Applying a health lens to the Environmental Assessment process: a British Columbia case study of the Ajax mine proposal

by

Erin Jade Yehia

Bachelor of Technology, British Columbia Institute of Technology, 2008
Bachelor of Arts, Concordia University, 2005

A Thesis Submitted in Partial Fulfillment of the
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in the Department of Geography

We acknowledge with respect the Lekwungen peoples on whose traditional territory the university stands and the Songhees, Esquimalt and W̱SÁNEĆ peoples whose historical relationships with the land continue to this day.

Supervisory Committee

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Abstract

This thesis presents a case study of an open pit mine proposal in Kamloops, BC. During an integrated Environmental (Impact) Assessment (EA) process mandated by the Provincial and Federal governments, stakeholders addressed the mine's environmental, social, heritage, economic, and health-related impacts. At the end of a 7-year process, the application was denied. My research sought to examine how health was conceptualized in the EA, and, specifically, had the mine been approved, how would the permit conditions have protected the public from adverse health effects. To that end, I conducted a review of health-related documents incorporated in the EA and studied the results through a Health Impact Assessment (HIA) lens based on guidance from the International Finance Corporation (IFC). As well as reviewing and analyzing the EA documents, I conducted interviews with participants in and outside the formal stakeholder group, as prescribed by the IFC HIA Guidance. Specifically, my analysis was based on the scoping phase of the assessment, and the baseline health profile that was included, using this internationally recognized HIA framework. My results show that the social determinants of health were not factored into the EA as per HIA best practice. Many in the formal stakeholder group, and outside of it, felt that institutional barriers prevented inclusion of the social determinants of health in the assessment. That finding raises questions about the reality of EA processes to protect public health.

Table of Contents

List of Tables

List of Figures

Acknowledgements

I would like to begin by expressing deep thanks to the loved ones and people in my life that made this all possible. The time it has taken me to complete this degree, I have experienced many life milestones. I always said, school would be easy, but life gets in the way. It does take a village and I couldn't have done it without the following individuals… First off, to my husband Steve, my rock, and the man who always has a way of putting things in a beautiful, yet straight forward perspective. To my incredible baby girl Makenzie who endured, allowing me to focus on my academic dreams; when all I wanted to do was play and spend every moment with you. To my stunning mama Elaine and mother-in-law Joanne who helped me so much (its honestly hard to sum up and put into words). To my friend Crystal who listened and brought me back to earth (to the world of academia) when I needed it most. I must thank my work, my bosses, and Medical Health Officers that gave me the time that was so key. Above all, I want to thank my supervisor Michael Hayes and committee member Janis Shandro. I would have never crossed the finish line without your patience, kindness, and jaw dropping intellect. I am honoured to be supported by so many in my life to attain a goal I have always wanted to accomplish. I am deeply indebted to you all, and the above doesn't even give you the acclaims you deserve. Thank you.

Dedication

I dedicate this thesis to my amazing daughter Mackenzie Jay Orme… I did this not only for me baby girl but to try (and optimistically) to make this world a better place.

List of Acronyms

BC – British Columbia
BCCDC – British Columbia Centre for Disease Control
BCEAO – British Columbia Environmental Assessment Office
CEAA – Canadian Environmental Assessment Agency
CAG – Community Advisory Group
CAQDAS – Computer Assisted Qualitative Data Analysis Software
CS – community sector (interview participant category)
EA – Environmental Assessment
EHA – Environmental Health Areas
EHO – Environmental Health Officer
EIA – Environmental Impact Assessment
e-PIC – BC Environmental Assessment Office Project Information Centre
HBE – Healthy Built Environments
HC – Health Canada
HHERA – Human Health and Ecological Risk Assessment
HIA – Health Impact Assessment
HP – health professional (interview participant category)
IAIA – International Association for Impact Assessment
ICMM – International Council for Mining and Metals
IFC – International Finance Corporation
IHA – Interior Health Authority
KAM – KGHM Ajax Mine
KGHM - Kombinat Górniczo-Hutniczy Miedzi
LHA – Local Health Area profile
LG – local government (interview participant category)
MHO – Medical Health Officer
NCCEH – National Collaborating Centre for Environmental Health
O – Other (interview participant category – representing academia or provincial government)
PHAC – Public Health Agency of Canada
RHA – Regional Health Authorities
SDH – Social Determinants of Health
SES – Socio-Economic Survey
VC – Valued Component
WHO – World Health Organization

Chapter 1 – Introduction

1.1 Introduction

This thesis explores the inclusion of health in the Environmental Impact Assessment (EIA) process. I start by describing the social determinants of health and the "many factors that combine together to affect the health of individuals and communities" (WHO, 2010). Next, I discuss the history of EIA and similar tools or procedures that have evolved from this process. Fittingly, one of the daughter processes of EIA is Health Impact Assessment (HIA). EIA is legally required throughout the world whereas HIA is not. EIA may consider health but HIA puts it at the forefront. I will touch on these differences in this chapter but discuss them in more detail in the subsequent literature review. The Ajax mine proposal was to build an open-pit mine next to a residential community in Kamloops, BC. So, the importance of assuring the health of local residents would not be compromised was paramount. HIA and EIA processes are the mechanisms by which such protection should be ensured. Baseline health data and reporting protocols are integral to both HIA and EIA processes. The point I investigate in this thesis is the extent to which the EIA undertaken for the Ajax mine included sufficient information on the potential health impacts upon humans and other animals to ensure that unintended harm would be mitigated.

1.2 Professional practice – what led me to this line of inquiry?

The National Collaborating Centre for Environmental Health (NCCEH) states, "overall, health has not been consistently incorporated into environmental assessments; as a consequence, there may be missed opportunities for the mitigation of negative health impacts and the enhancement of positive health impacts. Environmental public health practitioners can play an important role in providing a health perspective to EIA" (Peterson, E. & Kosatsky, 2016, pg. 4). As a practicing public health professional in this area, I agree. Our profession is not routinely stepping outside of our regulatory role related to the abatement of dose-response (or toxicological) related health hazards. This is why my thesis attempts to discover what health

threats communities are facing when a mine or new industry comes to town and if the current EIA process functions to protect them.

According to the Scientific Director of the NCCEH, funded by the Public Health Agency of Canada (PHAC), “projects that undergo EIAs, such as resource extraction and development projects, can lead to changes in our physical (e.g. air quality, access to green space), social (e.g. personal connectedness, traditional practices), and economic (e.g. job creation/loss) environments" (Peterson, E. & Kosatsky, 2016, pg. 4). With this in mind, in October 2010, the Medical Health Officers (MHO) collectively put forward resolutions to provincial ministers through the conduit of the Health Officers Council requesting a legislative mechanism to enable Health Impact Assessments (HIA) in BC. It is the Environmental Health Officers (EHOs) and their higher-ups, the MHOs, who receive EIA referrals from the BC Environmental Assessment Office. They are the face of the health authority, the health representatives bringing concerns to the foreground during any EIA. They alone respond to correspondence and, if applicable, participate in health-related working groups. However, in the absence of a HIA mechanism, health professionals, EHOs and MHOs, are left to make best practice recommendations based on health evidence and relevant literature, and/or resort to legislative roles under the *Public Health* and *Drinking Water Protection Act*.

I am a certified EHO, employed by one of the Regional Health Authorities (RHA) in British Columbia. I have been working in the field of environmental health for the past eleven years and more recently (the past six years) specializing in the emerging area of Healthy Built Environments (HBE). The objective of my job is to work with local governments and liaise with provincial Ministries. I coordinate internally (with health protection and population health) on land use planning referrals submitted to the RHA. I organize the external response on local government development planning referrals, such as a new subdivision or neighbourhood plan. To support healthier developments, I help staff think beyond the regulations and include a broader HBE perspective. I am also the EIA referral recipient and response coordinator on behalf of the health protection department. Thus, if the case study in question, the Ajax mine proposal, were put forward in my RHA, I would be the health professional at the table. Knowing that our environment can significantly impact our health beyond dose-related contaminants (air, water, soil, food), EHOs now offer HBE commentary. We emphasize broader social determinants of health (SDH) for local (government) land use planning but do not routinely offer the same HBE

lens for industrial land use projects. It is for this reason that I undertook this study. This research will inform my work and help me to better perform it.

Additionally, in BC and Canada, governments are looking at the EIA process, hoping to modernize and update the process. The most recent (2019) International Association for Impact Assessment (IAIA) conference's theme is "Evolution or Revolution." Internationally, the Impact Assessment practitioner community is calling to revisit this half-century year old practice of EIA and assess if it is working as intended. How can we improve upon this environmental (and health) management tool? Therefore, I feel the timing could not be more perfect to conduct this work.

1.3 The state of health in Canada

Canada's health services system conflates health with health care. The system is also being faced with an epidemic of chronic disease. Diabetes, cancer and cardiovascular disease are now the leading causes of death (Tam, 2017). Traditionally, society has primarily looked to the health sector to deal with concerns about health and disease (Marmot, 2008). Certainly, the distribution of health care or lack of equitable distribution is a key determinant of health. "But nevertheless much of the high burden of illness leading to premature loss of life arises because of the immediate and structural conditions in which people are born, grow, live, work, and age" (Marmot, 2008). That is, environmental factors play a much more significant role in chronic disease than was previously thought. It is widely accepted that if you come from a lower income bracket you are more likely to be unwell than your higher income bracket counterparts. Access to education, conditions of work and leisure, and place of residence impact your chances of leading a flourishing life (Marmot, 2008). The Canadian Medical Association (2008) states that ≥75% of health has nothing to do with health care services at all (as illustrated in Figure 1) and rather it is conditioned by ones experiences, biology and environment.

However, most industrial projects can result in marked changes in these factors, both positive and negative. Often, from a health equity perspective, the negative effects of an industrial project, e.g. loss of land, or air and water pollution, disproportionately affect those of lower incomes. In contrast, positive effects, i.e. profits, or employment opportunities, accrue to groups who are better off (ICMM, 2010). Thus, industry has the power to alter the health of the

individuals who reside in its proximity. Accordingly, the significance of forward thinking, informed decision-making and transparent processes via Impact Assessments can have a powerful influence on population health.

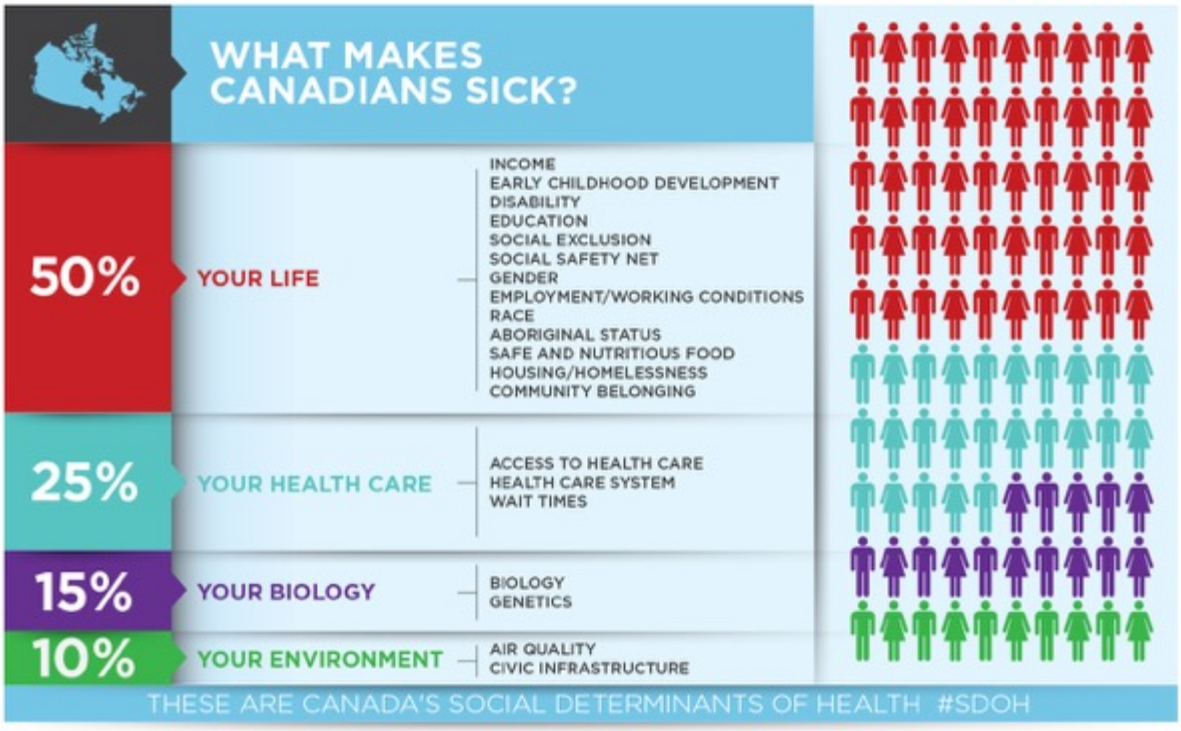

Figure 1: Health equity and the social determinants of health (Canadian Medical Association, 2008).

1.4 Health – what does it even mean?

Any discussion of EIA and inclusion of health considerations must deal with the question: what is health? "Many people identify health with illness" (M. Birley, 2011, pg. 34). However, the World Health Organization's (WHO) widely accepted definition is that "health is not merely the absence of disease and infirmity, but a state of complete physical, mental, and social well-being" (WHO, 1948). Another way of thinking about health is imagine that you feel whole, supported, happy, and have choice or otherwise put you can take control of your life and are able to live your life to the fullest (Welsh HIA Support Unit, 2004 as cited in Pennock & Ura, 2010, pg. 61). These definitions of health include the biomedical model, or traditional view of health. But they also include the more expansive socio-economic model known as the SDH. The biomedical model focuses on illness, disease, causality, and medical interventions to make us

well. The socio-economic model focuses more on the causes or roots of illnesses and aims to prevent them from occurring in the first place. The idea of improving health and preventing disease through changes to our environment is well founded. For example, "infectious disease rates in the last century were reduced not just through scientific innovation and vaccination, but also through infrastructure planning by improving sanitation and addressing overcrowding in residential neighbourhoods" (Tam, 2017, pg. iii).

We know that many factors combine over the life course to affect the health of individuals and communities (WHO, n.d.). Health determinants cause these outcomes. As illustrated in Figure 2, the more hazards an individual faces in their life or environment, the greater challenge it is for them to attain a healthy, long life. Individuals are unlikely to be able to directly control many of the determinants of health (WHO, n.d.). "Health is a resource for everyday life and not the objective of living. Health is a positive concept emphasizing social and personal resources, as well as physical capacities" (WHO, 1986 as cited in Birley, 2011, pg. 33).

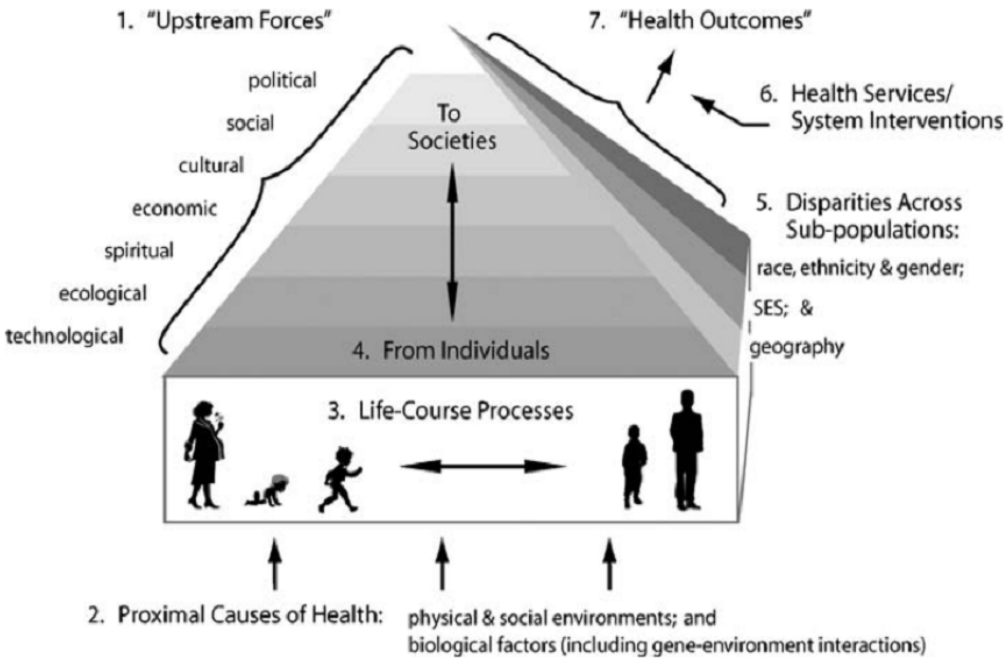

Figure 2: Graphic from the Canadian Institutes of Health Research—Institute of Population and Public Health (CIHR-IPPH) shows a conceptual framework of population health. This frameworks points to the influence and indicators of disparities across sub-populations (Etches, Frank, Ruggiero, & Manuel, 2006).

1.5 Environmental Impact Assessment - how health fits into it

Environmental Impact Assessment (EIA) is considered a subset of Impact Assessment. However, EIA is actually the first of all Impact Assessment forms. EIA was developed in the 1970s to help governments and industry manage environmental impacts and promote transparency to the public (Birley, 2011, pg. 5). The discovery of major environmental contamination sites (e.g. Love Canal, Times Beach, Harland Nuclear sites) and greater regulatory controls concerning environmental pollution and contamination prompted the establishment of Superfund.

Rooted in a regulatory framework, EIA initiated widespread international uptake. Its objective is to prevent and mitigate for potential environmental impacts related to industrial development. It has been well documented in the literature, from industry (ICMM, 2010) to health related publications (e.g. M. H. Birley, 1996; G. Gibson & Klinck, 2005; R. E. Kwiatkowski, Tikhonov, Peace, & Bourassa, 2009; Ross, Orenstein, & Botchwey, 2014; Shandro, 2015…) that projects, such as natural resource development and extraction can have inadvertent positive and negative impacts. As Aalhus (2018) writes: "Scholars and researchers highlight both negative and positive community impacts, which often exist in tension. Even impacts that are commonly thought of as uniformly positive (such as the employment, business, technological, and educational opportunities) are not always agreed upon, or experienced as such" (pg. 13). EIA ultimately aims to help government and industry predict and prevent negative effects and capitalize on positive impacts.

1.5.1 Impact Assessment (IA) Application and Procedures

Since EIA, there have been a number of IA typologies that have emerged and diverged from their EIA origins. Generally speaking, the practice of Impact Assessment (IA) attempts to proactively improve the design and implementation of large-scale developments by assessing the 'potential' effects of developments. IAIA defines impact assessment as "a structured process for considering the implications, for people and their environment, of proposed actions while there is still an opportunity to modify (or if appropriate, abandon) the proposals," and "is applied at all levels of decision making, from policies to specific projects" (IAIA 2012 as cited in Ross et al., 2014, pg. 34). To this end, all IA modalities or types have a common goal: to prospectively identify the potential impacts of a proposed project, policy, or program in order to minimize

potential harms and maximize potential gains (Ross et al., 2014). This research will, however, focus on mining projects in particular but some of the other IA forms will be discussed in the literature review. Simply defined, IA is the name given to a range of approaches and methodologies that are used to predict the future consequences of a proposal on human populations, flora and fauna (Harris, Viliani, & Spickett, 2015).

The names and aims of the IA steps are similar, regardless of IA type. The first step, Screening, ascertains whether an IA should be conducted in the first place. If additional information is needed, or the IA is required, the second step— the Scoping phase—determines what further work should be conducted, by whom and how. Scoping is foundational, and therefore crucial to get right. It determines which stakeholders will be at the table, what geographical bounds will be considered, and what parameters will be examined. Whatever type of IA and approach agreed upon, scoping will be followed by a report on the findings, appraisal of the report, and any action to adjust the proposed project if required (WHO, 1999). The process is systematic and follows a required flow of consecutive steps, but it is also iterative and non-linear in situations where new information discovered in later steps can be fed back into earlier phases (ICMM, 2010, p. 29). The subsequent steps involve, in some form or another, Assessment, Recommendations, Reporting, Evaluation and Monitoring. These steps may have variability in them but essentially follow a similar process. It is the Scoping phase of the Ajax mine proposal that will be examined in this research study. My line of inquiry investigated what health parameters were included in the EIA. In addition, if a broader range of key informants, to discuss health concerns or local knowledge, were included how might the EIA have changed? The analogy of building a house can be made; if you change the foundation, that is the scoping phase, how might the house look different.

1.6 Scoping baseline health data in the EIA

This study will examine the extent to which possible health effects were Scoped in that EIA. “Sources of knowledge to use in making impact assessment judgments include measures of baseline health status and vulnerability, empirical studies and original qualitative research, structured and unstructured interviews, and group or expert consensus” (Bhatia and Seto 2011, pg. 301). Understanding the baseline conditions of health determinants is key to predicting activity impacts, and for determining a base against which to measure changes. An additional

benefit of baseline Scoping is identifying groups that may be particularly vulnerable to the activity, and that should be focused on during subsequent steps (Metro Vancouver, 2016). Such sources of knowledge are valuable additions to the EIA process, but to what extent were they included in the case study examined here? This research intends to examine how the approval agencies incorporated baseline health in particular to this EIA.

1.7 Case study – geographical context and site selection

In the province of British Columbia (BC), Canada, large-scale land use projects are reviewed by a regulatory Environmental (Impact) Assessment (more commonly referred to as EA in BC). As it does on the international stage, this practice provides a legal mechanism for reviewing projects and assessing potential impacts from new activity, or amendments to existing operations (BC Environmental Assessment Office, 2015). The categories for evaluation of effects are: environmental, heritage, economic, social and health. Together they comprise an integrated EA. BC conducts EAs for certain types of projects, as legislated by the BC *Environmental Assessment Act*— including industrial processes such as mines (Ministry of Environment, 2015). The provincial BC Environmental Assessment Office (and in some instances jointly with, superseded or delegated by, the Federal Canadian Environmental Assessment Agency) manages the assessments, recommending for or against approval as well as any conditions of permit. Many health authorities, including Health Canada (1999), have recognized the need for, and benefits of, addressing health in EAs (Noble & Bronson, 2005). Zeroing in on the case study, in British Columbia, where EAs are mandated to address health, the question that arises is: did this integrated process give human health – especially the SDH – the attention it deserved in the Ajax proposal?

1.7.1 Case study: the Ajax mine proposal in Kamloops, BC

My research examined the EA application submitted by the proponent, KGHM International, for the Ajax mine proposal in Kamloops, BC. I started by performing a document review of the material that was submitted publicly as part of the EA. I then applied the International Finance Corporation (IFC) HIA Guidelines.

Integral to both the EA and HIA process is the Scoping phase. In this step baseline health data is used to frame future monitoring requirements, and act as the benchmark for comparison. Health data is vital to make informed decisions as they relate to impacts on health. This inquiry therefore developed a better understanding of the baseline health data that was considered prior to the launch of the mine's operation. If the mine had been approved, what would have been included in its final certification regarding health? To that end, I reviewed EA documents for the proposed mine. As well, stakeholder interviews led to a deeper understanding of the extent to which baseline health was included.

1.8 Research Objectives

Based on the above history and the prevailing practice in British Columbia—including an integrated EA approach with health as one of the pillars for review—the research goals for this Masters are:

1. To investigate how the EA for the Ajax mine evaluated health impacts during the scoping phase using an HIA framework (using guidelines established by the International Finance Corporation).

2. Particular to the Ajax mine, and the scoping phase of its EA, to determine what baseline health data was and could/should have been incorporated into its review.

Achieving these objectives will help to develop a better understanding of the role of baseline health parameter inclusion in British Columbia's EA process.

1.9 Key Research Questions

Q1 In the case of the Ajax mine, in what ways did the EA process include health impacts, as per established HIA frameworks, such as those prescribed by the International Finance Corporation (IFC)?

Q2 To what extent did the scoping phase of the EA for the Ajax mine use baseline health data and information?

1.10 Summary – bringing it back to scholarship: resource management and health geography

In the field of natural resource management, researchers evaluate the consumption and stewardship of natural resources, such as land, water, soil, plants, and animals, to determine how we use resources, maximize efficiency and minimize impacts from extraction. Health geography, at its basic level, can be described as the impact upon health arising through the interaction between people and the environment (Dummer, 2008, p. 1177). Where we are born, live, work and play directly influences our health. The air we breathe, the food we eat, our access to nature, amenities, and health care all affect health and well-being. These factors are directly related to our spatial location, and to government policies facilitating healthy behaviours and protecting us from unnecessary ills. Rising human population growth puts pressure on both natural resource management and health geography. Exponential growth necessitates an increase in urban development and our intake of raw materials. Natural resource development alters the local physical environment but it can also play an integral role in shaping the social, economic and political landscape (Shandro et al. 2011). Resource extraction in particular, such as mining, can spark a variety of needs, including the development of housing to support the influx of people seeking employment, as well as infrastructure requirements such as improving roads due to more frequent traffic loads (Shandro et al. 2011). Rural areas can rapidly transform into quasi urban settlements (Maire et al., 2012). As a result, there are mounting examples of conflicting interactions where industrial activities and communities intersect. To address these issues, this research's primary objective is to ensure health and wellbeing of impacted communities are fully considered in decisions about mining. I hope to contribute to the fields of IA, or EA here in BC, resource management and health geography with the lens of place shaping for health and a means to inform or educate on ways we may improve public health practice (Learmonth & Curtis, 2013, p. 22).

Chapter 2 – Literature Review

2.1 Introduction

As highlighted in Chapter 1, this thesis focuses on the breadth of human health in IA. The literature review defines and describes Health Impact Assessments (HIA). It details HIA's origins, and shows elements that are synonymous with other IA approaches. To map out HIA, I begin by looking at the roots of EIA, also more commonly called Environmental Assessment (EA) in Canada. Though EA's specific evolution has focused on the natural environment, the inclusion of human health as a component was instrumental in its uptake worldwide.

As a result, a variety of typologies have diverged from EA to address particular targets, e.g. stand-alone HIAs. First, I will explore the origins of IA, its evolution, and the divergent forms relevant to this discussion. Second, I will examine key steps in the HIA process, and baseline health data inclusion. Third, I will discuss the health concerns specific to mining. I will show how our understanding of health impacts and mining have changed over time, which has led to a responsive shift in what is discussed in the literature. Additionally, to inform the case study, I will detail British Columbia's requirements regarding EA and mine permitting and show how uncertainties and politics play a role in the EA process in BC. This chapter aims to provide the reader with a better understanding of IA and related decision-making processes, how these processes are used in BC, and the key deliverables to be included (i.e. baseline health data reporting).

2.2 Origins of Environmental Assessment (EA)

In 1969, the United States (US) pioneered EIA under the *National Environmental Protection Act* (NEPA). NEPA enactment provided the first formalized framework to address environmental concerns in a legislative form (O'Riordan & Sewell, 1981, cited in Morgan, 2012). The *Act* required US federal departments to perform EIAs and develop Environmental Impact Statements (EIS) for projects viewed as having significant environmental impact (NEPA, 2015). EIS is a formal report that includes basic information with which to review a project's

purpose, and likely environmental impact. EIA is now often referred to as EA, the term that will be used from this point forward. EA is prescribed as a means to integrate and disseminate environmental information, and to foster collaboration amongst a diverse set of actors from the public and private sector. Morgan (2012) traces the path of EA development from NEPA in the US to the present, where some form of EA is mandated in 191 of world's 193 (UN member) nations. He concludes, after almost 50 years, "EA is now universally recognized as a key instrument for environmental management, firmly embedded in domestic and international environmental law" (Morgan, 2012, p. 6). NEPA inception came to be to steward the environment and thus by extension to protect human health.

Human health concerns were influential in NEPA's creation. The purpose of NEPA was to require federal officials to consider the possible consequences of their decisions on the quality of the 'human' environment, including health (Caldwell, 1982). Section 101(c) of the *Act* states that "each person should enjoy a healthful environment" (Caldwell, 1982). But what comprises a 'healthful environment'? How is it ensured? And how does EA address this? NEPA came into being as a response to pivotal events such as the growing awareness of links between environment and health, the environmental movement of the 1960's, books such as Rachel Carson's *Silent Spring*, the emergence of planning theory (activism, advocacy), and a general concern for the environment (Ross and Orenstein, 2014, pg. 4). The US founded EA practice after various environmental disasters, or Superfund sites, increased public pressure on government. NEPA provided the first formalized framework to address environmental concerns in a legislative form (O'Riordan and Sewell 1981 as cited in Morgan, 2012). While this literature review does not intend to provide an in-depth historical account of the rationale behind EA, it is important to recognize the societal pressures that led to the use of this practice worldwide. Human health impacts from industrial pollution caused EA to proliferate around the globe. However, the questions remain, how are 'healthful environments' achieved, and how does EA facilitate this? These questions emerged as a consistent theme in my review of the EA literature regarding health. In practice, EAs rarely incorporate broad measures of health. In fact, their focus is narrow, concentrating only on exposure to environmental toxins (Ross and Orenstein, 2014, pg. 4). The timeline in Figure 3, collated by HIA scholars Harris-Roxas and Harris (2011), illustrates milestones in the evolution of EA, particularly in HIA.

