mine closure (+) continued funding for NWAB, supporting infrastructure development (-) continued subsistence impacts leading to more challenging hunting conditions
Environmental Contaminants and Health	cancer - no effects predicted (-) continued emissions of fugitive dust from mine

Table 3: Summary of the Potential Public Health Effects of Alternative C (Tetra Tech, 2009)

HEALTH FOCUS	PUBLIC HEALTH EFFECTS
Subsistence and Nutrition	(+) continued income from mining supporting the purchase of subsistence fuel and equipment (+) decreased traffic on haul road, reducing impact on caribou harvest (+) decreased fugitive dust emissions, resulting in less impact on subsistence resources in the vicinity of the mine over time
Social and Psychological Health	(+) continued employment and income, stabilizing socioeconomics across region (+) improved access to subsistence resources (less than Alternative D) (-) mine workers absent from families, creating potential stressors for family functioning (+) stabilization of current socioeconomic conditions (+) continued funding for NWAB
Environmental Contaminants and Health	cancer - no effects predicted (+) reduced emissions of fugitive dust from mine

Table 4: Summary of the Potential Public Health Effects of Alternative D (Tetra Tech, 2009)

HEALTH FOCUS	PUBLIC HEALTH EFFECTS
Subsistence and Nutrition	(+) continued income from mining supporting purchase of subsistence fuel and equipment (+) reduced traffic on haul road during caribou migration (+) reduced effects on beluga whale migration (-) continued fugitive dust emissions affecting community subsistence practices (less effect than Alternative B)
Social and Psychological Health	(+) continued employment and income, stabilizing socioeconomics across region (-) mine workers absent from families, creating potential stressors for family functioning (+) improved access to subsistence resources (+) stabilization of current socioeconomic conditions (+) continued funding for infrastructure
Environmental Contaminants and Health	cancer - no effects predicted (-) continued emissions of fugitive dust (less than Alternative B)

Precedents and Recommendations Offered by the Red Dog Aqqaluk Project HIA

Since beginning operations more than twenty years ago, Red Dog Mine has been criticized for its environmental abuses and their associated human health risks. Only

within the past year, however, and only in conjunction with a proposal for mining activity expansion has Teck authorized a study designed to assess the health effects of current and future mining operations on local residents. This study, adhering to HIA methodology and included within the Aqqaluk Project SEIS, represents the first instance in which the Alaskan mining industry has performed an HIA for a proposed project or project extension. As such, it sets a number of important precedents.

First and foremost is its recognition that large-scale mining operations confer both positive and negative impacts on local communities. A combination of factors, collectively termed modernizing trends and consisting of technical improvements, transportation and communication advances, and acculturation as well as mining activities, are responsible for transforming the economies and societies of traditionally subsistence-based rural Alaska Native villages. The Aqqaluk Project HIA is significant in that it includes a detailed analysis of psychosocial determinants of health and the means by which economic development projects, specifically large-scale mines, influence these determinants. Particular salience is granted to the relationship between cultural change and health, mediated through dietary shifts and increased substance abuse, which are each, in turn, facilitated by disposable income. Yet the HIA also acknowledges that the strength of its analysis is limited by the lack of relevant available data. Perhaps of greatest value would be a dietary survey that could be compared to current subsistence harvest surveys. Quantification of subsistence resource dietary contributions would allow extrapolation into the future and would provide an evidence-based foundation upon which to develop support measures designed to diminish the adverse nutritional effects associated with reduced harvests.

However, such a support measure would require that the company engage in mitigation in addition to monitoring activities. In fact, the HIA sets forth a comprehensive mitigation strategy in the form of a Stakeholder Participatory Monitoring and Review Committee established to coordinate and collaborate ongoing health initiatives within the NWAB, including those related to mining. The voluntary Committee, which would consist of a collaborative multi-stakeholder group representing ADHSS, Maniilaq Association, NANA, NWAB, and Teck, would perform oversight and advisory monitoring functions, would plan for anticipated changes such as mine closure, and would address new health issues and questions related to mining that may arise during future permitting, operations, and management decisions. The Committee would also be responsible for ensuring adequate consultation among public health agencies and stakeholders on any issues related to regional health (Tetra Tech, 2009). Currently, however, any mitigation measures enacted by corporate proponents are strictly voluntary; they are not mandated by federal or State permitting agencies. Thus, the mitigation recommendations contained within the Aqqaluk Project HIA need not be acted upon. Nevertheless, their very inclusion sets an important precedent and certainly creates an expectation of action.

Chapter 2:

Collaborative HIA Guidance for Natural Resource Development Projects in Alaska

Over the past three years, the HIA process has developed significantly in Alaska. While the NPR-A HIA represents the first comprehensive HIA performed in the context of large-scale natural resource development projects undertaken within the State, the Red Dog Mine Aqqaluk Extension HIA represents the first HIA performed with involvement of the State health and regulatory agencies that will provide significant HIA leadership and expertise in the future. Although only available in final form this past fall, the Red Dog Aqqaluk Extension HIA is the product of negotiations that began in September 2007 when Maniilaq Association contacted ADHSS requesting HIA assistance and ADNR asked to participate in the Red Dog HIA process. Given that HIA was so novel within the United States at the time, the State of Alaska could not refer to an existing protocol to guide its analysis. Aware of the values of methodological consistency, it recognized the benefits of a standardized HIA approach. Such an approach would improve understanding and consideration of potential health impacts of industrial development projects, would establish coherent guidelines and expectations of corporate action, would aid in the formation of effective mitigation strategies, and would generate a credible means of incorporating community stakeholder input into the HIA process. When overseen by objective State agencies, a standardized approach would ensure that predicted project impacts were, in fact, supported by scientifically-defensible causal relationships, that demonstrably effective and reasonable mitigation strategies were developed, and that HIA would be prevented from being manipulated as a tool to block project proposals (ADHSS, 2008).

In order to develop a general HIA guidance protocol, the State formed an interagency HIA working group among representatives of DHSS, DNR, the Department of Environmental Conservation (DEC), the Department of Commerce, Community, and Economic Development (DCCED), and the Department of Law. Tasked with determining when a project requires an HIA and which agencies are responsible for contributing to HIAs, the working group acknowledged that State agencies with authority over resource development are under no legal requirement to perform HIAs; nevertheless, it reached the consensus that all responsible resource development requires some level of HIA and that DHSS has the best expertise, experience, and information access to coordinate the State's HIA involvement. An HIA program would be placed within the DHSS Environmental Public Health Program (EPHP) within the Section of Epidemiology, Division of Public Health because EPHP possesses the toxicological, medical, and environmental public health expertise to evaluate the long-term implications of chemical contamination and the epidemiological trends of a wide range of health indicators and outcomes (ADHSS, 2008).

In September 2008, the State partnered with ANTHC and the CDC to host an HIA workshop attended by State regulatory and health agency staff, ANTHC staff, University of Alaska health researchers, and federal health and regulatory agency staff involved in natural resource development projects in Alaska. Attendees were invited to participate in an interagency HIA working group that is currently in the process of developing a set of general best practice HIA guidelines pertaining to permitting of natural resource extraction projects conducted within the State. Relying on published guidance concerning HIAs in other settings, environmental justice stipulations set forth under

NEPA, the comments and suggestions of working group participants, and, more recently, the contracted expertise of world-renowned HIA expert, Dr. Gary Krieger, the group has sought to develop a coherent methodology, to define appropriate and reasonable health effect evaluative boundaries, and to clarify funding and resource allocation responsibilities. Over the past year and a half, working group discussions have progressed significantly, a variety of technical issues have been addressed and solved, and numerous revisions have been conducted in the process of generating a final guidance document ultimately intended for public dispersal.

Fall 2008: First Considerations in Developing a Collaborative HIA Protocol

Perhaps the most fundamental issue that needed to be addressed during initial HIA working group meetings was that of collaboration itself. What kind of collaboration did the group hope to achieve? Informal collaboration would allow participating agencies to share data and responsibilities but would not establish a Memorandum of Understanding (MOU). The advantages of simplicity and flexibility would be counterbalanced by the disadvantages associated with the absence of a formal mechanism by which to share work and a binding structure by which to allocate responsibility. In contrast, an MOU would specify responsibilities, outline mutually accepted methods, and identify mechanisms by which data would be shared and reported. Alternatively, a separate entity could be created through which participating agencies could undertake HIA collaboratively. While such an autonomous structure would lack flexibility and would certainly be relatively cumbersome to construct and administer, it would effectively protect participating agencies from any potential political liabilities or litigation incurred in relation to the HIA process (Alaska HIA Working Group, 2008).

These questions of collaboration would not be answered in early meetings and, indeed, would later be transformed into a question of ownership that is only now being resolved.

The second set of issues raised within the first working group meetings simply involved determination of the objectives of a collaborative arrangement. Data sharing among agencies was readily identified as one essential objective, and a collaborative arrangement provided a mechanism by which sharing could be facilitated during the HIA process. Collaboration also promised to avoid costly overlapping and conflicting HIA efforts among different agencies and to prevent survey fatigue and confusion among affected communities. By defining the roles and responsibilities of participants, a collaborative arrangement would distribute the burdens of performing an HIA, including staff time, travel costs, and data collection expenses. Finally, a collaborative forum would allow agencies to address a set of essential questions related to establishment of statewide HIA guidance. These questions demanded that funding sources be identified, that mechanisms be developed to resolve interagency disagreements, and that coordination with subcontractors hired by lead agencies be arranged. Beyond logistical considerations, how would HIA conducted in conjunction with State permitting processes independent of NEPA be defined, and would a collaborative agreement still preserve each agency's right to individual action (Alaska HIA Working Group, 2008)?

Collaborative HIA Guidance Document Draft, December 2008

Having discussed the purpose of the collaborative structure and having examined the implications of such an arrangement on interagency relationships and responsibilities, the working group then turned its attention to its primary task, the creation of a general HIA guidance document applicable within the context of Alaskan natural resource

development. The first draft, limited to a section on public participation and stakeholder engagement and a section on the scoping process, was the product of contributions from BLM, EPA, ADHSS, ADNR, and ANTHC.

The public participation and stakeholder engagement section asserts that the HIA needs to be conducted in a publicly transparent manner with ample opportunity for public comment during the scoping process and in response to draft documents. Transparency is a means of engendering community trust, and agencies benefit from community feedback. In Alaska, local traditional knowledge (LTK) is a particularly valuable resource when attempting to predict the impacts of a large-scale industrial development project on rural environments and their human inhabitants. The draft HIA Guidance provides a discussion of stakeholder determination and suggests that stakeholder outreach take the form of education related to the HIA process, dialogue regarding health concerns, and the planning and execution of appropriate baseline health studies. When an HIA is conducted in conjunction with an EIS, the Guidance asserts that the NEPA public notice and meeting system offers the best means of addressing HIA stakeholder outreach objectives. If an HIA is performed independently of an EIS, then the Guidance provides criteria intended to ensure appropriate stakeholder outreach (Alaska HIA Working Group, 2008).

Specific to Alaska, the Guidance acknowledges that the geographic isolation of rural Alaskan communities, language barriers, timing of subsistence activities, and the number and diversity of small communities potentially affected by a single project represent unique challenges to the process of stakeholder outreach. Thus, in addition to posting notices in public venues and local periodicals and notifying the municipal

governments of affected communities, the Guidance urges lead agencies to also notify tribal governments, ANCSA regional and village corporations, and EPA Indian Environmental General Assistance Program (IGAP) representatives. While scoping meetings should be held in each affected community, the Guidance recognizes that travel to and from many small villages within a large geographic area could create significant permitting delays or could be very expensive. As a result, the Guidance sanctions a reduced number of centralized meetings to be held within the affected region; at the same time, however, it also states that intensive outreach should be considered for communities that do not host public meetings so that residents have the opportunity to comment by telephone, e-mail, or by "proxy" through community representatives who attend centralized meetings. The timing of all public meetings and comment periods must be carefully selected in order to avoid scheduling conflicts with major subsistence hunting, fishing, or harvesting periods (Alaska HIA Working Group, 2008).

The scoping section of the draft HIA Guidance provides a discussion of the process by which the agencies necessary to complete an HIA can be identified. It recognizes that local, regional, tribal, and State health agencies, which maintain specific disease surveillance and health record systems, are often the best and only sources of baseline health data required by an HIA. It then acknowledges that the level of HIA analysis needs to be commensurate with the magnitude of the anticipated project impacts and focused on public health effects that can be casually linked to the project proposal and its alternatives. According to the document, the first step in scoping is determination of whether potential public health concerns exist that merit analysis. Does the project proposal involve the potential release of harmful contaminants, or does it involve

physical changes in the environment that have the potential to directly impact public health? Does the project proposal involve social changes that have the potential to indirectly impact public health? If either of these questions is answered in the affirmative, then the draft HIA Guidance posits that an HIA is required. The next step then becomes determining an appropriate level of analysis (Alaska HIA Working Group, 2008).

If the public health impact is considered negligible or minor, then the Guidance suggests that a brief discussion and analysis incorporated into an EIS as a public health section or as a subpart of another environmental section would be sufficient. If the project has the potential to generate complex and/or extensive public health impacts, then the Guidance suggests that a detailed discussion of current public health status and the potential impacts on public health of the proposed action and its alternatives should form a stand-alone HIA or should be incorporated into other comprehensive public health and/or environmental sections of the EIS. In order to aid agencies in their attempts to determine an appropriate level of analysis, the Guidance provides a list of questions intended for use in identifying the intensity and magnitude of potential public health effects of a given project. Ultimately, however, it acknowledges that the extent of examination of public health effects of a given project is a subjective decision; the lead agency must simply be able to justify its approach as scientifically reasonable and as responsive to public concerns (Alaska HIA Working Group, 2008).

Ongoing Discussion, Spring 2009

Following the partial draft issued in December, the working group meetings held during the subsequent winter and spring months focused largely on specific technical

issues. Some of the questions posed for discussion in April and addressed in May 2009 are considered:

- When is an indirect effect too indirect? In approaching this question, the working group established that their answer, grounded within the context of public health, would differ from an answer grounded within the context of environmental science. Nevertheless, they insisted that any valid health effect needs to be linked to a project by a definitive causation analysis clearly articulated within the HIA. In the words of Ed Fogels of the State DNR, "The focus of HIA is on community health that can be reasonably linked directly, indirectly, or in a cumulative fashion to the project." However, a direct effect is not necessarily a significant effect. That is, an effect could be relatively well-defined but not significant because of low likelihood or low frequency of occurrence. The converse is also true and is illustrated by the persistent debate concerning the mediating role of personal choice in the shift from a subsistence- to a market-based diet and in the increased rates of alcohol abuse that follow road construction into a previously isolated area. While the operation of a large-scale industrial project is likely to facilitate the emergence of each of these behavioral patterns and the severity of each effect is great, personal choice is consistently cited as a confounding factor in any causal analysis. After much discourse, the working group determined that HIA can measure the plausibility of an effect influenced by personal choice, but it did not resolve the extent to which a corporate proponent is responsible for mitigating such an effect. Ultimately, the group concluded that a standard protocol could not be enacted to delineate when an indirect effect is too indirect. HIAs should focus on effects derived from specific project-

related activities through evidence-driven causal pathways and should target activities most likely to generate significant health effects rather than considering every possible health effect.

- What is the appropriate relationship between HIA and established regulatory thresholds for specific pollutants? If the project complies with regulatory standards, should an analysis of health effects from regulated pollutants be included in the HIA? While the working group never reached full consensus, many members stressed that the Guidance document should adhere to the NEPA policy of full disclosure if the pollutant in question threatens human health despite regulatory compliance. However, it is imperative that identified health risks be supported by scientific evidence and that the contribution of the project be isolated within the context of other contributing factors. The working group recognized that the analyses underlying regulatory standards set by the EPA often reflect explicit trade-offs among health considerations, economic constraints, and feasibility assessments. As such, the group granted that if a potential health effect pathway is identified that is different from the pathways employed in setting the regulatory standard, then it would be appropriate to analyze the health effects of the pollutant at its current level and to develop corresponding mitigation measures if warranted. Ultimately, the group acknowledged that disclosure is accompanied by both public health benefits and risks. Benefits include the establishment of community trust and the potential to motivate action. With regard to the latter, public concern could be transformed into voluntary industry imposition of stricter regulatory standards and routine data monitoring. However, addressing public concerns through full disclosure could also incite unreasonable or irrational public fear

and outcry even if the pollutant does not actually pose a significant health risk. These fears could generate behavioral changes associated with their own set of health consequences. Furthermore, from an industry perspective, disclosure of the health risks of pollutants meeting regulatory standards may create unpredictable new requirements. At what point would disclosure be warranted? How many excess deaths derived from incremental increases in contaminant level would be permitted until the HIA formally documented the risk?

- What is the value of applying HIA to a programmatic or leasing decision? Asserting that baseline data collection is valuable in the future to inform applicants or to identify health parameters that may need to be addressed in response to project proposals, the working group also cautioned that the baseline data obtained in the context of HIAs conducted for programmatic or leasing decisions should only pertain to effects related to reasonably foreseeable actions. Given available information, the baseline data collection should be neither too broad nor too prescriptive.
- What is the value of discussing mitigation if it is not enforceable? While HIAs are, like EISs, intended to serve as planning tools, NEPA does require that mitigation strategies be developed in order to inform all stakeholders of the measures that could be taken to minimize project-related harm and to maximize benefits. Although mitigation is not mandatory, multiple stakeholders may be able and willing to implement portions of the recommended actions. Health agencies may use mitigation measures to identify appropriate public health monitoring and intervention strategies, municipal and State governments may choose to act independently of regulatory requirements, and industry may accept voluntarily implementation. Nevertheless, the

working group acknowledged that the HIA Guidance must clearly define non-regulatory measures as voluntary in order to avoid the perception of obligation.

- How should community stakeholder concerns and fears be addressed when their link to a project is not supported by the weight of scientific evidence? While some members of the working group were adamant that these considerations be excluded from a formal HIA, others argued that these concerns and fears could actually lead to unintended yet real health effects and should, therefore, be evaluated within an HIA. For example, local residents fearing subsistence resource contamination may adopt a store-bought diet even if data analyses fail to find pollutant levels of public health concern among subsistence resource samples. The health consequences, specifically the greater incidence of metabolic disorders, that accompany such a dietary shift would be real even though the impetus of such behavioral change would be unsupported by scientific evidence.
- What are the limitations of HIA performed in the context of an EIS? The working group emphasized that HIAs must avoid duplicating the analyses and re-stating the results contained within the corresponding EIS. HIA is only appropriate if complete pathways linking project activities to human health are not considered in the EIS. HIA is not designed to develop new standards.

A Complete Collaborative HIA Guidance Document Draft, Summer 2009

By the time that the working group convened in June, the discussions conducted throughout the winter and spring had allowed for completion of a full draft of the HIA Guidance document. Although major revisions were still required and many familiar questions were once again raised, the group had made great progress towards achieving

its objectives. The synthesis of ideas into a written document substantiated the collaborative effort of the previous months and facilitated more constructive criticism, which shaped the development of a more comprehensive version of the document only a month later. The June draft and its subsequent July modification represent a significant departure from the early partial drafts presented in December. In addition to expanding upon the "Public Participation and Stakeholder Engagement" section and the "Scoping" section, the complete drafts also include an "Introduction" section, a "Screening" section, an "Assessment" section, and a "Monitoring and Mitigation" section.

After immediately establishing the purpose of the document, the "Introduction" section asserts that individual and community health are determined by a combination of genetics, personal behavior, and living conditions. However, it is the influence of large natural resource development projects on living conditions, or the environmental, social, and economic factors particular to a given community or region, that is the focus of HIA. Acknowledging that project impacts can be both positive and negative, the document cautions that careful planning is required in order to maximize potential community benefits while simultaneously minimizing harm. The document then defines the HIA process and clarifies its application within both NEPA and non-NEPA contexts. While the health effects analysis mandated by NEPA requires a description of the affected environment, an analysis of the environmental consequences of the proposed action and its alternatives as they may affect health, and a consideration of potential mitigation measures, the Guidance is careful to note the absence of any statutory authority requiring its own adoption. Although its audience includes any agency involved in the planning, evaluation, permitting, regulating, or operating of large-scale natural resource

development projects in Alaska, it does not claim any jurisdiction over these agencies; instead, its adherence by any of these agencies is strictly voluntary (Alaska HIA Working Group, 2009).

The "Public Participation and Stakeholder Engagement" section of the document remains largely unchanged from its description in the December drafts. The only notable changes consist of explicit references to the State Best Interest Finding (BIF) process whenever the NEPA EIS context is invoked and the addition of a comprehensive HIA/EIS table. Under the BIF process, which applies specifically to oil and gas leasing permitting decisions, the State presents general and specific assessments of potential project-related impacts and issues mitigation and monitoring plans to be implemented by the applicant (ADNR, 2010). By acknowledging the State BIF process, the Guidance document emphasizes the applicability of HIA in Alaska beyond the scope of federal projects governed by NEPA. At the same time, the comprehensive HIA/EIS table (Table 5) strengthened the role of HIA within the NEPA EIS process by juxtaposing the similar elements of each process in a visual format.

In the subsequent "Screening" section, which was a new addition to the December draft, the criteria responsible for determining HIA application were explicitly discussed. Projects warranting HIA could be regulated by NEPA or the State BIF, but they could also be independent of each of these processes. In any case, the Guidance states that the screening procedure, which is designed to determine if an HIA should be conducted, must be sensitive to three general considerations:

Table 5: Phases of HIA and Integrated HIA/EIS (Alaska HIA Working Group, 2009)

HIA PHASE	INTEGRATED HIA/ EIS
(1) Screening: Determine whether HIA is necessary, achievable, likely to be beneficial. This may require an initial brief survey of the context for the proposal, such as: A. Project design: • Water bodies • Roadways, pipelines • Construction camps • Operational facilities • Sources of potential exposure B. Potentially impacted geographic areas and communities, and health context: • Economy: subsistence, cash-based, subsistence/ cash-based combination • Influx: temporary, permanent, location of origin • Alcohol: dry, damp, or wet communities C. Identify key stakeholders	(1) Screening Under NEPA, federal agencies determine the need for an EIS by determining whether the action being evaluated is a "major federal action significantly effecting the quality of the human environment" (*NEPA Sec. 102 [42 USC § 4332]*). One of the considerations in determining "significance" is "the degree to which the proposed action affects public health or safety" (*40 CFR 1508.27).* Hence, screening for the need for a HIA is essentially built in to NEPA.
(2) Scoping 1.Identify potential project-related health effects 2. Identify the scope of health concerns to be addressed using Health Effects Categories 3. Determine the geographic boundaries, time scale, and population impacted 4. Assemble the HIA team 5. Evaluate adequacy of existing data sources, develop list of data gaps, and recommend new studies to address data gaps 6. Determine the HIA approach: comprehensive, complete, or rapid/ desktop appraisal	(2) Scoping: For an integrated HIA/EIS, the scope of health analysis is determined through the same process as other resource areas typically considered in an EIS. Public testimony, initial literature review, and evaluation by public health experts are used to determine the appropriate scope of the analysis. A health scoping summary is submitted to the lead agency. Scoping also determines the affected communities, the analytic procedures to be used, and whether there is adequate information available to inform the analysis.
(3) Assessment A. *Scaling:* describe the baseline health status and determinants of health in the affected population 1. Literature review by Health Effects Categories 2. Evaluation of existing survey and research data: data validation and statistical analysis 3. Evaluation of data from key stakeholders; traditional and local knowledge B. *Assessment of impacts:* uses qualitative or quantitative methods, literature review, expert analysis to project potential public health effects 1. Detailed description of risks and potential causation 2. Assess impact significance • perception of risks by affected communities • nature of impact: direct, indirect, or cumulative • timing and duration • extent, magnitude, and frequency 3. Risk ranking: severity and probability	(3) Assessment involves three steps: A. *Description of the Affected Environment (equivalent to scaling in HIA)* relies on the economic, sociocultural, employment, and demographic discussions in the EIS, in addition to multiple public health data sources, including: published studies, "grey literature," vital statistics, health registries, and public testimony. Data gaps may result in the need for baseline data collection. B. *Environmental Consequences of the Alternatives (equivalent to Assessment of impacts in HIA):* We identify evidence-based causal pathways between impacts described in other portions of the EIS (environmental, sociocultural, and economic), and health outcomes. The methodology is often descriptive, because the EIS impacts on health outcomes are often discussed qualitatively in the EIS. Quantitative modeling is rare. C. *Recommendations:* In integrated HIA/EIS, measures to protect health are developed and analyzed along with the impact analysis and proposed either as mitigation measures or modification of alternatives.
(4) Reporting and Mitigation The results are reported to the public, and recommendations are made for measures that could be taken to protect and promote health. For each mitigation measure, describe: the authority and responsibility for implementation and enforcement, and timing according to project phase.	(4) Reporting: The Public Health information is reported in subsections in the DEIS; the DEIS is reassessed based on public comments, and a Final EIS (FEIS) is issued.
(5) Implementation, Monitoring, and Evaluation 1.Evaluate HIA Results 2. Implement appropriate mitigation measures 3.Determine if monitoring is warranted and, if so, identify which health outcomes should be monitored 4. Define Key Performance Indicators (KPIs) 5. Establish roles and responsibilities of key stakeholders 6. Implement data collection and perform routine assessments to verify that mitigation measures are achieving their intended results	(5) Decision-making, Implementation, and Monitoring: Using the information in the FEIS, agency management renders a final decision approving, modifying, or rejecting the proposed action. This is called the "Record of Decision" (ROD). The ROD outlines the monitoring and mitigation plans. Some monitoring and mitigation may be implemented through non-regulatory agreements and partnerships – the ROD would clearly outline any such agreements if they are public.

