

**Inuvialuit Perceptions of Contaminants and Communication Processes
in Sachs Harbour, Northwest Territories**

by

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Abstract

Since the relatively recent discovery of elevated concentrations of contaminants such as mercury and persistent organic pollutants in the Arctic, Inuvialuit have been receiving information about the potential impacts of these contaminants on the environment, wildlife, and human health. Almost 20 years of communication efforts have resulted in only a general awareness of contaminant issues, as the focus on perceptions of message content has overlooked the important impact of communication processes (methods, sources) on message reception, understanding, and acceptance. For this research, interviews, focus groups, and informal conversations were used to explore the myriad of contaminant perceptions and associations held by Inuvialuit in Sachs Harbour, NT, as contaminants were used as a case example to investigate perceptions of and recommendations for science communication. Concepts of respect, time, and relationships influenced the inter-related impressions of communication processes and research/researchers (the mediums), which in turn influenced perceptions of contaminants among participants. The medium is thus an important part of the message in scientific communication, and is implicated in the conduct of research and research communication in small, remote Arctic communities.

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Dedication

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With love, from one biggest fan to another.

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post nubila phoebus

after clouds, sun

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List of Abbreviations

AANDC – Aboriginal Affairs and Northern Development Canada (formerly INAC, DIAND)

AiP – Agreement in Principle

ARI – Aurora Research Institute

BFRs – Brominated flame retardants

CAA – Canadian Arctic Archipelago

CASES – Canadian Arctic Shelf Exchange Study

CCGS – Canadian Coast Guard Ship

CFL – Circumpolar Flaw Lead System Study

COPE – Committee of Original People’s Entitlement

DEW Line – Distance Early Warning Line

DGM – Dissolved gaseous mercury

DIAND – Department of Indian Affairs and Northern Development

GEM – Gaseous elemental mercury

HCHs - Hexachlorocyclohexanes

HgP – Particulate mercury

HgT – Total mercury

HTC – Hunters and Trappers Committee

IDC – Inuit Development Corporation

IFA – Inuvialuit Final Agreement

IGC – Inuvialuit Game Council

IHS – Inuvialuit Harvest Study

INAC – Indian and Northern Affairs Canada (formerly DIAND)

IPY – International Polar Year

IRA – Inuit Research Advisor

IRC – Inuvialuit Regional Corporation

ISR – Inuvialuit Settlement Region

ITK – Inuit Tapiriit Kanatami (formerly ITC)

ITC – Inuit Tapirisat of Canada

MeHg - Methylmercury

NCP – Northern Contaminants Program

PAHs – Polyaromatic hydrocarbons

PFCs – Poly- and perfluorinated compounds

POPs – Persistent organic pollutants

RGM – Reactive gaseous mercury

Chapter 1: Introduction

1.1 Preface

Inuvialuit, as Inuit of the western Arctic identify themselves, are intrinsically linked to, and have known their environment since time immemorial (Berkes and Berkes 2009; cf. Bielawski 1992; Stairs and Wenzel 1992; O'Neil et al. 1997b; Rybczynski 1997; Fienup-Riordan 1999; Brody 2000). Generations of accumulated experiences have provided a baseline of knowledge regarding the inter-related elements of weather, climate, transportation, wildlife, harvesting, land, and sea ice, which are physically, socially, spiritually, economically, and emotionally linked to their cultural identity (Usher 1973, 2000, 2002; Ris 1998; Dickson and Gilchrist 2002; Van Oostdam et al. 2005; Whittles 2005; Pauktuutit 2006; Donaldson et al. 2010; Harwood and Kingsley 2013). Their knowledge has equipped them with an acute awareness of accelerating environmental changes while concurrently enabling the development of coping mechanisms and adaptive strategies to contend with climatic variability. (Riedlinger 2001b; Berkes and Jolly 2001; Ford and Pearce 2010; Pearce et al. 2010) Contaminants, however, present a dichotomous issue with which to contend, as their relatively new existence is not part of Inuvialuit oral history or their areas of expertise as lived experience, and their invisible nature is at odds with traditional, observational ways of knowing. (Bielawski 1992; O'Neil et al. 1997a, 1997b; Egan 1998; Berkes 2009; Berkes and Berkes 2009).

Environmental contaminants, as studied by researchers, comprise a group of invisible substances or chemicals such as heavy metals, and persistent organic pollutants (POPs), comprising organochlorine, brominated, and fluorinated compounds among others. Used and produced mostly in southern latitudes in industrial operations, pesticides, disposal mechanisms and flame-retardant material, these compounds were discovered in

Arctic human populations and their traditional subsistence foods in the 1970s (Usher et al. 1995). Almost two decades of research in the Arctic has elucidated contaminant transport mechanisms, biological processes, and environmental physico-chemical reactions, yet scientific uncertainties and understandings of contaminants continue to develop (Myers and Furgal 2006).

Inuvialuit living on Banks Island have been exposed to various forms of research since the island's only community, Sachs Harbour, was formally established. An increase in the number and extent of projects in recent years have focused on interdisciplinary approaches to studying climate change, including investigations into contaminants in the environment that exacerbate climate change through positive feedback loops (cf. Macdonald 2005; Macdonald et al. 2005; Outridge et al. 2008; Stern et al. 2012). Contaminants research conducted through the International Polar Year's Circumpolar Flaw Lead System Study (IPY CFL), Environmental Monitoring Projects from the Northern Contaminants Program (NCP), and ArcticNet provide the scientific context through which to explore Inuvialuit perceptions of contaminants and the communication of complex contaminants research. The community of Sachs Harbour, Northwest Territories, was chosen for this project due to its small population, the community's involvement in these research initiatives, and community interest.