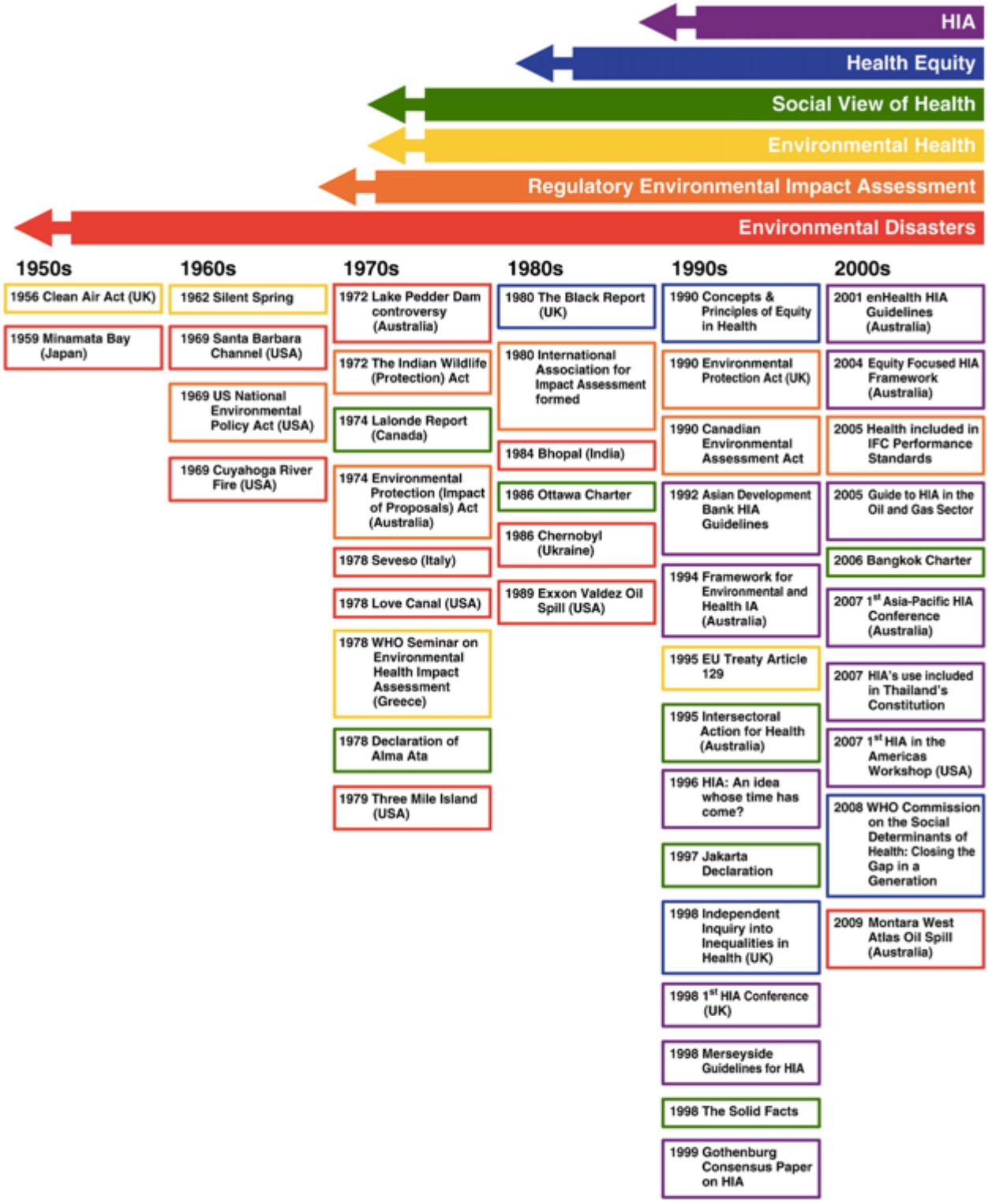

Figure 3: Selective timeline of the development of health impact assessment. Documents referred to in figure include Acheson (1998), Birley and Peralta (1992), Carson (1962), ECHP (1999), Harris et al. (1995), IFC (2006), IPIECA (2005), Lalonde (1974), Mahoney et al. (2004), NHMRC (1994), Scott-Samuel (1996), Scott-Samuel et al. (1998), UK Department of Health and Social Security (1982), Whitehead (1990), Wilkinson and Marmot (1998), WHO (1978, 1986, 1997, 2006, 2008a). NB: The arrows pointing left indicate that there was activity in all these fields prior to what is indicated in this diagram (Harris-Roxas & Harris, 2011, pg. 398).

This graphic shows the evolution of EA (orange field) and growth of the social view of health (in green). It provides a snapshot of how EA, when coupled with environmental disasters and the social understanding of health, paved the way for HIAs to emerge. (HIA will be discussed in greater depth, later in this chapter). Pivotal events in the US, e.g. NEPA, and, in Canada, the Lalonde Report—released in 1974, expressing the need to promote and protect health through action in non-health sectors— led to our current EA structure, and our understanding of what truly makes us healthy.

2.3 History and functionality of EA in Canada

The incorporation of EA into the US federal mandate paved the way for other countries to follow. Canada was one of the first to adopt legislation implementing an integrated EA strategy (McCaig, 2005). The Canadian provinces legislated their own processes throughout the 1970s and 1980s. Then, in 1984, the federal government adopted the Environmental Assessment and Review Process Guidelines Order (CEAA, 2015). This national framework evolved into the *Canadian Environmental Assessment Act* of 1995. The Canadian Environmental Assessment Agency (CEAA) implements this legislation. CEAA coordinates federal assessments that evaluate, for example, inter-provincial projects, and operations on First Nations land. It also oversees activities that trigger federal law, such as the *Fisheries Act,* which is enforced by Department of Fisheries and Oceans (DFO), and the Canadian Ambient Air Quality Standards overseen by Environment Canada. Figure 4 highlights the requirements and nuances of the federal process.

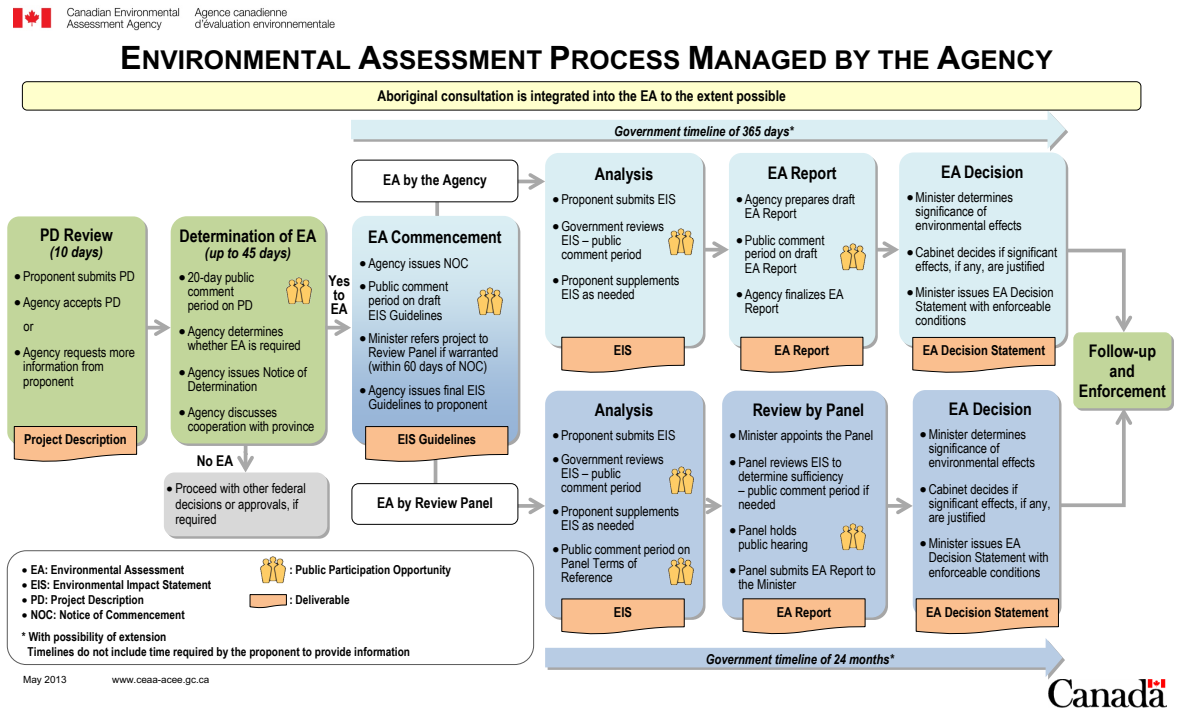

Figure 4: Process diagram managed by the federal Canadian Environmental Assessment Agency (CEAA, 2013).

In the province of British Columbia, the BC Environmental Assessment Office (BCEAO) leads the EA process, and ensures compliance with provincial regulations. This office coordinates assessment and enforces powers under the BC *Environmental Assessment Act*. Officers from the BCEAO refer proposals to stakeholders, such as provincial departments, regional health authorities, municipalities, and First Nations bands. The BCEAO facilitates requests (from stakeholders and the public), coordinates meetings, and disseminates information; it may also lead working group oversight, depending on the complexity of the proposal.

A Memorandum of Understanding (MOU) between CEAA and BCEAO regarding jurisdiction, responsibility, and protocols for public participation is integral to both levels of government. Each agency may present to the public, or input may be solicited solely via online submission. The proponent is, however, required to engage with the public. This is to facilitate transparency and collaboration in the spirit of the *Acts*. Figure 5 illustrates the BCEAO's responsibilities. These graphics describe the steps from proposal to project decision-making. They explain when the public can provide input, and highlight the timelines dictated in each EA

phase. Under the BC *Environmental Assessment Act,* for example, 180 days are provided for stakeholders and the public to offer comment, once the Application is drafted and under review.

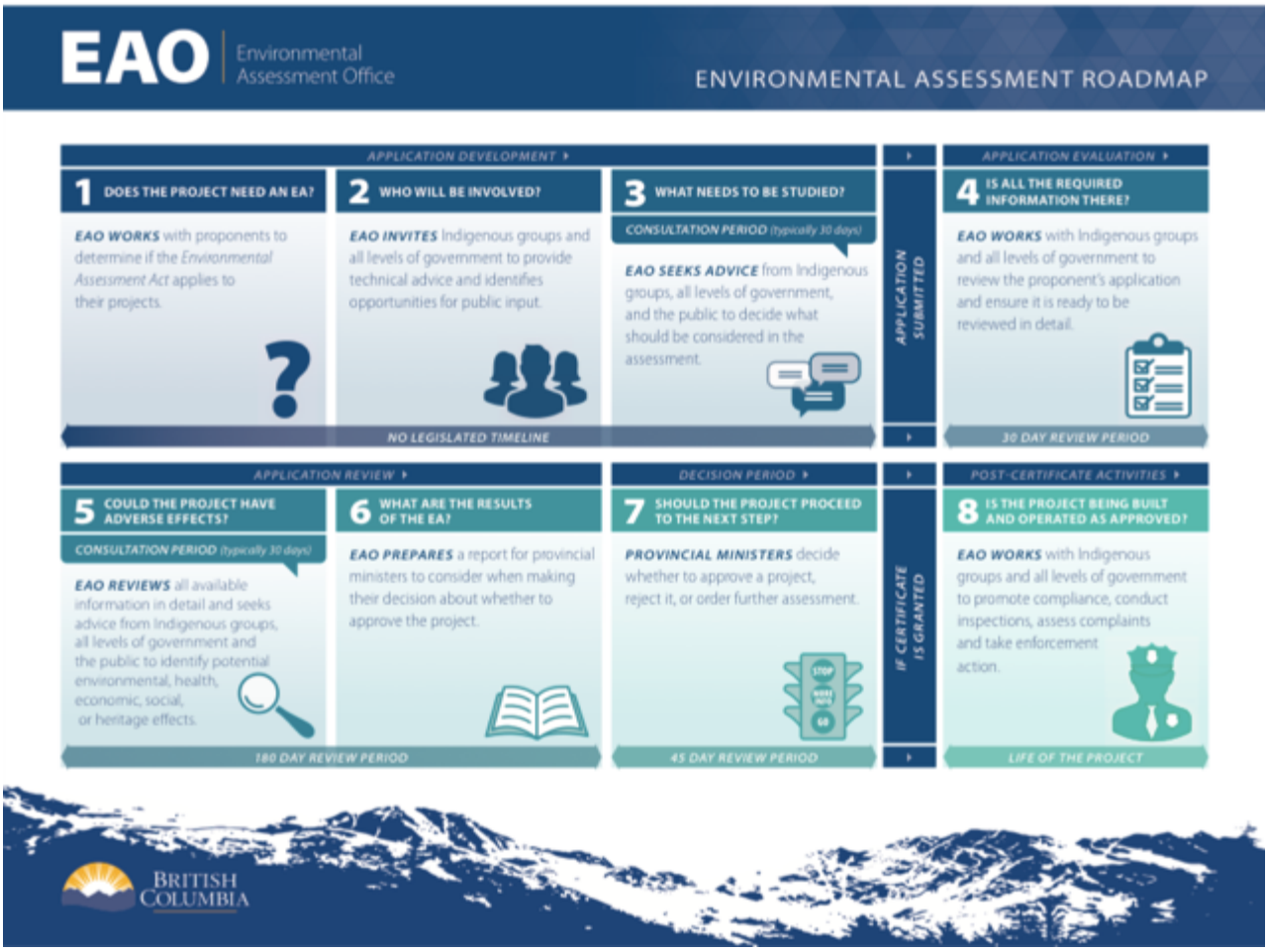

Figure 5: BC Environmental Assessment roadmap illustrating overall process and legislated timelines (BCEAO, 2015)

As the figures above illustrate, in both provincial and federal assessments time is of the essence. Ministerial decisions, governmental bodies, participating stakeholders and the interested public all have strict time constraints. Project descriptions and applications can be extensive; in the case of the Ajax mine, the application alone was over 18,000 pages. These applications can be challenging for the average layperson to review. Health Authority staff have a number of responsibilities and EA review may account for only one of their required tasks. Content experts may be broad generalists doing reviews off the side of their desk, while trying to provide meaningful commentary. Recent amendments in the federal *Act* in 2012 have raised concerns

about weakening EA practice by having to review more material in less time. The magnitude of complex technical material has compounded strict timelines. *Act* amendments now give responsible authorities (i.e. CEAA) considerable discretion in determining whether to launch an EA or not. Application of the "new assessment law cut the number of federally led assessments from several thousand to at most a few hundred annually. It also narrowed the scope of the assessments that are done" (Gibson, 2012, pg. 179). These changes reduced the evaluation time period. They limited opportunities for public consultation. As well, some critics believe they have threatened the legislation's efficacy. One might suggest that the amendments seem to be beneficial for the applicant, but do not benefit public health. If the current practice is undergoing a form of legislative retreat, or neoliberal rollback, is EA still working as was intended? Bond *et al.*(2014) argue that Governments have sought to streamline IAs in recent years "to counter concerns over the costs and potential for delays to economic development" (pg. 46).

It is not just the health sector or critics alone who are expressing concern on the complication on the federal and provincial EA processes. In a presentation made by the Mining Association of Canada to the BC Construction Roundtable (2008):

> "The primary criticism by industry is that the process is too complex and disjointed federally and provincially. It feels that this arises as a result of the Canadian *Environmental Assessment Act* and the BC *Environmental Assessment Act* (BCEAA) lacking timeline harmonization, clear policies or guidelines regarding aboriginal accommodation and consultation, in addition to limited administrative capacity [by government] to process large volumes of data in a timely fashion" (The Mining Association of Canada, 2008 as cited in Nelsen, Scoble, & Ostry, 2010, p. 167).

The quote demonstrates the frustration felt by the industry, their concern around timelines, complexity, and fragmented processes (federal vs. provincial). It also highlights guidance, staff and resource limitations. So, what about the other IA forms in Canada? How do these fare in regard to health, especially when we are now dealing with the absence of a legal framework?

2.4 Variable typology of Impact Assessment – from EA to HIA and related processes

A host of IA types exist beyond EA. Each form promotes different values. There are types of IAs not covered in this review, but the applicable forms for this case study, and their geographical context, will be covered. Definitions in IA vary slightly from country to country,

case-to-case, or even within the IA practitioner community. However, I will describe broadly their individual forms and functions.

2.4.1 (Integrated) Environmental Health Impact Assessment

Early IAs usually focused on the ecological and physical environment. They downplayed, or even ignored, issues such as social and health impacts (Mellanby, 1967 as cited in Morgan 2011). In the US, Canada, Europe and other affluent nations in the 1960s and 1970s, concerns surfaced about the human impacts on the natural environment. Pollution was considered to be a threat to our natural world, but was less so seen as a problem for people and their health (Mellanby, 1967 as cited in Morgan 2011 p. 405). Industry accounted for most environmental disasters, and the public was only just beginning to accept that there were negative human health repercussions from these activities. The shift of focus and emphasis for Environmental Health Impact Assessment (EHIA) studies owes much to the early foundations laid by the World Health Organization (WHO).

The concept of an integrated environmental review appeared in 1982, when the World Health Assembly introduced a framework for the development of integrated EHIA. By the mid-1990s, a number of EHIAs had been carried out, and several tools had been published in different countries to aid the integration of health in EAs (McCaig, 2005). More recently, WHO put out guidance documents using evidence-based health determinants specific to industries such as mining (WHO, 2015). The World Health Organization now estimates that over 25% of the burden of human illness worldwide is attributable to modifiable environmental factors (Bhatia & Wernham, 2008). This figure may underestimate the role of environmental factors because researchers have investigated only a fraction of the potential risks (Bell, 2014). In 1986, the Ottawa Charter on Health Promotion urged policy makers in all sectors to "be aware of the health consequences of their decisions" (WHO, 1986). More recently, this has been reinforced with a "Health in All Policies approach, to public policies, across sectors that systematically takes into account the health implication of decisions, seeks synergies, and avoid harmful health impacts in order to improve population health and health equity" (WHO, 2014, p. 1).

The many IA forms (e.g. EA and HIA) may contribute to decision-making for a project, policy, program or plan. For example, an IA could look at the implications of a site-specific industrial activity, or a new province wide climate change adaptation policy. It could also lead to

opening up a (historically closed) territory to mining or evaluating a neighbourhood plan. It all depends on the IA subset being used, and what is eligible for review. Table 1, taken from the National Collaborating Centre for Healthy Public Policy's (NCCHPP) website, illustrates some of the nuances between EA, Strategic Environmental Assessment (not discussed in this thesis but a process that exists in Canada), HIA, and Risk Assessment. However, for the purposes of this thesis, I will only be looking at the IA approach as it relates to a project: the Ajax mine proposal.

Table 1: Comparison of four types of impact assessment used in Canada, excerpt from National Collaborating Centre for Healthy Public Policy report (Mendell, 2010)**.**

	Health Impact Assessment (HIA)	**Environmental Impact Assessment (EIA)**	**Strategic Environmental Assessment (SEA)**	**Risk Assessment (RA)**
Definition	"A combination of procedures, methods and tools by which a policy, program or project may be judged as to its potential effects on the health of a population, and the distribution of those effects within the population" (WHO, 1999, p.4).	"In general, environmental assessment is a process to predict the environmental effects of proposed initiatives before they are carried out" (Canadian Environmental Assessment Agency, 2010). "An integrated EIA, which combines heath, social, economic, cultural and psychological well-being as well as the physical, biological and geochemical environments, provides a holistic understanding of the complex interrelationships between the human and natural environments that are key to health" (Kwiatkowski & Ooi, 2003, p.435).	"A systematic, comprehensive process of evaluating the environmental effects of a proposed policy, plan or program and its alternatives" (Parks Canada, 2009a, p.1).	"The use of the factual base to define the health effects of exposure of individuals or populations to hazardous materials and situations" (Mindell & Joffe, 2003, p.109).
Level of Analysis	Policy, program or project	Project	Policy, program or plan	Substance / exposure
Impacts Considered: Human health? Distribution of impacts? Effects on vulnerable groups?	Impact on health determinants, according to Dahlgren and Whitehead model (1991). Consideration of the distribution of impacts on vulnerable populations and of equity, in accordance with recommendations made by the WHO, following the Commission on the Social Determinants of Health (WHO, 1-23- 2009).	In Canada: Federal EIA legislation includes a formal procedure to assess health impact. A Health Canada division responds to queries made by ministries and organizations that solicit expert opinions within the context of this procedure (Gagnon & St-Pierre, 2007). However, it is unclear whether impact on health, on determinants of health or on vulnerable populations is systematically taken into consideration in all cases, across the provinces and territories.	More general, less detailed than EIA; in general, impact on human health not considered (Mindell & Joffe, 2003).	"Health Canada's mandate covers the management of health risks and benefits to individual persons, human populations and the natural environment" (Saner, 2010); Almost exclusive focus on adverse effects of exposure to a single toxin (Corburn & Bhatia, 2007; Regens, Dietz, & Rycroft, 1983).

2.4.2 The advent of Health Impact Assessments – the pros and cons of integration vs. separation

While health may be the impetus for early EA, reality tells us differently. There are numerous examples that show health was either included narrowly in IA or not at all. In cases where health was included, the assessment included only biophysical environmental impacts on health. HIA was meant to be a practice inclusive of and sensitive to the SDH. Hilding-Rydevik *et al.*, (2006) conducted a survey of then current practices in the European Union (EU). They considered best practices, case studies, and the pros and cons of addressing health in IAs, compared with stand-alone HIAs. In the EU states investigated, the study confirmed that health is being considered in assessments to some extent. It found variation in the nature and depth of treatment (Hilding-Rydevik *et al.*, 2006; Morgan, 2011). Since then, there seems to be a "small but noticeable rise in the recognition of the wider determinants of health among some stakeholders involved in the EA process, but the treatment of health impacts is dominated by health risk assessments of specific emissions to air, water or soil" (Morgan 2011 p. 406). In Morgan's (2011) summation of Hilding-Rydevik *et al.* (2006) there are identified:

> "…problems with deciding how to define human health (narrow or broad definitions), and the lack of guidance materials, and case studies, for incorporating health into IA (as opposed to guidance on HIA methods, which themselves range from the quantitative health risk assessment methods to the qualitative, public health methods). There is a desire to see integration, but just how to bring that about is still beset with problems" (p. 406).

How has North America fared in integrating health concerns in EA, or in the formal implementation of HIA? One US review of 42 federal EAs conducted under NEPA found that more than half contained no mention of health; a minority contained narrow discussions of health risks (usually cancer risk) associated with chemicals or radiation (Steinemann 2000; Bhatia and Wernham 2008 p. 993). Canada has had positive though inconsistent success expanding the traditional EA approach to include explicit discussions of health determinants (McCaig 2005; Noble and Bronson 2005; Bhatia and Wernham 2008 p. 993). In 1997, under the direction of Health Canada and International Association of Health Impact Assessment, Davis and Sadler (1997) examined the effectiveness of HIA globally. Their discussion paper drew attention to the potential benefits of HIA but found that the work required to reap these benefits was not being done. The study also identified difficulties in finding an entry point for HIA into EA.

Incorporation into EA of social, community and psychological dimensions of health and well-being was noted as a particular challenge. As well, inclusion of a health impact component in EA was found to be ad hoc — "dependant on the willingness of environmental assessment practitioners who frequently had to be persuaded that inclusion of health was desirable" (Davies and Sadler, 1997 as cited in McCaig 2005 p. 740).

The 1999 Canadian Handbook on Health Impact Assessment (R. Kwiatkowski, 2004) was revised in 2004, and had international impact. It encouraged proponents, regulators, and health professionals to consider HIA as a component of the EA process. However, the handbook is not used in British Columbia. Following this resource, along with guidance from the World Health Organization, other regions have enacted HIA legislation. In the province of Quebec, consideration of health impacts in government policies is legally mandated in their *Public Health Act* (Gagnon, Turgeon, & Dallaire, 2008). There is also a process in place to provide the resources, support and a mechanism for public engagement. The National Collaborating Centre for Healthy Public Policy (NCCHPP), funded by the Public Health Agency of Canada (PHAC), has in-house experts in Quebec that carry out HIAs. If an HIA is to proceed, or extend to other provinces, there must be updated implemented guidance to shape places that enhance health and wellbeing (Learmonth and Curtis 2013).

As described by Scott-Samuel in 1996, "the scientific community is only recently coming to realize the crucial role of public and private [policies and] projects in influencing the public's health" (Scott-Samuel, 1996, p. 183). The "Gothenburg Consensus, in 1999, fused the WHO's Commission on Social Determinants of Health to produce an HIA methodology based on the social determinants of health" (Krieger et al., 2010, p. 2129). The field of HIA has grown extensively in the past two decades, based on the work of seminal authors such as Scott-Samuel (1996), the Gothenburg consensus (1999), and even since the study by Hilding-Rydevik *et al.* (2006). HIA has developed to address the above-mentioned challenges and include all determinants of health. Many forms of HIA guidance and case study examples illustrate the difference between integrating health in EA and HIA, where EA typically excludes SDH. However, the philosophical question remains: are we learning from these illustrations or simply continuing a call that has been requested by health professionals for almost two decades?

2.5 HIA Frameworks – e.g. International Finance Corporation

HIA evaluates potential industrial risks, from site to community, such as those observed in mining operations. Even the mining industry has developed HIA guidance, such as the International Council on Mining and Metals *Good Practice Guidance on Health Impact Assessment* (ICMM 2010). In true HIA form, this document focuses on the impacts, but also emphasizes the ways that mining companies can positively contribute to the health and well-being of mine workers, and the communities in which they live. The ICMM makes a strong case for consideration of broad health impacts in mine planning.

In 2003, a private arm of the World Bank, the International Finance Corporation (IFC) "identified potential health impacts associated with private sector projects in emerging economies. These included: changes in nutritional status, mortality and morbidity, HIV and other communicable diseases, endemic diseases, impacts of in-migration on health services and associated infrastructure, and environmental (exposure) health impacts" (IFC, 2003, p. 12). As a result, in 2009, the "IFC released a guidebook to introduce the HIA procedure with main objectives of: providing guidance to associated corporations in relation to the HIA process, and assisting in assessing potential impacts to community health as a result of project development" (Shandro *et al.*, 2011, pg. 179). "The document aims to describe best guidance practices in conducting HIAs for both new projects and expansion of existing facilities" (McCallum et al., 2015, p. 105). While the IFC's health methodology is based on results from sub-Saharan Africa, the IFC showed that almost half of measurable health improvement was unrelated to the health system itself. Rather, it arose from improvements in the housing, water, sanitation, transportation, and communication sectors (Krieger et al., 2010). In the industrial context, IFC's Performance Standards have been made operational and adopted by a large consortium of multilateral lending institutions (Krieger et al., 2010). It is for this reason that I focus in and highlight the IFC HIA Guidance as this was the framework I used in this research project as a benchmark for comparison. IFC is not only an industry standard, and highly referenced in the literature, it is also a framework used internationally. If a mine, in sub-Saharan Africa or Asia, for example, sought funding from the World Bank these IFC Standards would have to be met. Conversely, for industrial development projects in Canada, or British Columbia, this framework is neither referenced nor used. In addition, IFC takes into consideration a broad range of

categories known as the Environmental Health Areas (EHAs) and provides prescriptive requirements on baseline data collection, scoping, as well as other user friendly features. Figure 6 showcases a selection of landmarks in HIA and stratifies the timeline by public and private sector.

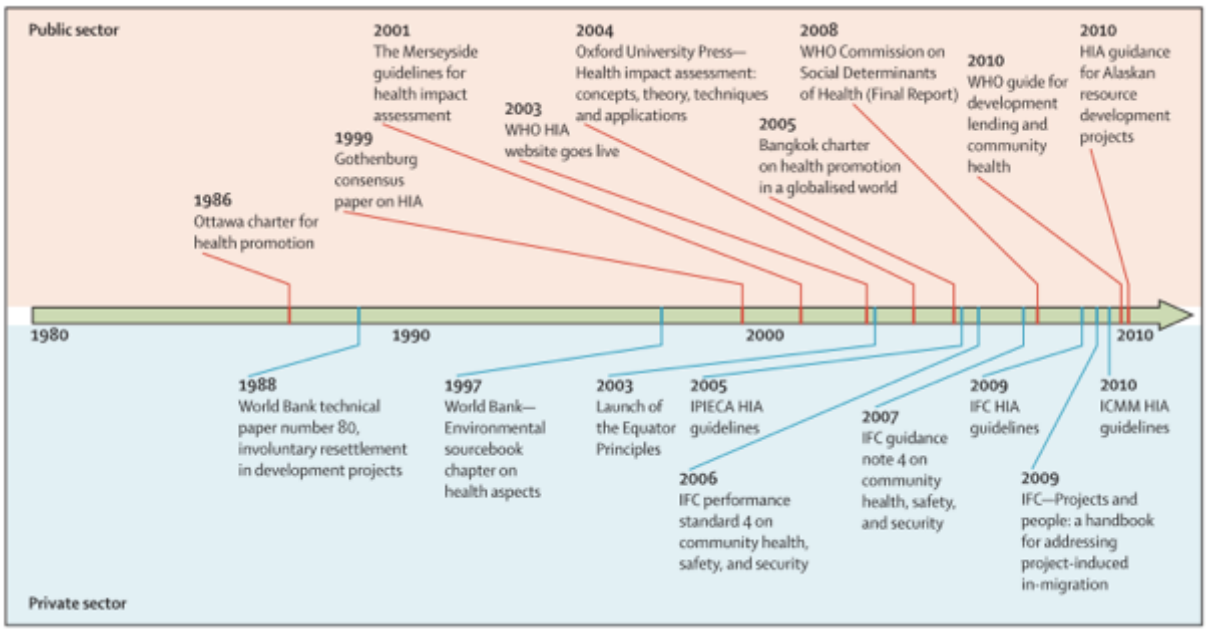

Figure 6:Landmarks of HIA, stratified by public and private sector. HIA=health impact assessment. ICMM=International Council on Mining and Metals. IFC=International Finance Corporation. IPIECA=International Petroleum Industry Environmental (Krieger et al., 2010, p. 2130)

2.6 Mining and Health

Historically, mining focused on worker health. It is true that "much of what we know about adverse health stemming from environmental factors is from our workplace experience" (Kwiatkowski, 1999, p. H2). Workers, in most instances, were the most proximal and heavily exposed. A literature review conducted by Stephens & Ahern, 2001, for Mining, Metals and Sustainable Development, concluded that workers were exposed to the greatest risks. Others assert that "[the mining] industry remains one of the most difficult, dirty and hazardous occupations causing more fatalities than other occupations even in the United States or in Europe" (Stephens & Ahern, 2001, pg. 13). Examples of occupational mining threats are: exposure to asbestos leading to mesothelioma or asbestosis, noise resulting in hearing loss or tinnitus, safety related impacts causing injury or fatality, all of which lead to stress on workers

and their families. Consequently, mitigation and prevention have targeted workers and to a lesser degree their families.