- the likelihood and intensity of potential public health effects: In Alaska, specific focus should be placed on subsistence resource effects and on the impacts of non-resident worker influx, the construction of new access roads, and the development of new infrastructure on remote and previously isolated communities.
- public concerns: If public concerns are significant, then it would be prudent to perform an HIA that addresses these areas of concern even when it appears that the analysis will not substantiate the concerns.
- the future benefit of the HIA to the lead agency or other stakeholders: The examination of public health impacts may help guide future planning and management of the project, may help develop improved monitoring programs, and may provide a foundation for public health analyses and mitigation in the future.

Once it has been determined that an HIA should be performed, the "Screening" section suggests a means by which to identify an appropriate level of HIA. HIAs can be, in ascending order of analytic depth and resource burden, 1) rapid or desktop, 2) complete, or 3) comprehensive. In determining the correct level of health analysis for a given project, it is necessary to consider the intensity and likelihood of the potential health impacts, the project footprint, the presence of adequate data, the financial costs of a more comprehensive HIA, the level of public concern, and the vulnerability of the affected population (Alaska HIA Working Group, 2009).

Following screening, scoping must be conducted in order to determine which health effects to include in the HIA and which groups of people are most likely to be affected. Although this section of the Guidance had been addressed in the December drafts, it underwent substantial revision as revealed in the June draft. By July, it had been

expanded even more. Specifically, a discussion of the agencies and expertise required to complete an HIA was added. A discussion of data availability and consideration of whether new studies need to be performed to fill in data gaps was also included.

The revised "Scoping" section clearly states that HIA should not attempt to address every possible project-related minor health effect or effects only minimally related to the proposed action. The scope should instead be limited to effects for which incremental contributions of the proposed action are most likely to generate significant health implications. Pursuant to the interagency discussions in the spring, the Guidance then notes that it may, nevertheless, be appropriate to address stakeholder concerns and fears that are not ultimately supported by scientific evidence. The value of such a strategy would be to provide the public with reassurance that their concerns have been considered. With regard to the fear of subsistence resource contamination, the Guidance contends that

> because of the extraordinarily close and long-standing dependence of subsistence communities on the natural environment, it may be reasonable to address the ways in which fears of contaminants may impact subsistence practices and diet. The benefit of doing so is to allow this issue to be addressed in a multi-disciplinary, collaborative manner and to prevent unwarranted changes in subsistence and dietary practices (Alaska HIA Working Group, 2009).

A table (Table 6) is included that provides a list of categorical effects generated by large-scale industrial development projects in Alaska that may impact human health. The table serves as a general overview supported by specific examples, but it is not intended to serve as a comprehensive source of all potential project-related health effects that may need to be considered for a given project.

Table 6: Aspects of Natural Resource Development that may Affect Health (Alaska HIA Working Group, 2009)

Category of Effect	**Examples**
1. Airborne Emissions	a. Fugitive dust b. Combustion of fuels c. Ore processing d. Volatile organics e. In situ burning of oil spills
2. Water Discharges	a. Treated discharges (storm water, mine runoff, pumped groundwater, equipment washdown) b. Untreated discharges (e.g. clean water diversions) c. Grey water d. Drilling muds, cuttings, produced water
3. Water Management	a. Surface water effects – change in drainage patterns, new standing water bodies, change in flow rates in local streams b. Groundwater – alterations in flow
4. Disturbances/Noise	a. Air traffic b. Road traffic c. Vessel traffic d. Operations (heavy equipment operations, drill rigs, flaring)
5. Industrial Infrastructure and facilities	a. Linear features – pipelines, roads, power lines b. Mine pit c. Housing d. Processing facilities e. Shipping terminals
6. Economy and Employment	a. Direct employment b. Subcontractor employment c. Induced employment d. Tax revenues e. ANCSA corporate dividends f. Changing local cost of living (housing inflation, fuel discounts, etc) g. Payments in lieu of taxes (PILT) h. Voluntary corporate initiatives and contributions i. Costs on local services (schools, emergency services, public safety, public infrastructure)
7. Demographic change	a. Influx of non-resident workers b. Bases of operations in villages c. Outmigration of resident employees facilitated by income d. Slowing of outmigration if revenues stabilize local economy
8. Energy	a. Altered fuel mix for local heating and power generation because of local production or transport of energy sources (eg. coal, natural gas production, lower bulk fuel shipping costs)
9. Access to natural resources	a. Legal/property restrictions on access to traditional harvest areas b. Disturbances of subsistence habitat, migration, reproduction

A separate table (Table 7), which was designed to offer a consistent categorization of public health outcomes and risk factors, consists of a list of Health Effects Categories (HECs) and typical areas of focus within each category. This table and the HECs presented therein are adapted from the International Finance Corporation (IFC)'s Environmental Health Areas (EHAs). The IFC, a lending institution and a member of the World Bank group, routinely requires that corporate project proponents conduct HIAs in order to receive IFC funding. Within the past year, the IFC released an updated HIA guidance document designed specifically as an aid for industrial sector development in complex environmental and social conditions throughout the developing world (IFC, 2009). This guidance document has served as an important model for the Alaska HIA working group, especially since Krieger, the primary author of the IFC HIA guidance, has joined the working group. However, the guidance generated by the working group is intended to be specific to Alaska and, as such, has been developed independently and, thus, does differ in some significant ways from the IFC guidance.

The Alaskan HIA HECs include 1) General Health/Wellbeing; 2) Psychosocial/ Gender Issues; 3) Accidents and Injury; 4) Contaminant Exposure; 5) Food, Nutrition, and Physical Activity; 6) Non-communicable/ Chronic Diseases; 7) Infectious Diseases; 8) Water and Sanitation; 9) Health Services Infrastructure and Capacity; 10) Community Health/ Occupational Interface; and 11) Maternal-Child Health. Three of these categories, "General Health/Wellbeing," "Community Health/ Occupational Interface," and "Maternal-Child Health" are not included as IFC EHAs. At the same time, four of the EHAs, "Vector-Related," "Respiratory and Housing," "Veterinary and Zoonotic Issues," and "STIs" have been modified and synthesized into the "Infectious Diseases"

Table 7: Health Effects Categories (Alaska HIA Working Group, 2009)

Health Effect Category	Typical Outcomes/ Issues Considered in Each Category	
General Health/ Wellbeing	• Population health indicators (life expectancy, mortality, infant mortality, child <5 mortality; disability-adjusted life years; quality-adjusted life years) • Survey-based measures of overall community well-being (eg BRFSS well-being module)	
Psychosocial/ Gender Issues	• Depression, anxiety • Suicide • Substance/alcohol abuse	• Violence/homicide • Cultural integrity/change • Public safety/enforcement
Accidents and Injuries	• Intentional or unintentional injury	
Contaminant Exposure	Health Outcomes in this category depend upon specific contaminant exposure. They could include:	
	• Cancer • Developmental delay • Acute poisonings	• Thyroid/endocrine disease • Respiratory & cardiovascular disease
Food, Nutrition, and Physical Activity	• Subsistence intake/dietary studies • Micronutrient deficiencies	• Food security • Physical activity
Non-communicable/ chronic disease	• Diet/physical activity-related disorders (Diabetes, HTN, Obesity, hyperlipidemia, cardiovascular disease)	• Chronic lung disease • Cancer • Cardiovascular disease
Infectious diseases	• Respiratory infections • Skin infections • Sexually transmitted infections	• Vector-borne (eg West Nile virus) • Zoonotic infections (eg echinococcus)
Water and Sanitation	• Level of water/sewer service	• Water supply
Health Services Infrastructure and Capacity	• Physical infrastructure – clinics, hospitals, airstrips	• Health Service personnel Health programs
Occupational/ Community Health Interface	This category does not include occupational health, which is generally considered an “inside the fence” issue dealt with by workplace regulations and policies. This category addresses crossover issues, such as:	
	• Workplace health screening and immunization protocols, if interaction between workers and the community is anticipated	• STI transmission prevention strategies. • Drug and alcohol policy and enforcement • Cultural orientations
Maternal-Child Health	• Prematurity rate • Adolescent pregnancy rate	• Adequacy of prenatal care • Fetal Alcohol syndrome

HEC. These differences in categorization represent differences in the health environments in which each guidance protocol is applied. For example, while tropical infectious diseases are of critical concern to companies operating in the developing world, they are irrelevant in Alaska. Therefore, a consideration of their role is prominent within the IFC Guidance but absent from the Alaskan Guidance.

By suggesting that the project-related health effects included in Table 6 be evaluated within the context of each HEC listed in Table 7, the Alaskan Guidance offers a systematic means of assessing the relationship between the proposed action and public health. Another table (Table 8) describes pathways that relate anticipated project-related effects to the HECs. Acknowledging that there will always be site and project-specific considerations, the Guidance does not propose that this table function as a comprehensive list of all potential health effects, but it does delineate some of the more common health effect pathways pertinent to Alaskan natural resource development. This table also includes health indicators associated with each HEC. The indicators are used to assess health at baseline and to subsequently monitor project impacts and the effectiveness of mitigation strategies. Indicators can measure health outcomes, intermediate health factors, or health determinants. Asthma prevalence is an example of a health outcome. Population BMI levels, which, if elevated, serve as a risk factor for cardiovascular disease and diabetes, are an example of an intermediate health factor. Fine airborne particulate levels, which increase the risk of asthma, are an example of a health determinant. Since health outcomes may take a long time to develop and are likely to be the product of multiple contributing factors, they may not serve as the best measures of project impact. Also, in Alaska, the small size of rural communities limits the statistical

Table 8: Health Scoping Table (Alaska HIA Working Group, 2009)

Health Effects Category	**Indicators**	**Pathway Description**
1. Overall Health/Wellbeing	◆ Life expectancy ◆ Mortality rates (overall and by age group) ◆ Quantitative well-being measures (BRFSS or SLiCA)	Many project-related effects can drive overall health status. Economy and employment, cultural continuity, and environmental conditions all play a role in general/overall health. This category reviews the overall contribution of project-specific effects on economy, employment, etc. to population health status. Limitations: this is a broad category and many specific indicators are better addressed in health effects category below.
2. Psychosocial & Gender Issues	◆ Anxiety and depression rates ◆ Alcohol and substance abuse-related clinic visits ◆ Reports of harm to social services, OCS ◆ Index crime rates	This section leads from the socioeconomic analysis, and considers: ◆ *Project-specific factors:* *(-)* prolonged absences of family members at the jobsite can create family stress and exacerbate dysfunctional coping (family violence, alcohol use, etc; (-) influx of non-resident personnel & new access routes to isolated rural communities can increase community access to and use of drugs and alcohol. ◆ *General factors:* (+) employment and income have a generally positive effect on psychological/social health problems. (-) Significant/large-scale change to the environment in rural regions can lead to general anxiety/stress regarding perceived threats to traditional ways of life. Limitations: this pathway in particular involves a mix of positive and adverse potential effects. The emphasis of the analysis is not on predicting overall whether the project will be good or bad for psychosocial health, but on identifying aspects of the project that may affect health, and potential management options.
3. Accidents and Injuries	◆ Accident/injury rates including Injury hospitalizations ◆ Outpatient injury ◆ EMS runs	(-) Influx of non-resident personnel (increased traffic on roadways, deterioration in roads from heavy equipment, enhanced access to alcohol and drug use) (-) Distance of travel required for successful

		subsistence. (+) Project-related income and revenue used for improved infrastructure (eg. roadways) and improved subsistence equipment/technology.
4. Contaminant Exposure	◆ Rates of specific illness related to contaminant of concern (COC), as validated by exposure and dose-response methodology ◆ Human biomonitoring and contaminant levels	Project emissions and discharges can lead to human contaminant exposure. Exposure pathways include, for example: ◆ Consumption of contaminated subsistence foods (risk based on analysis of foods or modeled environmental concentrations) ◆ Drinking water (risk based on WQ analysis) ◆ Respiratory (fugitive dust, criteria pollutants, VOCs, mercury) ◆ Secondary occupational exposure (exposure of home residents to dust/contaminants on worker clothing) ◆ Indirect pathways could include changing heating fuels/energy production fuels in villages Some of these pathways are addressed through regulatory standards but others are not. As discussed under "The health effects of regulated pollutants", the HIA should account for significant health effects that can occur, even if the exposure is below regulatory standards when appropriate.
5. Food, Nutrition, and Physical Activity	◆ Subsistence harvest and consumption ◆ Food security ◆ Micronutrient deficiencies	This section leads from the subsistence analysis, and considers: ◆ *Effect on Diet*: Communities in rural Alaska continue to rely on subsistence resources. This pathway considers the effect of subsistence impacts on diet, in the context of other factors (such as income and personal choice) that drive eating behavior in Alaskan communities. ◆ *Effect on Food Security*: food security is defined as access to adequate amounts of food to meet caloric and nutritional needs. It is driven by economy and, particularly in rural Alaska, by access to subsistence foods. This discussion considers project-specific impacts on both to evaluate the potential impact on food security.
6. Non-communicable/Chronic Diseases	◆ Nutritional: obesity, impaired glucose tolerance, diabetes, cardiovascular disease. ◆ Pulmonary: chronic lung disease, asthma; in-home heat sources; local village air quality; clinic visits for respiratory illness ◆ Cancer rates	1. Subsistence and nutritional disorders: subsistence diet and activities prevent nutritionally-based disorders such as diabetes, cardiovascular disease, and obesity. Dietary change (already occurring in most communities) could be intensified by project-related subsistence impacts, resulting in an incrementally increased risk of these problems. 2. Emissions and pulmonary disease: airborne

	◆ Rates of other disorders, specific to the contaminant(s) of concern	emissions and changes in local energy sources are common project-related sources of change in risk for pulmonary disease rates. The analysis reviews the Air Quality analysis, and considers potential incremental health effects in the context of the baseline prevalence of pulmonary disease. 3. <u>Emissions and cardiovascular disease</u>: particulate, NOx, SOx, and ozone emissions can increase adverse cardiovascular events. These are more common in people with known coronary artery disease. 4. <u>Cancer</u>: project emissions and discharges can include known and suspected human carcinogens. Exposure pathways should be evaluated for any carcinogen. 5. <u>Emissions and discharges and other chronic disorders</u>: specific contaminants can be associated with specific health outcomes, such as, for example, lead causing elevated blood pressure. The contaminants of concern from the project should be evaluated for potential health effects, and the contaminants that appear to pose a potential risk to the community included for further analysis in the HIA. *This section overlaps with section 4 below: this section is limited to chronic disease, whereas section 4 focuses on all possible health effects related to contaminants. Depending on the nature of the contaminants of concern for a given project, HIA authors can determine where the discussion of contaminant-related health effects would fit best.*
7. <u>Infectious Disease</u>	◆ Lower respiratory tract infections (clinic visits, hospitalizations, and mortality) ◆ Skin infections ◆ Sexually transmitted infections	◆ 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; drug and alcohol use; and mixing of low and high prevalence populations create a risk for transmission of STIs such as syphilis, HIV, and Chlamydia. ◆ Vector-borne diseases could be an issue if standing groundwater/wetlands changes resulted in altered distribution of insect vectors. This is

		not felt to be a likely scenario in Alaska, but with the cumulative effects of climate change may become an issue of greater concern in the future.
8. Water and Sanitation	◆ Availability of adequate supply of running water, and adequate sanitation facilities ◆ Respiratory infection rates ◆ Skin infection rates	Adequate and safe supplies of running water and adequate sanitation service correlate with health, both in Alaska and worldwide. In rural Alaska, lack of adequate water service is linked to the high rates of lower respiratory infections observed in some regions, and to invasive skin infections. Projects have two potential effects on water and sanitation: ◆ 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.
9. Health Services Infrastructure and Capacity	◆ Availability of health services; staffing ratios; emergency medical services; medivac services	Projects can affect health services infrastructure and capacity, through, for example: ◆ 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.
10. Occupational/ Community health interface	◆ Company policy regarding alcohol and drug use ◆ Occupational health screening practices ◆ Decontamination requirements	Company practices can affect community health. This category includes issues such as: ◆ Company hiring and diversion practices for people with a history of drug/alcohol problems ◆ Company infection control policies and immunization practices affect likelihood of transmission between workers and the community. ◆ Fugitive dust and contaminants being carried home on worker clothing/baggage
11. Maternal & Child Health	◆ Premature birth rate ◆ Low birth weight ◆ Adolescent pregnancy ◆ Maternal alcohol/substance abuse	◆ Premature birth rate and low birth weight relate closely to socioeconomic indicators. The analysis of this pathway leads from the socioeconomic analysis (predicted changes in employment and income, access to health care, etc), and reviews available public health data regarding the predicted socioeconomic changes and these health outcomes. ◆ *Influx* can rapidly alter measures of social cohesion, increase access to and use of drugs and alcohol, and through these effects can alter rates of teen pregnancy and maternal alcohol/substance abuse.

reliability of many disease rates. In such a context, it is unlikely that valid village-level prevalence rates could be established, and it is even less likely that sufficient statistical power will exist to resolve changes in incidence or prevalence over time or between villages. Thus, when identifying indicators to be employed for the purpose of monitoring project-related health impacts, health determinants tend to be more reliable than health outcomes (Alaska HIA Working Group, 2009).

Having determined the potential health effects that will be assessed within the HIA, the scoping process is also responsible for identifying the communities and population subgroups that are most likely to be impacted. Communities included within the "affected environment" designated by federal and State permitting statutes are clearly included, but the Guidance states that the relevance of health effects among populations located beyond the geographically-defined "affected environment" must be determined on a case-by-case basis. Factors to consider in such a determination, as set forth by the Guidance, are included in Table 9.

Table 9: Factors to consider in determining which communities will be included in the HIA (Alaska HIA Working Group, 2009)

- Communities lying within the "affected environment" as defined for a given project by the HIA team
- Geographic proximity to the project
- Location of community downwind or downstream from projected emission and discharge sources
- Communities relying on subsistence resources that could be exposed to pollutants in the project area
- Communities relying on subsistence resources that could be affected by other project-related activities
- Communities that will experience project-related social and demographic change related to influx
- Communities into which new roads or access routes will be constructed
- Communities that will experience significant economic change

During the June working group meeting, participants discussed how far an "affected environment" could reasonably extend. Within the body of the document, a statement

was included acknowledging that ore obtained from an Alaskan mine but smelted out-of-state or even out-of-the-country would produce health effects far beyond the geographical project area. Another statement posited that greenhouse gas emissions derived from a particular project would incrementally contribute to climate change (Alaska HIA Working Group, 2009). Each of these statements was excluded following the July revision, because working group participants were adamant that their inclusion would violate established jurisdiction given that the Guidance is only authorized for use within the State of Alaska. Among identified affected communities, however, there are certainly subpopulations that experience atypical health effects at a given exposure level. According to the Guidance, these vulnerable groups consist of 1) low income and ethnic minority populations; 2) children; and 3) people with pre-existing illnesses that could increase sensitivity to environmental insults (Alaska HIA Working Group, 2009). Project-related health effects are likely to occur earlier among members of these groups, so it is critical that they be included within routine monitoring activities.

Responsibility for conducting monitoring activities, as well as for completing the HIA, is determined during the scoping process. The HIA team includes the individuals responsible for completing the HIA as well as a larger group of reviewers. As explicitly stated within the Guidance, each of these contributors must demonstrate adequate familiarity and experience with Alaskan public health issues and the social, demographic, economic, cultural, and environmental factors that influence health within Alaskan communities. Understanding of unique baseline factors, such as the extreme northern climate, the importance of subsistence, the predominance of Alaska Native culture in

rural regions, and the high cost of food and fuel in these same rural regions, is essential (Alaska HIA Working Group, 2009).

Typically, regulatory agencies or third-party contractors serve as lead agencies taxed with performing an HIA. However, the Guidance strongly recommends that the entity leading the HIA consult and collaborate with relevant local, regional, State, and tribal health agencies to the greatest possible extent. Given that large-scale natural resource extraction projects may generate changes in illness patterns and health service demands, these health agencies have a direct interest in the project permitting process. Furthermore, representatives from these agencies possess the ability to answer public health questions and concerns posed by communities during the project planning and evaluation stages; their technical public health expertise enhances cooperation and trust among lead agencies, cooperating agencies, and communities. These health agencies also maintain specialized databases, disease surveillance systems, and health records that are the best and often the only way of characterizing the baseline health status of affected populations (Alaska HIA Working Group, 2009).

Frequently, however, the data derived from these surveillance systems and health records is not available at the village level. In some cases, additional baseline studies may generate data to fill these gaps, but in other cases, the difficulty of obtaining statistically reliable results at the village level may limit the value of these studies. The Guidance document provides a list of data gaps that are likely to be encountered while performing HIAs in Alaska and suggests possible means of filling in those gaps. The list is not intended to be inclusive, but it does acknowledge the lack of information pertaining to dietary changes resulting from subsistence impacts, the relative contribution of

subsistence foods to total diet, and the baseline levels of contaminants in subsistence resources as well as specific disease prevalence rates and health outcome data at the village level. However, the Guidance is also careful to state that individually identifiable health information may not be used in any document related to HIA. In addition to the issues that it poses in relation to statistical reliability, the small size of rural Alaskan villages also presents unique challenges in terms of the ethical use of health data. Indeed, simply reporting the number or rate of a rare disease in a small village may compromise confidentiality. In other cases, disclosure of village-level disease rates may stigmatize an entire community. Therefore, the Guidance advocates for local and tribal government consultation in determining whether and how health statistics may be released publicly. Even when health information cannot be reported, the Guidance still recognizes that baseline studies can be performed as a private collaboration between stakeholders for the purposes of disease surveillance and service planning (Alaska HIA Working Group, 2009). Within the HIA, some acknowledgment of baseline health considerations should be made even if exact numbers or rates cannot be disclosed. Currently, if the number of disease cases within a village is less than six, then the State of Alaska simply reports that fact. The same standard protocol could easily be applied to the HIA process.

Indeed, some protocol must be applied, for the HIA "Assessment" process requires that an analysis of baseline health status and health determinants be conducted among affected communities. According to the Guidance, these baseline health measures should include the leading causes of morbidity and mortality within the affected population as well as the prevalence of illnesses corresponding to potential project-related health effects identified during the scoping process. Baseline health serves as the

foundation against which change can be monitored and measured. In addition to this quantitative evaluation, the assessment section of any HIA must also include a qualitative analysis of the potential health impacts of a proposed action and its alternatives. The objective of such an approach is a description of the incremental contribution of a proposed action to a given health outcome or health determinant in the context of other factors known to influence that health outcome or health determinant. For each causal pathway identified as potentially significant during the scoping process, the qualitative assessment should include a review of available public health evidence supporting or refuting the pathway and a review of local community input that may prove valuable when supported by scientific principles. The assessment should also determine which phases of the project are subject to anticipated health effects, the direction of those effects, the intensity of those effects, and the likelihood of those effects (Alaska HIA Working Group, 2009). The "Assessment" section of any HIA is the final predictive component of the document. However, mitigation strategies must also be proposed, and much support has been granted to the subsequent establishment of long-term monitoring and evaluation structures.