1.2 Knowledge Gaps

Inuvialuit and other northerners have been receiving information about environmental contaminants and their potential impacts on environmental, wildlife, and human health for almost twenty years (Van Oostdam et al. 2005). While messages regarding the safety of traditional foods have improved over time to be more appropriate and sensitive, more than a decade of considerable effort put into disseminating this

information has resulted in only general awareness of contaminants issues (Myers and Furgal, 2006). Additionally, the construction of the research process warrants further consideration (Gearheard and Shirley 2007), as Inuit and Inuvialuit are increasingly the subjects of contaminant-related human health studies while remaining largely uninformed by the study. To best inform northerners about contaminants research, the voices in the community need to be heard; it must not be assumed that the best way to communicate results to communities is known without consulting the community members themselves.

The need for culturally appropriate communication of contaminants messages has been stressed over the past several years (Furgal et al. 2005). Using contaminants research as a case study, this science communication study emphasizes the development of a collaborative research relationship with the community of Sachs Harbour (ITK and NRI 2007) to explore a different way of approaching the concept of communication. The importance of using a collaborative approach in the context of extended visits to the community to build trustworthy relationships is key to successful reciprocal knowledge sharing with participants (Jardine and Furgal 2010), distinguishing this project from previous contaminant-communication studies.

1.3 Project Rationale and Research Questions

1.3.1 Rationale Statement

Past science communication work has focused only on message content and target audience perceptions of the message itself, while disregarding how audiences perceive the communication processes (methods and sources) that are the primary means through which a given message is disseminated. Therefore, perceptions of the mediums – the ways that communication is approached and carried out, and impressions of communicators (e.g. researchers) and the research process – may be of notable importance to perceptions of the

message. To address this knowledge gap, this thesis explores how the interconnected perceptions of communication processes influence perceptions of content among target audience members in the construction of messages about scientific information in Canadian Arctic communities. Specifically, it considers perceptions of long-range atmospheric and oceanic contaminants and contaminants communication in the Inuvialuit community of Sachs Harbour, NT, Canada as a case study, and illuminates community-based recommendations for how contaminants research can be communicated to Inuvialuit communities in accessible, understandable, and relevant ways. Broadly, this thesis proposes that the medium is an important part of the message in science dissemination strategies (cf. McLuhan 2006), with implications for how research and research communication are conducted in small, remote locations such as northern communities.

1.3.2 Research Questions

This thesis raises the following three research questions to address the aforementioned knowledge gap and situate Sachs Harbour Inuvialuit responses in the context of previous contaminant research conducted in Canadian Inuit communities:

1. How do Inuvialuit in Sachs Harbour perceive contaminants?
2. What are Sachs Harbour Inuvialuit perceptions of and recommendations for research communication content and processes regarding contaminants?
3. What elements influence scientific research communication, that in turn impact the reception, understanding, and relevance of the message information, such as contaminants?

The first research question is addressed through the first objective, stated below, while the three remaining objectives address the inter-related aspects and components of the second and third research questions.

1.4 Thesis Objectives and Organization

1.4.1 Thesis Objectives

In broad terms, project objectives are to explore participants' knowledge and perceptions of contaminants research and how it is communicated to communities, and discuss, from a community perspective, how contaminants research can be disseminated to communities in ways that are accessible and applicable to their daily lives.

More specifically, the objectives of this thesis are four-fold. First, this thesis aims to express the diversity of opinions and perceptions that Sachs Harbour Inuvialuit have with respect to contaminants, and to situate this in the contexts of Bankslander history and culture, and previous and ongoing research projects – contaminant-related or not – within the Inuvialuit Settlement Region and the community itself. Second, within the same context, this thesis endeavors to demonstrate Sachs Harbour Inuvialuit perceptions of past contaminant research communication and convey their recommendations for future communication strategies. Third, as an element that became evident through discussions about communication, Sachs Harbour Inuvialuit impressions of research and researchers will be explored as to their associations with communication perceptions and recommendations. Lastly, this thesis will explore the emergent notions of respect and time that constitute underlying principles connecting the mediums of research/researcher impressions and views regarding communication, which may contribute to the reliability, acceptability, awareness, and retention of information regarding contaminants for Sachs Harbour Inuvialuit.

1.4.2 Thesis Organization

This thesis is written in an extended manuscript format. Chapter 2 provides a literature review of contaminants in the Arctic that highlights the scientific knowledge and understanding of contaminants, which is followed by an overview of past and current contaminant-related research dissemination efforts. Chapter 3 discusses the community of Sachs Harbour as an integral component of this project, outlining important elements of geography, history, culture, politics, economy and identity that contributed to shaping Bankslander perceptions of contaminants, research, and research communication. A description of the project design, methodology, development, analysis, and ethical considerations comprise Chapter 4, followed by a descriptive presentation of project results in Chapter 5. Exploratory interpretations of the results are discussed in Chapter 6, which precede final remarks and recommendations in Chapter 7.

Chapter 2: Contaminants in Canadian Arctic Environments and Contaminants Research Communication

2.1 Preface

Commonly thought of as a 'pristine' wilderness, the Arctic environment is highly sensitive to change. In the early 1970s, the issue of contaminants in Canadian indigenous people, their country foods, and environment emerged through the highly publicized and politicized discovery of methylmercury in freshwater fish, and Anishinabe and Cree people of northern Ontario and Québec (Wheatley et al. 1979; Usher et al. 1995). Concurrently, measurements of mercury and persistent organic pollutants in marine mammals and fish began, with their presence in the Arctic merely considered as background information for studies conducted closer to source regions (Muir et al. 2005a). Elevated levels of polychlorinated biphenyls (PCBs) in Inuit of Qikiqtarjuaq, NU (formerly Broughton Island; Kinloch and Kuhnlein 1988), and PCBs and methylmercury in Nunavik (Dewailly et al. 1989; Poirier and Brooke 2000) were discovered throughout the late 1970s-1980s; associated inaccurate media accounts, sensationalism, and lack of communication strategies created alarm among Inuit (Wheatley 1994; O'Neil et al. 1997a), resulting in a cascade of economic, social, and human health consequences (Usher et al. 1995; Wheatley 1996). Subsequently, this prompted the expansion of contaminant measurements and monitoring throughout the Canadian Arctic, accompanied by various communication strategies and programs that have been met with low levels of success (Myers and Furgal 2006). The following 40 years has seen a major increase in the interest about anthropogenic contaminants concurrent with extensive efforts attempting to determine the pathways by which contaminants travel and ultimately accumulate in Arctic ecosystems, especially with respect to high concentrations

of organochlorine (OC) contaminants and mercury that have been documented in biota and northern consumers (Fisk et al. 2005; Muir et al. 2005b).