Over time, our understanding of mining risks has improved. As a result, our technologies to measure worker threats have advanced, as have practices to control them. This shift has reduced occupational risk and eased industrial liability. Still, the primary focus is on what is quantifiable, measurable, and supported by risk assessment. The industry and work safe legislation have concentrated efforts on ways to protect workers (e.g. via personal protective equipment [PPE] or safety training). Community impacts have not entirely been neglected. But substantial impacts on workers have been observed, explaining the historical emphasis on occupational health and safety improvements. In the past, workers unintentionally played the role of the "Mining Canary". Their negative health outcomes served as a warning for the rest of society. They were the most-at-risk, by virtue of the dose-response relationship fundamental to risk assessment and toxicology (Kwiatkowski, 1999, p. H2). However, many industries, including mining, use the terms health and occupational health and safety interchangeably (Kirsch *et al.*, 2012, p. 1).

In work by Kirsch *et al.* (2012) the researchers findings were consistent with those of Stephens and Ahern (2001) "who identified a major shortfall in research around mining and the health risks to the broader community" (Kirsch *et al*., 2012, p. 6). Stephens & Ahern (2001) stressed the need to look at the "whole mining and mineral life cycle, to identify the extent of health impacts related to mining, both for miners, the local communities around mines and the wider community of users of the mined products" (, p. 44). These studies lead one to question the scalar and temporal extent considered when evaluating health impacts related to mining activities. When focusing on mining impacts, it helps to reflect on what is considered, especially related to approval provisions, the lifecycle of the mine, and impacts beyond the mine's immediate footprint. During the exploration and planning stages it is crucial to consider health outcomes broader than those affecting the worker.

Kirsch *et al.* (2012) argue that research is needed (in EA) in order to understand the health impacts throughout the lifecycle of the mine, particularly in stages found to be underrepresented, e.g. during construction, closure, and recommission. The Kirsch *et al.* (2012) study urged governments to develop appropriate policy responses to influence better community health outcomes. To the industry, they write: "conducting, publishing and considering such

research in future decision making will also promote the overall social responsibility of the mining industry, improving public perception and relations" (Kirsch *et al.* 2012, p. 6). "An increased focus on health and well-being impacts within the life of a mine planning framework can directly result in reduced detrimental impacts, such as chronic disease from environmental exposure. It can also increase benefits, such as improved health service delivery by government agencies. Both would result in overall improved health outcomes" (Kirsch *et al*. 2012, p. 6). Reflecting on Kirsch *et al.*'s findings, is this information being translated into approval processes knowing that impacts can and will extend spatially beyond the mine site? During my own research for this thesis, I wrestled with how to spatially and temporally bound the case study. As for any industrial planning, some impacts are extremely challenging to forecast and prepare for.

If the scope of 'health effects' in an EA review of a proposed mine do not account for what is beyond the site or the lifespan of the project, what changes in population health indicators can we expect? Examining a mine in northern British Columbia, Shandro *et al.* (2011) documented:

> Increases in pregnancies, sexually transmitted infections, and mine-related injuries during booming mine activities. During bust times, mental health issues such as depression and anxiety were reported. Overarching community health issues prominent during both boom and bust periods included burdens to health and social services, family stress, violence towards women, and addiction issues (Shandro et al, 2011, p. 184).

This study shows mining influences, specific to boom and bust towns. In the EA application or permit conditions for the Ajax mine, were provisions required to address or prepare for these effects? It is noteworthy to mention that there are challenges in assessing these forms of more indirect causes of illness. Epidemiology focuses on morbidity, mortality and the identification of individual risk factors for disease (Shandro et al., 2011, p. 31). It is evident that economic changes affect local economies. Mineworkers in particular reap the financial benefits but face the most direct risks. As a result, it makes sense that many studies focus on worker health (Shandro et al., 2011, p. 32). Although now that we know more about the community health impacts from a mines' influence, have EA applicants, their consultants, and the regulators responded by including these more nuanced aspects of health impact? For example, some mining impacts that may be referred to as "psychosocial" might seem to be obtuse as far as the linkages are concerned. Local job creation and the development of infrastructure (e.g., highways, schools, and

health services) may translate to an increase in the quality of life of local residents. From a mental health perspective, people residing in proximity to a mine site and truck routes may have their lives disrupted by noise, road dust or see a decline in their property values. The presence of a mine site and related infrastructure can also detract from the landscape and from the recreational and cultural use of the natural environment (Kwiatkowski, 2004, Vol. 4, p. 5-13). These impacts, referenced in the Canadian Handbook for HIA are known to exist but how were they included in the Ajax mine proposal?

2.7 How does a generic EA process work?

The typical steps of EA (and HIA) are: screening, scoping, assess and report, monitoring, and evaluation:

1. Screening determines whether or not an IA is to be carried out.
2. Scoping establishes what issues are most critical (or valued) components to study. This step engages with the community to some degree, and decisions are made on which stakeholders will be brought to future discussion tables.
3. Detailed prediction and mitigation studies follow scoping and are carried out in parallel with feasibility studies.
4. The main output report is either an Environmental Impact Statement (federally), or the Application Information Requirements (provincially). It contains a detailed plan for managing and monitoring environmental impacts both during and after implementation.
5. Finally, if a project is approved, monitoring of the EA permit conditions is carried out during project construction, operations, and closure phases. Monitoring serves a useful feedback for ensuring compliance with said conditions and aids in adaptive management for taking corrective action.
6. Evaluation may include an audit, modification, and/or lessons learned to be considered for future assessments.

Figure 7 illustrates the HIA and EA process. There are differences in the flow and terminology associated with each but ultimately the process is similar for both. For this study I focus on the scoping phase in particular and the baseline health data or report that was considered during the Ajax mine proposal, which I will discuss in greater detail in Chapter 3 onward.

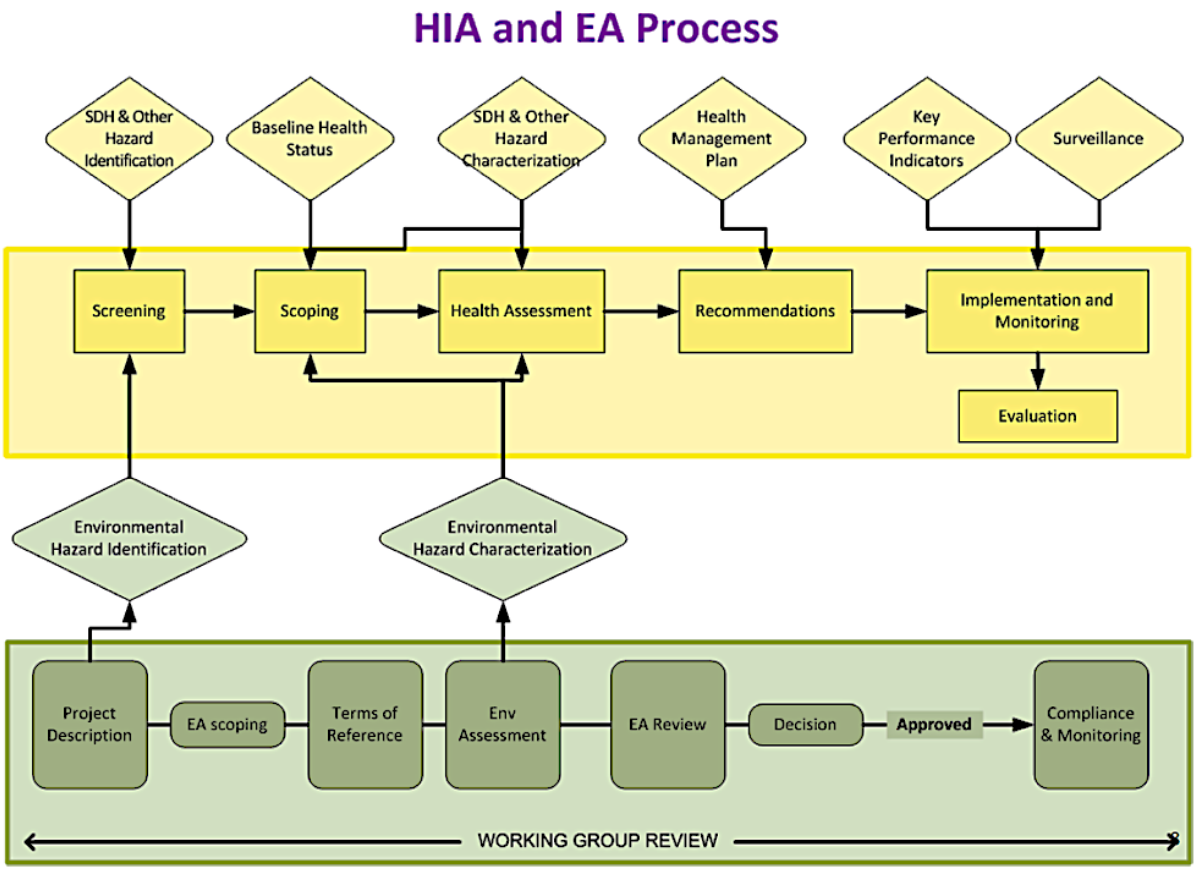

Figure 7: Generic HIA (above) and EA (below) Process (Elliot, 2012)

2.8 Baseline Health Data and Reporting

Additional challenges exist in any form of IA, whether HIA or EA, in the areas of inclusion, collection, and acquisition of baseline health data to assist with decision-making. This includes finding suitable indicators for the assessment of future impacts. In some instances, baseline data is not available, and resource restrictions can impede the development of new indicators and collection of relevant data. Health Canada (1999) suggests that prospective data should not be dependent on baseline availability and should be collected in all cases (McCaig, 2005, p. 744). But questions remain: what parameters are included? And how? An in-country HIA uses information that is already available or easily accessible. Thus, no specific new data collection is required. Data sources may include peer-reviewed scientific literature and health department data. Workshops or discussions with key internal and external stakeholders can provide useful health-related information (IFC, 2009, p. 10). Scoping studies focus the

subsequent impact prediction work, and they determine the information required in the baseline surveys (Beanlands and Duinker, 1983). Furthermore, many HIA methodologies call for baseline information before detailed scoping studies (Morgan, 2011).

2.9 Uncertainty and availability of information

Uncertainty in IA is unavoidable. It is impossible for proponents, consultants, government, and the public to know all of the impacts, how they will interact with each other, and what the impacts' magnitudes will be. With different perspectives, stakeholders and working group participants may sway the consensus on which impacts to consider. Uncertainties may also arise when there is limited agreement on how to evaluate, manage and monitor a particular impact. As well, uncertainties are often hidden to "avoid controversy among practitioners, the public, and project developers that could compromise project realization" (Cardenas & Halman, 2016, p. 24).

Another concern related to uncertainty, more specifically to HIA, is the lack of consensus on methods. "Relationships between environmental change and human health are emerging, complex, and dynamic, posing challenges to both conceptualizing pathways resulting in human health effects and developing impact assessment methods to assess such effects"(Bhatia & Wernham, 2008, p. 993). The HIA methods chosen in a particular case are likely to draw heavily on the experience of specific practitioners (Scott-Samuel, 1996). Another factor is the plethora of resources that have flooded the market on HIA Guidance. There are several important issues at play in the HIA process. For example, who is driving the process? Who is at the stakeholder table? What HIA framework is being used? How comprehensive of an HIA is being carried out, e.g. a tabletop or in-depth approach? What baseline data is being used, what is available, is any additional data being collected? If so, from whom, or what source? Was the HIA biophysically oriented or positioned more towards a health equity view? It only takes one moment to reflect on the many perturbations in the process that could lead to and add uncertainties into the HIA equation. The practice of HIA is almost a dance, an art form, rather than an exact science, so the process may not result in a perfect outcome. There will be always be some level of uncertainty but with intention, awareness, and recognition of this uncertainty in HIA practitioners can enhance trust, transparency, and confidence in the process.

The rationale for all forms of IA, whether EA or HIA oriented, is ultimately to provide decision makers and stakeholders with a complete understanding of a proposed project, including its potential impacts and strategies to effectively manage those impacts. The purpose is to identify and manage future outcomes therefore uncertainties are unavoidable (Duncan, 2008). Lees *et al.* (2016) further reflected on these uncertainties in EA, by drawing on the following studies:

> "Uncertainty in EA is due, in part, to complexities in the design and operation of large development projects (Noble and Storey 2005), and to the inherent complexity of environmental systems (Berg and Scheringer 1994) – such as the large number of potentially important components and interrelationships to be considered when assessing impacts, or time lags in their response (Jaeger 1998; Findlay and Bourdages 2000). Since there will *always* be knowledge gaps and uncertainty in EA (Arts, Caldwell, and Morrison-Saunders 2001), the problem is whether and how uncertainty information is communicated and how uncertainties are addressed in EA" (Tennøy, Kværner, and Gjerstad 2006; Duncan 2008; Leung et al. 2015; as cited in Lees et al., 2016, p. 2024).

There are innate uncertainties in any IA. These processes are not without fallibility and, while some might be inclined to say only HIA is wrought with uncertainty, this study illustrates that any IA process hoping to predict the future, is rife with ambiguity. Therefore, if uncertainty permeates all IAs, the standard of precision should be founded in a comprehensive literature review, using mixed typologies of evidence, fact checking, being iterative throughout and honest about the unavoidable uncertainties that persist the process. Once and if the project moves forward with approval, there are then mechanisms to address uncertainty through robust monitoring of the activity and adaptive management to make any alterations needed to alleviate negative outcomes. As written by Steinemann (2000), adaptive management recognizes that project implementation is a type of an experiment: project outcomes are uncertain, and thus we should be prepared to gather information, learn from surprises, improve our understanding, and change actions (p. 639).

2.10 Limitations & Politics

This section speaks to the limitations of IA, environmental or health, as a general practice. IA practitioners try to do so many things, for so many people, yet users can only strive to achieve so much. Its success depends on the variables under review and acknowledgment of

the uncertainties. However, additional challenges arise when health is included in assessments. Although health is generally considered in EA, there is no specific guidance or methodology to ensure comprehensive or consistent inclusion of specific health issues in EA. The International Association for Impact Assessment (IAIA) states the following with respect to health considerations in traditional environmental assessments: "the assessment of health effects is likely to be biased towards bio-physical health determinants rather than a holistic view that also includes important wider determinants. The scope of health issues covered may reflect the industrial country roots of EA, and therefore lack the level of comprehensiveness necessary to make the assessment fully relevant to local health conditions" (IAIA, 2006; McCallum et al., 2015, p. 100).

In work by Steinemann (2000) looking at NEPA in the USA, EA officers described how health is treated in the process and some very interesting findings emerged: (1) Analyzing health impacts can be difficult, costly, and add to an already complex analysis (p. 634). (2) One EA analyst said trying to address health is "opening up a can of worms" (p. 634). Another stated "how do I figure health impacts out? If I can't measure them, I can't put them in the EIS" (p. 634). (3) Legislation (NEPA) does not clearly mandate HIA. (4) Trying to address possible health impacts may only cast a wider liability net. As one officer said, the risk of doing a HIA is greater than the risk of not doing it, i.e. "we open ourselves up and can get shot down. If we don't do them, it's a whole lot easier, and we probably won't get sued" (p. 635). (5) Another EA assessor claimed, "if the public is not aware of a particular hazard, the lead agency probably won't address human health concerns" (p. 635). (6) A third officer said, "We'll spend all this time and money, figuring out the environmental impacts on a plant, but we won't bother to study the impacts on humans… when projects have human health concerns, EISs often provide a reference to relevant statutes, rather than provide analyses" (p. 635). (7) Lastly, this problem is compounded by the lack of communication between EA officers and public health professionals regarding potentially significant health impacts from environmental changes. One EA assessor said, "we need a public health person on board to tell us what a red flag might be." Another assessor explained that EAs tend to be one-directional—examining the impacts of humans on the environment, rather than impacts on humans from the environment—and that "we need to be looking at the interactions between the two" (p. 635).

The section above makes me reflect on how this might translate to the BC process. As an

enforcement officer, legislation gives you the tools, makes it clear was is in or out of scope of responsibility, but it may also tie your hand. If, for example, the legislation only speaks to the protection of Drinking Water, and to protect against health hazards defined as:

> *(a) a condition, a thing or an activity that*
>
> *(i) endangers, or is likely to endanger, public health, or*
>
> *(ii) interferes, or is likely to interfere, with the suppression of infectious agents or hazardous agents, or*
>
> *(b) a prescribed condition, thing or activity, including a prescribed condition, thing or activity that*
>
> *(i) is associated with injury or illness, or*
>
> *(ii) fails to meet a prescribed standard in relation to health, injury or illness* (BC Public Health Act, 2008)*,*

then the focus is primarily on the parameters 'prescribed' by regulation (food, water, sewer) under the *Public Health Act* (Elliott *et al.*, 2014). It is not only EA officers that are concerned about liability; health professionals must also be mindful of this fact. We know there is potential for greater impacts beyond the bio-physical. But without the legal authority to make an impact an issue, is it a merely a best practice recommendation. Where, then, is the avenue to include broader SDH in the absence of legislated authority. As illustrated in Steinemann's (2000) research, EA officers commented on their legal responsibility, and even if a particular health impact is the right thing to include, it may not be the legal thing.

2.11 Summary

EA is viewed more as an environmental management tool, both by the department administering it and the public health agencies involved. In its present form, it is not widely recognised as a means for addressing health objectives. Beyond HIA guidance documents, EA practitioners lack direction about how to analyze health impacts. That forces approval agencies to fall back on environmental health statutes to define the scope of health concerns. The necessary inter-disciplinary approaches are often compromised by a lack of communication and collaboration between departments. Despite these and associated problems, Bhatia and Wernham (2008) conclude that lead agencies will often "accept well- reasoned, scientifically grounded

public health arguments as justification to increase the scope of an EA". Moreover, "the scope of health issues that can be addressed through EA is surprisingly broad, including concerns as diverse as traffic injuries, social cohesion, traditional subsistence diets, social problems such as domestic violence, and psychological problems such as stress from displacement" (Morgan 2011 p. 406). Bhatia and Wernham (2008) also make interesting points about the standards of evidence in the needed areas of IA and empirical public health research. In particular, they point out that EA operates in a context where decisions are made "at the pace required by political or economic priorities and based on available evidence and professional opinion" (Morgan 2011 p. 406). The evidence cited above indicates opportunities for robust health inclusion in the EA process, but it also points to the challenges to providing consistent response by agencies, in the absence of prescribed parameters.

In British Columbia, where there is no regulatory requirement for HIA, the public can be left voiceless—lacking engagement and involvement—regarding health impacts. Where you live contributes to potential risks you may be exposed to as an individual. The connection between urban planning and health equity is becoming increasingly evident, as urbanization expands. Responding to land-use pressures challenges regulators. This research explores these regulatory gaps, builds on the work presented above, and probes into barriers that may prevent adequate health inclusion in the EA process. Identifying and, perhaps, limiting those barriers is a key reason underlying my taking on this study. It is why health professionals are behind calls to the province of BC, urging for the enactment of HIA legislation as in other jurisdictions.

The link between health determinants and outcomes is complex and multi-faceted. "There may be substantial time lags, feedback and an absence of known parametric functional relationships between cause and effect" (Birley, 2002, p. 33). One response to this uncertainty is to focus the assessment on the determinants of health rather than the health outcomes. The EA "must weigh the evidence regarding the likely changes in health determinants and provide argument as to whether the net effect of these changes will be beneficial or detrimental to the health of specified community groups" (Birley, 2002, p. 33). As a result, the assessment of health impacts has lagged behind. The importance that has been attached to physical environmental impacts, in contrast to social impacts, is significant. We can and need to do a better job of assessing health issues in EA. However, the "framework of EA and the EA process itself are not sufficient at present to assess and promote human health through project development in

Canada" (Noble & Bronson, 2005, p. 403). At the same time, HIA is a useful example of a health system developing its own capacity to undertake equity focused HIA through "learning by doing" (WHO, 2008). HIAs also provide the public with a mechanism to input into planning processes (Gunning et al. 2011). In light of the potential health benefits of using HIA, I examined the integrated EA process described in the Ajax mine proposal case study to determine what was included, and what might have been missed.

Chapter 3 – Methods

3.1 Overview

In the IA, EA and HIA literature reviewing projects, authors often reflect on the assessment's application in a single or multi-comparison case study. Therefore, from a research design perspective, it seemed logical to use a similar approach. In this chapter I begin by describing case study methodology and how it applies to my thesis. I then discuss the methods taken to investigate the research questions. Finally, I describe the HIA framework I used, the IFC HIA Guideline and Performance Standards. These international standards, along with a case study approach, are referenced extensively in the literature and were the guides to frame this work.

3.2 Case study methodology

Simplistically, a case study is defined as the inquiry of a bounded system (Putney, 2010). This methodology is an empirical inquiry that investigates a contemporary phenomenon (or case) in depth, and within a real-world context. It aims to better understand and contextualize this real-world case. To address this, case study methodology relies on multiple sources of evidence, and triangulation of data (Yin, 2014, p. 16). Case study evidence comes from many sources, such as documentation, archival records, interviews, direct observation, participant-observation, and physical artifacts (Yin, 2014, p. 103). Its sources depend on the research questions asked and on the phenomena being explored. In the words of one observer:

> "the essence of a case study, the central tendency among all types of case study, is that it tries to illuminate a decision or set of decisions: why they were taken, how they were implemented, and with what result (Schramm, 1971 as cited in Yin, 2014, p. 15)."

For this research, I am examining which aspects of health impacts were considered in the Ajax mine EA proposal. An added benefit is to illuminate how potential health impacts were factored into the decision-making process for this case study.

There is much debate about the definition and application of case study methodology. While the case study is recognized as a "distinctive form of empirical inquiry, many researchers nevertheless disdain the method" (Yin, 2014). Some of these concerns include a perceived lack

of rigor, an apparent inability to generalize from case study findings (i.e. "how can you generalize from a single-case?"), an unmanageable level of effort, an often-lengthy duration to complete, and a questionable comparative advantage to other cases (Yin, 2014). The intent of my project was to analyze the inclusion of health in the BC EA process, not get into a methodological debate. To simplify my task, I focused on Robert Yin's (2014) text Case Study Research Design and Methods. This resource was referenced extensively in the literature on case study methodology, and I decided to use its standardized approach to guide my design. As said by another well-known author in this field: "the case is of secondary interest: it plays a supportive role, facilitating our understanding of something else…" (Stake, 2000, p. 237). That something else is a description of the treatment of health in the case study of the Ajax EA mine proposal in BC.

Yin (2014), along with many other scholars, speaks to the importance of bounding a case study. In particular, "case study is an inquiry about a bounded system… where researchers are able to put boundaries or limits around the system being researched" (Putney, 2010, p. 3). The Ajax mine proposal had what seemed like a clear natural container in which to research the case, that is, what was and was not reviewed in the EA. Nonetheless, the further I delved into the research, the more those boundaries blurred. Some of the challenges I grappled with were: the timespan of documents, jurisdictional limitations, response rate for participant recruitment, definition of health and wellness (as it relates to a mine's influence), participant's sphere of expertise, and spatial bounds to the study. Ultimately, I limited my discourse analysis to documents made publicly available on the BCEAO's e-PIC webpage, documents that clearly spoke to the health implications of this mine proposal. I will speak to the rationale I took in binding my case in the document section below, but wanted to introduce it here, because I believe case study to be the best-suited methodology for my study.

For a single-case design Yin (2003) suggests that one way to think about conducting the research is "to consider it as a holistic examination of an entity that may demonstrate the tenants of a theory" (p.5). My hypothesis is that health is not given the same level of attention in an integrated EA as it would if a stand-alone HIA was conducted. To test this hypothesis, I plunged into the instrumental case of the Ajax mine EA. This instrumental case study subtype has implications for case study design subtleties. The Ajax mine has facets that render it an instrumental case, as it is one that explores an issue or phenomenon beyond the case itself. "In

this instance, the case selection is made for further understanding of a larger issue that may be instrumental in informing policy" (Putney, 2010, p. 4). My principle objective is to explore the particulars of the Ajax mine EA proposal as it relates to health concerns. Specifically, for this case and the current EA process in British Columbia, what is in and out of scope when considering potential impacts to human health? How might this case provide learnings to other integrated EA processes locally and around the world? Reflecting back on this case study, since this thesis was conducted, there have been pivotal aspects such as the First Nations stand-alone HIA process that was carried out, the Community Advisory Group that was established during the EA, and in fact, learnings from this case are now (in 2019) being factored into policy decisions in light of federal and provincial EA revitalizations.

3.3 Research question reflections and theory implications

To reiterate my research questions: (1) in the case of the Ajax mine, in what ways did the EA process include health impacts, as per established HIA frameworks, such as prescribed by the International Finance Corporation (IFC); and (2) to what extent did the scoping phase of the EA for the Ajax mine use baseline health data and information? While these questions allude to an element of quantification, their purpose is to provide a deeper understanding as to how and why health related parameters were included in the integrated EA, or not. Yin states that how or why questions should dominate case study research with the goal of assisting in theory development. This idea strongly influenced the development of my questions and theory. My specific hypothesis is that baseline health is not included in the BC EA process as per international HIA practice. I use Ajax mine case to explore this hypothesis and applied an iterative approach, based on the IFC HIA Guidance.

According to Yin (2014) I should be aware of the full range of broad theories that might be relevant to my study (p. 39). I would say largely that IA forms grapple with and cut across illustrative types: decision-making (innate to the EA process), organizational (e.g. theories of bureaucracies) and societal theories (e.g. theories of urban development). A "common topic of case study research is the evaluation of publicly supported programs" (p. 39). Ultimately, the goal of this research and theory exploration is to explain how the treatment of health in this case specific EA was included. And, if gaps were observed, how might we make the process more effective or inclusive of health.

3.4 Designing the case –selection and definition

Many factors went into choosing the Ajax mine EA proposal. I will highlight three elements of them. First, there was an outcry from the community for an HIA to be conducted. This public request for a HIA was apparent in the media and local government meeting minutes. Aspects of an HIA were undertaken by a community group (Kamloops Physicians for a Healthy Environment [KPHE]) and First Nations band (Stk'emlupsemc te Secwepemc Nation [SSN]). However, a comprehensive HIA in the EA never formally occurred. Second, there was the issue of proximity between the proposed mine and the populated city of Kamloops. The Aberdeen neighbourhood closest to the mine site is projected to house one third of the city's population by 2036 (City of Kamloops, 2006). I mention this issue of location because it was raised by public health officials even prior to the pre-(EA) application phase for the mine. It also came up repeatedly in the interviews. Third, while some documents were not used in the analysis for this research, one in particular was instrumental for case selection. Once the Valued Components (VCs) were selected by stakeholders, through the scoping phase, the Interior Health Authority (IHA) established a clear line of what they were (and were not) going to review (IHA, 2013). They submitted a letter to the BCEAO outlining what the health department had the mandate, capacity or resources to evaluate. Many alternate cases were considered, e.g. Blackwater Gold Mine project. For this EA the Northern Health Authority was involved in a different capacity from the perspective of internal staff processes and external peer support (that is involvement from the BCCDC). Another site that was considered was e.g. South Island Aggregates a contaminated soil remediation facility that never went through a formal EA (due to being below threshold limits triggering an EA). Health concerns dominated the public discourse for neighbouring residents. However, as this case was on Vancouver Island, it would have posed a conflict of interest issues due to my professional practice. Given all of the above, I chose the Ajax mine case to pose my research questions.