The greatest criticism leveled against the June Collaborative HIA Guidance draft was related to the perceived weakness of its "Monitoring and Mitigation" section. Thus, the primary focus of the July draft was substantial revision of this section. As defined within the July draft, mitigation consists of actions taken to avoid, minimize, or eliminate an adverse effect or to maximize a potential benefit. It is an ongoing process that begins when a project is first conceptualized and ends when reclamation has been concluded and project effects have been eliminated (Alaska HIA Working Group, 2009). Within the

international HIA context, mitigation plans are referred to as Health Management Plans or Health Action Plans (IFC, 2009). According to the Alaskan Guidance, "monitoring and mitigation are described together because mitigation is best seen as a dynamic process in which monitoring informs ongoing efforts to identify and manage health effects." This integrative process, known as adaptive management, "is a scientific, organized, and iterative method to optimize decision making when outcomes or results of proposed actions are not known or certain" (Alaska HIA Working Group, 2009). Relying on continual feedback and response, adaptive management is intended to adjust mitigation strategies in response to monitoring results in order to improve outcomes and to ultimately reduce uncertainty over time. In relation to HIA, adaptive management is

> the integration of project design, management, and monitoring to systematically test health outcome assumptions in order to adapt and learn, with the goal of ensuring that project mitigation strategies are successful and that human health is protected and improved. The application of adaptive management may be especially useful given the limited experience of most environmental regulatory agencies with public health and because the effects of an agency's decisions regarding public health cannot be known for certain until decisions are implemented at the field level (Alaska HIA Working Group, 2009).

However, regulatory agencies may have limited authority to impose new requirements based on health effects. Indeed, State permits pertaining to natural resource development projects in Alaska do not evaluate health parameters. Nevertheless, as discussed during working group meetings in the spring and as explicitly stated in the updated Guidance drafts, it is important to identify mitigation measures even if they are not enforceable by a federal or State agency. Identification serves to alert and encourage agencies and officials who can implement components, if not the entirety, of the measures. Beyond new federal or State regulatory standards, options for implementing HIA adaptive management strategies include new site-specific borough or village

ordinances that address some aspect of the project related to health, voluntary actions by health agencies, and voluntary industry agreements. For any given project, a collaborative relationship among stakeholders is likely to yield the most successful results. While industry proponents may sometimes resist new regulatory efforts, many companies do expend considerable effort and financial resources on voluntary measures. (Alaska HIA Working Group, 2009). As will be discussed at length in Chapter 4, these measures often serve the business interests of the proponent as well as the public health concerns of affected communities. Thus, internal meetings should be conducted among lead regulatory agencies, project proponents, and community stakeholder groups in order to determine if any recommended mitigation proposals are feasible through voluntary industry implementation. As emphasized within the Guidance, it is critical that adaptive management involve public health agencies or contractors and regulators possessing health expertise (Alaska HIA Working Group, 2009).

Monitoring and mitigation strategies should include both project-specific measures and health-supportive measures. Project-specific measures are intended to address health effects that can be attributed, incrementally or entirely, to some aspect of the proposed action. Measures can be designed to either reduce exposure or to provide compensation for unavoidable effects by strengthening risk programs or services required to address the effect. Health-supportive measures are intended to bolster general services and community attributes (schools, cultural programs, public safety and emergency response systems, and healthcare) that protect health. They may help prevent adverse project impacts or may help to maximize potential health benefits, but they tend not to be directly linked to specific project effects (Alaska HIA Working Group, 2009). Included

within the Guidance document is a template for developing mitigation measures specific to natural resource development projects in Alaska (Table 10). In addition to outlining general approaches based on effective public health strategies, it also identifies which stakeholders have the ability, either regulatory or practical, to implement mitigation measures. When a regulatory agency or project proponent is identified as the appropriate entity to implement a given mitigation measure, the Guidance once again states that the agency or company should hire contractors with health expertise or collaborate with local, State, or tribal health authorities (Alaska HIA Working Group, 2009).

Given that each federal and State regulatory agency has different regulatory authority and that not all mitigation measures are governed by regulation, the means of verification is project-specific (Alaska HIA Working Group, 2009). However, monitoring and evaluation (M&E) cannot simply rely on routinely collected health data. Instead, data must be gathered with the primary goal of policy evaluation. Predictive studies, in which hypotheses are declared prior to data collection and appropriate outcome indicators are determined, allow for definitive evaluation of mitigation measures of interest (Kypri et al, 2009). Therefore, M&E processes should track the same indicators identified during scoping and measured originally in the form of baseline studies. M&E should function as an iterative process that extends baseline studies throughout the life of the project and beyond until effects have disappeared. Thus, as it also did in the context of baseline studies, the Guidance suggests that affected communities be involved in the verification process. Community collaboration will enhance trust between stakeholders and, in doing so, will improve compliance and, therefore, mitigation effectiveness (Alaska HIA Working Group, 2009).

Table 10: Mitigation examples by health effects categories, with suggested indicators and authority (Alaska HIA Working Group, 2009a)

Health Effect Categories and specific effects	Indicators for Monitoring	Examples of Possible Mitigation	Authority & Responsibility
1. Overall Health/Wellbeing a. Improved general health status because of improved economic circumstances	• Standard population health indicators: life expectancy, overall mortality, etc. • Health infrastructure improvements (eg. new water/sanitation projects, improved roads, added EMS services	Mitigation options to optimize the health benefits of increased revenue include, for example: • Planning meetings between applicable health departments and the entities (state, local governments, native corporations) expected to receive project revenues to identify public health priorities in the community. • Creation of a health steering group • Effective local hire programs, developed through deliberate study of regional issues that make native hire challenging, and review of successful efforts elsewhere.	• Voluntary action by municipal or state government receiving revenue • Voluntary action by industrial proponent (or negotiated agreement with impacted community or native corp.)
b. Fear of adverse impacts on traditional way of life and subsistence lead to general decrease in well-being	• Survey-based quality of life/well-being indicators (such as BRFSS)	• Effective environmental protections • Community-based, participatory monitoring and oversight of the project, to enhance local trust in data quality and regulatory oversight	• Community-based, participatory monitoring and oversight can be implemented through voluntary agency actions or direct collaboration with the project proponent.
c. Sudden increase of cash income has potential to disrupt or support traditional social networks and cultural resilience	• Survey-based quality of life/well-being indicators (such as BRFSS)	• Collaborative, multistakeholder economic planning to enable native corporations, regional governments, and state governments to distribute economic benefits in such a way as to strengthen community social structure and resilience. Examples: funding for subsistence activities, local services, native language education programs, and other support for core cultural/social attributes. • Personal finance training, savings incentive programs for	• Voluntary action by proponent, native corporations, state and regional government

		employees, to ensure that young workers derive maximum benefit from wage income.	
2. <u>Psychosocial & Gender Issues</u> a. New roads and influx of personnel to isolated community facilitates drug/alcohol importation to isolated/"dry" communities	• Injury rates • Drug and alcohol-related clinical encounters • Rates of arrest for drug/alcohol-related events	• Consideration of "island" or "gated" development alternatives, in which industrial facilities are isolated from community. • Increased staffing for public safety and EMS personnel • Proponent hiring and employment practices: screening employees for prior drug/alcohol problems, arrests for dealing drugs, etc.	• NEPA allows consideration of "gated development" alternative, but may not give agency authority to require. • Proponent can elect to implement "gated development" design • Borough may impose zoning requirements • Funding for public safety/EMS through project-related borough or state revenue, PILT, or other voluntary agreement with industry.
b. Prolonged absences of family members for project-related work can exacerbate family stress, create challenges for parent and children left at home, remove one parent from the home for extended periods	• Family violence	• Orientation to block scheduling lifestyle & support groups for families & employees; family counseling • Preemployment screening for high-risk employees (prior domestic violence convictions, mental health issues) • Flexible leave options • Family visitation policies	• Voluntary action by proponent • Program developed cooperatively between local/tribal health agency and industry • Monitoring by local/regional health care agency or state DHSS
c. Drug/alcohol abuse by community members employed on project. Personal choice, but can be influenced by factors such as company policy, behavior of other employees, inexperience with responsible management of personal finances	• Injury rates •Drug and alcohol-related clinical encounters •Rates of arrest for drug/alcohol-related events	• Preemployment screening for drug and alcohol problems • Evidence-based occupational health program for employees with pre-existing or discovered problems: the most successful programs often involve proactive screening, and occupational diversion/counseling for employees with (+) screens • Attention to the "work-site culture" – for example, not encouraging heavy drinking on off days/end of shift; benefit incentives for saving paychecks rather than spending.	• Voluntary actions by proponent
3. <u>Accidents and Injuries</u> a. Increased traffic flow on	• Injury rates	• Traffic planning: evaluate	• Boroughs may have

local roads	• EMS activation • Police calls for accidents	existing roads and predicted traffic flows, correct any problems (road improvements, traffic calming measures) • Funding for infrastructure maintenance • Funding for services (EMS, Police) • Funding for injury prevention program	planning authority and road maintenance authority • Borough may be able to recover costs through tax revenue or PILT • State and borough government can evaluate village-level impacts and allocate resources appropriately • In some cases, it may be appropriate to ask proponent to fund through voluntary impact-benefit agreement
b. Displacement of subsistence animals by project activities, leading to longer travel times and more difficult hunting conditions	• Injury rates • EMS activation • Search and rescue calls • Police calls	• Effective project mitigation to prevent subsistence impacts • Funding for injury prevention program • Funding for EMS, Police	• Boroughs and state may be able to allocate tax revenues from project to address village-level impacts and fund these programs • Voluntary impact-benefit agreement
4. <u>Contaminant Exposure</u>: Exposure pathways: a. Oral Ingestion b. Respiratory c. Occupational d. Subsistence Consumption e. Secondary occupational (family exposed through contact with worker/clothing)	Monitoring strategy can include: • Monitoring levels of the contaminant of concern (COC) in the environment • Monitoring levels of the COC in the human population • Monitoring specific health outcomes. *NOTE: in general, monitoring exposures is preferable to monitoring health outcomes, given the complexity of interpreting health outcome data in small populations*	• Regulatory standards* • New site-specific standards to address some aspect of the exposure-dose-response pathway not covered by regulation. For example, subsistence users may benefit from added monitoring of COCs in fish/game/human populations. Emission/discharge restrictions can be predicated on results of monitoring.	• Federal and state authority for regulated pollutants. • Some federal, state, and municipal agencies may have authority to impose site-specific monitoring and emissions/discharge standards to address specific issues that fall outside existing standards. • Voluntary emissions/discharge reductions and monitoring by proponent.
5. <u>Food, Nutrition, and Physical Activity</u> a. Impacts on subsistence resources leading to decreased harvest and consumption of one or more subsistence species	• Quantitative nutritional survey data on baseline consumption of subsistence vs. store foods • Food security • Market basket price	• Adaptive subsistence mitigation: monitoring, and changes to specific project activities if they are found to impact subsistence and diet • Efficient food storage: if subsistence supply is adversely impacted by project, provide support for more efficient storage of successfully	• Some federal and state agencies have authority to regulate based on subsistence impacts • Borough regulations are a possible source of authority to implement requirements for compensatory mitigation

		harvested resources in order to increase the effective supply of food (eg. community freezers) • Measures to aid subsistence harvest: for example, funds for community hunters, equipment, fuel • Measures to support a nutritious diet: if people are less successful harvesting subsistence resources and must therefore turn to village stores, measures that fund shipping healthy food choices to villages, public education to support a healthy store-bought diet	• Voluntary agreements with proponent
b. Block work schedules conflicting with subsistence hunting/fishing	• Quantitative nutritional survey data on baseline consumption of subsistence vs. store foods • Food security • Market basket price • Days spent hunting	• Flexible work schedules, subsistence leave during key seasons	• Voluntary agreement with proponent
6. <u>Non-communicable/Chronic Diseases</u> <u>Examples:</u> • Dietary change because of subsistence impacts may increase risk of cardiovascular disease, diabetes, high blood pressure, obesity • Exposure to air emissions can increase or exacerbate asthma and cardiovascular disease • Exposure to contaminants, and dietary change, are associated with specific types of cancer	• Rates of specific diseases • Exposure to risk factors (eg. air pollution, dietary change, as discussed above)	Some outcomes in this broad category are addressed in "contaminant exposure" and "food, nutrition, and physical activity". This section summarizes mitigation approaches described in more detail above: • Measures to reduce exposure to contaminants • Measures to reduce subsistence impacts • Measures to support subsistence activities • Measures to support a healthy diet	(See previous discussions in relevant sections)
7. <u>Infectious Disease</u> • Influx of workers to isolated community can be source of exposure to	• Rates of specific infections	• Employee health screening: appropriate approaches to screening and infection control can	• Employee health screening: voluntary cooperation between health authorities and

new/uncommon infectious diseases • High prevalence of MRSA skin infections in some areas of rural Alaska may pose risk to facilities/workers • Sexually transmitted disease outbreaks sometimes observed in association with personnel influx during resource development "boom"		be developed through collaboration between proponent and local/tribal health agency • "Island" or "Gated" development • Paid sick days (evidence-based reduction in transmission of infectious diseases)	proponent's occupational health program. • Borough zoning could provide authority to require gated development; in some cases federal or state regulatory agency may have such authority as well; or, voluntary agreement with industry • Paid sick days can be legislated at state level, or offered voluntarily by proponents
8. <u>Water and Sanitation</u> • Revenues from projects may be used to fund water and sanitation projects • Worker influx related to a project may place higher demand on water and sanitation infrastructure.	• Level of water and sanitation infrastructure and function • Prevalence of diseases related to water and sanitation (parasites, respiratory infections, gastrointestinal infections)	• Tax revenue from the project can be used to support development of adequate water/sanitation programs in communities that do not have functional programs or require repairs. • If worker influx is projected to significantly increase demand on a water/sanitation program, a system of voluntary or mandated payments to compensate for the maintenance/expansion costs can be implemented.	• Borough or state tax revenue, via allocation to address the identified need; native corporation revenue; voluntary 'good neighbor' efforts by proponent • Borough or state may have authority to levy fee or negotiate separate payment agreement (eg. payment in lieu of taxes) with proponent.
9. <u>Health Services Infrastructure and Capacity</u> • Revenues from project may support health and public health services • Project may create higher demands on health and public health services	• Inpatient and outpatient visit statistics • Medivac statistics • EMS statistics	• Tax revenues from the project could be used to support development of specific programs or facilities identified as needs for the affected region • If the project is anticipated to increase service demand in a region and tax revenues are not available or sufficient to address the increase, a system of voluntary or mandated payments can be instituted.	• Borough or state allocation • Borough or state may have authority to levy fee or negotiate separate payment agreement (eg. payment in lieu of taxes) with proponent.
10. <u>Occupational/ Community health interface</u> • Company drug and alcohol policy can affect rates of native	• Alcohol and drug-related clinical visits and arrests	• Effective occupational health program to prevent alcohol and drug	• Most of these issues would be handled by occupational health

hire, and drug and alcohol use by community members employed at the project		abuse by staff. Company culture that does not support unhealthful drinking patterns.	and jobsite nutrition programs. Voluntary collaboration with local/state/tribal health authorities may offer a means to improve the efficacy of these programs, and protect workers more effectively.
• Company health screening practices can affect community exposure to infectious diseases	• Infectious disease rates	• Collaboration between local/tribal/state health authorities and project proponents to develop appropriate screening and management protocols for infectious diseases.	
• Company food/nutritional services can affect diet (eg., employees who have specific medical dietary requirements)	• Rates of diet-related medical problems; quantitative dietary survey	• Nutrition programs at jobsite that offer/encourage healthful food choices, snacks, and support subsistence food preparation.	
• Decontamination policies can reduce likelihood of secondary occupational exposure to contaminants	• Contaminant levels in homes and families of worker	• Effective decontamination policies in the workplace. Periodic screening of worker's homes and families.	
11. Maternal & Child Health • General improvement in economic indicators can lead to reductions in infant mortality and premature births • Specific project-related changes such as influx of non-resident workers and new roads can increase the risk of teen pregnancy and maternal alcohol/drug abuse through increasing access and altered social cohesion	• Premature birth rate • Maternal substance abuse • Teen pregnancy rate	• Consideration of "island" or "gated" development alternatives, in which industrial facilities are isolated from community. • Increased staffing for public safety and EMS personnel • Revenue from project can be used to support health and public health approaches • Comprehensive economic planning can be used to identify ways to ensure that impacted communities derive maximum economic benefit.	• NEPA allows consideration of "island development" alternative, but may not give agency authority to require. • Proponent can elect to implement "island development" alternative

Yet at the July working group meeting, much discussion revolved around the validity of even including M&E within HIA. NEPA does not address long-term monitoring, so meeting participants, particularly those representing federal regulatory agencies, questioned the basis of M&E in the HIA context. If HIA is modeled on the EIS process and the EIS process is designed for predictive rather than ongoing evaluative

purposes, then what is the logic, they reasoned, of extending the function of HIA to include M&E. In response, other members of the group argued that effective adaptive management strategies are actually in the best interests of industry as well as affected communities. Mitigation measures proposed within the HIA allow for up-front engineering alterations before substantial costs have been sunk into an original project design. M&E aids in determining which mitigation measures are successful and which can be abandoned. In doing so, it eliminates financial inefficiencies. The group concluded that M&E would serve a valuable function as a component of HIA, but uncertainty regarding enforcement mechanisms remained. The following month, at the August working group meeting, the question of M&E enforcement was once again raised, and participants conceded that the benefits of M&E, even if not mandatory under existing statutory authority, warranted its inclusion.

Another persistent issue, that of personal choice as a mediating factor in health effects analysis, was also re-visited in August. This time, however, specific concerns related to the role of nutrition surveys as a component of HIA. Representatives from State regulatory agencies dismissed the relevance of dietary information to permitting decisions, arguing that nutritional surveys are useful strictly for non-regulatory public health entities. These agencies noted that ADF&G already collects information related to subsistence harvests. However, others with public health expertise contended that harvest surveys do not convey the same information as nutritional surveys. Data obtained from nutritional surveys could be employed in making regulatory decisions if, for example, an affected community is found to rely on a fish species that is already characterized by high levels of a contaminant that will be released from the proposed

project; under these circumstances, consideration of alternative actions would be well-warranted. While State regulatory agencies were adamant that current regulatory conditions do not permit appreciable contamination to occur off-site and that fear of contamination should not elicit formal response, health agencies described reasonably foreseeable circumstances under which contaminants could reach subsistence resources. These agencies also contended that actions, such as community-based participatory research, could be taken to reduce contamination fears and, in doing so, would contribute to the public stakeholder outreach efforts acknowledged to be a critical component of HIA. Furthermore, under Executive Order 81298 of NEPA, which establishes environmental justice, measurement of consumption rather than simply harvest is explicitly mandated. Thus, federal permitting agencies are required to communicate consumption risks to the public. However, given that the Alaskan HIA Guidance document is not limited to projects invoking NEPA, the most promising means of securing the routine administration of nutrition surveys consists of rendering them cost-effective from the perspective of State regulatory agencies and project proponents.

At the August meeting, Guidance document ownership was also discussed. While the final draft would reflect the contributions of all participants and any agency would possess the ability to undertake its own health analysis, it was recognized that legal responsibility needed to be assigned for maintaining and supporting the document electronically as well as for leading periodic revisions. It was proposed that ADHSS, which represents all Alaskans, and ANTHC, which possesses tribal credibility, should accept joint ownership and should collaborate in holding an annual conference at which agencies undertaking HIA would discuss their experience with the process, specifically

with novel mitigation strategies. Yet before issuing a final Guidance draft, the working group suggested that input be solicited from industry and from environmental conservation groups through either a workshop or through more selective invitation to a working group meeting. And well before this process could occur, participating agencies needed to conduct internal document review. The next working group meeting was scheduled for November in order to allow adequate time for intra-agency revision.

State of Alaska Review of the HIA Guidance Document, Winter 2009-2010

When the working group reconvened in November, few of the agencies had actually succeeded in conducting comprehensive internal review of the Guidance document. Most notably, State agencies had not submitted a unified critique, and many State representatives were absent from the meeting. Krieger, contracted by ADNR, cited several general objections to the draft. Concerned about the confusing role of NEPA in some parts of the document and the limits that it seemed to place on application of the Guidance to non-NEPA projects, he recommended creating a separate appendix that would provide a complete discussion of the relationship of the NEPA EIS process to Alaskan HIA. He also advocated for transformation of the Guidance into a technical document. As a technical document, the majority of the Guidance would describe methods rather than processes; like the NEPA discussion, process descriptions would also be allocated to an appendix. Ultimately, the Guidance would serve as a resource tool used to determine which measures are appropriate for a specific project within the HIA framework unique to each lead agency. Collectively, these critiques would form the foundation of the major State-initiated revisions that would occur over the course of the following months.

By January, when State agencies met for internal review, the Governor's office had granted formal support for the development of HIA guidance pertaining to large-scale natural resource extraction projects, and Krieger had significantly re-written the Guidance document. Intended to function as a technical tool, the Guidance was now devoted to explaining how to perform an HIA rather than why to perform an HIA. References to the NEPA process and to the State BIF process were each removed from the body of the text, and neither process was discussed in an appendix; while the Guidance could certainly be applied within either the NEPA or BIF framework, it was restructured to function through generic application. If HIA was to be performed in Alaska, it was expected that it would adhere to the Guidance protocol. Although each agency maintained autonomous authority to undertake HIA, the Guidance document was redesigned with the intent of avoiding multiple HIA practices. The document was further streamlined by removal of discussions pertaining to issues about which the working group remained unresolved. Any perceived tribal focus was eliminated, and the State asserted its right to act as a cooperating agency for all HIAs given that it represents the interests of all Alaskans. The document, described in more detail below, is currently undergoing further internal State revision. Once the State has met once more and reached consensus, the Guidance will be distributed to other working group agencies, and a final draft will be issued following subsequent meetings. The working group intends to meet a few times each year to maintain collaboration and communication, but a new department within the ADHSS Section of Epidemiology devoted entirely to future HIA endeavors will exercise primary responsibility for maintaining and modifying the Guidance in addition to overseeing specific HIAs performed throughout the State.

State Revision: HIA Guidance for Alaskan Resource Development Projects

Immediately establishing itself as a technical document, the State-revised Guidance defines its purpose as the provision of "good practice" HIA protocol. While it acknowledges that it could be employed within the context of a stand-alone document or within the context of environmental and social impact assessments, it makes no explicit reference to NEPA. In fact, in describing its objectives and limitations, it states that it is not designed to serve as a NEPA-specific HIA manual. Although it still includes the section from the previous draft that describes general health determinants, the influence of large-scale natural resource development projects on community health, and the unique environmental, social, and economic factors that shape the Alaskan health profile, the importance that it places on public outreach and community stakeholder participation is framed within the context of business performance and reputation as well as community welfare.

Like the working group Guidance document, the first section of the State-revised Guidance document provides general background information in the form of an overview of HIA function, definitions of HIA terminology, and descriptions of the processes involved in any HIA. Following the statement that HIA should be "fit for purpose," the second section identifies the types of HIAs that pertain to different levels of analysis and that require different degrees of public consultation and additional baseline studies. In determining an appropriate level of HIA, lead agencies should assess the anticipated project footprint as defined by consideration of potential hazardous material exposure, human relocation and influx, endemic disease profile, existing health systems and infrastructure, stakeholder concerns, and social determinants of health (Krieger, 2010).

Of critical importance, as emphasized repeatedly throughout the document, is coordination of the HIA within the overall environmental and social impact assessment processes. The HIA should not be performed subsequent to the environmental and social assessments, for it is intended to influence decision-making and to affect change. According to the Guidance, HIA imparts maximum benefit when it is conducted before final engineering design specifications are made and construction contracts are settled. Furthermore, coordination among each impact assessment process prevents costly and time-consuming duplication. However, the Guidance does acknowledge that the nature and geographic distribution of potential environmental and social impacts may not completely align with anticipated health impacts. The affected communities selected by each impact assessment process may also differ depending upon the differential environmental, social, and health consequences of a given action. Thus, the HIA may rely on some of the same data that is integral to the environmental and/or social impact assessments, but it should examine specific health-related implications of that data. In any case, the mitigation measures proposed within the HIA, like those proposed within the environmental and social impact assessments, must be realistically bounded, "operational rather than aspirational" (Krieger, 2010). A diagram of the HIA process, as well as a table intended for use in determining the appropriate level of HIA, are each included within the second section of the document in order to facilitate understanding.