Comprehensive reviews have improved the scientific knowledge base in understanding contaminant characteristics (cf. Braune et al. 1999; Muir et al. 1992, 1999) and the implications of contaminants on Inuit health (cf. Van Oostdam et al. 1999). More recent publications have been compiled in special editions of the journal *Science of the Total Environment* in 2005 (cf. Braune et al. 2005; Campbell et al. 2005; Evans et al. 2005a, 2005b; Fisk et al. 2005; Gamberg et al. 2005; Hickie et al. 2005; Lockhart et al. 2005; Muir et al. 2005a, 2005b; Rigét et al. 2005; Stern et al. 2005; Van Oostdam et al. 2005; Wagemann et al. 2005), and in 2010 in association with the sixth 'State of the Arctic Environment' report produced by the Arctic Monitoring and Assessment Programme (AMAP 2009; cf. Butt et al. 2010; de Wit et al. 2010; Donaldson et al. 2010; Hung et al. 2010; Rigét et al. 2010; Weber et al. 2010). Efforts such as these continue to increase the expanding and changing understanding of contaminant processes.

Inuvialuit knowledge is situated in language-based ways of knowing, where language shapes terms and concepts (cf. Berkes and Berkes 2009). As this study focuses on Inuvialuit perceptions of contaminants and the communication of contaminant information, terminology and meaning are thus of significant importance. In order to contextually understand participant meanings of 'contaminants', we must first distinguish the scientific conceptualization and current understanding of contaminants, as it is from this point of reference that contaminant information has been disseminated in the past (Myers and Furgal 2006). Previous endeavours to communicate contaminants research are then reviewed to situate the perceptions and recommendations that Sachs Harbour Inuvialuit have regarding contaminant communication efforts.

2.2 Terminology

2.2.1 'Contaminants'

Depending on context, the word 'contaminant' can have very different meanings, ranging from general or colloquial terms to specific categories of substances. Furthermore, words such as 'toxic' or 'pollution' are often used interchangeably with 'contaminants,' yet they are not synonymous. Toxins are poisonous substances produced via metabolic processes in living organisms, and toxic refers to something that is poisonous or contains poisonous materials that are capable of causing extreme harm; toxins can thus be considered a sub-category of poisons, which are natural or manufactured substances that are harmful or deadly to living cells (SLH 2012). Furthermore, the toxicity of a substance depends on its prevalence and concentration, at which point it could be considered a contaminant or pollutant. According to Stengel et al. (2006: 361):

'Contaminants' are defined as inputs of alien and potentially toxic substances into the environment; not all contaminants cause pollution, as their concentrations may be too low. 'Pollutants' are defined as anthropogenically-introduced substances that have harmful effects on the environment. Sometimes the distinction between contaminants and pollutants is not simple, since concentrations at which contaminants become pollutants cannot always be defined; also long-term damage to organisms or systems may occur that is not evident initially.

Thus a contaminant may or may not be a pollutant; an environment can be contaminated without being polluted, but you cannot have a polluted environment without it being contaminated. With respect to biological systems, for example, if mercury concentrations in the brains of Arctic marine mammals are above toxicity thresholds, this contaminant can be considered a pollutant (F. Wang, pers. comm., June 2014).

The range of substances scientifically studied as contaminants through the Northern Contaminants Program (NCP) and the Arctic Monitoring and Assessment Programme (AMAP) fall into three main categories: persistent organic pollutants (POPs), heavy metals,

and radionuclides (NCP 2011). Heavy metals most commonly monitored include cadmium, lead, and mercury, yet only mercury will be addressed here, as per AMAP (2011), as their associated issues differ significantly. Although lead and cadmium are naturally occurring in the environment, anthropogenic industrial sources have increased their release, resulting in elevated levels in some Arctic wildlife and human populations (cf. Evans et al. 2005a; Fisk et al. 2005; Gamberg et al. 2005; Macdonald et al. 2005; Muir et al. 2005; Van Oostdam et al. 2005; AMAP 2009; Donaldson et al. 2010). Routes of human cadmium exposure have been well documented and defined; cigarette smoking remains the predominant means, in addition to the consumption of caribou tissues and organs. The introduction of lead-free gasoline and a ban on lead shot used for hunting have greatly reduced human exposure and lead deposition across the Arctic. Conversely, mercury exposure pathways, transport, and the processes of methylation to a toxic bioavailable form are not understood to the same extent, and mercury levels are observed to be increasing in some areas; as such, mercury continues to pose uncontrolled risks to Arctic wildlife and humans. Furthermore, based on established health guidelines, exposure to radionuclides occurs at lower levels than heavy metal and organic contaminants, and since they have not received as much attention or concern, they will also not be addressed (Myers and Furgal 2006).

For the scope of this thesis, POPs and mercury constitute contaminants that are of particular concern in Canada's North due to their persistent, toxic, and bioaccumulative characteristics, and because they are capable of long-range atmospheric and oceanic transport.