3.5 Overarching focus of methods – (the what?)

To answer my research questions, I performed an intermediate level HIA for the scoping phase of the Ajax mine. This step of the assessment drives the preparation of the Application

Information Requirements (AIR) and provides the basis for identifying information to be collected and analyzed in an EA (BC EA Office, 2015). The scoping step addresses the following objectives: (1) determine the factors to be considered, alternatives to the project, and the potential effects of the project to be considered; (2) prioritize the issues to be addressed in the EA; (3) set appropriate boundaries for the EA study; and (4) determine the appropriate level of effort for the EA (Canadian Guidebook for HIA, 2004). Integral to the scoping process is a community needs assessment and baseline health report. The AIR culminates all of the aspects of the proposal that were scoped, assessed, reviewed by stakeholders, and vetted by the BCEAO, which then goes forward for Ministerial decision. The KGHM Ajax mine's AIR was the focus of study for the document review phase of this research. In particular, I examined the health-related VCs in this central document that were scoped for inclusion and assessed, and the socio-economic report that included reference to baseline health data profiling. Further to a document review, I interviewed representatives from government, academia, social service, community, and health professionals congruent with HIA practice.

3.6 Specific methods – data collection

I collected these two main information sources, similar to work done by Noble & Bronson (2005) evaluating the inclusion of health in the EAs of mines in Canada's North. Their study took a multi-method approach, by incorporating information from document reviews and key informant interviews (Noble & Bronson, 2005, pg. 397). For my research, I took a phased approach as the document review informed participant selection. The first phase was a document review of the KGHM's Ajax mine proposal, and the second was key informant interviews. Interviewees were involved in the EA, snowball selected from early interviews, or provided a health-related service in the community. Participants had an interest in, or were employed in the field of, health. I evaluated these two data sources using a discourse, narrative and content analysis. As described by Yin (2014), multiple data sources add to rigor as multiple resources can be triangulated. Supplementary document reviews and informal conversations provided further context, but these were not incorporated into the analysis. The two main data sources are described in the following sections.

3.6.1 Phase 1: Document selection

The documents analyzed were found on the publicly accessible BC Environmental Assessment Office Project Information Centre (e-PIC) website. This site publishes proponent submissions, stakeholder correspondence, public input, the AIR, proposed conditions made by the BCEAO (once the project is up for ministerial decision), and then, when decided, the Ministers' decision on the project's approval or denial. This document review informed the first research question. This research sought to explore a review of the scoping phase for the Ajax mine. The KGHM mine proposal dates back to 2011, when the proposal was in the pre-Application phase. The magnitude of material accessible and specific to this case on the e-PIC site is in of itself extensive. Therefore, I had to limit the scope of documents reviewed. The Application Information Requirements (AIR) were in the order of magnitude of >18,000 pages, laid out over 25 volumes. That does not include any supplementary material or background information that led to the AIRs development. Due to the number of documents, their size, and because the nature of the study was on health, in particular, the SDH, the chapters specific to health (and to a lesser degree social impacts) were examined.

I had to narrow down the scope of documents to analyze in this research, to that end: the socio-economic baseline report, Human Health and Ecological Risk Assessment (HHERA), health and social summary chapters, and VCs not reviewed by the regulating health agencies were included. The rationale for these specific documents emerged from scanning supplementary documents and from interview participant input. One document critical for inclusion was the baseline socio-economic report. This report was used almost exclusively in the health and social assessment of the baseline and was therefore explored with the greatest scrutiny. A review of the Table of Contents (of the AIR) also ensured that topics located in other chapters, for example water quality or quantity found in the Environmental Chapter, were included in the document analysis. In Table 2 below, I list all of EA retrieved documents (from e-PIC) that were analyzed using NVivo, the Computer-Assisted Qualitative Data Analysis Software (CAQDAS). As mentioned, not all of the health subsections in the AIR were included in this analysis. For the topics reviewed by the regulating health agencies, IHA and Health Canada, there was extensive reference to the Human Health and Ecological Risk Assessment (HHERA). This document contained biophysical aspects of health that were assessed and thus the HHERA was the main document for my review respective to these parameters, e.g. air quality and country foods.

Consequently, I incorporated the HHERA technical data report in my document analysis, rather than the full and complete Chapters of the AIR. I further studied the VCs not included in the HHERA, (and not reviewed by IHA or Health Canada), e.g. Healthy Living and Community Health and Well-being. To verify I had not missed any key information, I included the summary subsections for both the health and social effect Chapters.

I reviewed key supplementary documents that helped me to confidently select what documents to review. Four complementary documents provided insight on the areas of the AIR and helped me focus my research. The first document was the letter from IHA regarding Health Authority involvement and input on the VCs as already stated. The second was a Review of the KGHM's Environmental Impact Statement, that the Kamloops Physicians for Healthy Environment contracted Habitat Health Impact Consulting and Gate Post Risk Analysis firms to carry out. This same consultant team wrote a Holistic Health Assessment for the Stk'emlupsemc te Secwepemc Nation (SSN) that I used. Fourth, while not as relevant but still offering insight, the City of Kamloops retained the SLR environmental consulting firm to conduct a technical peer review of the proposed Ajax mine final report (in July 2017). These documents, performed by skilled practitioners in the field of EA, HIA, and RA, objectively appraised the AIR for accuracy, inclusion, and how it held up to industry best practice. Because I am a novice scholar and emerging HIA professional, I felt it prudent to defer to these experts, while objectively engaging with the material, formally and informally.

Table 2: List of EA documents analyzed with (interpreted) level of significance.

Document	Brief Description or Specific Chapters included in analysis	Level of Significance
Approved AIR (Jul 2015)	KGHM Ajax Mining Inc. Ajax Project Application Information Requirements / Environmental Impact Statement	Important
Ajax-EIS Health Chapters	10-4 Human Health 10-6 Healthy Living 10-7 Community Health & Well-being 10-8 Summary of Health Effects	Moderate
Ajax-EIS Social Chapters	8-8 Summary of Social Effects	Moderate
Appendices Data or Supplementary Information	10-4-A HHERA Technical Data Report	Important
	7-1-A Socio-economic baseline (SEB)	Critical
	Letter from IHA regarding HA involvement & input on Valued Components	Important

Ajax Mine Project – Schedule A (Aug 2017)	Certified Project Descriptions for an Environmental Assessment Certificate	Moderate
Ajax Mine Project Schedule B (Aug 2017)	Table of Conditions (ToC) for an Environmental Assessment Certificate	Moderate
Ajax-EIS Introduction & Other Chapters	1 Purpose of the Application 2 Project Overview 3 Detailed Project Description	Low
Ajax Joint CSR – AR Final Report (Aug 2017)	Joint Federal (CEAA) Comprehensive Study and Provincial Assessment Report	Low
Ajax Summary Assessment Report (Aug 2017 Draft)	Summary Assessment Report for Ajax Mine Project (Ajax) put out by the BCEAO	Low

3.6.2 Phase 2: semi-structured interviews

Based on the information I garnered from the document review, I proceeded with interview recruitment. I have included the interview recruitment script and introductory email in Appendix A – Interview Guide. In total, I interviewed sixteen participants. The response rate for participation was 64%. I approached twenty-five potential interviewees for this research study, and sixteen agreed to be interviewed. For confidentiality and as per my ethics approval, I cannot disclose any identifiable information about participants. I can say they were selected from the health sector, local or provincial government, academia, and members of community service groups, all from Kamloops.

Participants may or may not have been involved formally in the EA. The nature of their roles ranged from involvement in a technical working group to no formal involvement at all (not even a submission via the public input option of the EA). To gather potential interviewees, I reviewed the documents outlined above, in Phase 1. To identify key figures in the case study, I first used purposive sampling, then snowball sampling. I also used the IFC HIA Guideline (2009) – Appendix F: recommended baseline data collection activities and tasks (p. 62). It outlined who to contact for fact-gathering meetings and how to perform ground truthing. Due to resource limitations in the field, and ethical considerations, there were deviations from the IFC's recommended approach. For instance, I did not speak to the proponent, their hired consultants, or project personnel. There were governmental or institutional personnel missing from my key informant interviews. With respect to community members, I did not recruit representatives from

any woman's group explicitly, or First Nations to discuss their parallel Holistic Health Impact Assessment.

All interviews were semi-structured and followed an informal flow. Thus, we were able to go off script to explore respondents' specific areas of expertise, interest, focus, or passion. Interviews took place either face-to-face or by telephone, between September and November 2016. Similar to work by Noble & Bronson (2005), participants commented on the state of practice of human health integration in the EA, focusing particular attention on the nature of health assessment (Noble & Bronson, 2005). This line of questioning in the interview guide followed HIA guidance and thesis committee recommendations. As is illustrated in the work done by Noble & Bronson (2005, p. 397), the World Health Organization's (1948) definition of health was used as an underlying reference. This contextual definition is built into standard HIA practice. This definition was used to frame questions about what participants believed was the definition of health. Furthermore, was their definition of health included in the Ajax mine's EA? If not, what was missing?

To establish a better understanding of what may have been included in the baseline, questions probed the current health priorities of people in Kamloops. They focused on specific demographic groups (i.e. women, men, children, seniors, families), trying to determine if any group was more vulnerable, and, if so, how? Participants had an opportunity to speak to existing resource extraction activities in the area, such as New Afton (~10km away) or Highland Valley Copper (75km away in Logan Lake) mines, as well as the Ajax proposal. Questions were asked of participants about any noted or perceived potential future risks, impacts, and possible opportunities with these mine sites. As the interview guide developed and feedback was gathered via piloting, a question was asked about institutional barriers to the EA. Did the interviewee believe there are any obstacles to including health in the EA? To see the entire interview guide, please refer to Appendix A – Interview Guide. Each interview lasted approximately one hour. These interviews provided an in-depth discussion as to the key baseline health issues and narrative regarding health inclusion into the Ajax mine proposal.

Table 3: Participants, their pseudonyms, and their affiliated sector

Interviewee Number	Participant pseudonym	Sector
1	Jim	Health professional
2	Jeff	Provincial government
3	Suzy	Academic
4	Sam	Academic
5	Lucy	Local government
6	Ted	Community sector
7	Tom	Community sector
8	Pat	Health professional
9	Sue	Health professional
10	Fred	Community sector
11	Alex	Health professional
12	Cathy	Local government
13	Jason	Health professional
14	Hugh	Health professional
15	Travis	Health professional
16	Gail	Community sector

3.7 Ethics and pilot interview guide

I want to highlight the preparation that went into the field work and interview portion of this research. I ensured that all ethical protocols were addressed. I received approval from the University of Victoria Human Ethics Board (HEB). The University of Victoria was my Board of Record, although they conferred with the Interior Health Authority (IHA) following the harmonized ethics program in practice in the province of BC. If any research has the possibility of engaging with RHA staff this is the procedure. I also engaged with staff from the First Nations Health Authority (FNHA). When the research took place, they had yet to be integrated into the harmonized system. I familiarized myself with their Ownership Control and Possession (OCAP) principles, as well as discussing my study with their research ethics coordinators. My ethics application was approved through the University of Victoria in May 2016 under protocol number BC15-468.

Prior to the field work, I also piloted my interview guide. There were several iterations of this guide. The questions were reviewed by my committee (supervisor and internal committee member). I also sought input from my research assistant, Alison Stockwell, an experienced researcher and practitioner in the field of HIA. For my first two formal interviews, I consulted

with my RA and we decided to adjust a few questions for clarity, and added one on institutional barriers, as it seemed to be an emerging and poignant topic for inclusion. Further insight came from a health professional who was versed in the case study. However, due to extraneous factors (that must remain vague for ethical reasons), they did not formally participate in the study, however their assistance proved invaluable for this step.

3.8 Study site and history – case study of the Ajax mine

Figure 8 - Geographical location of the Ajax mine proposal in Kamloops, British Columbia (CEAA, 2015).

My research focuses on the City of Kamloops. This location has past and present ties to the mining industry. Currently, there are two active mines in the region, with varied approval histories and operating at different lifespan stages. Canada's largest copper mine, the Highland Valley mine, operates 45 minutes from Kamloops, just west of Logan Lake. It employs 900 people from the nearby communities of Kamloops, Logan Lake, Ashcroft, and Merritt and produced 161,000 tonnes in 2006 – four per cent of global copper production (City of Kamloops,

2015). The New Afton mine is an underground blockcaving mine that commenced production in July 2012, ten kilometres outside of Kamloops. Operator New Gold predicts that it will produce an annual average of 75 million pounds of copper and 80,000 ounces of gold, over a 12-year mine life (New Gold, 2015).

KGHM International Limited, a Polish owned and operated company, put forward the Ajax mine proposal. If approved, this open-pit mine would have been located on the historic Ajax-Afton mine site, which, between 1989 and 1997, saw a range of exploration and extraction—from small-scale mine operations to the development of an open-pit operation under Teck Resources Limited and the Afton Operating Corporation. KGMH's proposal called for a mine with a 20-year-life span, "employing state of-the-art mining and environmental protection monitoring technologies" (Ministry of Environment, 2015). Annual production figures called for 109 million pounds of copper and 99,000 ounces of gold. Once constructed, the proponents claimed it would have employed 500 individuals full-time, in positions ranging from technical, to mining services, health and safety, and administration. To put the mine size into perspective once constructed:

> "[It] would have [had] a footprint of approximately 1,700 hectares and would [have] include[d] an open pit, ore processing plant, tailings storage facility, mine rock storage facilities, and water and waste management systems. It would [have] also include[d] upgrades to an existing water intake on Kamloops Lake, a new 16 kilometre water line to transport water to the mine site, and a new 5.3 kilometre natural gas pipeline connecting with the Fortis pipeline near the community of Knutsford. A new 9 kilometre, 230 kilovolt transmission line would tie in with an existing BC Hydro power line near Knutsford to supply electricity to the Ajax Mine Project" (CEAA, 2017, p. iii).

The dimensions would have included a width of more than 2km and depth of 500m in total. This translates to the bottom of pit being approximately at the same elevation as the Kamloops Lake shoreline.

Ajax would have operated within the Thompson-Nicola Regional District (TNRD), on traditional Secwépemc territory partially within the city limits of Kamloops. Approximately two kilometres would have separated the mine from the densely populated neighbourhood of Aberdeen. The Aberdeen Neighbourhood Plan, released in 2006, placed the neighbourhoods population at "8,475 persons or approximately 10% of the City's population" (City of Kamloops, 2006). "Within six kilometres downwind of the proposed Ajax mine site are eight elementary

schools, four high schools, four seniors' care homes, one hospital, and one university. And Pacific Way Elementary School, home to roughly 300 students, is less than 2.2 kilometres away from the proposed mine site" (McSheffrey, 2016, p. 107). In 2011, the population of Kamloops (census agglomeration) was 98,754 (Statistics Canada, 2011), making it the fifth largest municipality in the province of British Columbia.

The closest proposed project infrastructure to town would have been the East Mine Rock Storage Facility, approximately 850 metres (m) from the City of Kamloops' Urban Growth Boundary, approximately 1.4 kilometres (km) from the Knutsford community, and approximately 1.7km from the neighbourhood of Aberdeen. Approximately 87% of the main project infrastructure footprint would have been located on private land owned by KGHM, with approximately 13% utilization of Crown land (Figure 2.2-1) (KGHM, 2015.). See Figure 10 for project details, design specifications and spatial extent. It is noteworthy to mention that the project's infrastructure—specific to the mine footprint—changed over the course of the EA. It is my understanding that this occurred as a result of public input and stakeholder concerns. However, this alteration, and the reason behind it was not explored.

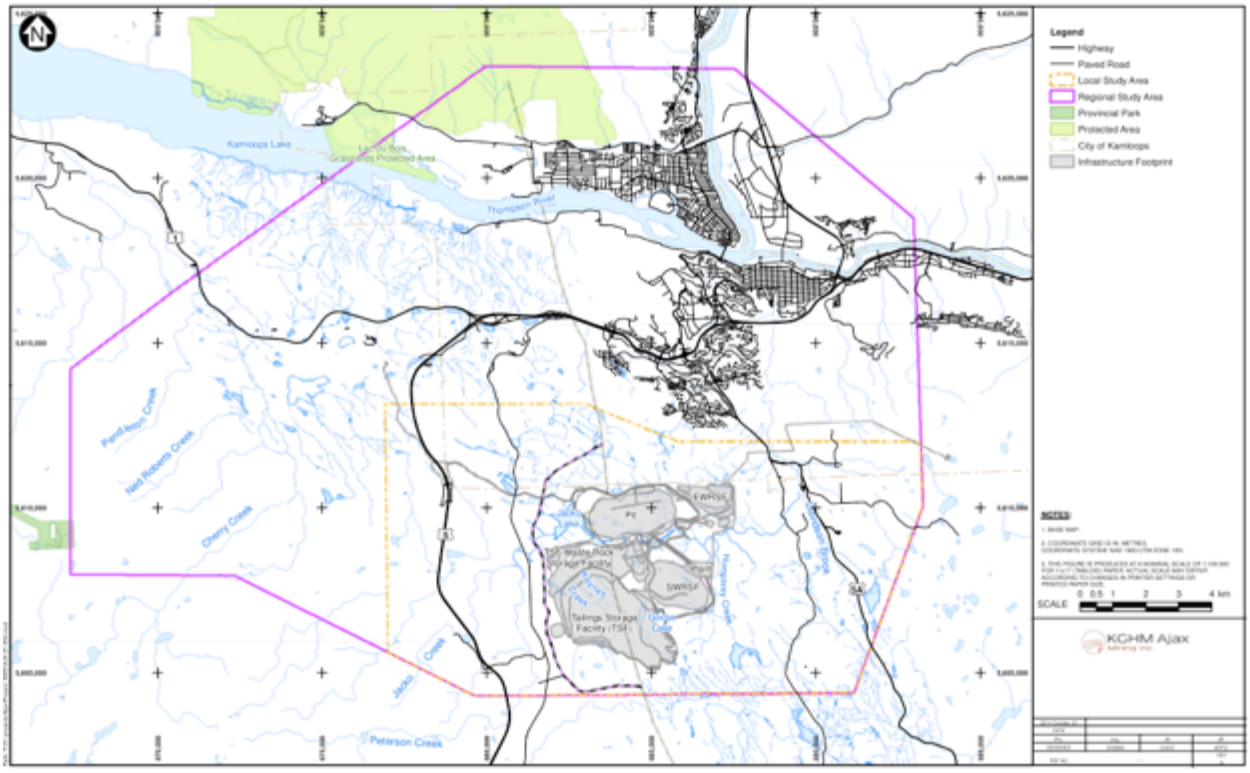

Figure 9: Ajax location and general arrangement (KGHM, 2015)

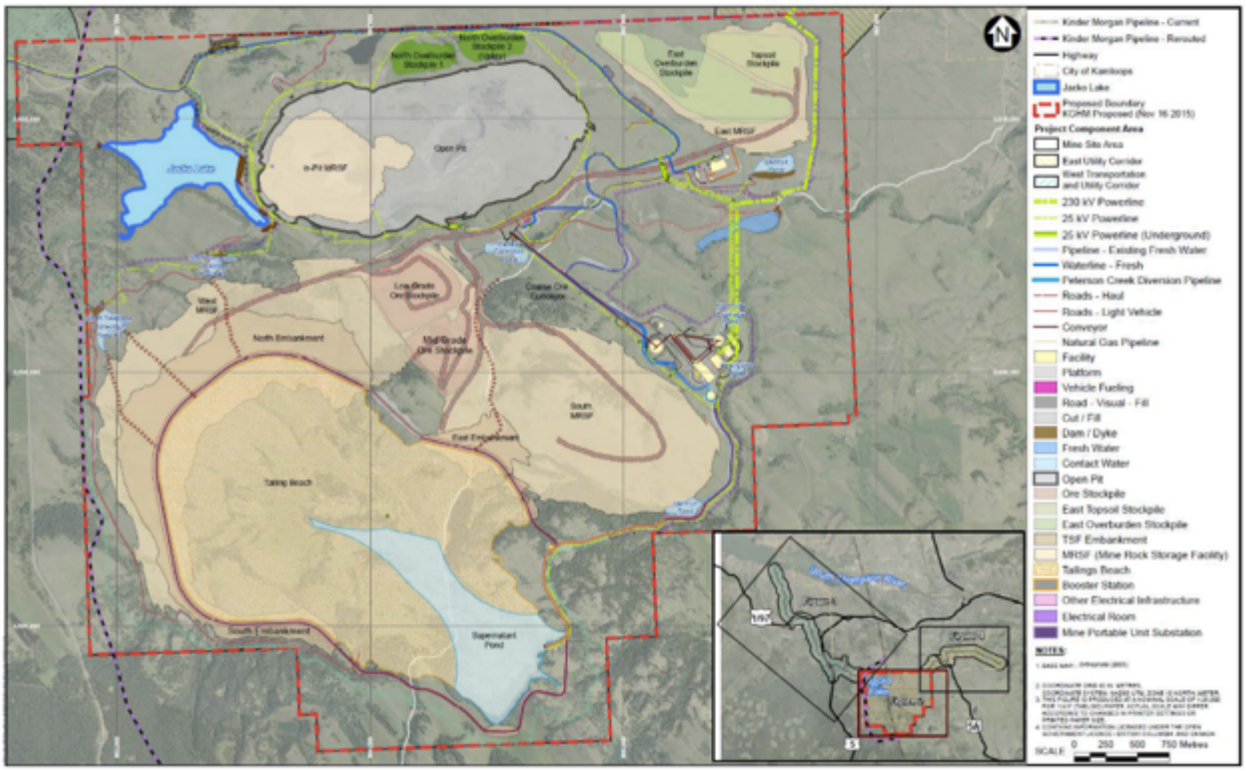

Figure 10: Proposed Ajax mine site and layout of facility (KGHM, 2015)

3.9 Analysis methods using NVivo –Description of the analysis (i.e. explanation building)

I used Computer Assisted Qualitative Data Analysis Software (CAQDAS) to achieve uniformity in my analyses. The particular CAQDAS technology I employed was developed by QSR International commonly known as NVivo, a widely used and referenced tool in qualitative analysis literature. The technique itself is a form of pattern matching. The goal is to analyze case study data by building an explanation about the case (Yin, 2014). According to Yin (2014) CAQDAS can be helpful (1) to compile the data, (2) disassemble the data, and (3) to reassemble it (p. 171). This tool only guides a user's approach. It does not do the analysis. It assists the user in finding key terms and words, in addition to providing consistency and continuity of data review. Without the user's explicit guidance, and contrary to quantitative analysis, the computer alone cannot arrive at any usable output (p. 171). I had to make decisions whether to code single words, sentences, or sentiments. The level of analysis I did varied between the document (or discourse) analysis and the interview (or narrative) analysis.

3.10 Themes – Environmental Health Areas (EHAs)

I coded themes by Environmental Health Area (EHA) based on the International Finance Corporation's Introduction to Health Impact Assessment (2009) guidance document. The EHA framework "defines the types of health impacts and provides a structure for organizing and analyzing potential project impacts on the community" (p. 20). This resource document helped me pull out health related topics from EA documents and interviews. The EHAs were established "based on experience in analyzing and mitigating the key burden of health impacts" by the industrial sector. The EHAs are listed as:

- Vector-related diseases
- Respiratory and housing issues
- Veterinary medicine and zoonotic issues
- Sexually transmitted infections
- Soil- and water- sanitation related diseases
- Food- and nutrition- related issues
- Accidents and injuries
- Exposure to potentially hazardous materials
- Social determinants of health
- Cultural health practices
- Health services infrastructure and capacity
- Noncommunicable diseases (NCDs)

In Appendix B – EHA Definitions I include the EHA definitions as per the IFC guidance. I then teased out how these EHA themes match up to the Valued Components included in the Ajax mine EA. These EHAs assisted in assessing what was present in the documents, what was included, whether touched on lightly or robustly in the EA review. For Phase 1 of this case study, the discourse analysis portion, I dissected the definitions of the EHAs to make every effort to ensure EHAs related to the VCs were brought to the foreground. There were, however, significant limitations to key word searches, because of the immense volume of documents in the AIR and related background material.

I manually coded themes for Phase 2, the interviews. I took elements of a grounded theory approach. I read, re-read, and memoed the interview transcriptions. I allowed the themes to

emerge inductively, grouped them in subcategories and then stratified the codified themes into their respective emergent categories. However, I did so with the EHAs in mind. Then, I put the themes into a 'logical model,' which aligned them with the definitions in the IFC HIA Guidance on EHAs. This helped me to compare and contrast what was included in the EA documents, and what may have been considered, if the interview data had framed the process. To add to the certainty in the analysis, I also queried the themes to verify that my manual coding had not missed anything and was properly triangulated with the other sources of evidence in my case study research and data collection.

3.11 Summary

My research, using case study methodology and design, followed direction by Yin (2014). An integral element to this research approach is to bind the case, in particular what was included in the EA for the Ajax mine proposal in Kamloops, BC. The parameters for inclusion were the scoping phase for the EA, a process that began in 2011 until the projects' final EA permit rejection in 2017. The scoping phase is the step that determines what VCs will be reviewed throughout the entirety of the EA, who the key stakeholders or informants are to the process, and the baseline characteristics or data to be included to structure future monitoring requirements. Digging into the specificity of health consideration in the EA, I overlaid a lens of HIA on this EA. To do so, I began by reviewing documents in the EA, the rationale for including a document for analysis was that it spoke to the mines' potential impact on human health. Next, I interviewed representatives that may have or have not been actively involved in the EA. The criteria for recruiting participants was taken directly from IFC HIA Guidance. All interviewees lived in the regional study area as defined in the EA. Interview respondents were government employees (provincial or local), health professionals, academics, or community representatives. Interviews occurred in the Fall 2016 prior to the EA permit application being denied. In the next two chapters I will present the (NVivo) analysis reviewing the EA document submissions and the HIA based interviews.

Chapter 4 – Results and Interpretation: EA Documentation

4.1 Introduction

I begin this Chapter by briefly mentioning the EHA, 1) what was included, and 2) what was lacking or absent in the EA documents. I present the document section in the following ways. I refer to a letter written by the Interior Health Authority (IHA) in 2013, outlining the Valued Components (VC) IHA intended to review. That is the VCs that IHA reviewed and provided comment on, namely: water quality, air quality, country foods, noise and vibration. These aspects of the EA were reviewed using a Human Health and Ecological Risk Assessment (HHERA). Thus, it is the HHERA topics that I describe in the first main subsection. The VCs that were included in the health chapter but were not reviewed by IHA are then discussed. These other health related VCs, specific to baseline, were recorded in the socio-economic status (SES) baseline report.

A vibrant thread in the tale of the Ajax mine is the battle of the experts that ensued in this EA. There were a number of third-party reviewers contracted by stakeholders, such as varied members on the Community Liaison working group, First Nations (SSN), and City of Kamloops. Due to these parallel processes, that is the external reviewers hired to assess the proponent's submissions, a polarizing debate and mistrust in the EA process emerged. This is, in itself, a strong theme that emerged from the EA documents and surfaced in the interviews numerous times. While these third-party reports were not included in the analysis, I reference them in this section, as they are an essential part of the written narrative on health. These sources of information will come up extensively in the following two chapters.

4.2 Summary - comparison between EA documentation and HIA scoped interviews

The following Table 4 provides a brief overview of EHA topics that were included in the EA and/or HIA approached interviews. It indicates whether these EHAs were discussed and if there were any discrepancies between the two discourses being reviewed and analyzed. For more information on the definition of the EHAs, an excerpt from the IFC HIA Guideline outlining them can be viewed in Appendix B – EHA Definitions.

Table 4: This Table summarizes the comparison from EA documents and HIA approached interviews. This comparison is based on the EHAs in the IFC HIA Guideline. See Appendix B – EHA Definitions.

Environmental Health Areas (EHAs)	**EA documents**	**HIA interviews**	**Notes**
Vector-Related diseases	-	-	What about, in the context of BC, e.g. Lyme disease and West Nile Virus?
Respiratory and Housing issues	✓	✓	Housing inflation, property damage, or loss of market value due to mine activities was emphasized.
Veterinary Medicine and Zoonotic issues	-	-	Not present in the health chapter (and somewhat out of scope)
Sexually transmitted infections	-	✓	Came up in one interview specific to baseline (i.e. absence of STI clinic in town)
Soil- and Water-borne diseases	✓	✓	Focus in EA documents and interviews was on chemical contamination of water.
Food- and Nutrition-related issues	✓	✓	While country foods & agricultural impacts occurred in both the EA documents and interviews. The EA documents did not address 'nutrition'.
Accidents and Injuries	✓	✓	Traffic Impact Assessment (TIA) discussion included in EA documents.
Exposure to potentially hazardous materials	✓	✓	Road dust, air pollution, and release events were topics of significant EA review.
Psychosocial	-	✓	This category includes SDH.
Cultural health practices	-	✓	This definition alone was quite different in EHA Guidance and EA documents. The Heritage Chapter focused on archaeological impacts and loss of traditional hunting & gathering sites.
Health services infrastructure and capacity	✓	✓	While this is discussed in the EA documents, the solution was to have one doctor hired and retained by KGHM to serve the mine's workers (and families).
Noncommunicable Diseases (NCDs)	-	✓	These topics were found in the Socio-Economic Report of the EA but were lacking in inclusion in subsequent EA documents (e.g. AIR).

4.3 Phase 1 – EA document review: what prevailing EHAs themes were included in the EA

The Ajax mine EA proposal was an extensive volume of documents, in number and in length. As such, only the health-related VCs and applicable baseline data used in the EA were included in my inquiry. I focused my analysis on the documents that either (1) spoke to health or social components in the AIR or proposed conditions on permit, and any reference to (2) baseline health data. There were, however, additional sources of information that were factored into the broader context of the study, documents that were referenced in the participant interviews, but not analyzed in NVivo. Table 5 below outlines the results and most common themes of the EA document analysis, including details of source. The most frequently sited themes were drinking water, followed by air quality, exposure to hazardous materials (that often was tied into air quality as the primary route of exposure), housing (impacted by noise, vibration or changing property values), cultural effects, and food. These themes are quite common in the literature in HHERA approaches employed and EA practice in BC.