The next section is devoted to screening. That is, it provides a methodology by which federal and State agencies can determine if a given project warrants a formal HIA. During the internal State review meeting, some participants objected to the placement of this section subsequent to the section describing levels of HIA. Arguing that the level of

HIA appropriate for a given project should only be determined after it has been determined that the project requires an HIA, these participants suggested that the screening section be placed immediately after the background section. However, within the screening section, it is recommended that the assumption be made that all projects warrant some level of HIA. Given the tremendous variability in size, location, complexity, and, thus, in the magnitude of potential effects of natural resource development projects, the Guidance contends that it would be impractical to apply a rigid set of screening rules. Perhaps counter-intuitively, it is far easier to assume that all projects require individual review of their potential health impacts. And given that "reproducibility is key," a consistent screening methodology is critical (Krieger, 2010).

The screening methodology set forth within the Guidance document states that the health effects evaluated within an HIA can be derived from 1) specific project characteristics, 2) potential environmental and social hazards, or 3) community concerns. Project characteristics refer to the linear features of a proposed project, its geographic footprint, and the significance of its exploration and construction phases. Environmental hazards are derived from the release of potentially toxic materials into the air, water, and soil. Given that these contaminants may bioaccumulate in fish and in mammals and that traditional subsistence practices persist in rural Alaska Native communities, the State-revised Guidance, like that of the working group, emphasizes that HIAs conducted within Alaska should evaluate hazardous material exposure scenarios that are unique relative to those considered throughout the rest of the nation. Ultimately, the HIA must consider two critical subsistence questions: 1) whether the proposed project affects community access to subsistence resources and 2) whether the project affects the objective quantity

or quality of these resources. Given that these questions are likely to be addressed within the EIS process, the HIA should use data gathered during EIS investigations (Krieger, 2010). It is worthwhile to recognize, however, that these questions may be more accurately answered with the aid of a nutritional survey. While the performance of nutritional surveys, which would require an HIA data-gathering procedure independent of the corresponding EIS, remains controversial, the State-revised Guidance explicitly acknowledges that previous dietary surveys have demonstrated that subsistence harvest rates are not equivalent to consumption rates in Alaska. Thus, according to the document, HIA should entail quantitative measurement of subsistence resource consumption rates (Krieger, 2010). Nevertheless, it is unlikely that this issue will be fully resolved until early projects employing HIA establish a precedent. The screening methodology section concludes by reinforcing the importance of stakeholder participation to the overall HIA process and by recommending that community outreach efforts be coordinated among the environmental, social, and health impact assessments.

The State-revised Guidance then introduces a significant new structural element to the layout presented within the working group Guidance document. Before undertaking a detailed discussion of the scoping process, the State-revised Guidance proposes that an understanding of the health analysis framework be imparted. Specifically, a separate section is devoted to consideration of the Health Effects Categories (HECs) employed during the scoping process. As stated within this section, "the role of the HIA is to disentangle the determinants of health (i.e. the individual, social, environmental, and institutional factors that are directly, indirectly, or cumulatively affected by the proposed project)" (Krieger, 2010). The HECs are intended

to facilitate this function. However, the Guidance also notes that HIA is not intended to serve as a "social engineering" exercise. Instead, the HEC framework is designed to capture the most significant determinants of community health; for each HIA, care must be taken to elucidate the pathways of causal project-related effects (Krieger, 2010).

Retaining the language of the working group Guidance document, the State-revised Guidance document limits the scope of any HIA to incremental contributions of proposed project actions that are most likely to produce significant health impacts. According to the State-revised Guidance, stakeholder concerns must be managed in a scientific, culturally acceptable, and cost-effective manner. In an attempt to provide "a sufficiently detailed template that can be systematically applied to every project," the Guidance offers a list of questions that the HIA team should consider during the scoping process (Krieger, 2010). A list of social, economic, and health factors to be evaluated when identifying affected communities is also included. While it acknowledges the role of ADHSS as the State's technical lead, the Guidance also recognizes the value of involving a variety of key stakeholders, particularly relevant tribal health agencies, in the HIA process. By providing a list of tribal health agencies throughout the State, the document encourages lead agencies and contractors to collaborate with tribes; however, unlike the working group Guidance, the State-revised Guidance clearly demarcates the role of tribal organizations in the HIA process.

The creation of the next section, devoted exclusively to a discussion of baseline data collection methodology, is another example of the way in which the State re-formulated the Guidance as a generic, technical document. Intended to assess the data implications of the scoping process, this section is designed to aid lead agencies and

company-hired contractors in determining what data is available and what data needs to be collected (Krieger, 2010). The table of Alaskan data sources included in the working group document, as well as the portion of the working group document that discussed the methodological, ethical, and legal challenges of human health data collection in Alaska, are each retained within this section. However, a description of the activities and tasks typical of baseline data collection is a new addition. According to the Guidance, key activities include 1) obtaining a demographic profile for the impacted community, including important community features; 2) identifying community health issues delineated within the context of other HIAs, published studies, and reports of similar projects; and 3) defining baseline data using the HEC framework. Key tasks include 1) a baseline literature search, review, and analysis pertaining to data of the forms listed in Table 11; 2) fact-gathering meetings conducted with project personnel (a list of relevant individuals and the type of information they are likely to offer is provided within the Guidance document); 3) fact-gathering meetings with governmental or institutional personnel (a list of relevant departments, programs, and organizations is included in the Guidance document); 4) site visit and review; and 5) community member focus groups. Taken collectively, these activities and tasks allow for a comprehensive data gap analysis (Krieger, 2010). First presented within the working group Guidance document, the table listing data gaps likely to be found in Alaska and corresponding baseline studies that could be conducted to fill in these gaps is retained within the State-revised Guidance.

Table 11: Potential Sources of Existing Baseline Data (adapted from Alaska HIA Working Group, 2009)

• Social impact/ management reports
• Subsistence literature review
• Traditional and Local Knowledge (TLK) surveys
• Environmental impact/ management reports
• Drinking water sampling results
• Influx management plan
• Sewage-treatment plant capacity plans
• Medical response to spills plan
• Food and water safety plans and procedures
• Contaminant air, water, soil monitoring data
• Contaminant human and/or subsistence species biomonitoring data
• Stakeholder consultation meeting reports

Also like the working group Guidance, the State-revised Guidance includes an extensive discussion of the importance of subsistence to the economy, culture, and society of rural Alaska Native communities and considers both the positive and negative impacts of full-time, year-round wage employment on subsistence activities. The discussion contained within the baseline data collection section reiterates what was already considered in the screening section. That is, it reinforces the two questions that must be asked in any subsistence evaluation: 1) Is there a significant risk of subsistence resource contamination that makes a loss of availability likely? and 2) Do particular project aspects make a loss of subsistence resource access likely? (Krieger, 2010). In order to assess the extent to which these impacts are likely to affect public health, the Guidance, within the context of the baseline data collection section, recommends that nutrition surveys, subsistence resource contaminant level measurements, and human biomonitoring studies be performed. The nutrition survey would be designed to determine how much of the subsistence resource harvest is actually consumed, what alternative food sources are available, and whether the proposed project threatens food security. Subsistence resource contaminant levels would be tested when exposure

pathway(s) from project-released hazardous materials to humans are established. Biomonitoring studies would accompany these subsistence resource contaminant level measurements in order to determine the significance of identified exposure pathways in the context of public health. The Guidance includes a table intended to aid in design of a subsistence resource contaminant monitoring protocol and another table intended to facilitate determination of when human biomonitoring studies should be performed. For both subsistence resource contaminant level measurements and human biomonitoring studies, as well as for nutrition surveys, the Guidance strongly advocates for baseline data collection in order to provide a means of determining a given project's contribution in the future as well as to assess potential cumulative impacts and corresponding human health risks at the present (Krieger, 2010).

Following the baseline data collection section is a section devoted to the concept of stakeholder engagement. This section is largely identical to that included in the working group Guidance. Each asserts that effective stakeholder engagement is an essential feature of HIA, emphasizes coordination with the public participation processes provided for within the environmental and social analyses, and discusses the unique challenges related to stakeholder engagement in Alaska (for a more detailed description of these challenges, please refer to the review of the working group Guidance document earlier in this chapter).

Once potential health impacts have been identified, risk assessment is employed "to investigate, assess, and qualitatively or quantitatively rank the impacts to help prioritize management actions" (Krieger, 2010). As listed in the Guidance, the risk assessment process may include:

- review of available State, regional, and local health data and comparison of local data to State and regional data
- analysis of vulnerable subgroups
- field survey visits by the HIA team, including consultation with local health agencies
- seasonality considerations, which may impart differences in subsistence practices, water use, and associated disease-transmission dynamics
- variability of existing healthcare infrastructure across different project areas
- capacity for coordination with existing State disease-control programs

Health risks of proposed actions should be estimated based upon their significance, nature (direct, indirect, or cumulative), timing and duration, intensity, frequency, and geographical extent. In order to assess the first of these categories, significance, the Guidance proposes that the magnitude of the change in health-related baseline data, the local capacity to absorb that change, and community acceptance of that change each be considered (Krieger, 2010). To lend quantitative credibility to qualitative risks, the Guidance includes a risk matrix intended to facilitate the ranking process based upon the likelihood and severity of health effects. Overall, the Guidance emphasizes the importance of developing a process that rates risks from multiple perspectives, allows for adequate stakeholder participation, and considers the "manageability" of a project, or the capability of stakeholders to influence risk responses. The risk-rating scales employed in the HIA should align with those employed in the environmental and social analyses (Krieger, 2010).

The outcomes of the risk assessment are used to determine actions intended to mitigate identified project-related health impacts. According to the Guidance, these

mitigation strategies may be outlined in the social development plan or may be independently conceived. They are generally developed in accordance with two fundamental public health concepts, those of 1) disease prevention and 2) health promotion and education. Disease prevention, defined as "any intervention that seeks to reduce or eliminate diagnosable conditions," may be applied at the individual or community level and may involve primary, secondary, or tertiary levels of prevention (Krieger, 2010). An appendix from the working group Guidance document providing examples of mitigation for community-focused measures is retained within the State-revised Guidance. However, the State-revised Guidance differs from the working group Guidance in emphasizing the need for a clear distinction between impact mitigation strategies and discretionary community-outreach efforts. According to the document, mitigation is usually specific and tied directly to a project-related effect, whereas community outreach efforts are typically implemented because the project proponent recognizes the value of enhancing general community services. Health promotion and education measures differ from community outreach efforts in that they are related to specific potential project impacts. "Designed to facilitate behavioral and environmental adaptations to achieve better health in combination with primary prevention," health promotion and outreach is, according to the Guidance, "the most efficient and cost-effective method of managing potential impacts" (Krieger, 2010). In this statement, an appeal to corporate project proponents is evident. Specifically, the Guidance advocates for workforce health promotion and education programs as a means of significantly affecting behaviors in local communities. This concept of employees as peer educators

will be illustrated in a Chapter 4 discussion of the comprehensive community outreach programs implemented by Donlin Creek LLC in the Yukon-Kuskokwim region.

According to the State-revised Guidance, all mitigation strategies must be assessed in terms of resource flows and responsibilities, local absorptive capacity, and social and environmental determinants. An evaluation of resource flows and responsibilities "ensures the effective use of limited resources and the successful collaboration between the project and various stakeholders" (Krieger, 2010). If the identified health effects and selected mitigation measures are to be fully understood and accepted, then these stakeholders must include local government and community members. In order to ensure long-term sustainability, the capacity of local agencies, in terms of sufficient human and financial resources, preparation, and experience, must be assessed and, if necessary, developed. Indeed, the Guidance specifically states that structural improvements, such as the construction and refurbishment of healthcare facilities, sewage treatment and disposal facilities, and water purification systems, must be coupled with human resources training if existing skills are lacking (Krieger, 2010). Human resources training is likely to reduce the negative social effects of the proposed project; however, separate mitigation measures are typically designed to specifically target social determinants of health. According to the Guidance, the measures designed to target social determinants must 1) be coordinated with social impact mitigation, 2) be accompanied by a realistic appraisal of roles and responsibilities, 3) be disentangled from the mediating role of personal choice, and 4) employ measures that can be implemented within the timeframe of the project (Krieger, 2010).

All mitigation strategies should include a plan for monitoring and evaluation (M&E) as well as a verification component. Thus, the next section of the State-revised Guidance is devoted to a discussion of M&E. In order "to capture early effects and unanticipated [project] consequences, [the M&E plan] should be based on appropriate, applicable, and relevant key performance indicators (KPIs)" (Krieger, 2010). Termed differently, these KPIs are the equivalent of the health indicators described in the working group Guidance. While the working group Guidance defined health indicators as health outcomes, intermediate health indicators, or health determinants, the State-revised Guidance defines KPIs as structural, process, or outcome-oriented. However, the table originally included in the working group document that presents health indicator examples for each HEC and the appendix that provides a detailed list of health indicators and data sources specific to Alaska are retained in the State-revised Guidance. Each document also acknowledges that health indicator/ KPI identification is likely to require technical collaboration with State epidemiologists and biostaticians given that disease rates are often difficult to obtain below the State or regional level due to the small sample size of rural Alaskan villages. Furthermore, in addition to allowing for statistically accurate data reporting, health indicators/ KPIs should be selected to ensure that data is available in a timely manner. While verification, the transparent review of mitigation measures to determine effectiveness, cannot realistically begin until at least 6-12 months following the initiation of M&E data collection, the State-revised Guidance recommends at least annual verification performed thereafter by a formal external entity (Krieger, 2010). Thus, routine measurement of health indicators/ KPIs should permit detection of change within this timeframe.

Responsibility for M&E plans, as well as for baseline studies and other HIA components, should be defined in terms of financial and human resources. In keeping with its technical mission, the State-revised Guidance, unlike the working group Guidance, includes a section that specifically discusses resource allocation. This section, intended to address a corporate audience, urges project proponents to work with State and, if applicable, federal agencies to assign budgetary and performance roles. Resources devoted to the HIA effort should be commensurable to potential health impacts, and adequate data should be collected in order to develop clear and transparent development and operations plans. Coordination of resource allocation with the environmental and social impact assessment processes is, of course, of the utmost importance (Krieger, 2010).

Chapter 3:

Specific Alaskan HIA Project Proposals

At the same time that the general HIA Guidance document was being developed, participating agencies were also being asked to perform HIAs for specific natural resource extraction projects entering the permitting stage. During the summer of 2009, corporate proponents of two proposed mining projects, the Chuitna Project and the Donlin Creek Project, requested that HIA be incorporated into the EIS process that each was initiating. Having recognized that HIA was gaining significant attention from State regulatory agencies and that the baseline study and stakeholder outreach components of HIA served business interests, these companies were eager to engage in HIA efforts. However, each company envisioned the scope and associated activities of its particular HIA in relatively narrow terms. Many of the contentious issues debated in working group meetings, particularly those related to subsistence resource-related health impacts, were derived from concerns raised by corporate proponents. The objections that proved most intransient continue to inhibit HIA progress today. This chapter provides a review of the history and current status of the HIAs initiated for the Chuitna Project and the Donlin Creek Project.

The Chuitna Project

Proposed as a surface coal mining and export development operation, the Chuitna project is intended to extract ultra-low sulfur, sub-bituminous coal from a 5000-acre site within the Beluga Coal Field of south-central Alaska, approximately 45 miles West of Anchorage and 12 miles from the Cook Inlet coast (ADNR, 2010). Currently, the project area is largely undeveloped with the exception of a system of primitive roadways

remaining from logging activities and oil and gas exploration and production. In addition to the surface mine, the project proposal requires construction of support facilities, a mine access road, a coal transport conveyer, employee housing, an airstrip facility, a logistic center, and an export terminal at Ladd Landing (Figure 5). Although no coal processing would be performed on-site, coal would be crushed into 2-inch by 2-inch cubes, carried to the export terminal in a gondola, stored in an open stockyard capable of holding 100,000-500,000 tons of coal if necessary, and then loaded onto ocean-going transport ships from a 10,000-ft. trestle extending into Cook Inlet (EPA, 2006b). The site is estimated to hold a 300 million ton coal resource, and the mine is predicted to operate for a minimum of 25 years with 12 million tons of coal extracted each year. During the operations stage, approximately 200-250 workers would be employed on-site (EPA, 2010). While streams traversing the area would be diverted throughout the life of the mine, a continuous process of overburden removal, coal extraction, backfilling, grading, and revegetation would occur with the final goal of returning the land to its original ecological condition. Monitoring would be performed in order to evaluate reclamation success (EPA, 2006b).

In the early 1990s, a project design was evaluated through an EIS process, and permits were issued by most of the applicable State and federal regulatory agencies; however, the project did not proceed to development. Due to substantive changes in project design and regulatory requirements during the interim period, a comprehensive stand-alone SEIS is being prepared for the new proposal. On March 13, 2006, the EPA, the lead agency responsible for conducting the SEIS, entered into a Memorandum of Understanding (MOU) with PacRim, the Chuitna project corporate proponent, to define

terms of cooperation in the development of the SEIS. Subsequently, the EPA hired AECOM (formerly ENSR Corporation), a third-party contractor, to assist in preparation of the SEIS and related documents. The U.S. Army Corps of Engineers and ADNR are each cooperating agencies and are responsible for coordinating the permit application reviews with the SEIS process. The U.S. Fish and Wildlife Service is also participating as a consulting agency. Scoping meetings were held in the communities of Kenai, Anchorage, Beluga, and Tyonek during July 2006 (EPA, 2010).

Three years later, given the increasing prominence of the HIA process in the context of large-scale Alaskan resource extraction projects, the EPA requested assistance from ANTHC and the State of Alaska to prepare an HIA in conjunction with the Chuitna SEIS. The objectives of the HIA included 1) a description of the baseline health status of potentially affected communities, 2) identification and assessment of direct, indirect, and cumulative public health effects from the construction and operation of the mine and its alternatives, and 3) development of mitigation measures in response to identified health effects. While the villages of Tyonek and Beluga were selected as potentially affected communities largely due to their geographical proximity to the project site, the entire Kenai Peninsula Borough (KPB), particularly the villages of Kenai, Soldotna, and Nikiski, were selected as potentially affected communities due to the project-triggered human influx and overall socioeconomic changes that they would be likely to experience. Overall, anticipated project impacts with the potential to affect human health included the following (State of Alaska, 2009):

- emissions and discharges in the form of fuel combustion and fugitive dust from the mine, conveyer belt, export terminal, and trestle

- treated and untreated water discharge
- altered surface water location, flow rates and drainage patterns
- reduced and/ or contaminated groundwater supply
- noise pollution derived from mining operations, constructed transportation corridors, and shipping traffic
- employee and camp follower influx
- new energy sources

However, a complete evaluation of all potential health effects required community participation. Although integration of the SEIS and HIA scoping processes would have been most efficient, SEIS community outreach meetings had already been held. Therefore, a new series of meetings specific to the HIA process was organized.

During June 2009, HIA scoping meetings were conducted in the Tyonek and Beluga communities, with the KPB Mayor's Office, and with the Kenaitze Tribal government. Agency representatives in attendance at these meetings recorded comments relevant to the HIA process and later assembled these comments, as well as responses issued by the EPA, into informal partial transcripts. While these partial transcripts will not be included in the final HIA, they will inform potential project effect identification, risk assessment, and mitigation formulation. They serve as a means of incorporating traditional and local knowledge (TLK) into the HIA process and will, thus, render the public HIA document both more transparent and more meaningful. The community participatory meetings held in association with the Chuitna Project will serve as a prototype for future Alaskan HIAs.

In addition to agency representatives from the EPA, AECOM, ADHSS, and ANTHC, approximately 25 residents attended the meeting held in Tyonek. The two-hour meeting began with a brief presentation that provided an overview of NEPA, the EIS process, the integration of HIA into the EIS process and its rationale at Chuitna, the components of HIA, the limits of HIA, and the contribution of HIA to public health. A Chuitna Project update followed, and then the meeting was opened for public comments and questions. Those comments and questions relevant to the HIA process, organized according to EIS category, are included in Table 12. While community concerns were broad and comprehensive, the most poignant issues were related to bioaccumulation of harmful contaminants in subsistence resources and a decline in the abundance of these resources due to altered habitats and obstructed migration routes. In Tyonek, 76% of residents collect subsistence harvests; these subsistence resources constitute a large share of dietary intake and significantly moderate purchased food expenditures (ANTHC). Yet more than the potential adverse dietary and economic impacts of diminished subsistence activity, villagers recognized the profound psychosocial consequences that would accompany the abandonment of a largely subsistence-based diet. They were very worried that the loss of their traditional subsistence way of life, combined with the influx of employees from outside of their community, would ultimately lead to the destruction of their culture. From their perspective, the Chuitna Project represents a new form of foreign exploitation; they fear that, this time, they may not survive.

Table 12: Chuitna Project HIA Relevant Testimony from Tyonek Public Comments (adapted from Wernham and Bell, 2009a)

Air Quality

PUBLIC COMMENT:	**I am worried about air quality. Dust will be generated from dry coal in the open stockyard and from traffic on dirt access roads. How will this affect people with asthma, people with allergies, and pregnant women (an example of fugitive dust in Seward was given, the air transport system was mentioned in relation to the winds changing with the tides and winds circulating air around Anchorage, Wasilla, Ninilchik, Knik, Eklutna, Nikiski, and Kasilof).**
RESPONSE:	The HIA team will consider the potential health effects of coal dust and other air pollution related to the project. This analysis will be based upon the air quality analysis. Baseline incidence and prevalence of asthma and allergies in Tyonek are also being investigated.
PUBLIC COMMENT:	**What about Alaska Native workers breathing in bad air at the mines?**
RESPONSE:	This comment relates to occupational health, which is not a subject of the HIA. If there is considerable local employment projected, it may be reasonable to evaluate worker health issues. These issues are subject to separate regulatory standards under OSHA and MHSA regulations.

Geochemistry

PUBLIC COMMENT:	**Coal will get into the water and contaminate it with mercury and arsenic. These chemicals will impact salmon fry in the streams.**
RESPONSE:	The HIA and EIS teams will review geochemical reports included in the EIS in order to determine the locations and quantities of toxic substances and their corresponding potential human health impacts. A fish biomonitoring plan is currently being considered as a possible means of addressing this concern.
PUBLIC COMMENT:	**This mine will unearth radioactive material and expose people to it.**
RESPONSE:	This comment addresses naturally occurring radioactive material (NORM). We will review the geochemical data to determine whether there is any documentation of NORM at the site. We may also review the literature relevant to NORM in sub-bituminous coal deposits and the relation of NORM in these coal deposits to human health.

Water Resources

PUBLIC COMMENT:	**We use artesian springs for water because the lake was**

	contaminated. The coal pit could disrupt the water table that feeds these springs.
RESPONSE:	This comment refers to water and sanitation issues that may be impacted by the project and indirectly impact health. This will be included in the HIA analysis.
PUBLIC COMMENT:	**The mine area will never be properly reclaimed and, therefore, our streams will never be returned to their original condition.**
RESPONSE:	The HIA team has little say in reclamation activities, but it can establish effective baselines for understanding if impacts to water and sanitation systems do occur.

Aquatic Resources

PUBLIC COMMENT:	**There will be invasive species attached to the bottom of boats and inside boats docking at the trestle (an example was given of mussels in the Great Lakes, rats on ships, and spruce bark beetles on ships).**
RESPONSE:	The project proponents will likely have a mitigation measure in place for invasive species. If these are found to be relevant to health, they will be discussed in the HIA.

Subsistence

PUBLIC COMMENT:	**Are you considering the potential impacts to wildlife and fish? The mine is going to run along 11 miles of streams and through a staging area for moose bulls.**
RESPONSE:	The comment relates to subsistence food resources for villagers and will be evaluated using wildlife information in the EIS.
PUBLIC COMMENT:	**The 7 million gallons a day of mine wastewater discharged daily into the Chuit River is a threat to our subsistence fish. One solution I would recommend is piping the water out to the coast. Diverting water is a big problem in a salmon stream. How will the fish know where to go, and will sediment build up at the mouth of the Chuit near Ladd Landing?**
RESPONSE:	The EIS and HIA teams will review hydrology reports and, to the extent possible using public input and other data sources, evaluate the accuracy and completeness of the data. This comment relates to a subsistence food source that is directly relevant to individual and community health. The piping option may be considered as a possible alternative strategy.
PUBLIC COMMENT:	**The project area is located in the migration route of the moose population. The moose will be exposed to mining contaminants, and people will consume these contaminants when they harvest the moose.**

RESPONSE:	Impacts to the moose population affect a subsistence food source that has direct relevance to health. The HIA will review available data on fugitive dust emissions, and contaminants present in dust that could accumulate in moose and harm human health. At present, no additional biomonitoring is planned to address this potential exposure pathway.
PUBLIC COMMENT:	**Will Alaska Native workers at the mine have access to subsistence foods?**
RESPONSE:	At the meeting, Aaron Wernham mentioned that mitigation measures could address this issue. At Red Dog, employees were allowed to have a subsistence food locker on site.
PUBLIC COMMENT:	**Our wildlife is already stressed, our salmon catch this year is much smaller, and the moose numbers are down.**
RESPONSE:	The wildlife and subsistence sections of the EIS will be referred to for consideration of the project's impact on salmon and moose and the subsistence and socioeconomic pathways to health. Adequate baseline surveys should reflect the current state of the wildlife.