2.2.2 Biomagnification and Bioaccumulation

Xenobiotic substances that increase in concentration with each trophic level in aquatic food webs where the elimination rate of the substance is less than the rate of uptake

is the process termed biomagnification (Borgå et al. 2004). Whereas biomagnification occurs through food webs, bioaccumulation is a process related to an individual organism over time, defined as the net process through which the chemical concentration in an aquatic organism exceeds the chemical concentration in the water resulting from chemical uptake through all exposure routes and chemical elimination through all possible routes (Borgå et al. 2004). Another process, termed bioconcentration, occurs when aquatic organisms accumulate chemicals directly from the water (Borgå et al. 2004), yet this primarily refers to persistent OC contaminants, except for the diffusion of some mercury species through the membranes of microorganisms (Morel et al. 1998). Water is not considered to be a major contaminant exposure route for vertebrates, where the dominant means of exposure is through food consumption (Fisk et al. 2003). Essentially, short-lived lower trophic species that are in great abundance each contain relatively small amounts of a contaminant; predation through the food web results in subsequently larger species with greater energy requirements consuming larger quantities of lower trophic species, hence increasing their own contaminant burden through biomagnification. Since higher trophic species are also longer-lived, their contaminant load will also be affected by consumption of contaminated organisms over time, leading to bioaccumulation of the substance.

2.2.3 On the Significance of Contaminants in Arctic Environments

As summarized by Macdonald et al. (2000), the influx of globally transported contaminants to the Arctic (and Antarctic) occurs through a process termed 'global distillation' whereby contaminants travel to the poles and condense with varying degrees of effectiveness; the time it takes a given contaminant to complete this journey depends on its physico-chemical properties and prevailing oceanic and atmospheric conditions. Since relatively small amounts of contaminants released from southern latitudes reach the Arctic

– compared to what remains in temperate regions – a mismatch occurs when the resulting contaminant concentrations measured in Arctic environments exceed those at temperate latitudes; this is caused by both physical and biological pathways (Macdonald et al. 2000; cf. Wang et al. 2010). While global contaminant cycling also occurs in temperate regions, the presence of these compounds in the Arctic is of particular concern due to three unique characteristics: contaminants have long residence times in the Arctic; many Arctic and Subarctic peoples rely on subsistence foods which bioaccumulate high levels of contaminants; and these northern populations have not produced or used these compounds to any appreciable extent nor have they directly benefitted from the production and increasing use of these compounds (Macdonald et al. 2000). The presence and consequences of Arctic contaminants are of intense interest and concern for both Inuit and scientists. Thus, the uniqueness of Arctic environments, wildlife, and human populations as interconnected aspects of a whole system, illustrate the importance and necessity of understanding biotic and abiotic contaminant cycling and effects.

2.3 Persistent Organic Pollutants (POPs)

2.3.1 Legacy POPs

Persistent organic pollutants comprise a large group of anthropogenically-produced chemicals including pesticides and compounds that stem from industrial and disposal processes. The characteristic chemical properties of these substances enable them to resist degradation, persist in the environment, travel over long distances from point sources, and accumulate in biota and humans (Van Oostdam et al. 2009). Since the early 1970s, the concentrations of many OC chemicals, such as PCBs and dichloro-diphenyltrichloroethane (DDT), were observed to biomagnify through Arctic food webs (Hickie et al. 2005), and they have since been considered ubiquitous throughout the Arctic environment. Since POPs

have seen little direct release in the north, their presence indicated that the Arctic serves as a contaminant sink for substances originating from southern latitudes (Macdonald et al. 2000), with Arctic biota bearing the brunt of the consequences of indirect contamination via long-range atmospheric and oceanic transport (Fisk et al. 2005). Concerns for wildlife and human health – such as observations in the late 1980s that Inuit who consumed marine mammals in their country food diet had higher PCB levels than southern Canadians (Dewailly et al. 1989) – prompted the need to reduce contaminant intake; yet the only long-term solution to decrease the elevated levels of POPs in the Arctic is the reduction or elimination of their release into the environment at source locations (AMAP 2009).

Legacy POPs are past-use chemicals whose production and use is banned or severely restricted under the Stockholm Convention, a legally binding agreement for global POPs management created through the United Nations Environment Program (UNEP). Signed in 2001, the treaty was put into effect in 2004, and ratified by 153 countries as of 2008 (AMAP 2009). As such, their current presence in the environment is a result (a 'legacy') of past releases (Rigét et al. 2010). In addition to twelve legacy POPs (the 'dirty dozen') that are governed by the convention, eleven more were proposed for inclusion in 2009 (AMAP 2009), of which ten were accepted (Stockholm Convention 2011).

For legacy POPs, Table 2.1 indicates the three categories under which POPs are classified according to the convention (pesticide, industrial chemical, industrial by-product), including their intended manufactured usage and observed health impacts to wildlife and humans. Pesticides include aldrin, chlordane, DDT, dieldrin, endrin, heptachlor, hexachlorobenzene (HCB), mirex, and toxaphene; industrial chemicals include HCB and the PCB group of chemicals; and industrial by-products include HCB, PCBs, and polychlorinated dibenzo-*p*-dioxin and polychlorinated dibenzofurans (PCCD/PCDF). Although use and production of legacy POPs has largely discontinued, their ability to remain in Arctic

Table 2.1. Intended use and unintentional biological impacts of legacy persistent organic pollutants with restricted or eliminated use and production governed by the Stockholm Convention under the United Nations Environment Program (Van Oostdam et al. 1999; Stockholm Convention 2008; AMAP 2009).