As I will speak to more in the limitations section, there are cautions in interpreting the numbers presented in Table 5 as hard fact. There are inaccuracies in running word searches due to accuracy in language, or the use of synonyms, leading to a concern. To address this issue multiple queries, with variability of search terms, were run for each EHA. This was to verify that the dominant themes in the documents are the ones presented. While the more prevalent themes did not vary there were substantial fluctuations in ranking. ‘Water AND quality’, for example, pulled out any reference to ‘quality’ overall, including air quality. When searching for ‘air AND quality’ any reference to the Application Information Requirements or AIR was populated in the search. Another case in point, mentioned in the footnote in Table 5, is for the word ‘cultural’. If additional qualifiers were used, such as ‘Aboriginal OR heritage’ this altered the number of times this theme was referenced and sourced in the documents. Thus, I suggest viewing this list as the overall dominant themes and less as a hierarchy of frequency. As there was clear variability in the number of times the concepts appeared in the targeted documents analyzed.

Table 5: This table shows the top ten (EHA stemmed) themes found in the reviewed documents. This includes number of times referenced and number of documents they were found. The documents analyzed were: Approved AIR, Table of Conditions, Summary Assessments by BCEAO and CEAA, Health Chapter, Social Summary Chapter, Purpose, Project Overview and Description Chapters, HHERA, Socio-economic status baseline report.

	EHA	Queried Terms	Referenced	Source (/16)
1.	Soil and water sanitation related diseases	Drinking AND water	2873	8
2.	Exposure to potentially hazardous materials	'Air quality'	921	12
3.	Exposure to potentially hazardous materials	Exposure AND hazardous	756	7
4.	Respiratory and housing issues	Housing	499	10
5.	Cultural health practices	Cultural[a]	417	11
6.	Food and nutrition related issues	Food AND nutrition[b]	139	3
7.	Accidents and injuries	Accidents AND injuries	126	5
8.	Healthcare services infrastructure and capacity	Health services infrastructure	101	8
9.	Social determinants of health	Mental health	39	3
10.	Social determinants of health	Social determinants of health	14	4

*Refer to Table 2 for descriptor of what documents were included in this query search and their acronyms.
[a]If "cultural AND heritage AND aboriginal" terms included with this query the results were 1800 (referenced) and 12 (sourced – additional document sourced was Chapter 1).
[b]Querying "nutrition" on its own it was only referenced 11 times in 3 sources (i.e. HHERA, SEB, Chapter 10-6).

4.3.1 The HHERA and Evaluation of Biophysical VCs of health in the EA

The HHERA, and any form of risk assessment, is quantitative in its approach. It is based on sampling, aggregate data, and if predictive by design (as is the case in an EA application) it is largely desktop-based using computer modelling to support its findings. This key document intended to capture the vast majority of health impacts up for review and was referenced extensively in the EA, AIR, and supplementary information. The HHERA did not factor in SDH. Instead it evaluated the complexities of dose-response related criteria with clear routes of exposure through environmental media, such as water, soil, air, and uptake or deposition on country foods. The objective of the HHERA and consideration of baseline data was clearly articulated in the executive summary:

> "A Human Health and Ecological Risk Assessment (HHERA) was completed to quantify the potential change in risks to human and ecological health that could result from the Construction, Operation, and Decommissioning, Reclamation and Closure of the Project. The potential human and ecological health risks were assessed for existing conditions, referred to as the Baseline Case, the contributions from the project by itself (referred to as the Project-alone Case), and future conditions which included contributions from both the Baseline and the Project (referred to as Future Case). The risk assessment approach followed published regulatory guidance" (HHERA, 2015, p. i).

The HHERA dominated the health and technical review in the EA. Apparent issues such as staff capacity, workload, background and expertise drove the prioritization of this integral and lengthy document. There was a working group consisting of professionals from Health Canada, the Interior Health Authority, and Ministry of Environment to name but a few. The primary VC in the HHERA under most scrutiny was air pollution, and in particular dust. Air contaminants that could potentially be emitted from the mine, and specifically from the construction and operation phase, were recorded to have strong potential for uptake into the ecological and human environment.

As stated in the AIR, specifically Section 10.0 in the Assessment of Potential Health Effects, the HHERA "included the potential effects of the Project with regards to chemicals of concern, relevant human ecological receptors, and exposure pathways" (AIR, p.152). The HHERA was provided as an appendix to the Application/EIS and the findings of the HHERA informed the assessment of each of the Health VCs. The HHERA was completed based on guidance documents from Health Canada. This approach was "designed to protect the health of people and ecological receptors, which rely on the viability of the local environment and ecological resources within the study area of the Project" (Stantec, 2015, p. 1.1). Evidently, the HHERA and the health chapter that relied heavily on this resource was transparent with its goals: to assess for the biophysical determinants of health. Figure 11 illustrates the linkage between air quality, which includes dust as the principle pollutant, and the resultant outfall that would have impacted the surrounding environment, the routes of exposure being direct or through bioaccumulation in the soil, sediment, water, and uptake in the food chain.

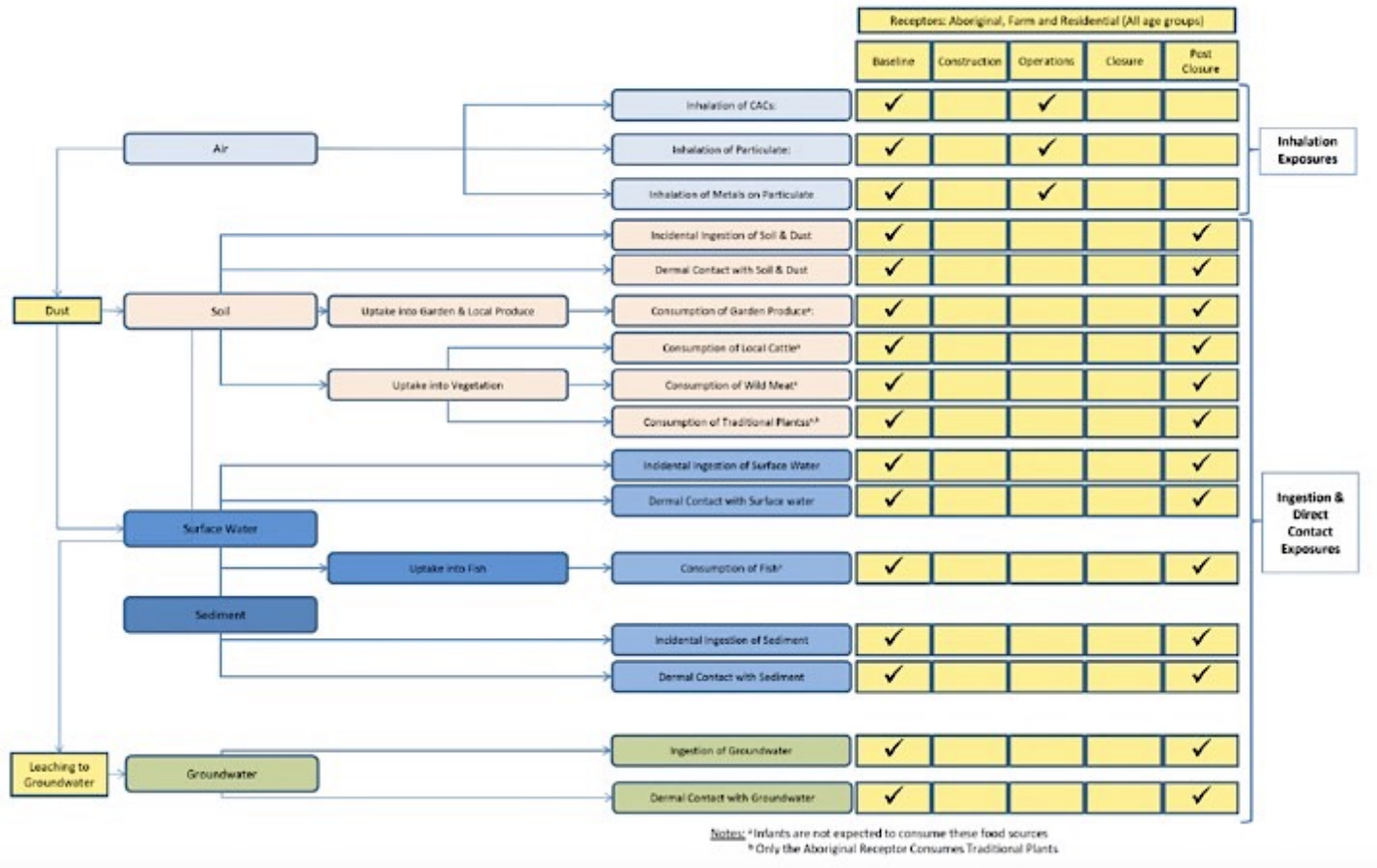

Figure 11: Human Health Conceptual Site Model (Stantec, 2015, p. 4.71)

4.3.1.1 Air Quality

Air quality, as highlighted in (Table 5), was the consistent thread from the keyword search found in twelve of the sixteen documents analyzed. It was also arguably the top referenced concern in both the EA and HIA interviews due to the fact that Kamloops has innate conditions that place air quality at the foreground. Regarding baseline conditions specific to air quality, one of the predominant parameters of investigation relates to occasional provincial Air Quality Objective exceedances beyond the daily threshold of 25µg/m3 and approaching annual limits of 8 µg/m3 for $PM_{2.5}$. Fine particulate matter, otherwise known as $PM_{2.5}$, or respirable dust with a diameter of 2.5 microns or less (about 30 times smaller than the human hair), can penetrate deep into the lungs exacerbating respiratory and cardio-vascular health especially in individuals with underlying health conditions, the young, elderly, or vulnerable. “Particulate air

pollution is like lead pollution, there is no evidence of a safe threshold even at levels far below current standards, including in the rural areas we investigated," (Shi et al., 2015). There are air pollutants in Kamloops targeted for action in the Airshed Management Plan in place for the Valley and brought forward for review in the EA, however, respirable dust was the parameter of most heated debate.

The City of Kamloops is projected to reach 120,000 residents by 2036 (City of Kamloops, 2012). As the population increases, so will the level of activity from mobile (e.g. vehicles) and area sources (e.g. home heating) that could negatively affect local air quality (City of Kamloops, 2012). While the following quote is now somewhat outdated and provincial in scope, it still speaks to the role air quality has on the health care system and the health of individuals. Cited in the Kamloops Air Management Plan: the "Provincial Health Officer's 2003 annual report on air quality and public health in BC found that poor air quality (air pollution) can lead to an estimated $85 million increase in health care costs and as many as 250 premature deaths every year" (City of Kamloops, 2012, p. 8). It is for this reason that $PM_{2.5}$ has been labelled the worst public health problem from air pollution in BC.

Another point related to air quality being the dominant theme is due to the contentious fact that the proponent claimed they would be able to contain fugitive dust emissions to the site, in particular 90%+ dust control. This was a highly debatable subject that many experts questioned of the proponent and their consultants. This was a driving factor in the HHERA as many of the routes of exposure hinged on air quality modelling. In fact, On May 4, 2016, the Environmental Assessment Office suspended the 180-day review timeline of the environmental assessment for the proposed Ajax Mine Project. The purpose of the suspension was to fulfill Working Group requirements on this air quality model, along with concerns of meaningful consultation with First Nations and the public. Confidence in the model output was critical to the assessment of potential effects as the results of the model were used in the assessment of health effects due to inhalation and ingestion through the HHERA (MOE, 2017).

As mentioned throughout the EA, a strong element of the 'battle of the experts' surfaced, from consultants commissioned by the KGHM, to academics or consultants contracted by community groups. This was the case for the air quality piece of the HHERA. Stantec (2015) was the consultant firm behind the HHERA paid for by the proponent. Kamloops citizens, involved in clean air advocacy, contracted Dr. Douw Steyn (Professor Emeritus of Atmospheric

Science, UBC, Department of Earth, Ocean and Atmospheric Sciences) to review the Air Quality Section of the KGHM Ajax mining application and prepare a report in 2016. Dr. Steyn indicated that these core objectives of conservatism and defensibility may not be supported by the model. His review: "...revealed a number of instances of what [he] considered to be technical and study design weaknesses. These weaknesses are in the context of a regulatory study, rather than a study in the research realm. Their resultant effect is to undermine the robustness of the overall conclusions" (Steyn 2016 p. 8). Dr. Steyn stated that the City is currently over the provincial yearly average benchmark for $PM_{2.5}$ air pollution and that the: "...City of Kamloops has no choice but to pursue an aggressive program of emissions reduction to improve air quality for its citizens. This means reducing emissions from all sectors - domestic heating, road dust, diesel emissions, and of course all industrial emissions. In such a situation it makes no sense at all to allow a new industrial source of the pollutant in question ($PM_{2.5}$) no matter how small its incremental effect." (Steyn, 2016, p. 9). This report rattled the confidence of public participants in the EA respective to the air quality model. Even though the timeline for the EA's review was suspended to address this concern, the public were not involved in these closed-door (Working Group) discussions further adding to concerns about a lack of transparency and inclusivity in the EA process.

4.3.1.2 Exposure to potentially hazardous materials

The topic of exposure to potentially hazardous material was linked to a myriad of factors in the EA and in many respects was an overarching theme in the HHERA. This comes as no surprise, as traditional methods of risk assessment have relied on standard setting of hazardous chemicals or practices (Briggs, 2008). It truly was tied to the three biophysical environmental impacts that dominated the document review respective of health, that is air, water, and food. In the HHERA, the word 'hazardous' was primarily referenced when discussing the chemicals of potential concerns (COPCs) or "chemicals that [would have been] released by the Project that may be 'hazardous' to ecological or human health" (Stantec, 2015, p. viii). Whereas, in the AIR, reference to the term 'hazardous' was broader. The AIR spoke to Workplace 'Hazardous' Materials Information Systems standards; included a description of the proposed site ancillary infrastructure, such as the warehouse that would have stored any 'hazardous' materials; 'hazardous' products that would have been transported along access corridors; and an operational

management and monitoring plan that contained a ‘Hazardous’ Waste Management Plan (including liquid effluent disposal). Overall, in the documents analyzed, querying the qualifier ‘exposure and hazardous’ related extensively to air quality as the primary route of exposure and most pressing impact due to its link to water quality, the hydrological cycle and bioaccumulation in country foods. Thus, even though I have teased out ‘exposure and hazardous’ in Table 5 separately, it was inherently interconnected to each of the biophysical parameters scrutinized in the HHERA for public health risk (and woven into occupational risk, within the mine site).

4.3.1.3 Country foods

While the assessment of potential impacts on country foods in the HHERA was ancillary to air quality, it was a noteworthy area of focus, especially related to baseline sampling and data collection. In defining country foods generally, they are those that may be produced in an agricultural (non-commercial) or backyard setting or harvested through hunting, gathering or fishing activities (Ajax Mine Project Joint Federal Comprehensive Study / Provincial Assessment Report, 2017). Baseline country food sampling in the HHERA was a significant focus of this analysis. It was conducted for various media including soil, vegetation, sediment, fish, small mammals and cattle. Some baseline concentrations, such as in terrestrial invertebrates, benthic invertebrates and wild meat (deer, wild hare and grouse), were based on concentrations in sampled media, using uptake factors and predictive modelling (Stantec, 2015). Baseline estimates of chemical concentrations in representative country foods were derived either by collecting and analyzing samples, or by using computer modeling to estimate chemical uptake from soil and plants (Habitat, 2016).

While upon initial review the sampling appeared to be quite comprehensive, there were critiques presented by Health Canada and others on the risk assessment related to country food ingestion. The Ajax Mine Project Joint Federal Comprehensive Study / Provincial Assessment Report (2017) informed Ministers in their decision to approve or deny the mine. In this document, Health Canada (HC) identified a number of concerns that included (1) “bioaccumulation could result in the underestimation of metals concentrations in fish consumed as country foods” (p. 175). This was also the case for (2) an underestimation on the consumption of non-migratory species. SSN and HC stated that (3) ingestion of Chemicals of Potential Concern (COPC) could be underestimated if KGHM Ajax Mining Incorporation (KAM)

underestimated country food consumption rates. The City of Kamloops, IHA, and HC voiced concern that KAM had (4) not provided a baseline consumption rate for country foods that considered consumption patterns, food preparation methods, and seasonal trends. HC suggested (5) sampling of fish of an appropriate size and species typically consumed, and local backyard produce for metals in accordance with accepted standards and guidance. Finally, HC further suggested updates to the HHERA if (6) "levels [of chemicals in fish and backyard produce] are higher than predicted and consideration of additional mitigation depending on the results of the updated HHERA" *(*Ajax Mine Project Joint Federal Comprehensive Study / Provincial Assessment Report*,* 2017). The takeaway is that even when the application was going forward for Ministerial decision there were concerns being presented by health professionals, First Nations, and other involved stakeholders about potential confounding or limiting factors in the HHERA. For reference, I have included an excerpt from the HHERA on the COPCs in Figure 12 for fish tissue that was tested for baseline and modelled for the future or predicted case.

COPC	Fish Exposure Point Concentrations (EPC) (mg/kg wet weight)	
	Baseline Case	Future Case
Aluminum	1.32E+01	6.98E+01
Antimony	2.00E-03	2.00E-03
Arsenic	5.68E-02	6.81E-02
Chromium	3.56E-02	1.71E-01
Cobalt	4.86E-02	1.03E-01
Copper	1.72E+00	3.01E+00
Lead	1.78E-01	2.53E-01
Manganese	1.54E+00	2.02E+00
Mercury (assumed to be 100% Methylmercury)	9.18E-02	9.70E-02
Molybdenum	1.57E-02	2.91E-02
Nickel	1.03E-01	1.67E-01
Selenium	1.13E+00	1.99E+00
Thallium	3.98E-03	3.98E-03
Uranium	7.92E-03	9.85E-03

Figure 12: COPC Concentrations in (Whole Body) Fish Tissue. For the baseline case, rainbow and brook trout were collected from surface water within the Peterson Creek Watershed (e.g., Peterson Creek, Jacko Lake, Edith Lake) during two sampling events in 2014 (Stantec, 2015, p. 3.56).

Beyond exposure assessment regarding food intake, nutrition was a less discussed item in the application. In reviewing the AIR, reference to nutrition was a lacking element. There was reference to Healthy Families BC, food security groups in Kamloops, and the City… as seen in the excerpt below: "Food security is an issue that has been addressed in Kamloops municipal planning documents. The IHA, the City of Kamloops, and the Kamloops Food Policy Council authored the Community Food Action Initiative in 2006 with the goal of increasing the capacity of municipal stakeholders to support food security practices and policy around the municipality. One goal of the initiative is to encourage policies and practices that promote nutrition and healthy eating. The City of Kamloops is currently also in the process of developing a food and urban agriculture plan" (AIR, 2015, p. 6-15). While food security planning was referenced in the AIR, it seems to be a gap that there was no consideration as to "the availability of healthy foods [or trust in traditional foods which] is an important determinant of health and food security is a critical issue linked to resource development" (Aalhus, 2018, p. 18).

Due to public interest and apprehension community groups, such as the Coalition of Concerned Citizens and Kamloops Physician's for a Healthy Environment, contracted an independent (from the proponent) consultant firm to evaluate the overall thoroughness of the Environmental Impact Statement, HHERA and Health Chapters. Habitat Health Impact Assessment Consulting and GatePost Risk Analysis teamed up for this review (2016). In respect to this review and country foods they stated that the KAM:

> "Application lacks consideration of the holistic health effects resulting from real and perceived changes to country foods. Country foods provide one of the most direct linkages between the ecological environment and health, however, KAM looks at only the contaminant aspect of consuming meat, fish and berries from the local study area (LSA). A detailed assessment of First Nations health and wellbeing associated with the dietary, cultural, and spiritual factors that are tied together with country foods and traditional land practices is needed. This assessment must go beyond evaluating the contaminants in the foods - the assessments on plants, fish, wildlife, etc… Aspects of the perception of risks due to contamination or loss of ecological integrity which may lead to lack of trust in country foods or abandonment of significant cultural practices also must be considered, as these also relate to mental, physical, spiritual, and emotional health outcomes" (p.21).

In addition, the consultants note the "KAM Application ignores the wider spiritual, physical, and cultural effects that will result from changes to access and availability of medicinal plants" (p.21). It is not just about the numbers, but the perception and understanding of risk, a loss of

traditional food source due to a lack of trust or security in its safety and supply is a health-related impact absent from the assessment of country foods in the EA. “Poor nutrition is a key driver and risk factor for disease” (The Lancet, 2019, p. 200) an aspect missing in the EA that strongly emerged in the interviews.

4.3.1.4 Water quality

Water quality and quantity impacts were evaluated at length in the EA. However, since this is not the main focus of my inquiry, only a brief and consolidated discussion below is included. As is the case for many of these subcategories there could be a whole thesis written on each and every Valued Component for inclusion, hence the reason the AIR alone was 18,000+ pages. As one interviewee said: “there is so much stuff it’s just too hard to keep track of everything”. Instead, I will point to the assessed water related risks and any discussion of flaws in the EA documentation. I distill this section dedicated to water on the battle of the experts that emerged in the document analysis.

The study site is located in the Peterson Creek watershed, an area of approximately 130 km^2, that discharges to the South Thompson River. The Peterson Creek aquifer is known to be highly vulnerable due to its proximity to the ground and lack of confinement. “Peterson Creek flows in a northeasterly direction through Jacko Lake, then through the community of Knutsford, and finally through downtown Kamloops [in fact, through a park bearing its name (see Figure 13)], where it is mostly contained in culverts and concrete waterways, until it converges with the South Thompson River” (CEAA, 2017). The neighbourhood of Knutsford a hamlet of ~150 rural groundwater users was a locale of deeper inquiry related to human risk in the EA. Figure 14, demonstrates the groundwater sampling locations selected to sample baseline water quality.

Figure 13: Photo looking south, upslope towards the Ajax mine site. To the right is Peterson Creek. This urban park has a number of trails for the most novice to advanced hiker (Photo credit taken by JYehia, Sept. 19, 2016).

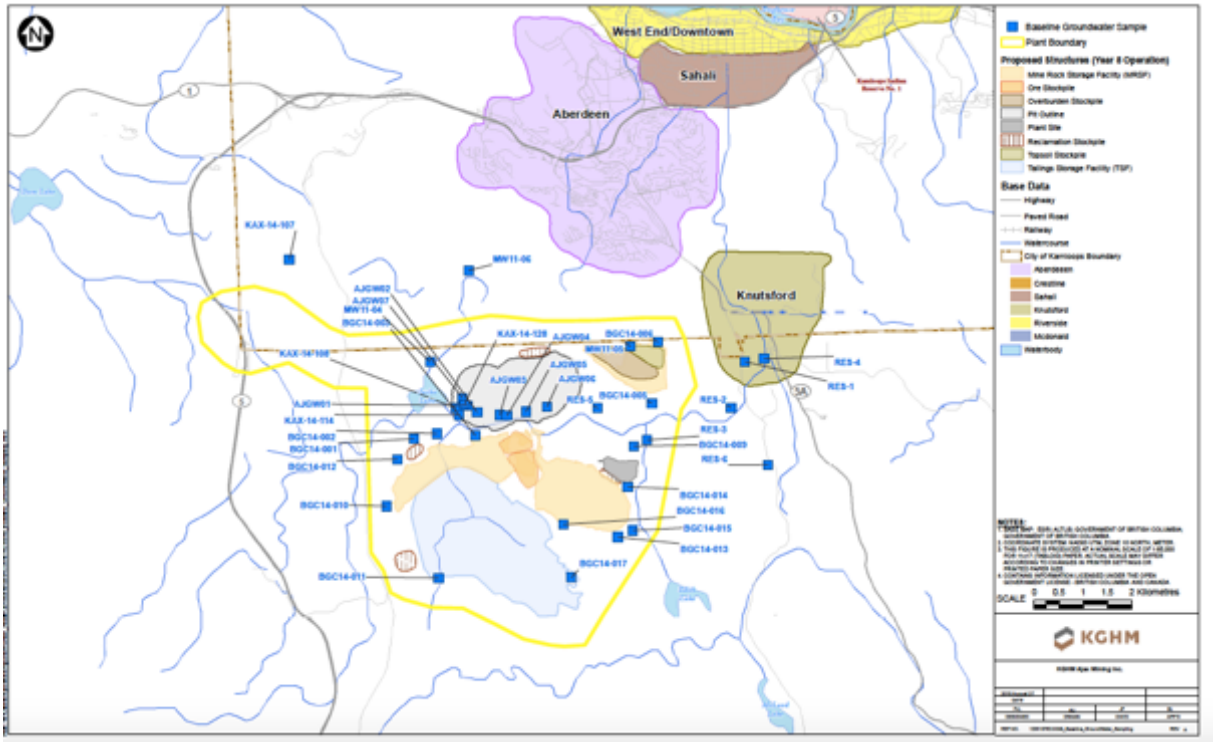

Figure 14: Location of Baseline Groundwater Sampling and Water Modelling Nodes (Stantec, 2015).

The HHERA scoped, specific to water, the COPC. These COPCs focused on the "baseline metal concentrations in surface water and groundwater to provincial and federal human health-based and ecologically-based criteria" (HHERA). In particular, the Peterson Creek watershed were compared to guidelines protective of aquatic life and agricultural land use. Groundwater samples from the site (including both monitoring wells and residential wells) were compared to guidelines for agricultural use and drinking water respectively. In reviewing the HHERA for the prediction of potential water quality impacts an intriguing thread emerged: "baseline groundwater data from the 37 locations were used for COPC screening; however, only data from RES-2 was considered in the risk characterization" (Stantec, 2015, p. 3.38). The rationale being that RES-2 is the only "active residential well location that [was] expected to be most affected by the Project" (Stantec, 2015, p. 3.38).

There were three documents not formally analyzed (in NVivo) but were brought forward by interview participants on gaps in the EA related to water (drinking and recreational respective to quantity and quality). These were all external reviewers to the Ajax mine AIR. First, the Sierra Club of BC Foundation asked the Minesite Drainage Assessment Group (MDAG) to review the AIR submitted in the Ajax proposal. MDAG, with Dr. Kevin Morin, hydrogeologist and geotechnologist at the helm, focused on the question: were the predictions of water contamination in the AIR reasonable? The short answer was no. In fact, the review stated that "they are not reasonable and significantly underestimate the likely contamination of water on and leaving the proposed minesite" (Morin, 2016, p. iv). KAM stated they would reconcile for uncertainties using the Precautionary Principle. This Principle "stipulates that lack of certainty regarding threats of environmental harm should not be used as an excuse for not taking proactive steps to avert that threat" (Morin, 2016, p. iv). In this same section, KAM explains that "the precautionary approach has been used throughout the environmental assessment by applying conservative factors in design, assessment inputs and modelling, including: conducting research to establish baseline data, and where data is not yet available incorporating examples from other similar, established operating mineral resource facilities…" (Morin et al., 2016, p. iv). Unfortunately, several non-KAM consulting companies did most of the technical work. These other companies did not use the Precautionary Principle. Furthermore, KAM in Section 3.2 of the AIR committed to "zero harm" for their employees, the community and the environment. However, this review found that the AIR underestimated the severity of contaminated water

originating on the minesite, and the amount and severity of this more contaminated water entering the Peterson Creek Aquifer. While commitments to the Precautionary Principle and Zero Harm are admirable, they are not easily carried out. Morin (2016) found that the AIR failed to uphold the Precautionary Principle and Zero Harm due to predictions on the contamination of water around and downstream of the proposed Ajax Project.

The MDAG report prompted the Kamloops Area Preservation Association and Sierra Club to consult with the University of Victoria Environmental Law Centre. In fact, an application for a Drinking Water Health Hazard Prevention Order was sent to the Interior Health Authority by this legal team. "In the assessment they didn't consider cumulative effects," legal director Calvin Sandborn says. "They looked at potential impacts on the nearest receptor from the closest potential contamination site, but not the impacts from all the potential sources of contamination at the mine." Sandborn adds the provincial study only looked at the impacts on ground water and ignored the potential effects surface water could have on drinking water in the area.

There was further debate in the HHERA around an integral risk assessment variable, the Hazard Quotient, that is the reference value used to determine risk. Health Canada recommends using a reference point of HQ = 0.2 when the assessment does not include full background exposure sources and pathways. KAM used a HQ = 1 as a reference point for all aspects of the HHERA. Generally, there is great debate on the validity and applicability of using one HQ value over another. While this is not an audit of the risk assessment that was done, instead, I want to illustrate that there were conflicting views in this key reference value. Exceeding HQ 0.2 does not mean an adverse effect will occur. It indicates only that exposures may exceed the risk-based reference dose for a particular exposure pathway.

The City of Kamloops contracted, with financial support from KAM, SLR Global Environmental Solutions consulting firm. This consultants' task was to the review the AIR and provide an assessment of the equality of the previous, KAM contracted, consultant firm on retainer. SLR found, and recommended, with respect to Hazard Quotients, using the Health Canada-accepted approach where maximum exposure concentrations are compared to appropriate risk-based screening criteria in all media. They were unable, however, to state that there would have been any difference in results between the two approaches without seeing the

results of the two approaches but the Health Canada approach would have in their opinion "better met the intent of incorporating the Precautionary Principle" (SLR, 2017, p. iv).