Health

PUBLIC COMMENT:	**Will you consider mental health impacts? The oil, timber, and commercial fishing industries have each contributed to historical exploitation of the local population. The Chuitna Project represents "the intrusion of more invaders on our shores. They leave rich, while we are left devastated."**
RESPONSE:	The HIA team is considering community mental health impacts of the project and would also consider the cumulative effects of past, present and reasonably foreseeable future activities in the cumulative scenario.
PUBLIC COMMENT:	**Has anyone lived around these mines in other parts of the country and seen what they have done?**
RESPONSE:	The HIA will include a review of the literature from other regions and determine whether any scientifically valid comparisons to the Chuitna project and surrounding communities can be made.
PUBLIC COMMENT:	**Will the Chuitna Project be a gated project? Will employees really be contained on-site, or will they bring communicable, infectious diseases and social pathologies into Tyonek? You cannot effectively fence people in, so employees will inevitably serve as disease and drug vectors between the project and the community.**
RESPONSE:	The HIA team will look into the project plan for controlling workers' interactions with the community and occupational health screening practices. Influx of non-resident personnel

	to isolated rural communities is a well-recognized contributor to some of these problems based on the public health literature, and this pathway will be discussed in the HIA.
PUBLIC COMMENT:	**The people in Beluga are from some areas that were impacted by mines, so they will be knowledgeable about mine impacts on a subsistence way of life.**
RESPONSE:	Partly in response to this comment, along with similar comments from Beluga, the HIA will include a review of the literature from other regions and determine whether any scientifically valid comparisons to the Chuitna project and surrounding communities can be made.
PUBLIC COMMENT:	**Will you consider alcohol use, domestic abuse, child neglect, and drug abuse?**
RESPONSE:	The HIA will consider baseline occurrences of these health indicators and discuss pathways they may be impacted due to the project activities.
PUBLIC COMMENT:	**Is there any information on increases in asthma from the Red Dog HIA, and can we use this for the present study?**
RESPONSE:	There is no applicable asthma incidence or prevalence information relevant to potentially affected populations identified by the Chuitna Coal Project.

Transportation

PUBLIC COMMENT:	**Any construction of roads, including one across the Susitna, will inevitably increase road-traffic deaths. More Alaska Natives die from traffic deaths than natural causes.**
RESPONSE:	Baseline injury mortality in Alaska Native is indeed very high (second only to heart disease overall) and will, therefore, receive consideration for any new roads built as a result of this project. The planned road across the Susitna is still being investigated for mention in a cumulative impact scenario.

Noise

PUBLIC COMMENT:	**How noisy will the mine be? We can already hear the oil rigs in the Cook Inlet.**
RESPONSE:	The HIA team will seek to address noise-related health impacts based on the available noise data submitted.

Socioeconomics

PUBLIC COMMENT:	**Will population changes be considered in other regional communities?**
RESPONSE:	Yes, given that many extraction industry workers live in the Kenai Peninsula area, employee flyout operations are likely

	to occur from Kenai, and the HIA will assess the socioeconomic health impacts of population influx to the Central Kenai Peninsula (CKP).
PUBLIC COMMENT:	**Will the mine construct its own clinic, or will employees depend upon medical services available in Tyonek? What about police and fire departments?**
RESPONSE:	Service provision by both the mining company and the KPB is a question that will be addressed by evaluating mine employee demand on services and the resulting impact on the existing community.

Environmental Justice

PUBLIC COMMENT:	**Will there be any compensation if our subsistence resources disappear?**
RESPONSE:	Processes of bonding and agreements between the project proponents and organizations cannot be mandated by an HIA. However, a discussion of subsistence-health impacts may help facilitate some common ground for such an agreement to be made.

Cumulative Effects

PUBLIC COMMENT:	**What about the proposed Eklutna coal mine, or Chickaloon, or the big gravel pit, or the proposed infrastructure in the Tyonek Native Corporation development land near the coal site?**
RESPONSE:	The HIA will analyze the potential health effects of the past, present, and reasonably foreseeable future activities in the region according to the cumulative scenario developed by EPA.

HIA Analysis Process

PUBLIC COMMENT:	**Will we be able to raise *new* health concerns at any time during the HIA process?**
RESPONSE:	This question was answered during the meeting: Yes, as the NVT is a cooperating agency, it receives drafts and relevant information as it is produced and will have the opportunity to raise any issue at any time concerning these documents before a final decision is reached.
PUBLIC COMMENT:	**Why is baseline information lacking at Red Dog when CHAs, emergency responders, and hospitals should be able to report relevant information?**
RESPONSE:	This comment was partly answered in the meeting: Aaron Wernham explained the need to go beyond anecdotal evidence to actually overturn a regulation or influence a project. He also mentioned that scientifically plausible health impact pathways based on public and expert

	testimony will be considered in the HIA, even in the absence of studies that specifically address the question.

Two days after the Tyonek village meeting, representatives from the ADNR's Large Mines Permitting Team joined the same representatives from the EPA, AECOM, ADHSS, and ANTHC to conduct an HIA community stakeholder engagement meeting in the village of Beluga. Identical in format to the meeting held in Tyonek, the meeting held in Beluga included a brief HIA overview, a project update, and an open forum for public comments and questions. The audience in attendance, however, differed significantly from that in attendance at the Tyonek meeting. While all of the people present at the Tyonek meeting were Alaska Native villagers living in Tyonek, the people present at the Beluga meeting were white and were certainly not all Beluga residents. Indeed, five NGOs, including the Cook Inlet Keeper, Trustees for Alaska, the Sierra Club, the Alaska Conservation Foundation, and the Center for Science in Public Participation, were all represented in the 38 people that attended the Beluga meeting. The comments and questions posed at the meeting that bear relevance to the HIA process are included in Table 13. While people in Beluga, like those in Tyonek, are primarily concerned about the effect of the mine on local fish populations, the origin of their concern differs markedly. Among the Tyonek villagers, the mine poses a threat to their traditional subsistence practices and lifestyle. Among the Beluga villagers, by comparison, the mine poses a threat to their sport and commercial fishing interests. While all of the nearly 200 Tyonek villagers are year-round residents, only about one-tenth of the Beluga residents are year-round residents (20 out of a peak of approximately 200 in the summer). Thus, the magnitude and extent of the potential health impacts of the Chuitna Project is not uniform among potentially affected communities.

Table 13: Chuitna HIA Relevant Testimony from Beluga Public Comments (adapted from Wernham and Bell, 2009b)

Air Quality

PUBLIC COMMENT:	**Coal dust falling from the conveyer onto fishermen below in its transit from Ladd landing along the trestle could affect health.**
RESPONSE:	The HIA will rely on the air quality analysis as well as public testimony such as this comment to evaluate the potential pathways by which coal dust may affect health.
PUBLIC COMMENT:	**Coal storage piles will be a source of fugitive dust. The coal stockpile cannot be covered because of fire danger, and PacRim will not wet it down enough because the additional moisture would make it unmarketable (examples of fugitive dust from Norfolk, VA; Seward, AK; 1990 Chuitna EIS appendix E; possibility of PAHs in dust; strong local winds out of Turnagain Arm).**
RESPONSE:	These issues will be considered in the HIA, which will evaluate potential health effects of coal dust based on the predicted patterns of its dispersal.
PUBLIC COMMENT:	**What about dust from the road (and a possible train)?**
RESPONSE:	These issues will be considered in the HIA, which will evaluate potential health effects of project-attributable changes to air quality. This includes dust from constructed roads.

Geochemistry

PUBLIC COMMENT:	**Mercury will be released at the mine site through percolation and dissolved coal dust in waterways.**
RESPONSE:	Pathways of mercury contamination from the local mine site and fugitive dust will be analyzed in the geochemical analysis
PUBLIC COMMENT:	**Most people around here have wells, but I get my water from a lake. I am worried about coal dust dissolving in the lake and contaminating it.**
RESPONSE:	Pathways of possible coal dust contamination through air and water transport will be considered in the geochemical analysis.

Water Resources

PUBLIC COMMENT:	**Current baseline snowfall and water balance data is based on averages. The project should be engineered to account for seasonal variability, maximum precipitation, and extreme storm events (investigation into the 1984 Typhoon was recommended).**
RESPONSE:	Considerable discussion ensued. An ADNR representative agreed to request the data on which the report was based,

	and all parties agreed in principle that maximum precipitation and storm events should be considered.
PUBLIC COMMENT:	**The 7 million gallons of water discharged daily into the Chuit represents a third of all river flow and will inevitably negatively impact the fish. "Show me a river near a mine site that has fish flourishing."**
RESPONSE:	The impact of discharge into the Chuit as outlined by the Hydrology and Wildlife (salmon) sections of the EIS will be employed to consider the potential impacts to salmon and resulting impacts on health through subsistence and socioeconomic pathways.
PUBLIC COMMENT:	**At Red Dog Mine, the company (Teck Cominco) cannot discharge water into the stream anymore. Instead, they have to pipe it out.**

Wetlands

PUBLIC COMMENT:	**How much of the wetlands ecosystem will the conveyer disrupt?**
RESPONSE:	The conveyer may alter wetland fauna, flora, and ecosystem services. Those aspects relevant to human health will be considered in the HIA analysis

Subsistence

PUBLIC COMMENT:	**Mercury will bioaccumulate in Alaskan salmon from the combustion of Chuitna coal in Asia. Mercury levels in Alaskan salmon are directly attributable to Chinese coal burning.**
RESPONSE:	An adequate response requires that two questions be addressed: (1) what percentage of the mercury found in Alaskan salmon is derived from coal burned in China? and (2) what would be the incremental contribution of Chuitna coal to the total mercury emissions from China? If, based on this initial inquiry, it appeared that Chuitna coal might make a significant contribution to the mercury content of Alaska salmon, it might be relevant to evaluate in more depth in the EIS.
PUBLIC COMMENT:	**There is a giant moose habitat on the southern side of the mine site. The 1984 and 1997 studies of wildlife impacts suggested that moose could be disturbed by the project.**
RESPONSE:	The wildlife section of the EIS will be referred to for consideration of the project's impact on moose and the subsistence and socioeconomic pathways to health.

Health

PUBLIC COMMENT:	**Are there any limits or allowable thresholds of health**

	impacts attributable to the mine that would stop the project?
RESPONSE:	This question was answered during the meeting: the HIA and EIS do not establish any thresholds above which a project cannot be permitted. Some regulatory acts have health-sensitive thresholds (such as air quality standards), but some health effects fall outside of any established regulatory standard.

Noise

PUBLIC COMMENT:	**Noise pollution from the conveyer, helicopters, and small aircraft will affect humans, belugas, salmon, ducks, and geese. The Inlet basically mirrors sound into the community.**
RESPONSE:	The HIA team will await the noise baseline and modeling data and will include an analysis of potential noise-related health impacts.

Socioeconomics

PUBLIC COMMENT:	**The new bulkhead is in front of State-leased set net sites as a replacement to a barge beach landing.**
RESPONSE:	The comment refers to a potential impact on the economic livelihoods of a small number of residents and, as such, is indirectly relevant to health.
PUBLIC COMMENT:	**This project represents the most recent in a long history of exploitative projects and cultural impacts. The communities here are always left with nothing.**
RESPONSE:	The HIA analysis will consider the impact of the project in the context of ongoing sociocultural change and will specifically evaluate the potential health-relevant economic costs, benefits, and mitigation measures that might address these issues.
PUBLIC COMMENT:	**I am concerned about employee health. They are likely to spend half of their lives at this mine site, just like the Conoco and Chugach employees who have to do that currently.**
RESPONSE:	Along with affected communities, the HIA analysis will consider the potential health-relevant economic costs, benefits, and mitigation measures of local employment at the mine site.

Cumulative Effects

PUBLIC COMMENT:	**Other projects in the area would have a cumulative adverse impact on the fish habitat and could actually eliminate the river if fill were permitted.**
RESPONSE:	The cumulative scenario will address the potential health

	effects from the mine.

HIA Analysis Process

PUBLIC COMMENT:	**What if the Corp of Engineers assumes the role of lead agency because EPA has delegated NPDES authority to the State Of Alaska?**
RESPONSE:	EPA will remain the lead agency.
PUBLIC COMMENT:	**PacRim hires baseline study investigators. The process has involved inadequate consultation with local residents regarding their concerns and knowledge base. The potential for biased results is also of concern.**
RESPONSE:	The HIA team will independently review any data and resource reports relevant to the HIA and, to the extent possible using public input and other data sources, will evaluate the accuracy and completeness of the data.
PUBLIC COMMENT:	**The HIA should consider impacts on communities near coal mines, nationally and internationally.**
RESPONSE:	The HIA will include a review of the literature from other regions and will determine whether any scientifically valid comparisons to the Chuitna project and surrounding communities can be made.
PUBLIC COMMENT:	**The mine-related health effects on current Beluga residents will be relatively limited because we are all getting old, but what about the following generations?**
RESPONSE:	The HIA will consider potential impacts on the affected communities over the projected 25-year life of the project.
PUBLIC COMMENT:	**Monitoring health effects is not effective. In West Virginia, communities have been monitored and studied for years but continue to die from mining-related health effects.**
RESPONSE:	Relatively little research and monitoring have actually occurred in relation to a specific project. The HIA will identify and recommend appropriate health indicators for monitoring. This could be used to form the basis for future project modifications or management decisions that would protect health.

The format of the meeting held with the Kenaitze Tribal government was identical to those held with the communities of Tyonek and Beluga, but fewer federal and State agency representatives were involved in the discussion. Comments relevant to the HIA process are include in Table 14. The greatest concerns related to potential water pollution and its subsequent impact on subsistence resources. Having suffered from

diminished subsistence harvests in the aftermath of the Exxon Valdez oil spill in 1989, the Kenaitze tribe alleged that certain fish populations had still not recovered. While they recognized that the mine would confer local employment benefits, they were concerned that the risks of subsistence resource contamination outweighed these benefits. The poverty that they currently endure would only be exacerbated if they could no longer rely on subsistence harvests to supplement or replace the goods purchased from meager incomes. Furthermore, they alleged that they were being forced to bear a disproportionate burden of adverse poverty-related health effects. In an attempt to prevent greater augmentation of these disparities, they were keen to establish effective regulatory and oversight mechanisms.

Table 14: Chuitna HIA Relevant Testimony from the Kenaitze Tribal Government (adapted from Wernham and Bell, 2009c)

Air Quality

PUBLIC COMMENT	**Airborne pollution is transported overseas into Alaska. What is the impact on us?**
RESPONSE	This coal is low in mercury and sulfur. We do not know how it will be used overseas, so it will be difficult to evaluate its impact in Alaska.
PUBLIC COMMENT	**Will PacRim burn coal for energy at the Chuitna Project site?**
RESPONSE	This is not part of the project plan.

Geochemistry

PUBLIC COMMENT	**Does the coal bed serve a natural environmental purpose, perhaps as a carbon filter? Will this function be eliminated by mining operations?**
RESPONSE	Unlike hard rock mining, coal mining does not require that processing be performed on-site. Thus, coal mining is not as potentially damaging as hard rock mining.

Water Resources

PUBLIC COMMENT	**There is very little pure water left in the nation. Much of what is left is here. How does the company treat the water on-site, and what is the volume of wastewater that will be discharged to the Cook Inlet? What impact will the mine**

	have on streams and fisheries? Are there any major rivers or streams that will be directly affected?
RESPONSE	The Chuit River and three streams will be impacted. This is a huge issue for this mine and could be a deal-killer. PacRim needs to demonstrate that they can return streams to their original pathways and re-establish the salmon run after diverting flow for 8-10 years.

Vegetation

PUBLIC COMMENT	**When you re-plant vegetation, do you try to use natural plants?**
RESPONSE	Yes. The mission of re-vegetation is to promote quick growth in order to prevent erosion while also allowing for succession.

Wetlands

PUBLIC COMMENT	**There will be a reclamation plan, and the reclamation plan will be ongoing, right? In the reclamation stage, will PacRim return the mining site to its original condition? If they take a stream, they have to put it back?**
RESPONSE	They must do a "contemporaneous" reclamation; they cannot reclaim it all at the end. There are already many examples of successful reclamation acts performed at Usibelli.

Wildlife

PUBLIC COMMENT	**Belugas spend much of their time near the proposed mine area. It may even be part of their nursing ground; some of our own hunters believe that it is. What will be the impacts on belugas? How many fish rely on the stream that will be removed? What will be the impacts on fish?**
RESPONSE	The EIS will address these questions in its wildlife section.

Aquatic Resources

PUBLIC COMMENT	**How many gallons of water will be discharged to Cook Inlet?**
RESPONSE	Only sanitary discharges will be released directly into the Inlet. Approximately 7 million gallons of wastewater will be discharged into local streams each day.
PUBLIC COMMENT	**We have not been satisfied with wastewater permitting in the Inlet. Who is responsible for monitoring and enforcement of these permits? Will the Chuitna Project rely on self-monitoring? How is this an adequate enforcement strategy if the mining company can afford to pay fines?**
RESPONSE	Every month, mining companies are required to take samples on-site and to compile reports for EPA review. Fines are only a first step; criminal investigation can be performed subsequently.

Subsistence

PUBLIC COMMENT	**We are a subsistence community. Twenty years after the Exxon Valdez spill, herring still have not recovered.**
PUBLIC COMMENT	**What incidental take of beluga would be allowed? We cannot hunt beluga because they are endangered, so incidental take is a big issue for us.**
RESPONSE	This is an issue for the National Marine Fisheries Service (NMFS). Incidental take may be allowed, but mitigation would have to be enacted.

Health

PUBLIC COMMENT	**There was a coal mining accident in the lower 48 that released pollutants. There is no "clean coal" mining. What is your response to that?**
RESPONSE	The accident was the result of an improperly designed dam that failed. There are dam safety programs maintained by engineers in Alaska.

Socioeconomics

PUBLIC COMMENT	**We suffer from the highest unemployment and poverty in the state. It would be devastating if we lost our resources.**
PUBLIC COMMENT	**How many people would the mine employ?**
RESPONSE	During the construction period, the maximum employment would be 400. During operations, employment would be reduced to roughly 200-250.
PUBLIC COMMENT	**Will you evaluate socioeconomic issues?**
RESPONSE	Yes, socioeconomic issues will be evaluated in the social analysis component of the EIS and in the HIA.

Environmental Justice

PUBLIC COMMENT	**A company that doesn't eat belugas gets an incidental take, while we get zero take? That's inequitable.**
RESPONSE	A biological evaluation must be conducted. An Endangered Species Act analysis will be performed by the EPA and reviewed by the NMFS. NMFS will issue a biological opinion.
PUBLIC COMMENT	**The poorest of the poor seem to be paying the most: more pollution, more cancer, more asthma. State coffers are not passed on to people in the local community.**
RESPONSE	This is one of the biggest issues that the State is facing.

HIA Analysis Process

PUBLIC COMMENT	**Who is going to monitor and enforce limits for waste discharge? Will it be self-monitoring?**
RESPONSE	Yes, self-monitoring is allowed. State inspectors and EPA

	inspectors are also involved.
PUBLIC COMMENT	**Are there any real consequences if companies exceed their permits?**
RESPONSE	Yes, fines may be levied. If permits are routinely violated, then a criminal investigation may ensue and the mine may be closed.

Rather than holding a community meeting open to the entire Kenai Peninsula Borough (KPB), the HIA scoping team met privately with the KPB Mayor, his Chief of Staff, two KPB land development representatives, and the KPB planning director. Following the brief HIA presentation and project update, the Mayor and his staff posed comments and questions that stimulated discussion. Those comments relevant to the HIA process are recorded in Table 15. Unlike the Tyonek and Beluga community meetings and the meeting with the Kenaitze tribal government, the meeting at the Mayor's office did not primarily address subsistence concerns. Rather than opposing the Chuitna Project, the Mayor and his staff supported the economic impetus that would accompany its development and operation. Given the persistent poverty and poor public service provision that characterize the region, the Mayor was eager to enhance local infrastructure by harnessing the potential political power of population influx and associated increases in service demands.

Table 15: Chuitna HIA Relevant Testimony from the KPB Mayor's Office
(adapted from Wernham, Bell, and Verbrugge, 2009)

Socioeconomics

PUBLIC COMMENT:	**In Tyonek and Beluga, the KPB provides solid waste management, public education, public fire and emergency services, and law enforcement. There are also some health services provided at the school. The Beluga landfill would likely have to be expanded if PacRim wanted to use it.**
RESPONSE:	The HIA team will utilize the KPB services information for its KPB impact analysis and will consider how the project might impact services that support public health.
PUBLIC COMMENT:	**Following the closure of the Agrium plant, we are**

	suffering from an economic vacuum. The projected project population influx would benefit our school system and housing situation.
RESPONSE:	The HIA will evaluate influx-related impacts in the context of the closure of the Agrium plant.

Environmental Justice

PUBLIC COMMENT:	**I am concerned about the cultural survival of Tyonek if all of the development projects outlined by the village Native corporation proceed.**
RESPONSE:	The impacts of the cumulative scenario on the overall health and well-being of Tyonek residents will be discussed in the HIA.

Cumulative Effects

PUBLIC COMMENT:	**There are a large number of projects at some phase of exploration or planning in the KPB. If some or all of these come to pass, they would result in substantial population influx, economic change, and possibly a new road across the Susitna river to the Beluga area. How would the HIA account for these project effects?**
RESPONSE:	The HIA will analyze the potential health effects of the reasonably foreseeable past, present, and future activities in the region according to the cumulative scenario developed by EPA.

HIA Analysis Process

PUBLIC COMMENT:	**We need to make sure this HIA is grounded in objective scientific data.**
RESPONSE:	The HIA does not advocate for or against the project; it considers the relative risks, benefits, and potential mitigation for each alternative. It will be reviewed by all of the cooperating agencies, and the EPA will ensure that it meets the standards of NEPA.
PUBLIC COMMENT:	**Does the HIA increase the opportunities for litigation?**
RESPONSE:	The HIA addresses substantive public concerns, and, as such, addresses a procedural requirement of NEPA.

Collectively, the community stakeholder outreach meetings reinforce the alleged importance of subsistence practices to local residents. And many of the subsistence concerns raised are validated by scientific evidence. As confirmed by Krieger and by Dr. Lori Verbrugge, the ADHSS EPHP Manager and a trained toxicologist, coal dust is likely

to be generated from the coal storage piles assembled at Ladd Landing. Polycyclic aromatic hydrocarbons (PAHs), which are carcinogenic chemical compounds derived from coal, attach to ambient dust particles. While the PAH air dosage would be unlikely to be great enough to affect human health, dust deposited into bodies of water could pose a human health threat if the water is used as a drinking source or if the PAHs bioaccumulate in the tissues of subsistence resources (Krieger, personal communication). Employing a conceptual site model, complete PAH exposure pathways have been investigated as an early component of the HIA analysis.

Where gaps in knowledge exist along the exposure pathway, new baseline studies have been proposed. In an effort to secure adequate funding, baseline study negotiations are proceeding prior to the construction and operations phases. While a previous subsistence harvest survey was performed in the villages of Tyonek and Beluga (Table 16), a novel dietary survey is currently under debate. Advocates of the dietary survey posit that it will guide the final contaminant analysis because it will determine which subsistence resource tissues, all of which are differentially susceptible to bioaccumulative effects among different species, are being consumed most frequently (Wernham, personal communication). Regardless of the nutrition survey, however, fish representative of the species harvested for food and preferably of a high trophic level and long lifespan, should be collected for the purpose of baseline tissue contaminant analysis (Lori Verbrugge, personal communication).