Name	Type of Chemical	Manufactured Use	Biological Systems Affected
Aldrin	Pesticide	Insecticide	Reproductive, immune, and nervous systems; potential human carcinogen
Chlordane	Pesticide	Agricultural insecticide Termite control	Reproductive and immune systems
DDT	Pesticide	Insecticide to control diseases (e.g. malaria, typhus) spread by insect vectors	Reproductive system; egg-shell thinning in predatory bird species
Dieldrin	Pesticide	Agricultural insecticide Termite control	Reproductive, immune, and nervous systems; potential human carcinogen
Endrin	Pesticide	Agricultural insecticide Rodenticide	Nervous system; potential human carcinogen
Heptachlor	Pesticide	Agricultural insecticide Termite control	Reproductive system; alters behaviour; potential human carcinogen
HCB	Pesticide Industrial chemical	Agricultural fungicide By-product from incineration and metallurgical processes, and chlorinated chemical production	Reproductive, immune, and neurobehavioural systems
Mirex	Pesticide	Insecticide against fire ants Fire retardant	Reproductive, endocrine, hepatic, and renal systems; probable human carcinogen
PCBs	Industrial chemical	Plasticizers Sealants Hydraulic & heat-exchange fluids Lubricating oils Transformer & capacitor oils	Immune system; disturbs behaviour and reproduction in mammals, birds, fish; probable human carcinogen
PCCD	Industrial by-product	By-products of waste burning and metallurgical processes By-products of some herbicides	Reproductive and immune systems; increased risk of cancer
PCCF	Industrial by-product	By-products of waste burning and metallurgical processes By-products of some herbicides	Reproductive and immune systems; increased risk of cancer
Toxaphene	Pesticide	Insecticide	Nervous system; liver; probable human carcinogen

environments and biota has facilitated long-term study, increasing the knowledge about contaminant behaviour in the North, and impacts on wildlife and human health.

2.3.2 Current-Use POPs

As legacy POPs were banned, alternatives have been developed for their replacement, and many of these substances display similar chemical properties and characteristics to their predecessors. Their potential pervasiveness in the environment, capacity for long-range transport, toxicity, and ability to biomagnify and accumulate in Arctic food webs has increased the need for scientific monitoring and understanding, as knowledge about them is more limited than that for legacy POPs (AMAP 2009). Whereas legacy POPs consisted of organochlorine compounds, newer products incorporated brominated and fluorinated compounds. Table 2.2 details the chemical category, manufactured use, and biological impacts of the nine current-use POPs incorporated into the Stockholm Convention in 2009; endosulfan was included in 2011 with technical exemptions (Stockholm Convention 2011). POPs discussed here that are not currently listed are under consideration for inclusion.

Brominated flame retardants (BFRs) are chemicals added to materials during the manufacturing process to increase their fire resistance (de Wit et al. 2010). Their differences in chemical structure allow them to be used in a variety of products, yet it also dictates which biochemical processes will be disrupted in living organisms (AMAP 2009). Polybrominated diphenyl ethers (PBDEs) are typically added to polyurethane foam (e.g. in mattresses, furniture, pillows), hard plastics used in electric and electronic equipment (e.g. computer casing and monitors), and plastics such as high impact polystyrene used in electrical equipment, rubber coating for wires, and textile back-coating in furniture (de Wit et al. 2010). Hexabromocyclododecane (HBCD) is used in expanded and extruded plastics

Table 2.2. Intended use and unintentional biological impacts of current-use persistent organic pollutants added to the Stockholm Convention in 2009 and 2011, whose use and production has been restricted or eliminated (Tomy et al. 2004; Braune et al. 2005; Evans et al. 2005a; AMAP 2009; Van Oostdam et al. 2009; de Wit et al. 2010; Donaldson et al. 2010; Stockholm Convention 2011).

Name	Type of Chemical	Manufactured Use	Biological Systems Affected
alpha-HCH	Pesticide Industrial by-product	Agricultural insecticide By-product of lindane	Reproductive, immune, and nervous systems
beta-HCH	Pesticide Industrial by-product	Agricultural insecticide By-product of lindane	Reproductive, immune, and nervous systems
Chlordecone	Pesticide	Agricultural insecticide (chemically related to mirex)	Reproductive, endocrine, hepatic, and renal systems; potential human carcinogen
gamma-HCH (lindane)	Pesticide	Agricultural insecticide	Reproductive, immune, and nervous systems
HBB (a PBB)	Industrial chemical	Flame retardant (PBBs are bromine analogues to PCBs)	Endocrine, immune, hepatic and nervous systems; possible human carcinogen
HexaBDE & HeptaBDE (PBDEs)	Industrial chemical	Flame retardant used in hard plastics for consumer electronics	Reproductive, endocrine, hepatic, and neurobehavioural systems
PeCB	Pesticide Industrial chemical Industrial by-product	Fungicide Flame retardant By-product of thermal & industrial combustion processes	Reproductive, hepatic, and renal systems
PFOS, its salts, & PFOS-F	Industrial by-product	Degradations product of related chemicals used in electric and electronic parts, fire fighting foam, photo imaging, hydraulic fluids, and stain repellents for textiles	Endocrine, hepatic, and renal systems; potential human carcinogen
TetraBDE & PentaBDE (PBDEs)	Industrial chemical	Flame retardant used in adhesives and polyurethane foams	Reproductive, endocrine, hepatic, and neurobehavioural systems
Endosulfan (Technical endosulfan and its related isomers)	Pesticide	Agricultural insecticide Wood preservative Ectoparasite control for cattle	Reproductive, neurological, renal, and blood systems; physical disorders; mental disabilities; potential human carcinogen

such as Styrofoam, and polystyrene foam in building insulation and in roads to prevent frost-heaving, in addition to textile back-coating in furniture (AMAP 2009; de Wit et al. 2010). Tetrabromobisphenol A (TBBPA) is predominantly used as a reactive flame retardant in printed circuit boards, meaning that it is chemically bound to material found in electronic and electrical equipment (e.g. computers, printers, mobile phones, televisions, etc.); it is also used as a replacement for banned BFRs as a flame retardant additive in hard plastics (AMAP 2009; de Wit et al. 2010). Polybrominated biphenyls (PBBs) such as hexabromobiphenyl (HBB) are flame retardant additives in textiles such as furniture, carpets, and curtains that are used in public locations (de Wit et al. 2010).