Additional concern was voiced in the HHERA because a single well was used for domestic groundwater use data in the Knutsford area. There was substantial uncertainty associated with the contaminant concentrations. SLR (2017) identified "a potential concern about whether predicted arsenic concentrations in the groundwater of the Peterson Creek Aquifer could potentially exceed the drinking water criteria if the point used for predicting aquifer water quality were closer to the site sources and were within the core of the predicted plume" (p. 16). The increase in arsenic exposure was cautioned to be evaluated carefully and more discussion (in the SLR, 2017 report) was warranted on the projected arsenic increase in groundwater in Knutsford. Even the Ajax Mine – Joint Federal Comprehensive Study/Provincial Assessment Report (2017) stated: *"*the CEAA and BCEAO note that Ajax is predicted to cause an increase in the concentration of arsenic in groundwater in Knutsford. While the predicted concentration (1.8 mg/L) is below the Canadian drinking water guideline (10 mg/L) and within average naturally occurring background arsenic levels in BC, they note that the increase in concentration of this parameter in drinking water can increase the risk of developing cancer..." (p. 70). Not only was arsenic one of the water quality parameters of concern, while below the Canadian drinking water guideline, exceedances were based on baseline from only one residential-domestic well.

It is evident in the HHERA that water quality (and quantity) for human and environmental health related concerns in the AIR, HHERA, and analyzed documents was a VC heavily scrutinized and assessed. Nevertheless, critiques were brought up by many (i.e. independent reviewers – Habitat Health Impact Assessment and SLR Global Environmental Solutions), academics (Dr. Morin, hydrogeologist and University of Victoria Environmental Law Centre) and stakeholders (City of Kamloops and Health Canada). These critiques while specific to water, demonstrate the parent theme of mistrust, perception of risk and uncertainty in the EA that permeated many of the evaluated VCs.

4.3.2 Socio-economic report

Thus far, I have painted a picture to explain what was assessed in the EA regarding biophysical effects and components that were reviewed in the HHERA. The reason for my lingering on these VCs in greater depth and detail is they are the ones reviewed extensively by

the health working group. Representatives from Interior Health and Health Canada were at the table providing oversight on the HHERA. They were also some of the most commonly referenced qualifiers in the analyzed documents. There were, however, other VCs found in the health chapter but these elements, especially the Healthy Living and Community Health subcategories had no third-party health authority review. Noise and vibration, emergency preparedness, health care services, and traffic/accidents were the other subcategories targeted in the health chapter of the AIR. As the iterative process of my research (and key informant interviews) sought to explore, it was not to delve into those topics that have been assessed reasonably well, or that did not emerge from the interviews. It is those parameters that appeared in the interviews that were absent in the EA documents, or alternatively there was debate on the approach, inclusion, or methodology of their inclusion in the EA. As stated by SLR Environmental Consultants, in their contract with the City of Kamloops:

> "in general, KGHM expended considerable effort in compiling the Environmental Assessment Application and the Technical Supporting Documents for the Project. It is consistent with our experience and expectations for a project of this size and complexity. In terms of the confidence or certainty of the Project conclusions, our findings are generally consistent with those of KGHM with respect to aquatic environments and species, acoustics and vibration, water balance, accidents and malfunctions, municipal infrastructure, and some of the socio-economic conclusions" (SLR, 2017, p. ii).

The socio-economic status (SES) report, provides a detailed description of baseline conditions intended to inform the environmental assessment for the proposed Ajax Project (InterGroup, 2015, p. 1-1). However, as illustrated by SLR, there are "heightened uncertainties and/or low confidence in the Environmental Assessment Application conclusions…found in the technical assessments for air quality, human health, dark sky, water quality, terrestrial environments and species, and some socio-economic conclusions" (SLR, 2017, p. ii). As I have already discussed the HHERA, here I will focus on their comments related to those socio-economic considerations that appeared to be lacking or uncertain in the AIR. In the SES report, outlined in the research approach, there were clear identified limitations. As described in the SES report "the literature review included use of Statistics Canada data, BC Stats data and reporting, government policies and reports, regional planning documents, journals, other publications, and online information. Where appropriate, context and findings drawn from the literature were confirmed and validated through key person interviews, focus meetings, and/or workshops"

(InterGroup Consultants, 2015, pp. 1–7). While this sounds comprehensive there was a footnote to this in the SES report. It stated that it:

> "be noted that there was a shift in how the census was administered [in 2011], with a National Household Survey replacing many of the questions previously covered in the census. One of the key differences has been a shift from a mandatory to an optional response requirement for citizens. Further to this, Statistics Canada's practices require that data be suppressed for reasons relating to small community size (less than 250 residents or 40 occupied dwellings), incomplete enumeration, and global non response rates to the survey (Statistics Canada's main data quality indicator). Given the small size of many of the communities being considered and these data quality issues, much of the 2011 data is not publicly available" (InterGroup Consultants, 2015, pp. 1–7).

It should also be noted that there are issues of comparability between censuses, particularly with the transition to a National Household Survey (NHS) in 2011. For this reason, caution should be used in interpreting the data (p. 1-8). These comments are not only present in the SES report but apparent in the many sources of academic and grey literature, such as "gaps or changes in data collection in some provinces and years (e.g. the 2011 Census) may potentially be important limitations" (Guhn et al., 2016, p. 1).

To address these limitations there were key informant interviews conducted to the inform the SES report. However, there is a flaw never brought forward in any of the externally reviewed consultant reports. The fact that input solicited at the public consultation events, interviews, and focus groups did not ensure an appropriate level of consultation with the health sector to fill in baseline health data gaps. Due to confidentiality concerns the SES report did not disclose who was consulted. But the SES report did state that "as of November 2012, a total of 35 interviews had been conducted with municipal officials, industry representatives (mining, forestry, real estate and agriculture), and representatives from educational institutions, government officials, recreation enthusiasts, land users, and ranchers. [The report then further said] in 2014 and 2015, an additional 13 interviews were conducted by InterGroup Consultants" (p. 1-8). Participants were not identified, due to anonymity requirements, yet focus group topics were identified for property value and the city's brand (i.e. the Tournament Capital image). The SES report then goes on to mention that consultation was done with the CAG. Nevertheless, the question remains about the level of involvement (if at all) from health professionals to provide input on this extensively referenced baseline health report in the EA. Nowhere in the report do they state that any health consultation occurred. While this report was quite comprehensive in its review of

health status and socio-economic trends in the Kamloops and North Thompson Local Health Area (LHA) profile, it is unclear on any additional health expertise to inform report. Which raises concerns on the absence of neighbourhood level data not included in the LHAs coupled with the source of this population health data package is now taken from the voluntary NHS.

4.4 The other most referenced health themes in the AIR

There are many topics that I could have included in the document review, such as: dark sky, noise and vibration, accidents and traffic, economic benefits or contribution, emergency preparedness (including discussion on a catastrophic tailing dam failure), community benefit agreements, on site mitigation to address changes in the biophysical environment, tourism, community image… the list goes on and on of parameters with health implications that came up in the document review. But, as mentioned, there are so many aspects to include I will only discuss the top three topics that came up in the document query search outside the HHERA. These are cultural, housing, and health care services. For a comprehensive list of all of the VCs that made their way into the AIR, see Table 6. This Table, located at the end of the chapter, points out the baseline health data that was used to inform on each of the VCs included in the EA and how they were each defined.

4.4.1 Cultural health practices

For Aboriginal populations some health determinants are different. For instance:

> "the physical, mental, spiritual and emotional components of health are integrated with connections to the land, to families and the community, and are not conceptualized as separate silos. For SSN [the local First Nations], health and wellbeing is guided by a set of unwritten beliefs and laws that support the survival of individuals, families, the communities and the Nation. These laws and beliefs are orally transmitted from generation to generation, without written mandates or legislated systems, to ensure that families and communities adapt and survive" (Habitat, 2016, page 1).

Among these determinants there are gaps in health and wellness between Aboriginal and non-Aboriginal British Columbia residents. These "include a range of non-medical determinants from higher unemployment rates, lower levels of education, and greater food insecurity due to poverty. Some of the contributing factors to health disparities stem from historical reasons, including colonization, systemic discrimination, and the residential school experience" (British

Columbia Provincial Health Officer 2009 as cited in InterGroup Consultants, 2015, p. 4-32). While the SES report identified Aboriginal health and listed off some stats and facts regarding this key demographic group, the emphasis was on health disparity. There was no mention of the different approach to health and wellness, as referenced in the Habitat Holistic Health Assessment (2016), yet another third-party report, prepared on behalf of SSN. The understanding, explanation and definition of health differed between these two reports. Although the AIR made significant effort to address losses of traditional lands by supporting SSN to document knowledge and find other areas to participate in traditional activities, these mitigation measures ignored indigenous ways of thinking and knowing and the deep connections between the health of the land and the health of all living things.

A waterbody of significant concern and attention in the EA was Jacko Lake. In fact, I could have included in the section on water above, but the significance expanded much beyond water quality. The popular fishing area, Jacko Lake, sees many recreational anglers. Also known as Pípsell, this body of water has deep ancestral meaning to First Nations (see Figure 15). Stated on the website, Protect Pípsell, co-created by MiningWatch Canada and SSN, The Pípsell area is of historical, cultural, spiritual, and ecological value. It is the origin of the 'Trout Children Story,' an ancestral oral story that connects the SSN peoples to their land, a place that sustained them for generations and is sacred to their laws, culture, customs and practices. Jacko Lake or Pípsell was a dominant topic and contentious point of discussion in the EA. More specifically, SSN requested an Independent Review Panel of the EA that was denied in 2015. The Nation undertook a historic, Indigenous-grounded assessment, collated by Habitat HIA consulting firm (2016), based in SSN laws, traditions, customs and knowledge. As a result of this assessment, "in March 2017, the Nation announced it would not give its free, prior and informed consent for the proposed Ajax Project… the primary reason being that the Ajax Mine Project in its proposed location at Pípsell is in opposition to the SSN land use objective for this profoundly sacred, culturally important, and historically significant cultural keystone site" (MiningWatch Canada and SSN, n.d.). In consideration of the importance of Pípsell and the Trout Children Story, the EAO and Agency concluded, taking into account the implementation of applicable mitigation measures proposed by KAM and the proposed EA certificate conditions, that there would be significant adverse effects to Indigenous heritage and to the current use of lands and resources for traditional purposes. The importance of Pípsell was "extensively considered by the EAO and

Agency in the assessment of the seriousness of impacts to SSN's asserted Aboriginal rights and title" (See BCEAO Report, 2017, page 13).

Figure 15: Photo of Jacko Lake. To the left you can see the Do Not Enter sign posted by KGHM and the road approaching the proposed mine site just below the escarpment (Photo credit taken by JYehia, May 16, 2016).

From a traditional (and country foods) knowledge perspective, preventing SSN members from accessing medicinal and food plants on any percentage of traditional lands infringes upon SSN's right to traditional medicines, knowledge, practices and customs. It also infringes upon SSN's right to learn and be taught the right ways through intergenerational teachings. The fact that these disturbances would have occurred around Pìpsell, a keystone cultural area, had great implications. The mine would have been a physical barrier for SSN to exercise their rights on these lands, which has direct implications for human health, today and in the future (Ignace R. 2008; Perry, 2009 as cited in Habitat, 2016). It was the postulation of the Habitat (2016) that, while considered, the health implications from an indigenous perspective had not been considered in the AIR and needed to be to ensure appropriate Project planning and development of mitigation measures that are protective and supportive of health (Habitat, 2016, page 33).

4.4.2 Housing issues

As was the case for many of the qualifiers searched, housing or property values were scattered throughout in the AIR and supplementary documents reviewed. There were errors in the query search, due to e.g. reference to 'property boundary' of the mine site or 'open house' for public engagement sessions, however, housing still remained a frontrunning theme. In the SES report there were distinct discussions on property costs, rental accommodation, housing stock, and real estate trends. There were connections to impacts from air quality, noise and vibration that floated to the surface in the EA. As I will discuss in the next chapter, the interviewees were concerned about how well the EA addressed the impact on housing, in particular, i.e. the closest neighbourhoods of Aberdeen and Knutsford. "KAM concluded that the rural residences closest to Ajax would be most affected by nuisance effects that could exert downward pressure on property values. KAM noted that residences in Knutsford and in Aberdeen may also experience Project nuisance effects, such as lower air quality, noise and vibration, and aesthetic changes that could put downward pressure on residential property values. KAM also stated that some public apprehension of larger-than-predicted nuisance effects may have short term adverse effects on property values, particularly in neighbourhoods closest to the Project at various stages of project development" (*Ajax Mine Project Joint Federal Comprehensive Study / Provincial Assessment Report*, 2017, p. 219). Although these items were brought forward in the public engagement sessions few assurances were provided to neighbourhoods to allay their fears.

Furthermore, KAM recognized that nuisance effects to property values were highly uncertain due to the multitude of factors contributing to property values. KAM stated that the best way to mitigate impacts to property values would be to address the nuisance factors. According to KAM, this included the implementation of project design and best management practices for air quality, noise and vibration, visual impacts and aesthetic features" (*Ajax Mine Project Joint Federal Comprehensive Study / Provincial Assessment Report*, 2017, p. 220). To address these nuisance issues there were a number of management plans that would have to be implemented, including dust control, air quality, noise and vibration plans. To complement the management plans, KAM proposed to monitor nuisance effects that could potentially influence a change in property values, during construction and operations. "KAM committed to share these monitoring results through engagement and information sharing mechanisms, such as the Community Liaison Group" (*Ajax Mine Project Joint Federal Comprehensive Study / Provincial*

Assessment Report, 2017, p. 220). While monitoring and management is a key component of any EA or HIA, at this stage in the mine's approval process, mitigation and modification of impacts if nuisance effects were to occur were not discussed.

The other aspect of housing was not only to existing stock but the pressure the mine would have applied to in migration. There was a recognition that the adjacent mine site of New Gold increased the need for rental stock in the adjacent communities of Aberdeen. For instance, identified in the SES report, local real estate experts noted that the housing market in Kamloops has been able to accommodate the influx of workers from New Gold (InterGroup Consultants, 2015, pp. 2–47). However, "KGHM concluded that up to approximately 400 workers and their families are expected to migrate to the City of Kamloops because of direct, indirect, and induced employment, creating a short-term increase in demand for housing. KGHM concludes that some residential development would take place, but that would be a gradual process, being unlikely above the current rate of development. KGHM concluded that the local housing stock is sufficient to meet the potential demands of the workforce" (SLR Global Environmental Solutions, 2017, p. vii). While existing rental stock and increased development could have met the need for the longer-term workforce as well as short term increases in the construction phase of the mine, this is a noteworthy piece to mention as this subtheme was entrenched in the housing discussion apparent in the EA.

4.4.3 Healthcare services infrastructure and capacity

Another health theme presented in the AIR was the strain on healthcare services. The population growth that would have occurred as a result of the project would have affected healthcare services, the system's ability to respond, and its capacity. This would have been due to workers and their families expected to migrate to the City because of direct, indirect, and induced employment, creating an increase in health care services demand. Additionally, there were many medical professionals engaged in the EA process who explicitly expressed that they would leave the community if the mine had been approved. The potential strain on healthcare services was acknowledged by KGHM but was not fully evaluated. As stated by SLR (2017) consulting firm, on retainer with the City, sufficient mitigation was not adequate beyond KGHM's commitment to provide a general physician for mine employees (p. vi). KGHM would have been required to retain one medical professional, or doctor, during the construction phase only for employees (it was unclear if worker families would have been under the care of that

practitioner). There was further recognition in the AIR that "healthcare services in Kamloops are currently experiencing a chronic shortage of family doctors and capacity issues at the Royal Inland Hospital. The SSN health centre is currently without a doctor, and its part-time nurse practitioner cannot always meet the demand (*Ajax Mine Project Joint Federal Comprehensive Study / Provincial Assessment Report*, 2017, p. 182). In the permit conditions, KGHM would have been required to hire this general practitioner who must have made themselves available to provide healthcare services to the project construction workforce for a minimum of 35 hours per week during this construction phase (BCEAO, 2017, p. 29).

4.5 Limitations (Phase 1 – document review)

The biggest limitation in the document review section is the sheer magnitude of documents that were included in the EA. As mentioned in the Methods Chapter, I had to make decisions on what documents to include in this research. I had to establish a boundary. Thus, there may be components with indirect connections to health discussed or described in other Chapters of the EA but I had to bound the study somewhere. Moreover, I did not read (page by page) all of the EA documents, including the subchapters, reports and technical appendices analyzed. I had to limit my scope to a query search through NVivo. I was new to NVivo (and CAQDAS software) therefore there may be additional limitations to my comprehension of the tool. I did spot check my findings, by pulling up the referenced document to verify that NVivo was extracting the correct theme. However, I was unable to do this for each and every theme throughout the material analyzed: as illustrated in Table 5, air quality alone was referenced 921 times. Another confounding factor was the way terms were queried as previously mentioned. If presented or identified by an alternative descriptor the results varied. An example of this can be seen in note [a] in this Table. I attempted to add rigour to this issue by reading excerpts and as stated spot-checking extracted themes.

4.6 Interpretation & Discussion (Phase 1 – document review)

As you can see illustrated above, there were immense challenges in deciding what to include in my review of the Ajax mine EA. I chose not to dig into each and every VC considered

for health. Noise, vibration, and dark sky, for instance, were not parameters that emerged as top themes in the document review. I made a choice to delineate my research to the VCs that, through the query search, came out as frontrunners, where discrepancy or debate existing in the EA documents, from early scoping, to the AIR, to the final permit conditions. I further made the decision to include parameters where uncertainty persisted between the documents included in the Ajax mine review and what stood out (analytically) in the interviews with key health and social service providers in the next chapter. I was iterative, between the document and interview analyses, while focused on my research questions. I targeted my review on the most commonly referenced themes from the documents while factoring in what emerged in the interviews. Those dominant themes were exposure to hazardous materials, air quality, water quality, country foods, cultural health, housing, and health care services.

My key findings in the EA documents were that the VCs that were included for health were missing key components. It is astounding that a document as involved as the AIR was mute on parameters that emerged at the forefront of my interviews. I will leave it with these two telling quotes from Habitat HIA Consulting that exposed shortcomings of the EA. "Ultimately, there are a range of possible health issues that have not been adequately addressed, specifically related to mental well-being and effects of perceived contamination. Without additional stakeholder input in addition to assessing the Proposed Project using a wider health lens, there could be concerns and issues that have not been properly recognized and mitigated" (Habitat Health Impact Assessment Consulting & GatePost Risk Analysis, 2016b, p. 18). Furthermore…

> "exposure to contaminants is only one factor in human health and community well-being. KAM acknowledges in various parts of the assessment that health and well-being are influenced by many factors. What is missing is a holistic analysis of the aggregate impacts on health from the overall mine project that is also grounded in stakeholder input and considers inequitable distribution of effects among the population. This could identify a wider range of factors that influence quality of life in a much broader sense than simply lack of illness or disease. Although KAM recognizes a sub-set of community health and well-being impacts, we identified the perception of risks as a significant factor in stress and mental health as a particular aspect of such a holistic analysis…It is this holistic aspect of evaluating a project such as the Ajax Mine that, combined with credible discipline-specific assessments, has the chance of addressing many issues that affect people's lives in the broadest sense" (Habitat Health Impact Assessment Consulting & GatePost Risk Analysis, 2016b, p. 24).

The final report released jointly by the BCEAO and CEAA stated that: “SSN and members of the public requested completion of a HIA to fully assess health risks related to Ajax. A HIA is a more comprehensive assessment than an HHERA, as it would consider SDH and community perspectives in addition to the physical determinants of health considered in an HHRA. KAM clarified that the HHERA considers baseline exposure levels for COPCs, changes to these levels resulting from Ajax, and the exposure pathways” (Ajax Mine Project Joint Federal Comprehensive Study / Provincial Assessment Report, 2017). So even the regulators, the overseers to this process, acknowledge gaps in the EA. However, while laudable that they come out and say this point blank, KAM’s approach is firmly rooted in the biophysical, desktop analysis, of the HHERA as was directed by the regulators. While I performed aspects of an HIA in the subsequent chapter, in my interviews, I want to recognize that the EA did not profess to be a HIA and there was a recognition of limitation in the methodological approach of the HHERA.

Table 6: Health related VCs extracted from the Ajax mine AIR and Joint Federal Comprehensive Study/Provincial Assessment Report (KGHM, 2015; CEAA, 2017)

Valued Component (VC)	Definition	Baseline Used
Economic	*Taken from the Economic Pillar in the EA review. The subcategory related to Respiratory and Housing Issues is found under the "Property Values".	Baseline Studies (Socio-Economic Baseline)
Water	*Reference to water is found in the Health and Environmental Chapters of the EA. Respective to Water in the Health Chapter, it is defined as: "this section of the Application/EIS will provide a summary of the local and regional water quality and the source of the information".	Baseline Studies (Water Quality Baseline)
Country Food	This section of the Application/EIS will provide a summary of local and regional sources of Country Foods and the source of the information. Background information will include traditional ecological and community knowledge relating to the VC, where publicly available or provided by Aboriginal groups. In the assessment, the definition of Country Foods will be in accordance with the Health Canada guidance documents as follows: "Country foods, also known as traditional foods, include those foods trapped, fished, hunted, harvested or grown for subsistence or medicinal purposes, or obtained from recreational activities such as sport fishing and/or game hunting. Country foods do not include foods produced in commercial operations (large farms, greenhouses, etc.)." However, all potential ingestion routes, and rationalization for inclusion/exclusion as a pathway of significance, will be included in the Application/EIS.	HHERA
Air Quality	This section of the Application/EIS will provide a summary of local and regional air quality and discuss the source of the information. Background information will include traditional ecological or community knowledge relating to the VC where publicly available or provided by Aboriginal groups, including the Kamloops Airshed Management Plan (2012). The Application/EIS will present background information on air quality in the local and regional air shed.	• Baseline Studies (Air Quality Baseline) • HHERA • Kamloops Airshed Management Plan
Human Health	This section of the Application/EIS will provide a summary of baseline human health as it related to human exposures to chemicals released to the environment by the Project. Background information will include traditional ecological and community knowledge relating to the VC, where publicly available or provided by Aboriginal groups. The human health assessment will follow standard human health risk assessment (HHRA) protocols as outlined in the guidance documents listed in Table 10.4-1). The HHRA will consider all potential exposure pathways (including, air, drinking water and country foods such as wild meat, vegetation, fish and traditional medicines), for human receptors for Aboriginal and non-Aboriginal people for all age groups and will consider sensitive members of the population (young children, the elderly, pregnant women etc.).	Risk Assessment and Guidance documents
Economic	*Taken from the Economic Pillar in the EA review. The subcategories related to SDHs are income and labour force & training.	Baseline Studies (Socio-Economic Baseline)
Noise and Vibration	The Application/EIS will describe the rationale for selecting and assessing Noise and Vibration as a human health VC. It addresses vibration (ground and air) and noise from daily blasting and other mine activities. This section of the Application/EIS will provide a summary of the local and regional background and the source of the information. Background information will include traditional ecological or community knowledge relating to the VC, where publicly available or provided by Aboriginal groups.	HHERA
Cultural	*Taken from the Heritage Pillar in the EA review. The subcategories (in entirety are: archaeological sites, aboriginal & non-aboriginal heritage sites).	Archeological Impact Assessment and Cultural Heritage Study (from SSN)
Infrastructure, Public Facilities, Services	Infrastructure, public facilities, and services are commonly used to describe the regional and local areas and the communities located within. The pathway of effects between the Project and infrastructure, public facilities and services are generally through the presence (and/or influx) of construction and operation-related workers and their associated incomes. Higher incomes are often associated with improvements in housing, health and wellbeing to project workers and their families. The topics generally considered for the local and regional study areas in support of these pathways include: • Population; • Housing; • Public facilities; • Public services (including health and emergency services); and • Transportation.	Baseline Studies (Socio-Economic Baseline)

Community Health & Well Being	This section of the Application/EIS will provide a summary of local and regional community health and the source of the information. This will include a review of health indicator data, health services indicators, socio-economic indicators of community health (e.g., the Community Well-Being Index), Aboriginal health issues, and community image. Background information will include community knowledge gathered during the key person interview program relating to the VC, where publicly available or provided by Aboriginal groups.	Baseline Studies (Socio-Economic Baseline)
Healthy Living & Healthy Education	Broadly defined, healthy living is the inter-related undertaken practices that support, improve, maintain, and/or enhance health. In particular, the Public Health Agency of Canada (2012) concentrates on healthy eating, physical activity, and maintaining a healthy weight as the critical components for leading a healthy life. Health Education is being included as a part of the healthy living VC with respect to its role in the others visiting or using the area. These two topics are typically included in BC assessments. This section of the Application/EIS will provide a summary of local and regional health education programs, as well as a summary of the local and regional health, recreation, and fitness levels and the source of the information. Background information will include traditional and community knowledge relating to the VC, where publicly available or provided by Aboriginal groups.	HHERA
Dark Sky	This section of the Application/EIS will summarize existing light levels in proximity to the Project, including the Aberdeen, Knutsford, Sahali, and Pineview Valley subdivisions, and existing light levels at the Stake Lake observatory, Edith Lake Road and Lac Le Jeune Provincial Park.	Baseline Studies (Socio-Economic Baseline)
Outdoor Recreation	This section of the Application/EIS will summarize the outdoor recreational opportunities around the Project area, and describe the values associated with them from a socio-economic perspective for the local and regional study areas. The following activities will be included in the category of outdoor recreation: • Parks and protected areas; • Hunting, trapping and fishing; • Mountain biking, hiking and birdwatching; • Astronomical observation; • Off-road vehicle use; • Navigation; and • Cross-country skiing, snowshoeing and snowboarding.	Baseline Studies (Socio-Economic Baseline)
Visual Impact	This section will describe the current view-shed where the Project is situated. The analysis will be a visual impact assessment that examines various sight lines from different locations, including residential, recreational areas (including Jacko Lake), transportation routes (including the Coquihalla Highway, Lac le Jeune Road, Highway 5, Highway 5A, Goose Lake Road, Long Lake Road, and Edith Lake Roads, etc.) and commercial areas... The Application/EIS will also assess the potential for the Project to shade neighbouring properties. The assessment will utilize digital maps showing the potential direct sunlight and solar energy on the landscape for various time periods.	Baseline Studies (Visual Impact Baseline, including Dark Sky Analysis)
Land & Resource Use	This section of the Application/EIS will provide a summary of local and regional land and resource use. Background information will include traditional ecological or community knowledge relating to the VC, where publicly available or provided by Aboriginal groups. The construction, operation, and decommissioning of the Project is anticipated to have effects on the physical and biophysical environments. The extent to which physical undertakings result in changes to the physical, terrestrial and aquatic environments may have implications for land and resource use and resource users in the local and regional study areas. In support of these potential pathways, the assessment will consider: • Other Land and Resource Use; • Recreational use; • Community land and resource use planning and associated processes; • Residential land use within or in proximity to the Project site; • Agricultural land use, including ranching; • Mining; and • Forestry.	• Baseline Studies (Socio-Economic Baseline); • Baseline data for grass, hayland and cattle production

Chapter 5 – Results and Interpretation: Interviews

5.1 Introduction

This chapter is devoted to a description of what was not included in the EA and what surfaced from the interviews using an HIA lens. My findings describe the concerns expressed by interviewees that would have been included in the EA if a HIA was performed. The interviews were structured to answer the second of my research questions. That is, to what extent does the scoping phase of the EA for the Ajax mine use baseline health data and information? The interviews aimed to ground truth the health data that was included in the EA. Specific to health, and the local knowledge in the community, my interview questions revolved around the definition of health in the EA, the health priorities in the community, and identified vulnerable groups. Health impacts or VCs that were brought forward in the EA and the documents were reviewed in Chapter 4. In general, my findings illustrated that air quality, mental health (and connected themes), economic trade-offs, health care services and nutrition were marginally included in the EA. In this chapter I reflect on dominant themes that surfaced from the interviews. I conclude by highlighting some of the institutional barriers felt by participants in the EA and suggestions for improvements to the EA process to be more inclusive of health.

5.2 Phase 2 – Interviews - HIA scoping phase

The top three themes that emerged from the interviews were air quality (referenced 53 times from 11 out of 16 interviews), mental health (referenced 50 times in 11 interviews), and economic benefits or trade-offs (referenced 18 times in 10 interviews). The next tier of concerns that came from the interviews were health care services, food and nutrition, water quality, emergency preparedness, and risk perception (which, depending on the context, could have been included under mental health). As you can see in Table 7, the dominant themes that emerged were from the EHA social determinants of health (SDH) category. In fact, of the top ten themes that emerged, four were related to the SDH. The following sections of this chapter present these themes by EHA grouping.

Table 7: The top ten themes that emerged from interviews, including number of times referenced overall and in how many interviews did participants referred to this theme (out of a total of sixteen interviews conducted).