Table 16: Subsistence Harvest Survey (ANTHC)

Subsistence Resource	Percent of Total Harvest	
	Tyonek	Beluga
Salmon	69.5	42.9
Non-salmon fish	4.8	17.7
Large land mammals (primarily moose)	18.4	29.7
Marine mammals	2	0
Birds	1.3	3.3
Plants	3	5.4

In addition to subsistence resource baseline studies, baseline studies pertaining to public health outcomes and indicators were also initiated during the summer of 2009. Unlike the subsistence resource baseline studies, the public health baseline studies did not require that new data be collected at the community level. Instead, data requests were filed with a variety of State health agencies that routinely measure public health factors relevant to HIA. The data was requested for three separate locations: 1) the KPB, 2) an aggregated area consisting of Kenai, Soldotna, and Nikiski, and 3) Tyonek. It consisted of the following:

- overall mortality rate and leading causes of mortality
- leading hospital discharge diagnoses
- injury: overall injury mortality; separate unintentional and intentional injury mortality; injury hospitalization (overall and separate unintentional and intentional)
- chronic disease: diabetes; gonorrhea; chlamydia
- maternal-child health: adolescent pregnancy; prenatal care adequacy; maternal tobacco use during pregnancy; maternal alcohol use during pregnancy
- Office of Children's Services (OCS): substantiated allegations of reports of harm; substantiated numbers of unique victims

- Women, Infants, and Children (WIC): BMI of children aged 2-5 years; hemoglobin levels of children aged 2-5 years

For many of these indicators, data could not be disaggregated below the regional level or rates were too low to report as determined by both statistical and ethical constraints. However, the data that was available, even if it is only retained internally within State health agencies, establishes an important baseline that will aid in the evaluation of future project-related impacts. As the Chuitna Project nears the permitting stage (its application to federal and State regulatory agencies is expected in the spring of 2010), comprehensive community stakeholder outreach campaigns and baseline health studies will serve as valuable data sources in the development of an HIA that allows for fully informed decision-making.

The Donlin Creek Project

Following the discovery of gold over a century ago, placer mining, sluice mining, and exploration activities have characterized the Donlin Creek area (Donlin Creek LLC, 2008). However, the Donlin Creek Project proposes to extract the local gold resource at a previously unparalleled magnitude. Twelve miles north of the village of Crooked Creek and the Kuskokwim River, Donlin Creek has been proposed as a joint venture by Barrick, a large multinational mining corporation, and NovaGold, a Canadian mining company (Figures 5 and 6). Based upon extensive exploration activities conducted over the past fifteen years, the Donlin Creek site is estimated to hold as much as 30 million ounces of gold; as such, it would become one of the world's largest gold mines if developed (Rothe, 2006). The open pit would stretch two miles in length and one mile in width, and 50,000-60,000 tons of ore would be processed each day. During the

construction phase, which is estimated to last three years, the mine would employ 1500-2000 workers, and it would employ 600-800 workers for at least 20 years during the operations phase (Donlin Creek LLC, 2008).

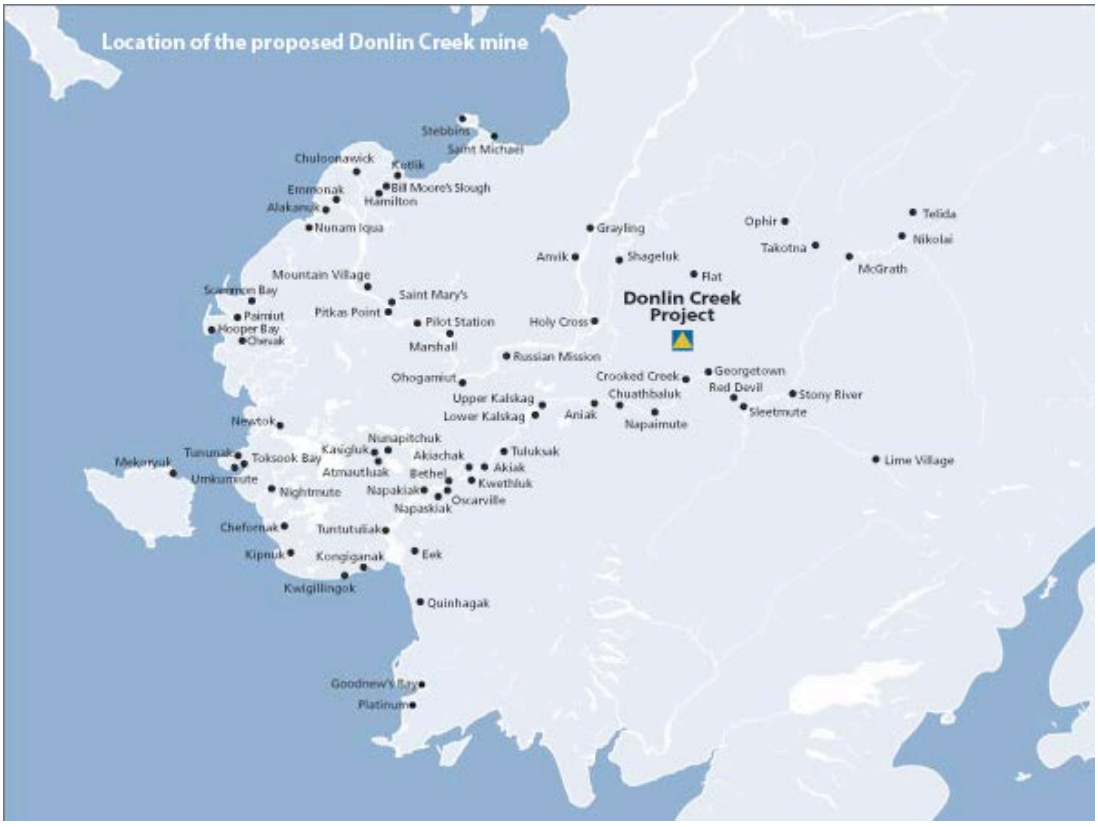

Figure 5 (Donlin Creek LLC, 2008)

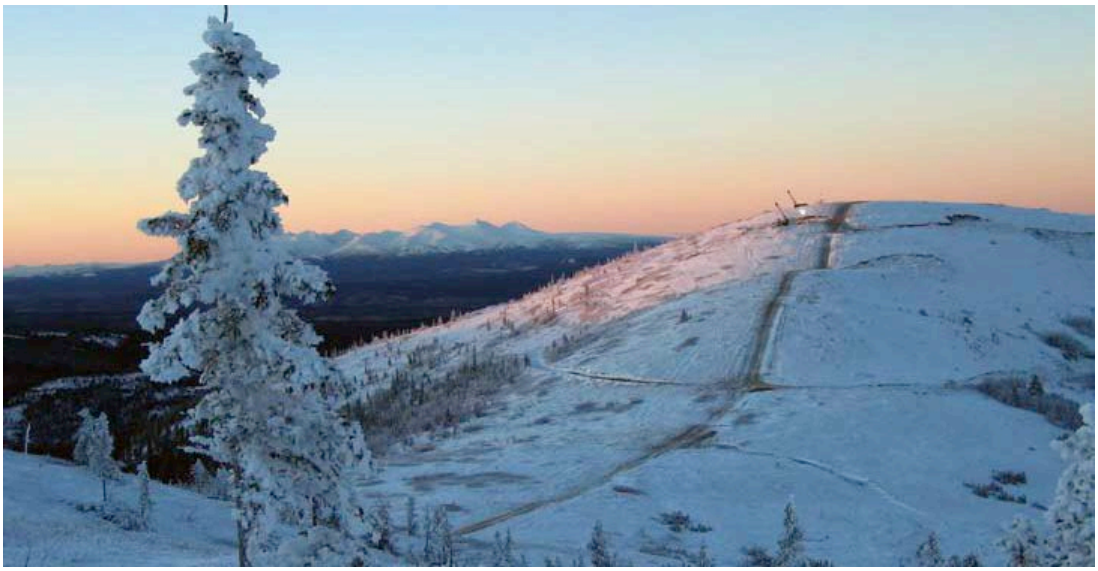

Figure 6 (Donlin Creek LLC, 2008)

At present, one of the greatest challenges facing the management team is the lack of infrastructure and power at the proposed site. A new airstrip, on-site housing, a port on the Kuskokwim River, conveyer systems, a mill, a tailings impoundment area, a water treatment plant, a truck shop, labs, a sewage treatment plant, offices, warehouses, and on-site access roads would all need to be constructed in order to support operations (Figure 7). An independent power system with the capacity to provide the mine with an average load of approximately 127 megawatts would also need to be built. Originally, on-site diesel turbines supplemented by wind turbines were proposed as power sources. Under this plan, diesel fuel would have been brought to Dutch Harbor by tanker, transferred to double-hull ocean barges to be transported to Bethel, and then transferred to double-hull river barges to be carried 116 miles up the Kuskokwim River to a proposed port at Birch Tree Crossing, about ten miles downriver from Aniak (Figure 8). The fuel would then be delivered to the mine via a buried pipeline that would follow the proposed 74-mile access road. However, this strategy would have required that one to three barge tows, each tow consisting of four 150-ft. barges pushed by a tug, be performed every day during the 90-110 day shipping season (Donlin Creek LLC, 2008). Given local residents' objections to such dense river traffic, specifically the water contamination threat that it posed, Donlin Creek LLC is currently considering an alternative power infrastructure. Rather than shipping barrels of diesel fuel upstream, the company has proposed the construction of a 300-mile natural gas pipeline from Cook Inlet. Feasibility studies are being conducted that will evaluate the financial and environmental costs of this alternative design.

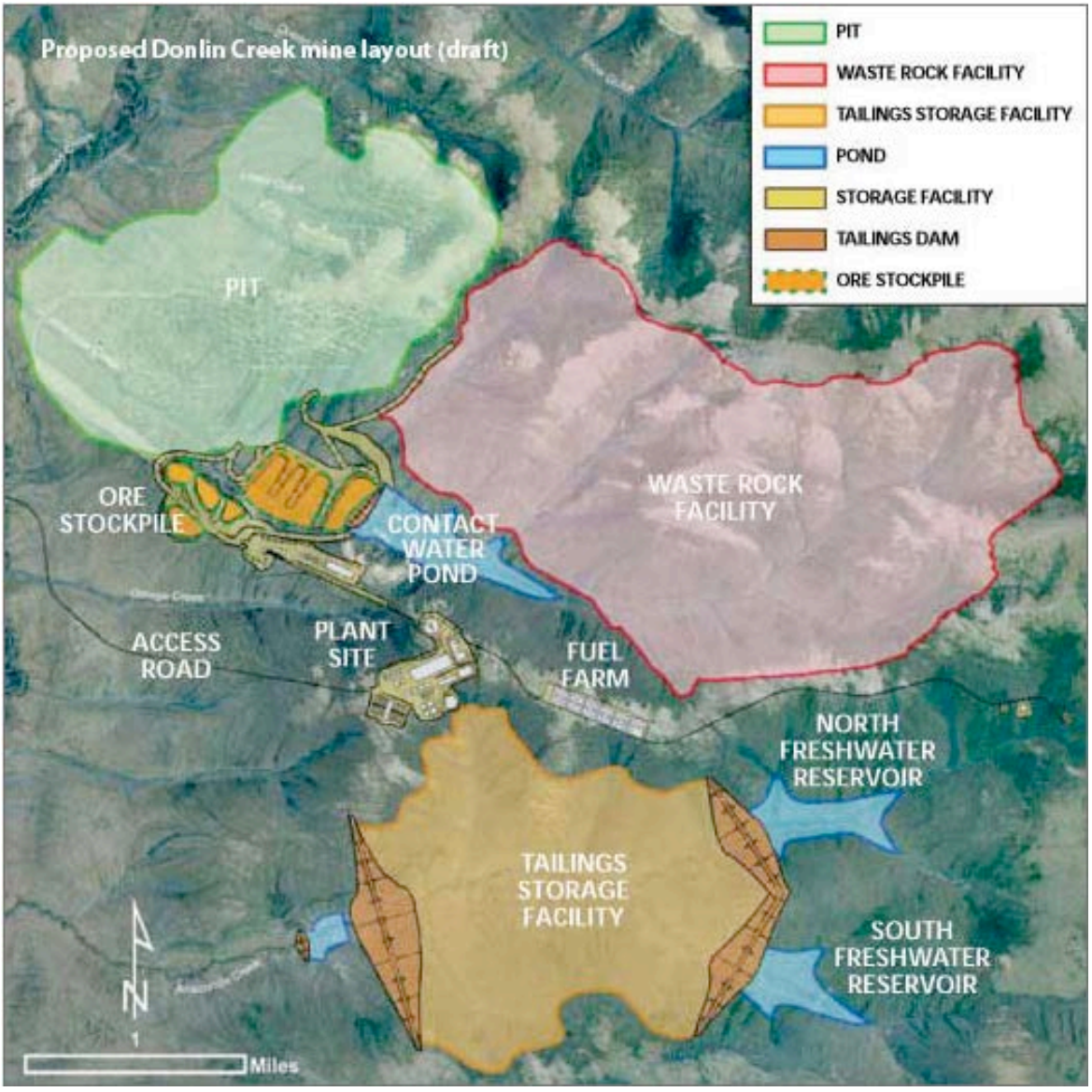

Figure 7 (Donlin Creek LLC, 2008)

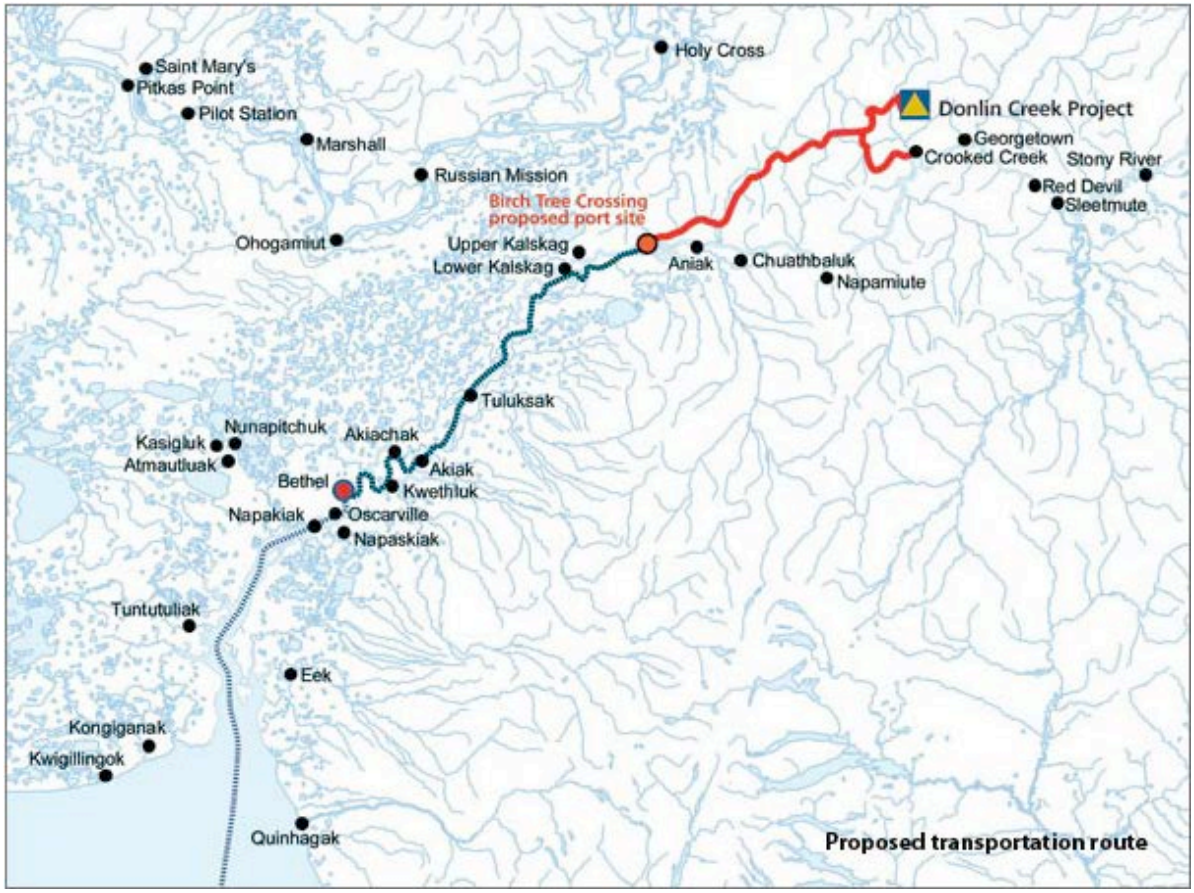

Figure 8 (Donlin Creek LLC, 2008)

Meanwhile, however, environmental activists have already developed a list of grievances in response to the proposed Donlin Creek Project. Most prominent among their concerns are the risks of cyanide, sulfide, and mercury contamination derived from mining activity. In order to extract the gold from the ore in which it is embedded, cyanide will be employed as a dissolving solvent. It will need to be imported to the Donlin Creek site and, after being reduced in concentration, will be deposited in the tailings storage facility. Sulfide minerals, which naturally occur at high levels in the ore present at Donlin Creek, can form acid rain when exposed to air and water. Despite company assurance that rock with this potential will be isolated and contained (Donlin Creek LLC, 2008), inadvertent release during ore processing is feared. The same fear

pertains to mercury, which is also naturally present in the ore on-site. When mercury is released into the air, it eventually returns to the land and into waterways. If mercury-polluted soil or water is consumed by local subsistence species, it may bioaccumulate and, in doing so, pose a threat to people continuing to practice subsistence lifestyles. The current Donlin Creek ore processing design is engineered to capture mercury at four separate stages; once captured, it will be shipped off-site to regulatory depositories or sold to qualified users in the United States (Donlin Creek, 2008). Of particular concern to the environmental lobby and to health agencies, however, is the absence of federal or Alaskan emission controls pertaining to mercury released as a byproduct of mining activity (Rothe, 2006).

Yet the potential environmental hazards of the Donlin Creek Project need to be weighed against the potential economic benefits that it would impart to the Yukon-Kuskokwim region and, particularly, to Calista Corporation shareholders. Under the 1971 Alaska Native Claims Settlement Act (ANCSA), fifty-six villages in the proximity of the Donlin Creek site were organized into forty-six for-profit village corporations, and the Calista Corporation, which represents the interests of the fifty-six villages, was created as one of thirteen regional corporations. While the village corporations were granted surface land rights, the regional corporations were granted sub-surface land rights. Thus, today, the right to explore, develop, or remove minerals from lands ceded to Alaska Native populations is subject to the consent of the relevant village and regional corporations (Jones, 1981). The Kuskokwim Corporation (TKC), a consortium of ten villages, owns the surface rights to the 27,000-acre proposed Donlin Creek mining area, while the Calista Corporation owns the subsurface rights. If Donlin Creek is developed,

the Calista Corporation will receive 4.5% of the profits from the sale of gold to smelters (Rothe, 2006). Furthermore, the Calista Shareholder Hire Program, which was developed to recruit and train shareholders and their heirs, has succeeded in generating a workforce that is over ninety percent local. The economic stimulus created by corporate dividends and the economic stability created by the Shareholder Hire Program are desperately needed in an area in which nearly thirty percent of the population falls below the federal poverty level and nearly seventy percent of the adult population is either unemployed or no longer seeking work (U.S. Census, 2000). A more complete economic profile of the area and discussion of the Shareholder Hire Program will be undertaken in Chapter 4.

Currently, an EIS, led by the Army Corps of Engineers (the Corps), is being conceptualized as a means of aiding decision-makers in evaluating the potential environmental and social impacts of the Donlin Creek Project. Since 1996, Donlin Creek LLC has conducted baseline studies on-site, which include the following measures:

- Surface water and groundwater quality monitoring
- Air quality monitoring
- Socioeconomic and archaeological surveys
- Fish and wildlife studies and habitat mapping
- Subsistence resource surveys
- Geochemical studies

The data derived from these studies is intended to be used to design a mine that meets environmental standards, to be submitted to regulatory agencies during the permitting process, and to form a foundation for comparative analysis of future monitoring and evaluation data (Donlin Creek LLC, 2008). Furthermore, like PacRim, Donlin Creek

LLC has recognized the value of voluntary inclusion of HIA in the EIS process, and, as such, has engaged in HIA scoping meetings with federal and state regulatory and health agencies and tribal organizations. Although a final determination has not yet been made, it is likely that the ADHSS and the Yukon-Kuskokwim Health Corporation (YKHC) will co-lead the HIA effort. While the State maintains a comprehensive health database, YKHC is the only source of village-level information. Potential respondent fatigue as well as financial expense resulting from the duplicative surveys that would be performed by a third-party contractor favor cooperation between the Corps, ADHSS, and YKHC.

Given that women in the Yukon-Kuskokwim region have already been found to have higher hair mercury levels than women in any other region of the State and that the Donlin Creek Project will inevitably add more mercury to the affected environment despite extensive emissions capture technology, ADHSS has advocated for baseline bio-monitoring of mercury among residents of the fifty-six Calista villages and among local fish, particularly pike, which are ranked highly in the trophic order and which are locally consumed in significant quantities. In response, Donlin Creek LLC has contended that any mercury found within biomonitoring samples could be derived from a variety of sources since mercury naturally leaches into soil and water in the project area. Accordingly, the contribution of the mine could not be accurately isolated. Furthermore, environmental scientists on-site are already monitoring mercury levels among salmon fry in the creek that will receive mine discharge input. However, ADHSS has argued that this monitoring protocol has limited meaning in the context of human health, for salmon fry are not typically consumed, and investigation of a single point source neglects the

potential hazard of atmospheric mercury discharges that could affect a broader area (Verbrugge, 2009).

In addition to the biomonitoring surveys, ADHSS also supports performance of a baseline nutrition survey, perhaps in the context of a subsistence harvest survey. The results of the nutrition survey, in combination with the biomonitoring surveys, would allow for prediction of the human health effects associated with increased mercury emissions and would allow for assessment of project effects through comparison to monitoring data collected in the future. However, Donlin Creek LLC, as well as ADNR and ADEC, have objected to the nutrition survey by arguing that measurement of subsistence resource availability would yield the same information as a nutrition survey while eliminating the confounding factor of personal choice. In response, ADHSS has noted that measurement of absolute subsistence resource counts would not account for diminished access due to project infrastructure or employee work schedules. Fear of contamination, which could produce altered dietary patterns, would also not be captured by quantification of subsistence resource availability (Verbrugge, 2009). From the perspective of ADHSS, biomonitoring and nutrition surveys are critical to the Donlin Creek Project HIA effort, but they may need to first be performed for the Chuitna Project in order to establish a precedent.

In any case, data should only be collected if the corporate proponent has been informed of how the data will be used in relation to the permitting process. Relationships between baseline measurements and future monitoring must be made explicit, changes in the indicator of interest must be quantifiable over time, and these changes must have the capacity to be linked to the project. If baseline data collection adheres to these principles,

then it is likely to serve the best interests of the company underwriting its expense as well as the affected communities. Indeed, corporate social responsibility often constitutes wise business decisions (Heal, 2008).

Chapter 4:

Corporate Social Responsibility and the Calista Shareholder Hire Program

Corporate Social Responsibility

Corporate social responsibility (CSR) refers to the extent to which a company mitigates the injustices and enhances the benefits of its operations on the external community. The specificity of its focus and the practicality of its response to project-related social and environmental issues distinguish CSR from philanthropy, public relations, and marketing. It acknowledges and attempts to resolve "the way in which a company's activities are embedded in the wider economy and polity" (Heal, 2008, p. 235). In doing so, it serves to align corporate and social interests. And "when corporate and social interests are aligned, the corporation can do well by doing good" (Heal, 2008, p. 226). Specifically, "society can gain from a fairer or more efficient allocation of resources and the corporation from a less conflictual relationship with the environment in which it operates" (Heal, 2008, p. 18). No commercial institution, regardless of size, is immune to the pressures arising from adverse public opinion or from the threat of litigation, and, thus, CSR functions as a form of risk management. However, more ethical behavior can also generate greater profits. As Geoffrey Heal demonstrates, a good CSR record is often correlated with superior financial performance (2006). In addition to the potential costs of lawsuits, the stock market reacts to information about companies' social and environmental policies. Furthermore, "dealing with environmental and social issues upfront could avoid costs associated with project delays and generate more revenue through efficiencies" (Heal, 2008, p. 82). It is this logic that led the banking industry to voluntarily develop the Equator Principles.