Poly- and perfluorinated compounds (PFCs), which were commercialized over 40 years ago, have only recently gained attention as persistent organic pollutants (AMAP 2009). Their chemical properties make them extremely resistant to heat and chemical degradation, which has promoted their widespread use both industrially and commercially; it also facilitates their extreme persistence in the environment (Van Oostdam et al. 2009; Butt et al. 2010). Two major groups of compounds that have been detected in the environment include perfluorinated sulfonates (PFSAs), of which PFOS (perfluorooctane sulfonate) is the most widely known, and perfluorinated carboxylates (PFCAs), of which PFOA (perfluorooctanoic acid) is well known (AMAP 2009; Butt et al. 2010). PFOS was primarily used as a surfactant in firefighting foams, and other PFSAs were used in the manufacture of fluoropolymers, which are used to make non-stick surfaces for cookware (e.g. Teflon®) and water, oil, and stain repellent coating for fabrics (e.g. Scotchgard®), carpets, paper, and food packaging (AMAP 2009; Van Oostdam et al. 2009). PFCAs, and PFOA in particular, are produced in large quantities and also aid in the production of fluoropolymers for use in stain repellents similar to PFSAs (AMAP 2009). Other PFCs are used in cosmetics, cleaning products, and adhesives, (Van Oostdam et al. 2009).

In addition to BFRs and PFCs, several other groups of compounds have been identified as having the capacity for environmental persistence, long-range transport, and biomagnification; some have received more attention and study than others.

Hexachlorocyclohexanes (HCHs) occur in three different chemical forms (alpha, beta and gamma) known as isomers; gamma-HCH is the same as the insecticide lindane – used for seed, soil, tree, and wood treatment – and both alpha-HCH and beta-HCH are produced as unintentional by-products of lindane (AMAP 2009; Stockholm Convention 2011).

Polyaromatic hydrocarbons (PAHs) are a component of crude and refined oil, exist in fossil fuels and are produced through the incomplete combustion of carbon-containing fuels (natural and anthropogenic) such as wood, coal, diesel, and oil (Macdonald et al. 2000; Motelay-Massei et al. 2005). Pentachlorobenzene (PeCB), related to the legacy HCB, was used as a fungicide, flame retardant, chemical intermediate for the production of other chemicals; it also exists as trace contaminants in PCBs, as impurities in solvent and pesticide products, and is unintentionally produced via thermal and industrial combustion processes (Stockholm Convention 2011). In widespread use since the 1950s, the organochlorine pesticide endosulfan is effective against broad spectrum of insects and mites, promoting its use on a range of crops that include cotton, tea, coffee, fruit trees, and cereals (Weber et al. 2010). However, through its persistence, toxicity, capabilities of long-range transport, and capacity to bioaccumulate in organisms, endosulfan only fulfills part of the criteria to be considered a persistent organic pollutant, as its ability to biomagnify remains uncertain (Weber et al. 2010).

2.3.3 Sources, Transport, and Temporal Trends

Location and size of contaminant source, interactions of compounds with surface waters, microbial degradation, temperature, conversion or degradation of the compound

during transport, and removal of the compound from the biosphere are all factors that influence POP distribution in Arctic ecosystems (Stern et al. 2005), in addition to the compound's physico-chemical properties (Mössner and Ballschmiter 1997). Local contamination sources, such as communities, resource developments, and Distance Early Warning (DEW) Line sites are regarded as minor in comparison to the significant amounts being atmospherically and hydrologically transported from more temperate regions (Bright et al. 1995; Gamberg et al. 2005). However, with the ongoing dramatic environmental changes happening in the Arctic, such as changes in wind patterns, temperatures, ice cover, timing of ice melt, precipitation, and ocean currents, it is highly likely that contaminant pathways will be altered (Macdonald et al. 2005; AMAP 2009).

Through atmospheric and oceanic long-range transport, legacy POPs have made their way into Arctic environments and biota from point sources in southern latitudes (Macdonald et al. 2000). Data from long time series monitoring indicate that the levels of most legacy POPs, including HCHs, are decreasing in the Arctic environment and air since their production and use has been phased-out heavily restricted (Hung et al. 2010); however, the concentration of some POPs in wildlife still exist at levels high enough to affect the health of certain wildlife species, especially apex predators (Rigét et al. 2010). Assessing temporal trends in wildlife is more complicated due to the compounding factors of age and variations in foraging habits; in general, most POP levels are showing a decline in all wildlife species sampled over the past 20-30 years, consistent with reported trends for Arctic air (Hung et al. 2010), with few examples such as beta-HCH exhibiting declining, increasing, and lack of trends depending on the geographic location monitored (Rigét et al. 2010). While PCBs have been measured at DEW Line sites, the contribution of local PCB sources is limited to the vicinity of the site, and thus have little impact overall PCB levels in the Arctic (Macdonald et al. 2000). It is anticipated that climate change will impact POP

temporal trends in addition to transport pathways, and that increased frequencies of forest fires will remobilize POPs stored in soils (AMAP 2009).

Western Europe and eastern North America are major source regions of BFRs, which are transported to the Arctic primarily through the atmosphere due to their ability to bind to particles (de Wit et al. 2010). Commercial products comprise the sources of BFR release into the environment. Most BFRs are added to products during the manufacturing process and are not chemically bound to the material, and are thus able to dissipate into the environment; other BFRs react and bind to materials, but in instances where reactions are incomplete, residues form that can be released (AMAP 2009; de Wit et al. 2010). Additionally, processes that destroy plastics, such as extended exposure to sunlight and waste incineration, cause BFRs to be emitted into the environment, making them available for long-range transport; in Arctic communities lacking controlled landfills, burning of waste products that contain BFRs thus constitute local sources of BFR contamination (AMAP 2009). Furthermore, BFRs are continually released throughout a products' lifespan, making them bioavailable long after the production of a specific BFR has ceased, and facilitating their ubiquity in Arctic air, soil, sediments, and biota (de Wit et al. 2010). Spatial distribution in the Arctic shows declines in BFR concentrations traveling northward in both air and lake sediment samples, and overall concentrations of some BFRs (e.g. PBDEs) seem to be leveling off due to decreased use and production stemming from restrictions and regulations; however, replacement chemicals for those banned are beginning to appear in Arctic environments (de Wit et al. 2010).