	EHA	Themes	Referenced	Source (/16)
1.	Exposure to potentially hazardous materials	Air quality	53	11
2.	Social determinants of health	Mental health	50	11
3.	Social determinants of health	Economic benefits or trade-offs	18	10
4.	Healthcare services infrastructure and capacity	Healthcare services	21	9
5.	Food and nutrition related issues	Food and nutrition	17	8
6.	Soil and water sanitation related diseases	Water quality	15	7
7.	Exposure to potentially hazardous materials	Emergency preparedness	14	7
8.	Social determinants of health	Risk perception	14	7
9.	Social determinants of health	Drugs and alcohol	12	7
10.	Respiratory and housing issues	Housing	18	6
Other themes that emerged from interviews were: cultural health practices (referenced: 7, source: 4), accidents and injuries (including traffic impacts r: 5, s: 5), infrastructure (soil and water sanitation related r: 4, s: 4).				

5.2.1 Exposure to potentially hazardous materials – theme: air quality

The most pressing concern related to health in the Ajax mine EA proposal was air quality. This was definitely at the forefront of the most interviews, and for some, was of utmost concern. This was due to a variety of factors as highlighted in Chapter 4. One factor is the urban population of Kamloops and its proximity to the Ajax mine, and baseline air quality dust or $PM_{2.5}$ being the parameter of interest in the City. As mentioned by Cathy, a representative on the Kamloops Airshed Management Plan (AMP):

> "I really don't think the company understands the geography and nature of this place. It's hot and it's windy, is that a good place to put an open pit mine? There aren't enough money and resources to throw on the dirt up there to make the problem go away. Who's

> going to be checking on it later, and who is really is going to come down on them with millions of dollars' worth of fines?"

This sentiment was echoed by Jeff, another member of the AMP:

> "that the reason for the emphasis on $PM_{2.5}$ in Ajax is because of the proximity to a large population, 90,000 people. I don't know of any other mine in BC that's anywhere near this close to a large population centre. The main source of mine dust is usually the haul roads or erosion from tailings dam. Those issues occur under different environmental conditions. Haul road dust tends to be worse during periods of hot, dry weather, when the road surface dries out and they cannot keep it wet enough to suppress dust".

Concerns about the baseline geography, topology, meteorology and how Ajax would have further compounded existing air quality impacts in Kamloops was a dominant theme in the interviews. While baseline conditions were not, on average, regularly exceeding Air Quality Objectives, there was an approach to threshold limits of $25\mu g/m^3$ for daily averages (above the 98^{th} percentile over a three-year period) and $8\mu g/m^3$ for annual conditions. See Figure 16 for more information, taken from the Kamloops AMP.

Year	Annual $PM_{2.5}$ ($\mu g/m^3$)	$PM_{2.5}$ 98th Percentile (3 Year Average)[8]	Ozone Metric (ppb) 4th Highest Maximum Average[9]
2000	5.6	Insufficient data[10]	57
2001	5.3	14	55
2002	6.7	16	55
2003	7.9	25	58
2004	5.7	26[11]	60
2005	4.7	24	59
2006	5	16	57
2007	4.9	14	55
2008	5	15	56
2009	5.7	18	57
2010	5.4	24	55
Canada Wide Standard (2000)	N/A	30µg/m³	65 ppb
BC Ambient Air Quality Objective (2009)	8 µg/m³	N/A	N/A

7 Data provided by MOE
8 The 98th percentile of the daily averages in a calendar year averaged over the previous 3 years.
9 The 4th highest maximum 8 hour average for each day in the period April 1st to September 30th.
10 $PM_{2.5}$ Measurements began in Kamloops in the Fall of 1998. Therefore it was not until the end of the 2001 calendar year that a three year average could be calculated.
11 Because three years of data are averaged, the forest fires in 2003 resulted in high values for the period 2003-2005. The fires in 2010 will have a similar effect. Even if there are no forest fires in 2012, values will appear to be high in 2011 and 2012.

Figure 16: Air Quality Baseline Data extracted from Kamloops Air Management Plan (City of Kamloops, 2012, p. 12). It is noteworthy to inform that the provincial Air Quality Objectives, specific to $PM_{2.5}$ were based on 2009changes at the BC provincial level. That is, in 2009, the $PM_{2.5}$ 98^{th} Percentile (3 Year Average) was 25µg/m3 (MoE, 2018).

Many interview respondents were informed of the local air quality issues and topographic variability in baseline conditions. Many spoke to the poorer air quality at the Valley bottom compared to the hills of Aberdeen (where Ajax would have been situated). In fact, the prevailing

winds from the hills provide a level of cleaner fresh air flushing to the Valley bottom where downtown Kamloops is located. Ministry of Environment has only historically and routinely measured air quality using stationary instrumentation at the Valley bottom. As a result of community pressure and concern, and Ministry of Environment support, an additional (publicly funded) air quality monitor was sited in Aberdeen. The academic representative, Sam, stated that:

> "the location of that mine is probably in the worst location a mine could be, adjacent to the city and not just its proximity but its elevation in relation to the city and prevailing winds. It will blow a lot of that particulate matter right at us here into the densely populated areas. There is no question about it".

An objective of the new monitor in Aberdeen was to try and collect more robust and localized baseline air quality information to inform the decision of potential air quality impacts related to Ajax.

Interview participants expressed concerns found in the conditions native to Kamloops but also based on lived experience from proximal and similar mine operations, such as the Highland Valley Copper mine. That was pointed to in the Habitat Health Impact Consulting report (2016):

> "the KAM Project is not happening in isolation; other mines exist with similarities for evaluating emissions, exposures, regulatory issues, catastrophic events, and individual and community health issues (e.g. Canadian Malartic, Teck Highland Valley Copper, Imperial Metal Mount Polley). Stakeholders have significant concerns regarding issues, conditions, and events at these mines. KAM should address these concerns with direct discussion of how the Project compares" (p. 5).

Two long term Kamloops residents spoke to the impacts from dust in relation to the neighbouring Highland Valley Copper mine. For instance, Suzy said:

> "I have been to the Highland Valley Copper mine site many times and my observation there is a thick dust settlement on the ground, so it is an indication of how much fine dust you have around that major open pit mine within a 2-3km radius".

And Lucy said:

> "just take a drive up to Highland Valley Copper and see that mines by their very nature are dusty so you've got a big dusty mine and your impact is almost directly proportional to the distance from where you are from the mine and there's going to be some natural exacerbation of air quality episodes that we have here anyway because of the silt bluffs, the very nature of the valley, the prevailing winds".

The comparison between these two proximal mines were examples felt to be missing in the EA.

Baseline air quality comments and sentiments from interview participants were also tied to their confidence in the air quality model. Health professional, Hugh, stated quite frankly that the air quality health impact is huge and, in fact, "their air modelling was garbage and did a bad job of actually reflecting what the impact is". Ted, a community member involved in the community advisory group (CAG), mentioned that (as a group) they have been in contact with Mining Watch Canada, a non-governmental organization and mining watch dog in Canada. The inquiry was regarding the 90% dust mitigation from the tailings pond that KGHM claimed they would have been able to achieve. The questions posed inquired of Mining Watch if they were aware of any mine in Canada that has achieved that level of dust control?

> "And Mining Watch said that projects that have mitigation of 74% were being turned back as unfeasible. That's a big drop from 90% that we are needing in order to say this thing will be zero impact. They are saying zero harm; zero impact and they can't keep saying that… it's not just the weak and the frail… everyone will be part of that [mortality and morbidity] statistic [due to elevated levels of $PM_{2.5}$]".

This quote illustrates the lack of confidence in the air quality model and the many lengths members of the CAG went to in finding answers to their questions. The above testimonials speak to the main theme of exposure related to the mine, from baseline air quality characteristics to concerns about the model. This led to perceptions of risk, control, connections to mental health, and stress felt by many of the research participants.

5.2.2 Social determinants of health (SDH) – theme: mental health

In the EHA definitions (see Appendix B – EHA Definitions) it is possible to categorize mental health under Noncommunicable Diseases (NCDs) or SDH, dependent on cause. For instance, mental health under NCDs is associated with chronic disease whereas under SDH it is defined as psychosocial (related to the social environment). Many responses about mental health were attributed to participants perception of risk and their confidence in the EA to be protective of health, for instance, their concerns about air quality. It is for this reason I grouped aligned mental health using the more psychosocial definition in the EHAs, which placed it under SDH.

The second, most predominant theme arising in the HIA interviews was mental health. In fact, many of the themes that emerged from the interviews were inexplicitly tied to mental health. In this section I distill the theme of mental health by presenting its interplay with other connected themes.

Figure 17: Photo taken by JYehia on Sept. 20, 2016. This house is situated downtown Kamloops ~2 blocks from City Hall.

For example, there was an aspect of how the project in and of itself created stress felt by respondents. As seen in Figure 17, this photo illustrates the concern being voiced by many in the community. This sign saying "Ajax dust would travel this far and farther" was posted at many homes in town. There was also the opposing view of "I support Ajax" bumper stickers observed on many vehicles. There was a divisiveness felt in the social fabric of the community, in particular for those involved in the EA process. Reflecting on mental health related to a psychosocial effect, one CAC participant spoke about losing their hair from stress, another academic of being bullied professionally or publicly at events to their opposition, while others in the community expressed how they would have left town if the mine were approved out of fear of the perceived health impacts. Some participants spoke of mental health not apparent in the EA documents, and the health needs or priorities not referenced beyond minimal mention in the SES report.

There was also a fear that workers, or population influx related to the mine overall, might require more complex care service related to mental health. Interviews with health and social service providers conveyed baseline health priorities and challenges specific to mental health.

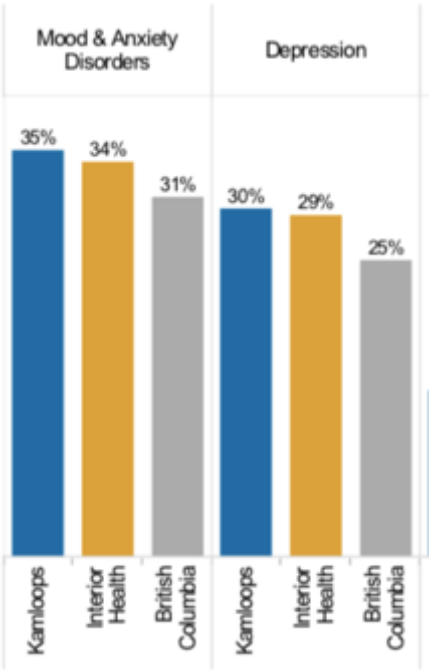

Figure 18: Mood & anxiety disorders and depression are the number 1 and 2 chronic conditions, in Kamloops. The values are based on residents over one year and up (Chronic Disease Registry, 2015/16 as cited in Interior Health, 2018, p.4).

Gail, who works for a social service in Kamloops, spoke to the fact that*:*

> *"*a number of years ago, they [the government] shut down a lot of mental health facilities or places where they housed people with mental health issues, and they turned them all loose on the streets and a lot of these people now… are not monitored".

Pat, a health professional, stated that:

> "some of the work that I'm currently doing is not just primary care but it's mental health and substance use services for complex care clients. So, I think anything to do with complex care patients is one of the difficulties that within Kamloops is accessing appropriate care without a waitlist…"

This sentiment echoed throughout many of the interviews.

Facets of baseline mental health were present in the EA SES report. In both Local Health Areas (LHA), for Kamloops and North Thompson:

> "in 2008-09, depression and anxiety were the most prevalent chronic conditions at 25.3% in the Kamloops LHA and 17.7% in the North Thompson LHA. The prevalence rates in the LHAs increased between 2008-09 and 2011-12. In the Kamloops LHA, depression/anxiety in 2011-12 had a prevalence rate of 27.0% and 21.0% in the North Thompson LHA" (IHA, 2010 as cited in InterGroup, 2015, pg. 4-22).

In fact, those prevalence rates continued to rise as is illustrated in the most recent LHA profile for Kamloops released in 2018 (shown in Figure 18) in comparison to the Interior Health and BC. Beyond the SES report there was very little reference to mental health in subsequent EA documents. There was no requirement for how the mine may alleviate this recognized baseline health statistic, e.g. hiring a counsellor to support workers affected by a mental health condition.

Scholarly research illustrates clear linkages between mental health and mining. For baseline, prevalence and increasing incidence were recognised in the SES but not how KAM could contribute to improving or (at a minimum) not further exacerbating this baseline. Klinck &

Gibson (2005) reviewed some of the effects that mining industries can have on well-being and found:

> "Depressive disorders in mining may be triggered by a combination of factors including roster schedules, the repetitive nature and high concentration demands of the work, the after effects of job-related physical disabilities, or the closure of the mine and job loss. While, due to high wages, miners typically enjoy lower levels of under-employment during mine operation compared to other resource extraction industries (Slack and Jensen, 2004), they face a more serious threat of post mine lay-off. In Avery *et al.'s* (1998) study of mining and mental health, following a national pit closure, 52% of unemployed former miners faced psychological disorders" (Klinck & Gibson, 2005, p. 122).

While the above quote points to the mental health of miners during bust and boom cycles there are ripple effects during those times that influence family and community life, necessitating a draw on supportive services. Shandro *et al.* (2011) demonstrated higher rates of mental health disorder following mine closure and as a consequence "key health issues for families, women and mine workers, called for attention to improved health and social service delivery" (p. 1). As emphasized by health professional, Hugh:

> "mental health and wellness are going to be the big ones that are impacted by the project. Those are the ones that are not being considered by the traditional EA process, not super measurable… but absolutely meaningful".

With baseline mental health on the rise, there was an apparent lack of consideration of the mines' impact on mental health in the community, should it have come to town. Furthermore, the document review illustrated a clear lack of recognition for what, if any, the mine would have contributed to local social service provisions to address mental health impacts known to occur with mining operations.

Then there was the issue of the mental health impact connected to the EA process overall and being part of that process. For instance, when asked about baseline health priorities in the City, health professional, Jason, emphatically answered:

> "this project is a major health concern, or possible impacts from this project to put it in perspective. It has got a huge amount of the community involved, which I would say is rather exceptional."

For every participant interviewed and involved in the EA, mental health came up. Sam, an academic, said:

> "you would not believe how many people walked by on a regular basis and would give me the finger at the window here because of that [pointed to a sign saying 'No Ajax']… there's a personal cost, there's no recognition [for involvement in the EA process and speaking out against the mine] in fact there's demonization".

When thinking about the concept of mental health as an indicator of health, Jim from the health sector highlighted that:

> "I think mental health is just finally getting recognised as an issue…it is being talked about [more] and the stigma around it is being addressed but it is only starting to be a valued aspect of health".

For the stigma of mental health, its prominence in Kamloops population health data, and its influence on health, one may not think about being part of an EA as impactful. For those who would have ended up with a mine in close proximity to their homes the impact, stress, pressure, anxiety and (in some instances) panic, and feelings of being ostracized in their community, were correlated with their level of involvement, and at times felt palpable in interviews.

To provide an illustration of the interconnections to mental health within the EHAs see Table 8. Although some of the Themes coded touched on a different EHA within the context being framed in the interview, mental health was the underlining concern. They also pointed to disparities in the integration (or lack thereof) of mental health in the EA process and the baseline health conditions that could have further exacerbated mental health impacts, with the lack of social supportive services. For instance, there was not one homeless shelter open to both men and woman all year round in town. There was no thorough property assessment conducted for homeowners, or compensation offered for impacted homeowners should their property values go down as a result of proximity to the mine. There was clear discussion, in multiple interviews, of skilled professionals leaving if the mine came to town. There was no mention of the current opioid crisis affecting BC. And finally, from a point of view of risk perception, the lone statement referenced in the final report, written by CEAA and the BCEAO sent to the Ministers for their decision, stated:

> "KAM reported that perceived risks tend to be related to a lack of trust and confidence in Ajax and proponent. As such, KAM said it is committed to be transparent in their information sharing in order to build trust with stakeholders. KAM also highlighted it intends to contribute and/or support initiatives beyond direct project effects through a community investment program. (p. 186)

This quote demonstrates the lack of trust in the proponent and the EA. It points to the lack of confidence felt by those involved. While the community investment program could have mended

the trust between the proponent and CAG, specifics were not disclosed and not made explicit by the regulators as a requirement of approval.

Table 8: Logic diagram illustrating mental health and the subthemes it intersected illuminating on baseline health data conditions.

	Activity impacts	Examples of evidence - Interview quotes	Baseline health conditions / priorities	Activity
Mental Health ⇑⇓	⇒ *Economic trade-offs*	Alex - "here's jobs, and without jobs there will be people sleeping in hunks of cardboard in front of store fronts. It's just that it can't be done at all costs and we don't want a clean-up bill." Ted - I don't feel respected or that I want to participate in such an adversarial environment, I don't need this… I could just take a loss on my house and move."	⇒ job creation vs. loss ⇒ who would leave if the mine came to town	**Ajax mine** ⇓⇑
	⇒ *Risk perception*	Jeff – "I don't know how many times I've had mothers phoning me, in tears, because they've been reading something and they are convinced that if they don't move, they're going to come to serious harm. As one of the medical officers of health once said is 'causing public hysteria is a health effect too', and it's true." Sam – "there were hundreds of gaps in the report having to do with methodology and their assumptions about risk."	⇒ trust in EA process	
	⇒ *Drug and alcoholism*	Pat – "the other thing is substance use services and if there is a mine coming that increases the likelihood of substance use in the community. There is a lack of those services that are available here. There are waitlists." Pat - "being part of the overdose response strategy, there's a lot street entrenched drug users stigmatized and less valued."	⇒ wait lists for treatment/counsellors ⇒ opioid crisis	
	⇒ *Housing*	Tom – "there's nothing in place to give us any kind of assurance that should I lose 20% of my property value, who is going to make up the difference. This is our life savings; this is our retirement fund." Gail – "they shut down a lot of mental health facilities or places where they housed people with mental health issues, and they turned to the streets"	⇒ lack of property assessment ⇒ homelessness (no shelter, excluding the emergency shelters)	
	⇒ *STI's*	Pat – "No STI clinic in Kamloops. Go figure!"	⇒ no STI clinic	
	⇒ *Domestic violence*	Lucy – "You know, e.g. if Domtar [pulp mill] were to close up tomorrow and leave town, we would have 100 families with the head of household unemployed, we would start to see some sharp increases in some of our health indicators related to spousal abuse, alcohol abuse, mental health issues." Gail – "there's 1 women's shelter, an emergency shelter that's open year-round... Other than that, there's only, out of the cold programs in the winter."	⇒ 1 woman's shelter	

5.2.3 Social determinants of health (SDH) – theme: economic benefits and trade-offs

Simply put, resource extraction creates jobs, a clear economic benefit, but at what cost? As health professional, Alex, stated:

> "there's jobs, and without jobs in the economy there will be people sleeping in hunks of cardboard in front of store fronts. No, it's a vital backbone of society. It's just that it can't be done at all cost and we have seen enough examples out there of the industries that have come and done their thing and left town and the government is left picking up the cleanup bill. In this case we do not want a clean-up bill".

Many interview participants spoke to this teetertotter between generating jobs and who might benefit vs. perceived community harms and changes should the mine be approved. As Fred said:

> "a young man who wants to provide for his family and not having a job, that is harmful to a person's well-being, [losing that] sense of security and if you have tree-huggers saying no don't have this mine. He is saying well that's a chance for me to provide for my family. Now what's sad is that you have got something like 6000 young men maybe who are hoping for a job and there's only maybe 500 to be had. Do you say, all line up boys and let's pull straws"?

Tom spoke about:

> "anything that creates jobs is not necessarily a bad thing, but you have to balance that with the cost so close to our community. This should never ever have been allowed to happen, but we don't have a law in place. The mineral tenure act is how old? … I know that Highland Valley Copper does a lot of business in Kamloops like all those support industries. So how much will that add to the Kamloops economy, we don't know but the flip side is what is the cost to our way of life that we know where our focus has been on healthy living and this concept of the tournament capital centre".

While not fully explored in these findings, the concept of loss in the Tournament Capital Brand or being an educational, technological sector with the presence of Thompson River University was a point of contention for several interviewees. There was a desire to move away from being the resource town that Kamloops was historically known for and move towards the educational or sports capital it is now recognized for.

Most of the academic literature on economic trade-offs and benefits, reviewed for this research, emphasized the economic hardships in the community after a mine, or industry, closed and left town. Shandro *et al*. (2001) found that "while these communities were shown to accrue economic benefits while a mine was in operation, upon closure many of these communities lost a significant proportion of their population because of the resulting lack of economic options and, higher rates of acute cardiovascular disease and mental disorders were observed in communities

following mine closure" (p. 1). While I did not review the economic chapter in the EA documents, I want to illuminate this theme that emerged from the interviews that many respondents felt the benefits did not outweigh the gains, or trade-offs. Furthermore, it is the age-old supposition, and sales pitch by the industry, that this mine would have brought jobs to the City of Kamloops. However, local worker recruitment, retention, and post mine closure impacts were sentiments discussed in the interviews and apparent in the mining and health literature.

5.2.4 Healthcare services infrastructure and capacity – theme: healthcare services

The third most prevalent theme in the interviews was healthcare services, in particular the physical facilities, healthcare workforce, and system efficiencies. This emergent theme aligned with the EHA definition for this category (see Appendix B – EHA Definitions). Baseline scoping identified a number of pressures that the KAM could have applied to healthcare in Kamloops. One such example is that the hospital was over capacity as reported by the CBC, the Royal Inland Hospital in Kamloops was 30% over capacity (Fisher, 2016). Ted, a hospital employee, claimed to be "totally desensitized to the overcapacity notices". Another baseline stressor on health care is the issue of many Kamloops residents not having a family physician. Tom emphasized this issue by saying:

> "are we going to attract physicians? We already have a huge problem, 20,000 people in Kamloops don't have a family physician… and I know there are some physicians who have said they will leave if this mine comes through because they do not want to bring up their family here".

So, if individuals or families need to seek out medical treatment but do not have a family doctor, they have to go to the Emergency Room of the hospital or a walk-in clinic. However, as stated by Pat:

> "there are only two walk-in clinics and…if you are not there by when the doors open, I think it's at 9am there is already a line-up of people about 30 people deep by 8 o'clock in the morning. I know this from my own personal experience and if you show up too late in the morning, they have already booked the whole day".

The above interview quotes exemplify the current strains on healthcare services in Kamloops, i.e. an overcapacity hospital, a lack of family doctors for ¼ (or more) of the population, and two walk-in clinics.

The health care system will be affected by mine worker influx. I discussed this in Chapter 2, more specifically in the mining and health section, the risky occupational nature of mining, in addition to basic routine medical visits workers and their families may need. While research speaks to this pressure more so observed in rural communities, where a new mine may cause a population to double in size, it still points to the impact this industry may place burden on existing services. This is seen in the following quote:

> "Resource development activities can lead to additional pressures on health care systems, due to the influx of workers and their families as well as the physical and at times dangerous nature of the work leading to more (and/or more complex) health care emergencies. For example, during the construction phase of a mine in north-central BC, there was an increase in both local and non-local workers at emergency rooms for occupational and non-occupational injuries and illnesses, putting a strain on health services. In addition, recruiting and retaining health care workers during 'boom' times can be challenging, due to high housing costs, wage competition from industry, and workforce pressures being placed on health care services which can lead to stressful work environments." (as cited in Aalhus, 2018, pg. 19).

This synthesis of mining and health research speaks to how day to day mine operations can draw on the healthcare system. What, however, would happen in the event of a disaster? At the Mount Polley mine, ~350km away from Kamloops, a tailings pond breached while the Ajax mine was going through the EA. This disaster came up during interviews such as by Ted:

> "the hospital is over capacity … what happens if there is a breach or an injury of a worker or some gas plume or whatever. What are you going to do, and their response was that they would call 911 and we already have a full emergency room? 911 is not an adequate response for an industrial catastrophe…911 is the first line of emergency response. That is tapping into our health care system".

From day-to-day healthcare system operations to disaster scenarios, there were concerns about healthcare service demands and needs. This was an underlying theme in the EA based on all of the information presented. The EA permit holder would have had to "retain under contract a general practitioner for the duration of Construction. The general practitioner must be available to provide healthcare services to the Project construction workforce for a minimum of 35 hours per week during Construction" (BCEAO, 2017, p. 29). However, that would only be one doctor, during the construction phase of the project. It is not explicit if this doctor would also see workers family members, in fact, it alludes to only being for the workers. Furthermore, as mentioned earlier, many interview participants commented that there were health professionals who stated they would leave town if the mine was approved.

5.2.5 Food and nutrition related issues – theme: food and nutrition

I will not linger long on this section as it was covered in length in Chapter 4. The key point is that nutrition was not mentioned in the EA but did come up in the interviews. For example, Hugh, from the health sector, stated:

> "there is no [good] data on consumption of traditional foods, it's really hard to say what the longer-term impacts of the reduction of those areas might be… [For First Nations it may] reduce their ability to consume those traditional foods and there's potential long-term health impacts like obesity, diabetes and all of those other things. Are they going to develop diabetes because of a reliance on processed foods because of a reduction in access to country foods or are they going to lose a historical food source leading to malnutrition"?

Jim, health professional, said:

> "diet has a huge impact on wellness and brain health. Your gut health is your brain health… So many of our families it's hard to access healthy foods. Not the ones with checkmarks on it but like whole foods and healthy foods. There is a lot of research done around showing that… eating high omega saturated foods like fish and avocados is more effective in treating depression then taking antidepressants".

The availability of healthy food is an important determinant of health and food security is a critical issue linked to resource development (Aalhus, 2018, pg. 18). There would have been a "requirement for one or more qualified professionals to conduct an analysis of dust deposition, water quality, soil, plant, and fish tissue for metals, for the purpose of determining their combined effect on the change in human health risk from baseline conditions, during Construction, Operations and Closure" (BCEAO, 2017, p. 31) had the mine been approved. There was mistrust in the proponent, a lack of clarity by interviewees what KAM had collected regarding baseline food data. That, in turn, reverberated feelings of skepticism and doubt in the process to protect environmental and human health (regarding country foods). This may have translated into a loss of traditional food sources and a shift to less healthy, nutritious, wholesome in some populations, e.g. the local First Nations communities. It also highlights that, for some, there was concern about nutrition and the loss of or trust in country foods.

5.3 Limitations (Phase 2 – interviews)

The limitations to the interview portion of this research were the participating interviewees, timeline for this study, and the fact that there is always more to investigate. I aimed to

purposively interview a number of people from a diverse group of sectors and I did have some key informants in mind. The main avenue for recruitment was the EA process itself and its publicly known stakeholders. Due to ethical considerations, I am not at liberty to state who participated and who did not. There were some individuals I wanted to speak to but they did not agree to be involved in this study. Through purposive and snowball sampling I interviewed who I could, in the timeframe available with fiscal constrains to this research in mind. I had no control over who participated and due to confidentiality, I am not in the position to mention who I spoke to. Unlike the document portion of this inquiry, which had substantial limitations, the interviews were robust and analyzed multiple times with extensive scrutiny.

5.4 Summary

In answering the second of my research questions (to what extent did the scoping phase of the EA for the Ajax mine use baseline health data and information?) I conducted a ground truthing exercise validating what was in the EA and how it aligned with baseline health concerns in Kamloops. There were clear important health priorities absent in the EA that emerged from the interviews.

For instance, air quality, one of the most heavily scrutinized VCs, did not factor in the mental health of those in the community who fear the potential dust related effects from the mine. I am not suggesting the mine could have changed this perception as the focus was on the air quality model and HHERA. However, as is the case with many EAs, the measures to actively curb or control pollution, e.g. the Air Quality Management Plan and Fugitive Dust Management Plan, were conditions of permit approval were yet to be written. There was an absence of participants' ability to be involved in those subsequent plans, which added to a heightened sentiment of mistrust.

This leads me quite clearly to the inclusion of mental health in the EA. While mental health was included in the SES, this VC was scoped out of the EA. Conversely, in the interviews it came through as a very strong theme. It permeated many other subthemes, presented in Table 8. The Habitat Health Impact Assessment Consulting (2016) report, referenced by the BCEAO and CEAA (2017) in their jointly produced summary stated that:

> "the EIS/Application did not directly assess the role of psycho-social components of health, such as stakeholders' perceptions of risk related to Ajax… a person's perception of risk due

> to Ajax could increase their stress levels. In their response, KAM acknowledged that potential effects on mental health and stress due to Ajax were not explicitly addressed in the EIS/Application. However, KAM said that potential project effects that may have an influence on mental health were assessed in various sections of the EIS/Application and that mitigation measures are identified in the EIS/Application to minimize adverse effects. KAM reported that perceived risks tend to be related to a lack of trust and confidence in Ajax and proponent" (p. 186).

There was the issue of how this mine might have also strained a community with mental health as the most dominant chronic disease in it (Chronic Disease Registry, 2015/16 as cited in Interior Health, 2018, p.4).

A further gap in the AIR was the economic benefits vs. trade-offs. The influence that the population influx (or loss) could have had on the social fabric of Kamloops (Habitat Health Impact Assessment Consulting, 2016b). For instance, social and economically connected trade-offs could have demonstrated in the community through bust and boom cycles typical of the mining sector and its impact on property value fluctuations. Fred stated that:

> "they are trying to build fear that if we don't have that mine then a lot of jobs won't come to the community and other industries won't want to come here…. There's too much fear in the economic losses… but, our wealth is our health."

While the mine would have clearly brought jobs to town who might have left? And there was concern about negative impacts to the University and Tournament Capital brands that had been steering the city away from a resource-based economy. Some of these concepts were present in the EA but no mitigation measures made their way into the final document submitted to the federal and provincial Ministers for decision; that is, they were scoped out.