The Equator Principles

Having met several times in December 2002 and January 2003 to discuss their experiences related to social and environmental difficulties encountered in response to project financing proposals, four large commercial banks, ABN AMRO, Barclays, Citigroup, and West LB, decided to develop a framework for addressing environmental and social issues related to project finance in emerging markets. Rather than inventing new standards, the banks chose to enact policies consistent with the principles outlined within the World Bank's Pollution Prevention and Abatement Handbook, the Safeguard Policies of the IFC, and the Sector Guidelines of the World Bank and IFC. The standards adopted by the banks were all above legally required minimums in the host countries and, in some cases, even above legally required minimums in the United States (Heal, 2008).

To date, sixty-seven banks worldwide have accepted the Equator Principles. Each of these signatories is required to identify project risks in accordance with IFC categories and to include a covenant in its project loan agreement that the project borrower will comply with specific environmental and social risk management plans. Thus, project proponents have developed greater awareness of social and environmental issues as a result of their funding negotiations, and banks no longer treat social and environmental issues as peripheral to their business concerns (Heal, 2008). In fact, they have recognized that attention paid to social and environmental issues will actually serve their business interests. As Heal notes, "the costs of implementation are low, little business has been lost, and the gains to reputation have been significant. And no doubt some significant pitfalls will be avoided" (2008, p. 91). Overall, then, "the business case for

environmentally responsible behavior is powerful, powerful enough to convince a group of important international banks to take it very seriously" (Heal, 2008, p. 94).

Despite being voluntary in adoption and lacking an enforcement mechanism, the Equator Principles have succeeded in transforming the international banking sector and industrial development projects in emerging markets. HIA implementation in Alaska has the potential to affect similar change. Indeed, interest in the HIA process among federal and State regulators indicates its value to society, and interest among corporate project proponents indicates its value to business. Nevertheless, some more conservative government agencies and many project proponents have voiced strong opposition to any evaluation of health effects that are not directly linked to a given project through an uninterrupted causal chain. Particularly vehement opposition has enveloped discussions of the metabolic and psychosocial impacts of a reduced reliance on subsistence resources. Citing the mediating role of personal choice in dietary and substance abuse decisions and the inability to adequately differentiate project-specific effects from global modernizing trends, these agencies and project proponents continue to resist certain baseline data collection and mitigation strategies intended to address indirect project effects.

Yet there is evidence of an Alaskan mining company that has rejected this position. While Donlin Creek LLC representatives present at State permitting meetings are unremarkable in their persistent opposition to nutrition surveys, the management team on-site has developed a response to social issues that is truly unique by virtue of its comprehensive nature. The Calista Shareholder Hire Program, in conjunction with a variety of community outreach programs, has tremendously improved the lives of the

local population and suggests a model of corporate social responsibility that could benefit the entire Alaskan mining industry and affected Alaska Native communities.

The Calista Region

More than 90% of the inhabitants within most Calista Region villages are Yup'ik or, to a lesser extent, Athabaskan Alaska Natives. Prior to the initiation of mining activity in the early 1900s, they relied completely on a traditional subsistence lifestyle. Over the past one hundred years, however, as a result of mining operations and of government projects, a mixed subsistence/ cash-based economy has developed. In the aftermath of World War II, federal and State expenditures for airports, communications facilities, and social services became increasingly important to the region. During the 1960s and 1970s, limited commercial fishing, construction, trapping, and craft production added marginally to individual incomes, but the absence of well-established markets limited the impact of these activities at the regional level. Most jobs were temporary or seasonal, and, given the lack of local skilled labor, they were generally filled by people from outside the region. High unemployment rates became endemic, and traditional subsistence practices persisted as the primary economic base (Calista Corporation, 2009).

However, even subsistence activities require cash; indeed, modern subsistence practice relies on the purchase of appropriate hunting and fishing equipment as well as fuel for transportation. Today, therefore, the economic stability of the Calista Region is dependent upon cash-generating industries. Given the lack of local infrastructure, external public funding provides the majority of cash influx. In 1990, for example, State and federal expenditures were estimated to account for approximately 65% of the total wages earned by Calista Region residents (Calista Corporation, 2009). Since these

federal expenditures largely took the form of project construction or seasonal maintenance, however, they did not offer people a reliable source of income. In the immediate future, the mixed subsistence/ cash-based economy is expected to persist because neither wage employment nor subsistence resource harvest can independently support the local population (Calista Corporation, 2009).

Since most Calista Region residents are trained as blue-collar workers and laborers, they cannot be employed in the growing governmental, trade, and service sectors that are emerging downriver in the city of Bethel (Calista Corporation, 2009). A hub for transportation, retail trade, and medical services, Bethel relies much more on the cash-based economy and much less on the subsistence-based economy than other villages in the Calista Region. A greater number of professional and technical jobs are available in Bethel, and, as a result, average wages of Bethel residents are substantially higher than those of residents from the surrounding communities. Therefore, regional economic measures are distorted when Bethel is included in the analysis (Calista Corporation, 2009). While the Bethel census area is certainly impoverished when compared to State and national economic measures, the average Calista Region village is typically far more depressed. Thus, examination of a single representative village, such as Crooked Creek, only twelve miles south of the proposed Donlin Creek mine site, is warranted when assessing regional economic indicators. While 46.3% of adults in the Bethel census area were either unemployed or no longer searching for work in 2000, 67.8% of adults in Crooked Creek were not in the labor force at that time. While 20.6% of the population in the Bethel census area was below the poverty level in the same year, 28.1% of the population in Crooked Creak was below the poverty level (Calista Corporation, 2009;

ADCRA, 2010). In the Bethel census area, food derived from subsistence activities accounts for approximately 35% of an individual's economic wellbeing, and Alaska Permanent Fund dividends account for 12% of per capita income derived from wages and transfer payments, which is more than double the Alaska average (Calista Corporation, 2009). Although not measured, the contribution of subsistence activities to economic wellbeing and the proportion of per capita income derived from Alaska Permanent Fund dividends in Crooked Creek are each almost certainly greater than those of the Bethel census area considered as a whole.

The Calista Shareholder Hire Program

Widespread unemployment and poverty in the Calista Region were responsible, in the past, for generating a pervasive sense of hopelessness among local inhabitants, and reliance on government food stamps and welfare programs only deepened the sense of despair. Unable to provide their families with a sufficient quality of life through income earned in a mixed subsistence/ cash-based economy, many men resorted to drugs and alcohol as a means of hiding their shame. Women were often consumed by the same addictive behaviors. Consequently, suicide, domestic abuse, and fetal alcohol syndrome each increased dramatically in prevalence. In the words of Evelyn Thomas, chief of Crooked Creek, the absence of economic prospects within the region "destroyed our men, and it destroyed the family unit" (personal communication). Thomas and other regional leaders were desperate to find a way to "save [their] people" (personal communication).

When Placer Dome (now Barrick) began exploration activities at Donlin Creek in 1995, project employment seemed to offer such a panacea. The Calista Shareholder Hire Program, which was established as a component of the contractual obligation signed with

the Calista Corporation in order to obtain surface land rights, stated that any Calista shareholder, spouse of a shareholder, or descendent of a shareholder should have first consideration for any job that becomes available at Donlin Creek for which he or she is trained or could be trained in a reasonable amount of time. Promising relatively long-term job security, Donlin Creek employment offered local people an alternative to temporary or seasonal government-funded projects. Furthermore, it did not limit them to unskilled labor positions; instead, management was obligated to provide them with skills training (Bieber, 2007). Recognizing that Donlin Creek granted them an "opportunity to stand on [their] own two feet," local people were eager to begin work (Donlin Creek employee, personal communication).

As expected, mandated basic training resulted in inefficiencies and lost production during the first year of program implementation. However, high injury rates, high employee drug screening failure rates, and high rates of voluntary termination produced staggering employee turnover rates that significantly increased the amount of basic training required to maintain an adequate workforce and, thus, greatly exacerbated the inefficiencies responsible for lost production. In 1996, Placer Dome had to hire 152 employees in order to keep 48 full-time positions filled. The company was frustrated by the costs associated with this turnover, and the Calista Corporation received intense pressure from its shareholders to solve the problem. But potential remedies were increasingly obstructed by strained relationships, for "a real cultural and trust barrier began to develop on both sides" (Bieber, 2007).

In 1996, Bill Bieber assumed the role of Operations Manager at Donlin Creek after being transferred from Golden Sunlight Mines in Montana. Partnering with

Wasillie Kameroff, the Shareholder Hire Coordinator at the time and a local Yupik resident, he made it his mission to "turn Donlin Creek into an icon so that people in the region would want to be a part of it" (personal communication). First, however, he and Kameroff decided to systematically analyze the 1996 shareholder hire program outcomes in quantifiable terms in an attempt to identify the most salient areas for reform. They found that overall employee turnover, due to a combination of drug and alcohol violations, missed rotations, poor work performance, and voluntary termination, had reached 318% over the past year. Random drug screening tests among employees yielded a 50% failure rate, and it was recognized that this figure would have been much greater if the tests had been conducted on a regular basis; in fact, only two tests had been performed in the past year for the specific purpose of maintaining a reasonably sized workforce on-site. Among employees who passed their drug screening tests and were not terminated due to project drug and alcohol policies, 30% were terminated due to poor work performance, and 70% voluntarily quit. In addition to the 318% overall employee turnover rate, 90% of applicants failed their pre-employment drug screening tests. Armed with these dire statistics, Bieber and Kameroff met with Jake Taylor, the President of Placer Dome, Stan Foo, the Donlin Creek Project Manager at Placer Dome, and Matthew Nikoli, the CEO of the Calista Corporation (Bieber, 2007). Cognizant of the fact that the region suffered from staggering unemployment rates and associated poverty, everyone felt that the Calista Shareholder Hire program needed to be successful. Thus, both the corporate project proponent and the local Native Corporation were committed to reform.

Nevertheless, it was Bieber and Kameroff that worked at the ground level to identify the underlying sources of Shareholder Hire Program failure and to develop specific corrective strategies. In order to improve employee drug and alcohol screening outcomes, they constructed and implemented a strict drug and alcohol policy. The policy, which is still in effect today, states that an employee found with drugs or alcohol on-site is subject to immediate termination; however, an opportunity for self-improvement is provided, for employees terminated due to the drug and alcohol policy are permitted to reapply for employment after meeting certain milestones. In August 2006, an on-site counselor specializing in substance abuse cases, family counseling, workplace counseling, and general stress management was hired, so now an employee who has not violated the drug and alcohol policy but whose work performance has been impacted by substance abuse occurring at home is referred to counseling. Overall, the policy is intended to "provide individuals with hope and with incentives to remain drug and alcohol free" (Bieber, 2007). It is presented to every employee, at every village, and in every Donlin Creek publication. Management has made clear that it will not deviate from the policy and that the policy applies to all employees rather than only to Calista Corporation shareholders. However, it has also been careful to be clear that the policy simply states that people cannot use drugs and alcohol while working on-site at Donlin Creek; this is different from stating that people cannot do drugs and alcohol under any circumstances. While it is hoped that the policy at camp will carry over into home life, it is not an attempt to dictate culture (Bieber, personal communication). Thus, the policy represents a response to the history of cultural misunderstanding within the region and during the early stages of the Donlin Creek Project.

Recognition of the contribution of cultural misunderstanding to employees' missed rotations in the first year of exploration activities also allowed for development of a policy and practices that have significantly reduced the incidence of this occurrence. Given the predominance of subsistence practices and temporary seasonal jobs within the region, Bieber and Kameroff acknowledged that shareholders were unaccustomed to working long rotations and to repeating rotations according to fixed time periods (Bieber, 2007). As explained by Mary Sattler, the current Donlin Creek Manager for Community Relations and Sustainability, "the Protestant work ethic is not something that is inherent to the region. We have a strong work ethic, but it's different. Cutting fish at fish camp or hunting moose [involves] very intense and hard work for blocks of time followed by rest" (personal communication). The policy outlined and enacted in 1997 states that if an employee misses a rotation without prior approval, the first offense results in a 60-day suspension, and the second offense results in a yearlong suspension (Bieber, 2007). However, Bieber and Kameroff did not simply present the policy to their employees without further elaboration; they actually "sat down and talked with them…told them that they would have to learn to work on a schedule" (Kameroff, personal communication). They called every employee the day before his or her shift was to begin in order to remind them, prepare them, and, in some cases, to encourage them to return. Today, this practice continues, but responsibility is split between Kameroff and his cross-shift counterpart, Leonard Morgan. In Yupik culture, every effort is made to avoid conflict. By contacting employees before their scheduled return to work, perceived conflicts incurred during the last shift, such as a supervisor's reprimand or a disagreement with a coworker, can be resolved before employees inadvertently violate the missed rotation

policy. If employees do not have telephones at their homes, Alaska Native tribal administration personnel are asked to contact them before their next shift (Bieber, 2007).

The concept of cultural sensitivity as integrated into the drug and alcohol policy and the missed rotation policy was identified as critical to the success of the reformed Calista Shareholder Hire Program during investigation of the issue of voluntary termination. According to Bieber, voluntary termination was "by far the most frustrating aspect of [the early] Shareholder Hire Program," because the management team had relied on these employees to serve as role models for other employees (2007). In order to determine the underlying causes of summary resignation from positions that offered a rare source of economic stability, Bieber and Kameroff decided to consult local people directly. Over the course of two weeks in 1997, they visited several villages and spoke with elders, former employees who had voluntarily quit, and residents who had never worked at Donlin. They literally "sat down with people at their dining tables over a cup of coffee" in an attempt to determine what was responsible for voluntary termination and what needed to be changed at the project site in order to reverse current trends (Bieber, 2007). Rather than speaking exclusively with regional and local leaders, they consulted a core contingency of community members. According to Bieber, "[they] learned some very eye-opening information about [themselves], the project, and the perception village residents had about the project" (2007). According to Kameroff, "it restructured [their] way of thinking" (personal communication). Given his background in psychology, Bieber was intent on identifying cultural values during the time that he spent in the villages. He believed that knowledge of local cultural values would help him to understand how to construct an adept shareholder workforce (Bieber, personal

communication). At the same time, Kameroff was becoming more familiar with the Western cultural values imbued in the operations protocols of the large-scale mining industry. They "helped each other and learned from each other" (Kameroff, personal communication). Following their village visits, they condensed the comments that they had collected pertaining to voluntary employee termination into a set of consistently cited issues.

The most commonly given explanation for voluntary termination was a "fear of failing," otherwise termed "Native pride." While local people were eager to find jobs at Donlin Creek in order to provide for their families, their lack of experience with specific job responsibilities and their unfamiliarity or apprehension of Western culture and the camp environment often resulted in job failure in the form of suspension. Witnessed by other village residents upon returning home, this failure was only compounded and a fear fostered among potential employees in the villages about their own prospects (Bieber, 2007). Thus, in order to avoid the individual sense of worthlessness and the community scorn associated with forced termination, employees often chose to quit prior to receiving any rebuke. Foreign to the Western work environment, the "fear of failing" was a product of the particular social, economic, and political factors that had shaped the Calista Region.

Yet the "fear of failing" was only one expression of the cultural discontinuities that contributed to voluntary employee termination. Perceptions of a confrontational work environment and of racism were also frequently cited as motivations for quitting. After speaking with local people at length, however, Bieber and Kameroff concluded that these perceptions were largely the result of misunderstandings. In response, they

advocated for cultural sensitivity training. While the Calista Corporation provided the Donlin Creek management team with a history of the region and cultural sensitivity classes, non-Native supervisors were trained to understand cultural differences with the aid of the book, *The Yupik Way*. This book is still in use today, and both Native and non-Native employees are required to participate in cultural sensitivity training (Bieber, 2007). Referred to as "Donlin culture," the working environment that emerged at camp as a result of these initiatives ensures that "everyone feels a sense of security, safety, and belonging" (Bieber, personal communication). Placing emphasis on Yupik cultural strengths, the qualities of honesty, integrity, teamwork, and family are promoted. Disrespect is not tolerated, and confrontation is restricted to disciplinary action in the context of private individual interactions (Bieber, 2007).

However, Donlin culture is not simply the product of cultural sensitivity training. As Bieber and Kameroff recognized in 1997, the misunderstanding stemming from both verbal and nonverbal workplace communication could only be sufficiently ameliorated if local people were promoted to supervisory positions. As Mary Sattler explains, "starting at the bottom of the ladder and working your way up is a fine concept if everyone has the same cultural patterns and colloquialisms, but it has not proven effective in cross-cultural situations" (personal communication). In addition to reducing confusion, local supervisors also provide employees with a trusted source of guidance and serve as an attainable model of success. Their promotion is a critical component of measures taken to address the pervasive lack of trust with which local residents originally approached the Donlin Creek Project and its partnership with the Calista Corporation.

Given the history of alcohol abuse, domestic violence, and neglected subsistence practice that was associated with the nearby Red Devil Mine when it was in operation during the 1980s, many local residents were initially leery of the Donlin Creek Project (Kameroff, personal communication). Having established personal relationships with many people in the region and being highly respected by all those that he did know, Kameroff was integral to the trust-building process. According to Bieber, "he made it possible for us to work our way into residents' villages, homes, and families by way of participating in group talks, being involved in village activities, and observing local customs" (2007). At community meetings and at local outreach events, Donlin Creek representatives were careful to never mislead anyone and to always tell the truth even if it was not agreeable. Only making commitments that could be kept, they were able to gain the trust of the local population (Bieber, 2007). In the words of Thomas, "Donlin LLC has kept their word to the Calista Corporation, to the tribe of Crooked Creek, and to Western Alaska. They said they would hire our people and train them to do everything from the bottom to the top, and they have" (personal communication). Donlin Creek representatives never became involved in political discussions, and they always expressed support for the Calista Region. Enabling open public communication, they answered questions and addressed concerns; in the process, local residents were kept informed and became involved in management decision-making. The corporate commitment to honesty was yet another reflection of the growing awareness of and respect for Yupik cultural values (Bieber, 2007).

In addition to their influence on camp culture and on community outreach efforts, Yup'ik values were also intentionally introduced into the workplace structure. Given that

the unfamiliarity of the camp environment was consistently cited as a factor responsible for voluntary termination, Bieber and Kameroff attempted to re-model it to resemble that of a typical village. Since Yup'ik villages always include large gathering places, a dining room and a recreation room were constructed in the same open space in order to foster traditional interactions among employees (Figures 9 and 10). Round dining tables were selected to enhance the sense of community, and employees' photos were displayed around camp in an attempt to mimic the family photos that are displayed prominently within employees' homes (Figure 11). These efforts have been met with great success. Indeed, employees now generally feel like the Donlin workplace is akin to home, and some actually prefer to be at camp rather than at home. As a drug- and alcohol-free setting, camp can offer a much-needed respite from the social struggles of typical village life (Donlin Creek employee, personal communication). Furthermore, self-improvement is not only possible but encouraged. As Bieber explains, "at Donlin, everyone is treated equally and with the greatest respect…success can be accomplished by everyone who is willing to work for it" (2007).

Figure 9: Donlin Creek Camp Dining Room, 2010

Figure 10: Donlin Creek Camp Recreation Room, 2010

Figure 11: Donlin Creek Employee Photos, 2010

That being said, most employees still value the time that they spend at home. Indeed, Bieber and Kameroff found that the long periods spent away from home during rotations often contributed to the decision to quit in the early exploration phase. In response, they altered the rotation schedule in place at the time. Rather than 20 days spent at camp followed by 10 days spent at home, the standard rotation was changed to

two weeks spent at camp followed by two weeks spent at home. Each working day was increased in duration to twelve hours in order to generate a 168-hour working month. By allowing for more time at home, the new schedule provides greater opportunities to engage in subsistence activities while still maintaining a good wage (Bieber, 2007). In fact, Donlin Creek employment has enhanced rather than hindered traditional subsistence practices, for people with adequate and reliable incomes are much better able to afford the fuel and equipment required for modern subsistence activities. As affirmed by Mary Sattler, "To live a subsistence lifestyle, you need cash for gas and ammunition. I don't know anyone whose wardrobe is entirely furs and sinew. We're all immersed in a mixed cash-subsistence economy in this region, and what I've seen from the project site is that the people who work at Donlin hunt more and harvest more because they have the cash to do it" (personal communication). And more local people have been able to recognize these subsistence benefits than would have been able to if the original schedule had been preserved, because the two-weeks on/ two-weeks off rotation allows two individuals to share a single job without increasing the payroll burden. Furthermore, if an unexpected event, such as a funeral, flooding, or home maintenance due to extreme cold weather, occurs while an employee is at home, then his or her cross-shift counterpart can cover the days that will be missed. With regard to events that can be anticipated, Kameroff and Morgan still frequently counsel employees about the merits of pre-planning for rotations away from home (Bieber, 2007).

While the reformed schedule offers benefits not realized while the original schedule was in place, it still does not negate the large amount of time that employees spend away from home. And although employees may enjoy the time that they spend at

camp, their spouses have often suffered. When Bieber and Kameroff visited local villages in 1997, they found that stay-at-home spouses had a tendency to engage in heavy alcoholic consumption and, as a result, sometimes had their children removed by the State Office of Children's Services (OCS). Village councils demanded that the Donlin Creek management team solve these problems, so Bieber and Kameroff responded by attempting to first identify the causal source of this behavior. They found that it was rooted in jealousy of the working spouse's success compounded by growing awareness of relationships developing at camp. In order to ameliorate the conditions that had fostered this jealousy, they began to involve spouses in certain events. Covering the cost of airfare through the corporate budget, they invited spouses to tour camp. The goal of the tours "was to allow the stay-at-home spouse to feel a part of the project and a part of the success the [working] spouse was experiencing" (Bieber, 2007). In addition to achieving this goal by generating desire among stay-at-home spouses to improve their lives, the tours also created a greater sense of pride among employees. For the more intractable cases, family counseling has been available since an on-site counselor was employed in 2006 (Bieber, 2007). While the majority of her work consists of individual and group counseling conducted at camp, she is also routinely sent to local villages in order to meet with families. Donlin Creek LLC covers all of her travel expenses (Virginia Woodmancy, personal communication). At camp, free phone and internet services are also available to employees. Collectively, the reformed rotation schedule, camp tours offered to stay-at-home spouses, family counseling, and communication services represent a formidable attempt to ameliorate the family tension generated from the long absences from home that are an inherent component of any large-scale mining project.

Perhaps less specific than other issues underlying voluntary termination in 1996 but no less profound was the fear of changing cultural values. While the concern was most prominent among elders consulted during their village visits, Bieber and Kameroff have recognized that Yup'ik values should be equally important to younger generations. These cultural values are not only meaningful expressions of a long and complex social history, but, if present at Donlin Creek, they also have the potential to improve mining operations. Indeed, the high regard that the Yupik people attribute to honesty, family, and hard work renders them tremendously valuable employees. Having come to understand the history of the region and recognizing the business incentives associated with cultural sensitivity, Bieber and Kameroff advocated for a comprehensive response to the elders' fears. Rather than discouraging the use of Yupik language at camp, they encouraged it (Bieber, 2007). Today, in every newsletter that Donlin Creek LLC distributes, a Yup'ik or Athabaskan term, expression, or concept is defined and related to the Donlin Creek Project with the explicit intent of educating readers who are not local residents. Often, traditional events are detailed as a component of newsletters, and both employees and management participate in their observation. Family members are allowed to attend funeral services while on rotation, and Donlin Creek LLC donates food to affected families holding potlatches. Since the majority of local residents subscribe to the Russian Orthodox religion, members of the Donlin Creek management team celebrate Russian Orthodox Christmas by traveling to Crooked Creek for festivities and, later in the week, by inviting village officials to camp to conduct a ceremony followed by a potlatch. Also, while subsistence activities are not normally disrupted and, as noted previously, are actually enhanced by Donlin Creek jobs, employees are permitted to take unpaid leave

during the 20-day moose hunting season if they notify their supervisors in advance and make arrangements to cover their missed shifts (Bieber, 2007). Finally, in addition to building trust at camp, the promotion of local people to supervisory positions has reinforced the respect and guidance traditionally afforded to elders, for local supervisors tend to be mature community members. They serve as mentors to younger employees, waking them up in the morning for work and engaging them in informal but honest and meaningful discussions of family life (Donlin Creek employee, personal communication). While it is acknowledged that the Donlin Creek Project is changing some cultural behaviors, specifically those related to rotational work and fixed time schedules, it has also afforded the greatest respect to the most significant regional traditions and activities. It is, as Heal would argue, an example of a company that is doing well by doing good. Local people represent a reliable, long-term labor source due to their commitment to the area; if the turnover resulting from drug and alcohol policy violations, missed rotations, and voluntary termination could be adequately reduced, then Donlin Creek LLC would be saved the cost of re-training a volatile workforce and providing airfare for employees residing beyond the Calista Region (Bieber, 2007).