China is believed to be the world's largest PFOS producer, and PFCs are considered ubiquitous in the environment (Butt et al. 2010). PFOS, PFOA, and other PFCs indirectly enter the environment as emissions of precursor compounds produced in manufacturing processes, through which they are atmospherically transported to the Arctic. The precursor

chemicals readily degrade to form the very stable and persistent PFSA and PFCAs (Butt et al. 2010). Direct long-range oceanic transport of PFCs also occurs, originating as impurities in commercial products and as a by-product of the degradation of other fluorinated compounds in effluent from sewage treatment plants, which reaches the ocean via riverine transport (AMAP 2009; Butt et al. 2010). Since PFCs have not been studied as long as legacy POPs, meaningful temporal trend data is only available for marine environments, with few data from the abiotic environment (e.g. sediment) to give a clear picture of PFC behaviour in the Arctic (AMAP 2009). Declines in Arctic PFOS levels have occurred since North American production ceased in 2002, yet PFOS is still emitted into the environment through the degradation of precursor chemicals; further, as a PFOS replacement, increases in PFOA levels have been observed (Butt et al. 2010).

Natural sources of PAHs include natural fires, natural seepage or loss of petroleum or coal deposits, and production processes in sediments and soils (Macdonald et al. 2000). Increased human fossil fuel usage worldwide over the past century has subsequently increased the release of PAHs, thus contributing to their environmental ubiquity, where they attach to atmospheric particles; combustion PAHs transported atmospherically to Arctic environments have thus been measured in air, sea ice, and snow (Macdonald et al. 2000), with the atmosphere playing a major role in their transport (Motelay-Massei et al. 2005). Naturally derived PAHs preformed in soils, peat, and vegetation can also be re-transmitted into the atmosphere as secondary sources (Motelay-Massei et al. 2005) or delivered to rivers and transported to sediments (Macdonald et al. 2000). While the majority of PAHs present in the Arctic are attributed to anthropogenic emissions from southern latitudes, local forest fires may cause episodic emissions in summer months (Becker et al. 2006). Other local secondary anthropogenic sources include oil released into Arctic marine waters resulting from oil exploration, development, and transport in the

Arctic, yet these inputs are considered to be small compared to the overall burden resulting from southern atmospherically-transported PAHs (Macdonald et al. 2000; Becker et al. 2006). PAHs exhibit elevated concentrations during the winter, which is observed to be a more pronounced phenomenon in the high Arctic atmosphere than at temperate latitudes (Becker et al. 2006). While many PAHs are observed to be decreasing in Arctic air (Becker et al. 2006), longer time series data are lacking.

Major producers of endosulfan are India and the United States of America, although it is used in many parts of the world (AMAP 2009). Ubiquitous in the environment, it is the most abundant OC pesticide in the global atmosphere, and also one of the most abundant in the Arctic atmosphere after HCB and HCHs (Weber et al. 2010). Long-term atmospheric trends show a lack of change in endosulfan concentrations, unlike most legacy POPs, which is likely due to its continued use (AMAP 2009). With physico-chemical properties similar to other OC pesticides (e.g. chlordane), the highest concentrations of endosulfan are typically found in sediments within soil and freshwater as it adheres to organic particles; riverine transport of sediments is thus a source of endosulfan to coastal areas (AMAP 2009). In warmer seasons, it is chemically capable of detaching from particles to become present in the atmosphere from where it is subjected to long-range transport to the Arctic; direct deposition from the air into the open waters of the Arctic Ocean is then the dominant source mechanism, causing widespread distribution in surface seawater (Weber et al. 2010).

2.3.4 Food web Dynamics and Human Exposure

The predominant route of contaminant exposure for biological organisms is via food uptake, with species at lower trophic levels (e.g. zooplankton) having shorter lifespans and relatively lower levels of overall contaminants. As longer-lived organisms occupying higher trophic positions eat lower trophic species, they accumulate the contaminant loads of those

they consumed (biomagnification); concurrently, their longevity enables them to build up their own contaminant load over time (bioaccumulation). Given the high concentrations in many wildlife species that are consumed as country food by Inuit and Inuvialuit, persistent organic compounds have been among the highest priority for research in the Arctic (Stern et al. 2005).

Despite being banned or restricted, legacy POPs are still present in the environment at levels of concern regarding biological systems. Studies have confirmed the causal relationship that POPs contribute to adverse health effects in top Arctic predators, including effects on reproductive, hormone, and immune systems; these are caused by breakdown products that result from POP metabolism, indicating that these compounds may be more deleterious than the original POP compounds themselves (AMAP 2009). For example, PCBs and several chlorinated pesticides including HCHs and DDT are able to accrue in organisms due to high biological inertness of the parent chemical or metabolites, and lipophilic properties (Braune et al. 2005). Their physico-chemical properties allow them to accumulate in mammalian adipose tissue, which is further compounded by the longevity and high trophic level of marine mammals (Mössner and Ballschmiter 1997).