For food, the aspect of nutrition especially when thinking about the loss of traditional hunting and foraging lands was not considered in the EA. From a perspective of food, the area surrounding the Ajax mine site was predominantly ranch land and includes recreational fishing areas, such as Jacko Lake (Pípsell). As stated by health professional Hugh, "we don't have data on consumption of traditional foods so it's really hard to say what the longer-term impacts of the reduction of those areas might be". However, an avoidance of country foods due to perception of contamination was neither addressed in the EA (Habitat Health Impact Assessment Consulting, 2016b) nor were data collected to understand what the impact could have been. A few other interview participants echoed these sentiments by Pat and Jim respectively (who work in the health sector) stating that "there are two things that come to mind [about this mine] are agriculture and healthy eating habits" … "I worry about the environment and the animals around

it [the mine] because when we go hunt and eat them, they can be contaminated". There is this gap or uncertainty on how the mine would have played a role in country or traditional food consumption and if/how the public might have sought out alternatives, as stated by Hugh, "processed foods because of a reduction in access to country foods or a loss in historical food source leading to malnutrition"

The last dominant theme presented in the above chapter and scoped in the HIA interviews, on the inclusion of baseline health data and information, was specific to health care services. While it may be unreasonable to expect KAM to fix baseline health service delivery shortcomings in Kamloops there were issues that KAM could have exacerbated that were not considered in the EA. For instance, how might Ajax's workforce, their families, and others that would have left or come to town in light of the mine's activities have altered health care provisions in the City? There are baseline stressors such as physician recruitment and retention, an over capacity hospital, very limited walk-in clinic services, and "~30,000 people in Kamloops that don't have a family doctor" (as highlighted by Ted). There was an apparent lack of consultation with hospital management, emergency responders, practitioners delivering care for substance abuse, domestic violence, sexually transmitted infections, and mental health. As mentioned, the only proposed condition on permit was for the mine to retain one general medical professional to offer service to mine workers during the construction phase of the mine. Whether these health service-related challenges would have been addressed in future community amenity contribution agreements between the mine and the City remains unknown. As identified in the Habitat Health Impact Assessment Consulting report (2016b):

> "baseline data that are provided [in the documents] are not utilized in the assessment of effects, and so rationale for the indicators selected is unclear. For example, there are data describing potential years of life lost due to suicide, natural causes and accidents but there is no indication of how this information informs the assessment of effects of… health care service capacity. (p. 17).

There could have many other facets of the health care continuum that could have been included in the EA, rather than the sole focus on the retention of one doctor should the mine have been approved.

Table 9: Responses to the more in depth analyzed questions from each interview participant. Identifiers removed to ensure confidentiality is maintained.

Interviewee	Definition of health	Concept of health in the EA	Risks, impacts, opportunities	Institutional barriers (if applicable)
1	-connected to things you value -absence of stress and illness -social connectedness -wellness	-it is measuring things in a vacuum -one toxin, one stream bed	-compromise wellness -employment -the negatives outweigh the positives	-lack of valuing (environmental) health -lack of transparency in the process -true value of indicators (VCs)
2	-public health definition -reduce exposure to pollutants -health education & promotion	-scientific difficulty & technical issues -simple definition	-air quality, dust, deposition (food contamination)	-No
3	-skipped questions		-air quality -proximity of the mine to the community	-Yes -communication between disciplines on common linkages -need for quantitative as well as qualitative
4	-to achieve your goals without having limitations “thrust on them” -not just in clinical terms	-it is about mortalities and exposures -oriented towards quantifying population health	-proximity to the mine -dust, noise, vibration, loss of property (value) -anxiety and uncertainty of impacts -water contamination -catastrophic failure -loss of biodiversity -impacts to ranching -job creation -liability to taxpayers	-focused on an engineering model -overwhelms capacity -there are so many different specialists that need to come together -we need a Royal Society of Canada model -the BCEAO should not be directly connected to the premier’s office (the process should be separate from the politics of it) -risk assessment and management (the politics of it) should be separate
5	-SDH	-they talk about SDH “in that tomb of information” but their value of health is not exactly as my own -it’s about the major risks and management of those risks.	-air quality (explosions, haul roads, traction, geography) -water balance -slope stability -vibration and noise -dark skies -job creation	-yes, media influence on the public -the process getting bogged down with public concerns that may be or not be valid
6	-absence of disease (would be good) -socio-economic impacts	-very toxin based -not required to take a precautionary approach	-air quality (inversions) -psychological risk factors -errors & gaps in the process	-at every level

	-psychologically and physiologically -happy, healthy, engaged & contributing to maximising their lifespan	-lack of or uncertainties in the baseline -based on proof (in the absence of 'this' is there no risk?)	-transparency? (e.g. lack of assay test disclosure) -groundwater breaches	
7	-not just your physical but your mental well-being	-health effects as it pertains to toxicity -actual core samples are proprietary	-jobs (but it's a boom and bust industry) -add to the economy -"cost to our way of life"; healthy living and tournament capital brand -may be future challenges attracting students, professors, doctors, athletes -divisiveness felt in the community	-health impacts cannot be assessed by the proponent -should have a federal review panel -saying there's no impact is not true and it's not believable
8	-taking care of myself and my family – eating healthy, being active, and being able to 'suck it up when I can' -having social networks -having housing and being connected to your community -having a healthy environment to live in	-just physical health -lack of social connection inclusion -one's connection to the land -mental well-being or stress not included	-emotional impact of the mine -impact to connectedness and sense of community pride -opportunities are predominantly job creation (but what about educational opportunities or increases to services that the mine could assist with)	-barrier to including the 'lighter science' of impacts to emotions, community pride, having a voice -barrier to including the qualitative data as fact -risk perception vs. real risk
9	-having a healthy mind (no stress) -having a job -having a healthy body -eating healthy and being active -clean environment to live in	-concern about doctor retention' quality of teachers that will want to stay -service strain (e.g. drug, alcoholism, abuse supports)	-jobs don't overweigh the risks -(skilled) people and families may want to leave -impact to community pride	-No comment
10	-physical health, mental health, quality of life -sense of security -natural environments (or capital)	-health included as per what is measurable -no polling of people's feelings	-peoples fear (e.g. catastrophic failure) -impact on mental health -air quality -loss of quality of life	-perceived corruption -lack of Health Impact Assessment because of fear in the economic loss
11	-physical and mental well-being -not just the absence of disease	-health is focused on water, air, noise, vibration, food -community health and well-being is in there (but not being	-air is the main issue, dust, deposition on country foods, & groundwater impacts -job creation	-BC is open for business -magnitude of material -short timelines

		reviewed by 3rd parties aside from the regulators, e.g. BCEAO)		-monitoring after the fact and corrective action
12	-where spirituality & physicality intersect -living a long life without too many problems	-it is listening to the health data adequately but not responding to it well (in light of air modelling)	-air quality -water quality -doctor retention -red herring of community contributions if health impacts will occur (e.g. related to dust)	-no barriers -but the decision against this mine should have occurred in the beginning (how many times does the community have to say no)
13	-impacts to human health from soil, water, air, food -SDH	-no, the process does not adequately consider impacts to health	-air quality -emergency response and planning -adaptive management planning	-yes (no further explanation)
14	-wellness -the community, the people and the environment -the whole person, mental, social and physical health	-it looks at the impacts of the environment on health (on a specific person) -doesn't consider social or cultural impacts of health -not a fault of the process but the way our society still is	-air quality (concerns on the modelling) -water quality -potential for spills -noise -mental health and wellness -social and traditional impacts on health	-yes, internal capacity (professional experts, resources, competing workloads) -data gaps
15	-individual health is the responsibility of the individual (related to behaviours) -people rely too much on the health care system	-have to rely on the science and that we're being fed the correct story from those involved	-company investing back into the community (e.g. for the hospital)	-I see no barriers -I have not been involved and would participate if invited
16	-being able to go outdoors, having good food on the table, being generally happy -feeling good physically and mentally -being able to have choices -involved in your community	-biggest issue seems to be health -the effects of dust and different contaminants coming out of the mine -as long as its monitored (everyone does their due diligence) the impact on everyone's health will be at a minimum	-dust -contaminants (e.g. mercury) -the watershed (Jacko Lake and Peterson Creek) -spills	-location of public meetings were only in Aberdeen, for example, at the Coast Hotel ("it made it hard for a lot of people to get up there/up the hill")

Chapter 6 – Conclusion

6.1 Introduction

The objective of this chapter is to summarize the key research findings from this thesis. Using case study methodology, I sought to explore the inclusion of health in the Ajax mine EA proposal. To do so, I conducted an intermediate level HIA specific to the scoping phase of the assessment. I used the IFC HIA Guideline (2009) as a framework to build the research design. This design was structured by reviewing the health sections of the EA documents and interviewing key participants related to the case study. Interview respondents were selected by either being involved in the EA or identified as persons of interest knowledgeable in the EA, health or social service sectors. The findings illustrate inconsistencies between the EA and the HIA that was conducted for the Ajax mine. I highlight the main points in the following final sections and endeavour to answer the research questions investigated, which were:

Q 1) In the case of the Ajax mine, in what ways does the EA process include health impacts, as per established HIA frameworks, such as prescribed by the International Finance Corporation (IFC)?

Q 2) To what extent does the scoping phase of the EA for the Ajax mine use baseline health data and information?

As you can see below in Table 10, I recap the side by side ranked comparison of themes from the EA documents and HIA interviews by frequency of occurrence. The notes section of this table illustrates examples of health impacts included in the EA and/or gaps on the inclusion baseline health and information.

Table 10: Taken from Table 4 from Chapter 4 summarized the comparison from EA documents and HIA approached interviews. This comparison is based on and ranked by level of prevalence from the EHAs in the IFC HIA Guideline.

Environmental Health Areas (EHAs)	EA documents	HIA interviews	Notes
Exposure to potentially hazardous materials	2nd, 3rd	1st, 7th	Road dust, air pollution, and release events were topics of significant EA review.
Social determinants of health	10th	2nd, 3rd, 8th, 9th	This category includes psychosocial perceptions of health (inclusive of mental health).
Health services infrastructure and capacity	8th	4th	While this is discussed in the EA documents, the solution was to have one doctor hired and retained by KGHM to serve the mine's workers (and families).
Food- and Nutrition- related issues	6th	5th	While country foods & agricultural impacts occurred in both the EA documents and interviews. The EA documents did not address 'nutrition'.
Soil- and Water-borne diseases	1st	6th	Focus in EA documents and interviews was on chemical contamination of water.
Sexually transmitted infections	-	✓	Came up in one interview specific to baseline (i.e. absence of STI clinic in town)
Respiratory and Housing issues	4th	10th	Housing inflation, property damage, or loss of market value due to mine activities was emphasized.
Cultural health practices	5th	✓	This definition alone was quite different in EHA Guidance and EA documents. The Heritage Chapter focused on archaeological impacts and loss of traditional hunting & gathering sites.
Accidents and Injuries	7th	✓	Traffic Impact Assessment (TIA) discussion included in EA documents.
Noncommunicable Diseases (NCDs)	9th	✓	These topics were found in the Socio-Economic Report of the EA but were lacking in inclusion in subsequent EA documents (e.g. AIR).
Vector-Related diseases	-	-	
Veterinary Medicine and Zoonotic issues	-	-	
✓ = brought up in the HIA interviews but was not in the top ten emergent themes.			

6.2 Research Question #1 – EA document reviews

The EA documents helped to inform the first research question. My findings showed that bio-physical determinants of health dominated the assessment. Conducting a query search of key health related documents in the EA showed that water and air quality, exposure to potentially hazardous materials, housing and cultural health practices were the top five themes. There were many aspects of health considered in the EA. However, the main way the EA process included health impacts was from the identified themes emphasized by stakeholders, data availability, and the HHERA. The toxicological emphasis was clear in the EA, although much effort was made to step beyond a dose-response related review, through the Community Advisory Committee,

socio-economic report, and inclusion of VCs such as Healthy Living and Health Education and Community Health and Well-being.

The IFC Guideline gives equal weight to the EHAs whereas the EA did not. VCs that were absent entirely from the EA were veterinary medicine and zoonotic issues, vector related diseases, and sexually transmitted infections (STI). While less significant, EHAs in the context of the Ajax mine proposal factors, such as the lack of STI clinic in town, or connections between zoonotic issues, cultural health, and traditional foods was not referenced or made clear in the EA at all.

Taking a wider lens to the EA process, there was a recognized absence of any HIA overall. As stated evidently by CEAA and the BCEAO (2017), in their jointly produced summary report for consideration by the federal and provincial Ministers for decision to approve or deny the EA:

> "SSN and members of the public requested completion of a Health Impact Assessment to fully assess health risks related to Ajax. A Health Impact Assessment is a more comprehensive assessment than an HHERA, as it would consider SDH and community perspectives in addition to the physical determinants of health considered in an HHERA. KAM clarified that the HHERA considers baseline exposure levels for COPCs, changes to these levels resulting from Ajax, and the exposure pathways" (p. 176).

There was clear acknowledgment of the difference in how health could have been treated if an HIA was conducted versus the HHERA that was done. Habitat Health Impact Assessment Consulting & GatePost Risk Analysis (2016b) summarized this eloquently in the report produced for SSN that:

> "From a western perspective, the application includes data gaps and lacks a broad consideration of community health. Impacts to air quality are estimated to be protective of human health; however, there are some uncertainties in the modeling that need to be addressed. These uncertainties influence the assessments related to country foods and the HHERA. Community health impacts considered do not meet the standards of HIA: they exclude impacts associated with mental health and wellbeing (depression, anxiety, stress); social cohesion within the community, spirituality, faith and traditions; cultural activities; and health equity, [sic] and the assessment lacks meaningful input from stakeholders that puts into question the accuracy of conclusions being made" (p.33).

The EA did not, or did it profess to, include health impacts in the EA process as per established HIA frameworks, such as those prescribed by the International Finance Corporation (IFC). It extensively considered the biophysical determinants of health, from a western perspective, while attempting to step beyond bounds of a typical EA in BC. It, however, did not carry forward the social or less quantifiable aspects of health throughout the EA process.

6.3 Research Question #2 – HIA interviews

The scoping phase of the EA used readily available population health data and statistics as the main sources of baseline health information. In the integral SES report, there was additional data collected from key informant interviews, but this document was not explicit if any representative from health was included as part of this scoping activity. I bring this up as the main themes from the HIA interviews were air quality, mental health, economic trade-offs, nutrition, and health care services. The extent to which these themes were included (if at all) in the EA were incongruent between the EA documents and HIA interviews. As pointed out by Ted: "when they say baseline of a population, we are doing a terrible job of that in health care let alone the idea of an experimental project like this". Thus, if existing population health data being included as adequate has gaps in it there remains the question on how the EA endeavoured to and achieved filling those gaps. Social and health related impacts the mine could have exacerbated were related to the existing strain on sufficient health service delivery meeting the current needs of the population, trust in the EA leading to a mental health impact in and of itself, and nutritional loss of country foods due to a perception of risk. These issues were lacking in the EA and not included in the scoping phase.

6.4 Definition of health in the EA

An interview question that proved enlightening was what participants definition of health was and if they felt that the EA incorporated this definition. For this research, I used the WHO (1948) definition of health, where health is "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity". This definition is in line with the IFC HIA Guideline and Performance Standards characterization of health. For Jason, he said, "no, I don't think the process adequately represents or takes into account impacts to health". Or Tom, who highlighted "has KAM even defined [health]?" Reflecting on Table 9, almost every interview participant stated that they did neither believe nor felt the EA was incorporating their definition of health. In many of these instances the social determinants of health were coined as participants view of how they would define health and that the EA did not address health using a SDH definition.

6.5 Institutional barriers to include health in the EA

I continue this chapter by discussing the perceived institutional barriers felt by participants that, in some instances, led to effects of individual stress and mental health impacts. These institutional barriers could be connected to the impetus behind the battle of the experts that ensued in the Ajax mine's EA. This is due to the fact that mistrust in the EA propelled the public to hire their own outside reviewers to look at the AIR. Whether they were embedded as a stakeholder from the beginning or brought in later into the process as a concerned member of the public, a social service provider, someone in the public eye, a mid-level government employee, or outside spectator there were those interview participants who perceived barriers. While beyond a question for analysis I wanted to bring it forward in this concluding chapter as it raises a question echoed by many HIA scholars. Is integrated EA practice incorporating health in the same fashion as a stand-alone (or parallel) HIA. As stated by Sam:

> …" there are multiple levels of barriers formally through the process itself. The EA process is not a good instrument, it is a very blunt instrument for looking at health impacts and social impacts, it is geared towards approval so it is very much focused on an engineering model and I'm sorry to say that for deficiencies and looking for deficiencies and solutions".

Questions of trust came out in the interviews that permeated the EA. Thus, the discussion on institutional barriers is one of significance. It echoes I sentiment I was observing in practice, the barriers to include SDH into the EA.

6.6 Implications for practice

I chose to explore this research to inform my professional practice. As mentioned in the introduction, if the Ajax mine project had been on Vancouver Island, my geographical area of responsibility, I could have been the health representative at the table. In the field of healthy built environments, and as an EHO, I align with the BC Ministry of Health – Guiding framework for Public Health (2017) that states:

> "There is a growing recognition of the importance of natural ecosystems and resources for the health of populations, communities and societies. Climate change, resource depletion, pollution, animal health and species extinction all pose threats to health that need to be addressed. These issues will be of increasing importance in the 21st century" (p. 39).

This is reinforced by a letter written by the Health Authority MHOs, in response to the current BC EA revitalization process, which recommends:

> "enhancing staffing, expertise and resources within government and health authorities to be able to critically review the work of qualified professionals, participate in the EA process meaningfully and develop guidance and policy to support the EA process. Support the development of leading practice guidance and policy for community-level engagement and health and social impact assessment methodologies (MHO, 2018).

The Provincial Health Officer's (2018) annual report stated that there is an urgent need and desire to "establish a legislated health in all policies approach in B.C., using a HIA model that includes a requirement for assessing health and equity impacts for all proposed, new or revised policy, legislation or programming across the B.C. government" (PHO, 2018).

6.7 Conclusion

It is evident that no HIA was integrally embedded in the Ajax mine's EA. My research questions explored in what ways health impacts were included in the EA as prescribed by the IFC. And to what extent was baseline health data and information included in the assessment. It was evident in the findings that gaps were observed in the treatment of health, as social determinants were not defined, incorporated or used in the EA. However, there were many lessons learned from Ajax. The mine was ultimately denied its EA certificate. Future research could explore how impending IA revitalization in the province of BC, and federally in Canada, intends and does evolve to be more inclusive of baseline health data and the social view of health.

As summarized by Habitat Health Impact Assessment Consulting & GatePost Risk Analysis (2016a) "The practice of Health Impact Assessment was created to address narrow definitions of health and a lack of meaningful inclusion of community perspectives in the EA process and is widely supported by WHO (World Health Organization, 2016), lending banks (International Finance Corporation, 2009), and member-supporting mining organizations (International Council on Mining and Metals, 2010). However, this [Ajax mines EA] Project application does not include an integrated or stand-alone HIA" (p. 33). Leading to a poignant question posed by Cathy: "we will survive without the gold mine. Will we survive with it, that is the question?". How might we work together to alleviate these sentiments, or stop them, and

create a better IA process especially right now in light of regulatory overhaul? Where health is given the treatment many of us innately or intuitively feel is our basic human right? How might we move towards a true integrated process where human health is provided the same level of protection as other pillars of EA review and reinforce trust in a fifty-year-old process where we may innovate and learn process from follies of the past? These are some of the questions I pose for future work and lines of inquiry.

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Appendix A – Interview Guide

University of Victoria

Draft Email Script Used to Recruit Participants

Title of Research Project:
The practice of integrated Environmental Assessment in British Columbia – using established frameworks to evaluate the inclusion of baseline health data

Informing Potential Participants of Research

Potential participants will be contacted via email and informed of the research project. The email script is as follows:

I am a student at the University of Victoria conducting a research project on the Environmental Assessment for the Ajax mine. The focus of this research is on the inclusion of baseline health data specific to the scoping phase of the assessment.

Purposeful participant:
*You have been identified as a potential participant due to your public submission(s) on the BC Environmental Assessment Office website (*http://a100.gov.bc.ca/appsdata/epic/html/deploy/epic_project_home_362.html*).*

Snowball participant:
You have been identified as a potential participant as an expert in the field being researched.

Asking Potential Participants for Their Consent to Participate

Following the above description, I will ask the potential participant if he or she would like to participate in an interview (45 min) related to their participation in this EA. The dialogue is below:

Would you be interested to participate in an interview? The information you provide is confidential and you are free to withdrawal at any point during the research. Is there any other information I may provide at this time?

For any potential participants with whom i have had a prior professional or other relationship with I will also state that: due to our prior (professional) relationship and/or affiliation I want to be clear that you should not feel obligated or pressured in any way to participate and that there will be no repercussions if you decide to participate or not.

Providing Participants with Explanatory Note of Research

The consent form will be attached to this intro script email and explained to the participant:

For more information on this research please see the attached consent form. If you would like to participate i will need either your signed or verbal consent as per the attached form. Please do not hesitate to contact me (or my supervisor) should you have questions and/or concerns.

If applicable, any other ethics departments that need to be consulted will be and their requirements met. If the individual wishes to proceed with the interview, the participant will then sign the consent form (or provide verbal consent if they deem that acceptable) and are provided with a copy before any interviews are scheduled and commence.

Thank you for your consideration and time.

Sincerely,
Jade Yehia
Principal researcher

Dr. Michael Hayes
Supervisor

INTERVIEW QUESTIONS

i. What is your profession? _____ Could you describe what your roles and responsibilities are in your job? (*question for context and not included in analysis*).

1. Do you work in Kamloops? Yes, or No Skip to Question 3
    a. How long have you been working in Kamloops? Years ____ Months _____
2. What are the key health priorities in Kamloops right now, in your opinion?
    a. For men?
    b. For women?
    c. For children?
    d. The elderly
    e. For families?
3. Thinking on these 'key health priorities' is there anyone you would consider more vulnerable from a health perspective in the Kamloops area? Yes, or No
    a. If yes, who?
    b. To what?
    c. Could you please expand on this?
4. What has been your observation on the following associated with current resource projects?

    a. New Afton
    b. Highland Valley Copper
        i. Impacts?
        ii. Risks?
        iii. Opportunities – such as?
5. Have you been involved in the Environmental Assessment process for the Ajax mine thus far? Yes, or No
    a. If so, how?

We're interested in hearing your view on health and how it is incorporated into the current BC Environmental Assessment process.

6. How would you define health?
7. Is the current Environmental Assessment process adequately incorporating your perspective on health?
    a. Yes, or No
8. Based on your experience, your observations, what do you feel are associated with Ajax?
    a. The critical health risks
    b. Critical health impacts
    c. Any opportunities
9. *(If applicable and participant was involved in reviewing the EA for the Ajax mine)* Being that you were (formally as an active stakeholder/informally as a community member)
    a. (If Not Applicable skip to Q11)
    b. Were you provided any supports to assist in your review of project documentation?
    c. Such as personnel?
    d. Resources?
    e. Did you use any references in your review of the Environmental Assessment? Yes (If No Skip to Q12)
10. Do you feel there are any institutional barriers to including health (or Health Impact Assessment if participant is familiar with this terminology) into the existing Environmental Assessment process (as it relates to the Ajax mine proposal)?
11. Is there anything I haven't asked you that I should?
12. Is there anyone else I should speak with? Yes, or No (Name and contact details _____)

Appendix B – EHA Definitions

Table 11: Environmental Health Area definitions from IFC Introduction to Health Impact Assessment (IFC, 2009, p. 21)**.**

Environmental Health Areas (EHAs)		Definition from IFC HIA Guidance
1.	Vector-Related diseases	Malaria, schistosomiasis, dengue, onchocerciasis, lymphatic filariasis, yellow fever, and so on.
2.	Respiratory and Housing issues	Acute respiratory infections (bacterial and viral), pneumonias, tuberculosis; respiratory effects from housing, overcrowding, housing inflation.
3.	Veterinary Medicine and Zoonotic issues	Brucellosis, rabies, bovine TB, bird flu, and so on
4.	Sexually transmitted infections	HIV/AIDS, syphilis, gonorrhea, chlamydia, hepatitis B
5.	Soil- and Water-borne diseases	Giardiasis, worms, water access and quality, excrement management
6.	Food- and Nutrition- related issues	Stunting, wasting, anemia, micronutrient diseases (including deficiencies of folate, Vitamin A, iron, iodine); changes in agricultural and subsistence hunting, fishing, and gathering practices; gastroenteritis (bacterial and viral); food inflation
7.	Accidents and Injuries	Road-traffic related, spills and releases, construction (home- and project-related) and drowning
8.	Exposure to potentially hazardous materials	Pesticides, fertilizers, road dust, air pollution (indoor and outdoor, related to vehicles, cooking, heating, or other forms of combustion or incineration), landfill refuse or incineration ash, and any other project-related solvents, paints, oils or cleaning agents, by-products, or release events
9.	Psychosocial	Including psychosocial, social production of disease, political economy of health, and eco-social issues such as resettlement or relocation, violence, gender issues, education, income, occupation, social class, race or ethnicity, security concerns, substance misuse (drug, alcohol, smoking), depression and changes to social cohesion, and so on
10.	Cultural health practices	Role of traditional medical providers, indigenous medicines, and unique cultural health practices
11.	Health services infrastructure and capacity	Physical infrastructure, staffing levels and competencies, technical capabilities of health care facilities at district levels; program management delivery systems; coordination and alignment of the project to existing national- and provincial-level health programs (for example, TB, HIV/AIDS), and future development plans
12.	Noncommunicable Diseases (NCDs)	Hypertension, diabetes, stroke, cardiovascular disorders, cancer, and mental health

Appendix C – Baseline health data (taken from interviews)

Table 12: Comments made by interview participants pointing out unique challenges for these respective demographic groups.

Woman	**Men**	**Elderly**	**Children**	**Families**
-stress related illnesses -sleep deprivation	-levels of inactivity -high meat consumption (or unhealthy diets) -substance abuse and alcoholism -smoking	-cancer and COPD -home care supports -ageing population -dementia and Alzheimer's -aging in place -adult care facilities (lack of space or costs associated with private pay) -connection to place	-asthma (exacerbation with e.g. forest fires) -safety at school -mental health -drug and alcohol experimentation -encouraging local employment (with higher waged jobs)	-cost of living -lack of affordable rentals -accessing activities for families in an affordable manner
Vulnerable				
-First Nations communities -seniors, babies/children, pregnant woman, people with respiratory difficulties, heart disease, or underlying health conditions (chronic ailments) -residents living in industrial area at the Valley bottom; lowest income groups -people with disabilities -people with language barriers -proximity of this mine to town -marginalized people, such as those living on the streets or are addicted to drugs				

Table 13: Some of the emergent themes mentioned by interview participants around baseline health challenges and priorities for the City of Kamloops.

General comments on health priorities or challenges voiced by interview participants (for the City of Kamloops and to a lesser degree the surrounding Region)
Social determinants of health; Noncommunicable diseases (recreation and healthy living); Cultural health practices; Food and nutrition; respiratory and housing issues -chronic disease management (COPD, hypertension, heart disease, diabetic or diet counselling) -broad Social Determinants of Health improvement -obesity, diabetes related to a reduction in the ability to consume traditional foods -stability of housing, housing availability, affordability, and stability of real estate prices -affordability for housing, food (use of the food bank), eating healthy, electricity/amenities -homelessness (there is only one woman's emergency shelter in town) -agriculture and healthy eating -spiritual connection to environmental areas (i.e. bodies of water) -Tournament Capital Centre facilities, brand, and draw for athletes -parks and recreational opportunities and programming -people in Kamloops valuing their outdoor activities, fishing hiking, boating, biking, cross country skiing, running… -lack of robust health data (by HAs, BC Cancer Agency, MoH) – linkages to next section *Health services infrastructure and capacity:* -shift work in the community (one participant mentioned insomnia being prevalent in town) -getting sent home from acute care even if you are not ready due to lack of beds -ability to age in place -social network and connectedness; supporting connectivity -mental health and substance abuse (fentanyl overdoses) -- waitlists -complex care and lack of specialists

-access to health care services that is culturally safe
-lack of STI clinic in town
-very few walk-in clinics in town (in fact there are 2-3 walk in clinics, and they are typically full up by 9am)
-some people not accessing health care services (because of past experience) until the situation needs more dire attention (such as going to the ER)
-hospital at ~30% over capacity (with a new wing slated to be built)
-1/3 of people in Kamloops have no family physician (that is ~30,000 people)

Exposure to potentially hazardous materials (including air quality); Soil and water related issues
-Air quality (Airshed Management Plan) – reducing PM2.5 (respirable particulate) – "every Airshed has a capacity"
-higher rate of smokers
-noteworthy improvements to water treatment system in Kamloops
-industrial outputs (air quality related) from e.g. Domtar – Kamloops is an industrial hub
-political cycles challenging to deal with longer term health priorities
-greenhouse gas reduction
-biophysical environmental concerns (traditional environmental health): safe drinking water, country foods
-this project is a major impact to health
-perceived environmental link to cancer clusters (e.g. -higher incidence of leukemia in Brocklehurst)
-areas with arsenic (or other chemical contamination issues) in drinking water

Accidents and injuries; Noncommunicable diseases
-heart health and active transportation
-transportation corridor (train, trucks and cars)
-public transit and biking not very accessible (e.g. Aberdeen not very walkable [topography plays a role])
-less auto dependence (car centric community)