In the first two years after the Calista Shareholder Hire Program was significantly reformed, pre-screening employee drug failure rates dropped from over 90% to less than 50%, and in the next year, they dropped to less than 10%. Within local villages, particularly the ten villages nearest the Donlin Creek site, elders affirmed these statistical declines through their own observations. By 2000, Donlin Creek had achieved 90% shareholder hire (Bieber, 2007). In the following year, however, NovaGold assumed operational control of the project and, in doing so, replaced Bieber. While the NovaGold

management team preserved the Calista Shareholder Hire Program agreements, they sought to improve cost efficiencies by reducing budgets for camp and equipment maintenance, reducing wages, lengthening rotations, and introducing non-Native supervisors and hourly non-Native laborers. These decisions resulted in a dramatic rise in employee turnover rates and the loss of many current supervisors, including Kameroff. Consequently, the relationships between Donlin Creek LLC, the Calista Corporation, and TKC became strained as trust was degraded (Bieber, 2007).

Fortunately, Placer Dome resumed operational control in 2004, Bieber returned to his former position as Operations Manager, and Kameroff reclaimed his former position as Shareholder Hire Coordinator. Almost immediately, they encountered significant community concerns that had arisen during the period of NovaGold on-site management. While Placer Dome partially reversed the wage reductions implemented by NovaGold, employees were still being paid 1996 salaries in 2005. Thus, the decision was made to raise wages incrementally based upon attainment of certain milestones that emphasized dedication, skill development, safety, and productivity. Today, wages are still about $2 per hour lower than the average for other mining projects in Alaska, but they are expected to increase when production begins and when the skills of the workforce equal those of other workforces. Concerns related to remedial work allocated to local people have been dispelled as skills training has once more been emphasized as an integral component of the Calista Shareholder Hire Program. Communications between Donlin Creek and the local villages have also been improved, and community engagement is ongoing. Donlin Creek representatives make regular visits throughout the region to provide project updates, to discuss the Calista Shareholder Hire Program, and to answer questions.

Village officials from Crooked Creek are also routinely invited on-site when they have concerns or suggestions related to the project (Bieber, 2007).

It was through these meetings that Crooked Creek residents expressed their interest in harnessing the economic development opportunities generated by Donlin Creek in order to benefit current and potential local business owners. Management has since responded by working with the village to 1) identify local services and products that could be used at Donlin Creek and to 2) develop procedures for purchasing and delivering these products and services. As a result of these initiatives, a small commissary has been established on-site where employees can purchase work clothes and safety boots using payroll deductions; an existing store in Crooked Creek provides the products based upon employees' recommendations. Crooked Creek businesses also provide housing to contractors working off-site, and accounts have been established with catering stores in upriver villages so that food can be purchased locally for donations at employee weddings and funerals. If the mine proceeds to the operations stage, then lumber will be purchased from a local supplier to be used at the on-site mill. Each of these arrangements is intended to help "spread the direct economic benefit [of the Donlin Creek Project], beyond the multiplier effect of employee spending, further out into the region" (Bieber, 2007).

However, community outreach has not been limited to economic interactions. As discussed previously, an on-site counselor is routinely sent off-site to local villages in order to meet directly with entire families. Although she was not hired until August 2006, Donlin Creek LLC had already been searching for an appropriate counselor for two years (Virgina Woodmancy, personal communication). In response to community

concerns related to employees' use of paychecks to purchase drugs and alcohol upon returning to their villages, Bieber and Kameroff realized that comprehensive substance abuse treatment would need to be made widely available. Substance abuse could not be cured solely by a restrictive on-site policy; therefore, Donlin Creek operations would continue to suffer if substance abuse was not mitigated through community engagement. At the time, the only treatment options available to local people could be obtained either in jail or by paying a large sum of money to access services beyond the region. Today, the counseling program offered by Donlin Creek is the only other alternative (Bieber, 2007). And it has been supplemented by workshops available to employees and their family members. In March 2007, for example, a five-day training program devoted to personal growth was held at a nearby retreat center. Employees who chose to participate were allowed to invite one other family member, and Donlin Creek LLC covered all travel costs. As a component of the program, a family from the Canadian village of Alkali Lake was invited to give a presentation. Prior to the sobriety movement that this family had introduced, nearly the entire Alkali Lake population suffered from alcoholism (Bieber, personal communication). This single family's story of community revival inspired many of the local residents in attendance, and the workshop itself represented Donlin Creek LLC's commitment to "social rehabilitation attached to personal and financial development" (Bieber, 2007).

Today, community outreach continues in a variety of forms. Cultural events are sponsored that would not normally occur. For example, a drum-making workshop was recently held at camp, and local residents were invited to attend. Also, in the past year, for the first time in thirty years, thirty-five Native dancers were brought to the nearby

village of Aniak to perform at the traditional elders' conference (Bieber, personal communication). However, Donlin Creek management is not only intent on enhancing local culture; they also recognize that local people need to develop modern industrial skills in order to attain success in the mixed subsistence/ cash-based economy that dominates the region. As one employee explains, "What I really appreciate about Donlin is that they give you opportunities to advance, to show who you really are…they're there to help you" (personal communication). In addition to providing current employees with basic skills training, the company also conducts a summer internship program for high school students that is designed to target young people who would probably not attend college but who could succeed in a trades school. The internship program provides these students with instruction and practical experience in road construction, engineering, and maintenance and allows for determination of whether a college education would be beneficial for a given job. Hired in 2006, Ross Maitland, the Donlin Creek Human Resources Coordinator, also regularly visits local schools in order to speak about jobs available at Donlin Creek as well as about the importance of sobriety and the meaning of success (Bieber, personal communication; Maitland, personal communication).

These outreach efforts, combined with the skills training and cultural sensitivity measures that have been implemented at camp, have reversed the failure of the early Calista Shareholder Hire Program and have generated significant social improvements in local villages. A stable workforce has emerged that is becoming more and more productive. This workforce boasts greater than 92% Calista shareholder hire, and more than 90% of the supervisors are Natives from the Yukon-Kuskokwim region. Remaining committed to transparency, Donlin Creek management is in regular contact with the vast

majority of local villages. According to Thomas, representatives from Donlin Creek "come to the villages to keep us informed during every stage of the project. They don't shut us out in any way. When they have any kind of job opening, they come to the villages first before they go anywhere else" (personal communication). And, as a result, "the quality of life, [particularly] in the ten villages nearest Donlin, has improved because people have predictable jobs that provide livable wages" (Mary Sattler, personal communication). No longer dependent upon government welfare or menial temporary jobs, local employees are able to provide their families with the goods and services that can only be attained with disposable income. Substance abuse counseling has helped to channel spending towards clothing, fuel, household supplies, and subsistence equipment, and when interviews are conducted in the villages, prospective employees are now overwhelmingly drug and alcohol free. Indeed, both employee and applicant drug screening failure rates have dropped to less than 5% (Bieber, 2007). The decline in pre-screening drug failure rates is particularly noteworthy, for it indicates change affected at the community-level rather than simply among employees. Yet the greatest benefits yielded to the region are not generally quantifiable. In the words of Thomas,

> Donlin Creek has brought us hope. They have brought excitement…You see the difference in the people. Those people who used to walk with their heads and shoulders downward with nothing to look forward to on a day-to-day basis are now standing tall and walking proud. That's what we want, and that's what [the Donlin Creek Project] has brought to us. It's that sense of purpose and contribution…Our people do not want to be a burden. We want to contribute. We see it in the young people. Before the mine arrived, we had no prospect of escaping our despair (personal communication).

Having been "neglected for so long…[their] pride and [their] way of life taken from [them]," local residents have now been granted an opportunity to regain much of what was lost (Wasillie Kameroff, personal communication). By securing reliable and

meaningful employment, they have entered the mixed subsistence/ cash-based economy on their own terms. As Mary Sattler explains, "A lot of the guys at camp are 'nukalpiaq,' which is the Yup'ik term for 'provider.' They are 'nuqalpiaq' not just by virtue of being good hunters or good fishermen but now, also, by having a wage-earning job so that they can be even better providers" (personal communication). While preserving and often enhancing traditional customs, cultural values, and subsistence activities, Donlin Creek employees have also earned the means of achieving modern socioeconomic success.

Thus, when considering the potential adverse impacts that the Donlin Creek Mine may confer on subsistence resources, local people must weigh their concerns against the tremendous economic and social improvements that have accompanied this particular project. As Thomas explains,

> We have to live in the here and now. Nobody wants to live hand to mouth anymore. We want heat and light, water, and sewer services. We want to be able to live here and to continue practicing our subsistence, but we would like it to be a little easier, too. Our children and great grandchildren will be able to have this by developing our natural resources…People who romanticize our past life have not suffered from unemployment. They do not think of regular villagers who struggle to feed their families and maintain their homes…We must have some kind of cash economy, and this project is bringing a cash economy to our region…The majority of villagers, those who have struggled and know it for what it is, understand this. They realize it. They realize we need to have money today, in 2010. We cannot go back to 1950 and work really, really hard and still maybe not have enough to keep body and soul together. The majority of people know that some sort of industry is necessary (personal communication).

Yet environmental awareness within the mining industry itself has also increased substantially in recent years; indeed, environmental monitoring, mitigation, and reclamation are each tightly regulated by both federal and State authorities overseeing the permitting and operation of large-scale mining projects. And people who understand the environmental protections that are in place tend to be much more accepting of the Donlin

Creek proposal (Mary Sattler, personal communication). While risk is inherent in any mining operation, mitigation strategies can be devised. Furthermore, as one employee explains, "the best stewards of this project are people from the region," and it is people from the region that are responsible for on-site environmental monitoring activities (personal communication). Local residents trust that their friends and family members employed at Donlin Creek will ensure that development proceeds in an environmentally responsible manner and, thus, that human health is not recklessly threatened. The subsistence lifestyle can no longer be solely relied upon to meet the changing material needs and social desires that define modernizing trends. However, the nutritional value of subsistence resources and the cultural strength conferred by traditional activities serve as protection against chronic disease and psychosocial insult. Human health considerations are, thus, best served when mixed subsistence/ cash-based personal economies are achieved.

Today, few people are currently employed on-site at Donlin Creek because exploration activities have ceased, but the permitting process has not yet been initiated. While local people had anticipated this period given their regular communication with company management, they are still eager to begin the operations phase. During this phase, employees can expect to earn a median annual salary of $70,000 in addition to retirement and health benefits; within communities that have historically suffered from extreme poverty, "that is staggering" (Mary Sattler, personal communication). However, local leaders also recognize that these jobs, though much more stable than the jobs supplied by seasonal or temporary government projects, will not last in perpetuity. As such, some have suggested saving money earned from Donlin Creek incomes for future

investment in new regional infrastructure. Thomas, for example, has proposed that some of this money be used to cover the up-front costs required to construct a water bottling plant or to develop a berry export industry (personal communication). Yet even if these or other local industries cannot be generated, then at least Donlin Creek employees now have the potential to find jobs elsewhere. Indeed, management has intentionally provided them with a skill set that is transferable to other industries so that they will still be able to maintain economic self-sufficiency once the mine ceases operations (Mary Sattler, personal communication). According to one employee, "Donlin has been a gateway" that has helped local people to develop both marketable skills and the Western work ethic demanded by modern industrial operations (personal communication).

During the construction phase, current levels of shareholder hire will not be maintained, because 2000-2500 previously trained employees will be required in order to accomplish the necessary work in a relatively short timeframe. Objections raised by local communities are expected and will be addressed through a variety of measures. Additional counseling will be provided by the Shareholder Hire Coordinators and by the Human Resources Coordinator, and region-wide public education programs will be conducted at both the village and school-district levels in order to inform local residents about the number and kinds of jobs associated with the three different phases of large-mine project development as well as to emphasize the short duration of the construction phase relative to the operations phase (Bieber, 2007). It is hoped that 600-800 people employed during construction will be local and that these people will be retained as the core operations workforce.

The 240 individuals who have already worked at Donlin during the exploration phase will be relied upon to mentor new employees and to spread "Donlin culture" throughout a much larger site. Inevitably, the social problems that characterized early exploration activities will re-emerge during the construction phase and the beginning of the operations phase; however, their magnitude is likely to be reduced by the efforts of veteran employees (Bieber, personal communication). Three training centers have been proposed throughout the region, and it will be imperative that the non-Native supervisors hired during the start-up operations phase understand the vital importance of training local people. Other large natural resource development projects in the State will be competing for employees, and, already, each large mining project currently in operation is struggling to find and retain skilled employees. Thus, training local residents at Donlin Creek is not just ethically appealing; it is also a business necessity. Due to their commitment to the region, the workforce will be sustainable. Indeed, government contractors are already unable to meet their labor demands by hiring members of the Donlin workforce despite offering $30 hourly Davis Bacon wage rates (Bieber, 2007). Having been exposed to the "Donlin culture," local residents recognize that the short duration and menial responsibilities of government jobs render them far inferior to the economic stability and personal development inherent in Donlin Creek employment. Ultimately, the programs implemented with the explicit intent of improving both on-site and community social conditions also yield operational efficiencies and corporate financial savings. Applicable to natural resource development projects throughout the State of Alaska and perhaps beyond, the Donlin Creek model of local shareholder hire and training exemplifies the gospel of corporate social responsibility.

Corporate social responsibility underlies voluntary HIA implementation. That is, minimization of adverse project-related health impacts and enhancement of positive project-related health impacts, the objectives of HIA, are also the outcomes of corporate social responsibility. In rural Alaska, the absence of a stable cash-based economy has contributed to significant physical and mental illness among indigenous populations. In particular, substitution of nutritionally-poor store-bought goods for subsistence foods is responsible for the rapidly increasing prevalence of chronic metabolic diseases, and the loss of traditional social organization and cultural practices have generated a pervasive sense of alienation expressed in substance abuse, suicide, and domestic violence. Thus, reliable wage-earning job creation offers a means of improving both physical and psychological health, especially when linked to skills training, counseling, and culturally sensitive community outreach.

However, if the statewide spread of local hire and training modeled on the Calista Shareholder Hire program is to be achieved within the context of HIA, then the psychosocial benefits that it confers need to be measured. Reproducibility relies on quantification. Furthermore, corporate project proponents, adamant that public health effects identified within the HIA be casually linked to specific project actions, need to have access to a methodology that permits changes in psychosocial health status to be tracked over time. If local hire and training programs are to become a standard HIA mitigation strategy within Alaska, then mental health and wellbeing measurement techniques need to be field tested, adapted appropriately, and then employed in HIA conducted as a component of the permitting process pertaining to large-scale resource extraction projects.

Conclusions

Given that the publication of a formal Alaskan HIA guidance document is imminent and that a new HIA office is being created within the ADHSS Epidemiology section, all indicators seem to suggest that HIA will become a standard component of the permitting process pertaining to large-scale resource extraction projects within Alaska. If HIA does become routine, however, then it is likely that a new methodology will need to be developed that allows for comparative analysis of risk assessment results. The current methodology relies upon qualitative risk classification determined by expert opinion; it is, therefore, inherently subjective and vulnerable to personal bias. Quantitative or semi-quantitative evaluation of potential project effects would facilitate reproducibility of HIA assessment and would engender greater understanding of the significance of identified impacts. It would provide decision-makers and stakeholders with more information, for they would be able to directly compare proposed projects to existing projects that received similar risk assessment rankings. The potential public health effects of a given project would be granted practical salience.

Although quantitative risk assessment strategies have not yet been discussed within the context of the Alaskan HIA working group or with specific project proponents, a quantitative HIA risk assessment methodology was recently proposed in a peer-reviewed scholarly journal. The matrix presented in the article is intended to function for the express purpose of facilitating the articulation and prioritization of evidence-based mitigation measures (Winkler et al., 2010). It details a procedure designed to analyze health impacts according to their comparative risk. The significance of each impact is evaluated in a stepwise manner based upon available health data obtained from literature

reviews, information gathered from stakeholder consultation, knowledge of the project context, and experience of previous HIAs conducted in similar settings. In the first step, the magnitude, or impact level, of four project parameters – extent, intensity, duration, and health effect – is determined by the criteria described in Figure 12. The output of this analysis is a score ranging from zero to three for each parameter depending upon its impact level. These scores are summed in the second step in order to assign the impact severity. The likelihood of the impact occurring is evaluated in the third step and is categorized as improbable (<40% chance), possible (40-70% chance), probable (70-90% chance), or definite (>90% chance). In the fourth and final step, the impact significance rating, defined by the intersection of impact severity and likelihood, is determined. A low significance rating indicates that a potential health impact may be negative but that its magnitude is sufficiently small to negate the need for mitigation. Medium or high significance ratings require that the negative health effect(s) be reduced to as low a level as "reasonably practicable" through mitigation strategies. High or very high significance ratings indicate that the health effect(s) may, without mitigation, present an unacceptable level of risk; thus, health effects that are assigned high or very high significance ratings may bar a proposed project from becoming operational (Winkler et al., 2010).

Although the model does not allow for quantification or ranking of potential project-related positive impacts, it does explicitly provide for their acknowledgment as qualitative statements. Thus, the inclusion of a quantitative risk assessment matrix as a component of future HIA methodology does not exclude complementary qualitative evaluations. Furthermore, even the matrix itself represents a balance of objective evidence and subjective experience. While it would generate more robust outcomes than

the current qualitative analyses, it still relies upon human input and, thus, is still vulnerable to bias. Nevertheless, it does offer a more transparent risk assessment process than do entirely qualitative approaches, and it promises to facilitate comparisons between projects as well as providing for comparative ranking of health effects within a single project. If an alternative quantitative risk assessment methodology is desired, however, the authors do offer another option. That is, they suggest that anticipated project-related health effects could be linked to severity or disability weights used to calculate disability-adjusted life years (DALYs) lost or averted (Winkler et al., 2010). While such a strategy would be difficult to employ in the developing world due to the paucity of detailed baseline health data available, it is certainly conceivable within the Alaskan context.

	Step 1			
	Consequences			
Impact level (Score)	**A – Extent**	**B – Intensity**	**C – Duration**	**D – Health effect**
Low (0)	Punctual Rare individual cases	Minor intensity	< 1 month	Health effect is not perceptible
Medium (1)	Local: small and limited A small number of households is affected	Those impacted will be able to adapt to the health impact with ease and maintain pre-impact level of health	Short-term (1-12 month) Low frequency	Health effect resulting in annoyance, minor injuries or illness that does not require hospitalisation
High (2)	Project area: medium but localised Village level	Those impacted will be able to adapt to the health impact with some difficulty and will maintain pre-impact level of health with support	Medium term (1-6 years) Medium or intermittent frequency	Health effect resulting in moderate injury or illness that may require hospitalisation
Very high (3)	Extends beyond the project area Regional level	Those impacted will not be able to adapt to the health impact or to maintain pre-impact level of health	Long-term/irreversible (> 6 years) Constant frequency	Health effect resulting in loss of life, severe injuries or chronic illness that may require hospitalisation

Figure 12a: Quantitative Risk Assessment Matrix (Winkler et al., 2010)

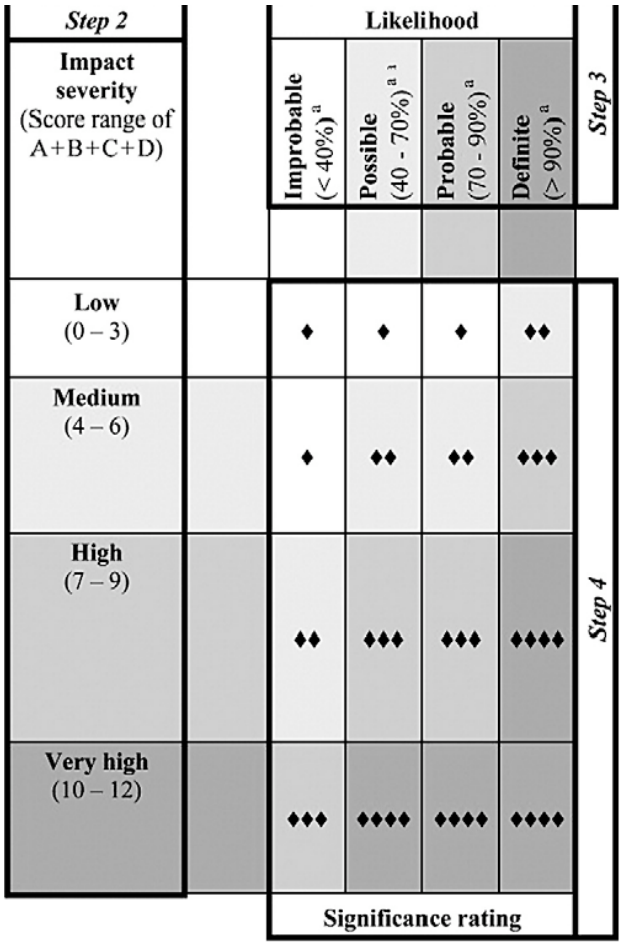

Figure 12b: Quantitative Risk Assessment Matrix (Winkler et al., 2010)

In addition to implementing a more quantitative risk assessment methodology, future Alaskan HIA procedures will also need to resolve contentious debate regarding the evaluation of vast social determinants of health. While the loss of traditional subsistence lifestyles exerts profound pychosocial consequences within Alaska Native communities, particular projects cannot be held singularly responsible for effects that are largely the product of macro-level modernizing trends. In the case of Donlin Creek, the corporate management team chose to voluntarily address broad social and economic sources of poor workforce sustainability. The health of local residents, as defined by chronic disease and social pathology, was intimately linked to shifting dietary and cultural patterns stemming from the creation of a mixed subsistence/ cash-based economy.

However, many of the measures enacted by the Donlin Creek management team, ranging from employee industrial skills training to the provision of substance abuse counseling to culturally-sensitive community outreach efforts, do not distinctly represent HIA-specific mitigation. Instead, it may be more appropriate to allocate such responses and the project effects that they address to an entirely different impact assessment framework.

While HIA is still considered relatively novel for extractive industry projects, at least within the United States, another impact assessment tool has been developed even more recently. In fact, this new tool, termed Human Rights Impact Assessment (HRIA), is still being conceptualized and currently lacks any published examples of application or even of formal definition. It has been proposed as a means of addressing the perceived gap among established impact assessment processes with regard to issues that might create or exacerbate human rights violations, and it, thus, differs from other evaluations in both extent and perspective (Nomogaia Foundation, 2010). In the same way that HIA should rely on data collected and analyses performed within the context of the EIS process, HRIA should rely on data collected and analyses performed within the context of both the EIS and HIA processes. While governments retain express responsibility for protecting human rights, HRIA seeks to guarantee that corporations are subject to the same standards.

Designed to protect rights pertaining to labor, security, environmental, economic, educational, political, and indigenous parameters, HRIAs seem to offer an apt methodology for assessing the complex socioeconomic and cultural repercussions of large-scale industrial development projects sited in rural Alaska. Indeed, many of the benefits derived from the Calista Shareholder Hire program and many of the problematic

social issues mitigated by the Donlin Creek management team would probably be best evaluated within the context of an HRIA rather than within the context of an HIA. Specifically, regular wage-earning job creation, indirect increases in economic activity, and construction of new infrastructure in the economically depressed Yukon-Kuskokwim region serve to protect the right to work. Increased purchasing power, higher standards of living, and greater employability due to skills training each guard the right to just remuneration. And local cash influx in the form of employee wages and the ways in which these wages are spent each bear upon to the right to an adequate standard of living. Finally, indigenous rights, such as the right to natural resources, the right to subsistence, and the right to cultural participation, are each very much implicit in the development of the Calista Shareholder Hire Program and the subsequent efforts designed to make it successful. Corporate social responsibility may be codified by creation of an HRIA tool.

Ultimately, the development of a quantitative HIA risk assessment methodology and the separation of HRIA from HIA will allow for more informed consideration of potential project-related health effects without neglecting equally important social effects that do not easily lend themselves to standardized quantitative analysis. While Alaskan HIA procedures are still in the formative stage and specific application is limited, current momentum in the field favors significant progress in the coming year. Nevertheless, the principles of adaptive management, so critical to project monitoring and evaluation, are also relevant to HIA practice in the future. That is, HIA methodology can be expected to exist in a constant state of flux as practical project experience incrementally remodels existing protocols.

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