As apex predators, polar bears are exposed to a variety of legacy POPs through foraging, and accumulate and store POPs in fatty tissues; recent studies have verified that biological effects of exposure to several legacy POPs include diminished immune system capacity, altered liver and kidney function, and changes in thyroid function that are linked to reproductive ability, thermoregulation, and brain development (AMAP 2009). Although POPs are known to accumulate in whale and seal blubber, the same scope of recent data is not available for these high trophic level species (Rigét et al. 2010). Outside of the Arctic, well-documented side effects of exposure exist for highly contaminated seal (Baltic Sea) and beluga (St. Lawrence estuary) populations, where animals display noticeable immune

system impairments; it is currently unknown if Arctic population display subtler effects, but since legacy POP levels are still considered elevated, further research is warranted. Some marine seabirds that feed at the top of the food chain are also exposed to legacy POPs at concentration levels elevated enough to cause concern for physiological alterations (e.g. endocrine and immune system function) that may cause changes in ecology; as in polar bears, thyroid disruption affects thermoregulation, which may affect heat transfer to eggs for nesting seabirds, which in turn may alter nesting behaviour (AMAP 2009). Adverse effects of POPs are further amplified with increases in other stressors such as predation, infection, and food availability (AMAP 2009). Legacy POP levels in Arctic fish species, however, are low enough not to be of concern, except in localized hot spots near seabird nesting grounds as POPs can be deposited into waters via avian guano (AMAP 2009).

Because of their adherence to atmospheric particles, BFR concentrations measured in air are higher than those in aquatic systems, however BFRs that are not atmospherically degraded are deposited in oceans and on land; lakes and rivers receive BFRs through the air in addition to local waste burning sources and avian guano (de Wit et al. 2010). The Arctic Ocean receives riverine input, leading to higher background concentrations in marine versus freshwater sediment (AMAP 2009). BFR levels in top marine predators exceed those of top terrestrial predators as the longer length of aquatic food webs increases the ability for biomagnification (de Wit et al. 2010). BFRs have been measured in marine mammals, raptors, seabirds, fish, invertebrates, and plankton, yet they biomagnify differently at different stages of the food web due to the varying metabolic abilities in animals; as such, some BFRs were observed to increase in some species over time and decrease in other species (de Wit et al. 2010). Known hydrophobic characteristics enable their accumulation in adipose tissue, however the toxic effects of BFRs have not been studied in great detail,

and their trends and routes of exposure regarding human populations lack adequate information (AMAP 2009).

Due to the strength of their chemical bonds, PFCs are extremely persistent and ubiquitous in the Arctic environment and biota; chemical precursors degrade (atmospherically) or biotransform (biologically) into PFOS and PFOA which are not metabolized in wildlife, enabling them to accumulate within organisms for long periods and easily biomagnify through the food web (Butt et al. 2010). Temporal trends of PFOS in marine wildlife indicate an initial increase beginning in the 1980s, while more recent studies have subsequently shown both continual increases and sharp declines; measured declines track with the reduction of direct PFOS production (Butt et al. 2010). As PFOS replacements, increases in PFCAs have been measured in Arctic marine wildlife since the 1990s, consistent with the continued production of their precursors (Butt et al. 2010). Due to their longevity and top trophic position, polar bears exhibit some of the highest PFC levels measured in wildlife (AMAP 2009). Whereas most POPs accumulate in fatty tissues, PFCs behave differently in biological systems by accumulating in blood, kidneys, and the liver (AMAP 2009). While PFCs have been studied in Arctic marine environments, including seabirds (Braune et al. 2005), there remains little known about their behaviours and trends in freshwater and terrestrial systems (AMAP 2009; cf. Evans et al. 2005a). Similar to BFRs, trends, exposure routes, and toxicity of PFCs have not been adequately studied with regard to humans (AMAP 2009).

The chemical composition of PAHs varies as both natural and anthropogenic origins exist, which contribute to differences in bacterial degradation and thus influences their bioavailability (Macdonald et al. 2000). Ubiquitous and persistent in Arctic environments, they can severely impact wildlife as they have the potential to form carcinogenic and mutagenic compounds that react with DNA and disturb cell membrane functions, (cf.

Macdonald et al. 2000; Becker et al. 2006; Konovalov et al. 2010). Tolerance by some organisms at lower trophic levels that are exposed to PAHs through sediments, combined with the tendency of PAHs to bioaccumulate may cause deleterious effects in higher trophic species (Konovalov et al. 2010), yet temporal trend and biological information regarding PAHs in the Arctic is sorely lacking.

Endosulfan has a limited biomagnification potential due to the ability of higher trophic species to metabolize its degradation product, endosulfan sulfate; while there is clear evidence of biomagnification in fish, this is not observed in marine mammals (Webb et al. 2010). Limited biological information indicate that endosulfan and endosulfan sulfate are present in marine mammal blubber at concentrations much lower than those of legacy POPs such as chlordane and DDT, yet the slow degradation of endosulfan sulfate may cause prolonged, chronic exposure (AMAP 2009). Estimates of human exposure through diet and associated health impacts to Inuit remain uncertain (Webb et al. 2010).

2.4 Mercury

2.4.1 Mercury Characteristics

Of the many contaminants found and currently being studied, mercury has been identified as particularly troubling due to its global prevalence, very high concentrations in certain biota and poorly understood sources and processes in the Arctic (AMAP 2011). Years of research calling for a global, legally binding treaty against mercury emissions were finally answered when UNEP agreed to begin negotiations in 2009; after five sessions of negotiations, the text for the Minamata Convention on Mercury was approved in January 2013 (cf. UNEP 2013). The Minamata Convention is the second international convention on contaminants (the first being the Stockholm Convention on manmade chemicals), and the first convention on the regulation of a naturally occurring chemical. As of October 2013, the

convention is open for signatures, requiring at least 50 countries as signatories in order to be enacted; ratification of the convention and subsequent entry into force is expected to occur in 2015 or 2016. This convention represents a major advance in the efforts to lift the environmental and health impacts of mercury by stemming mercury production and emissions (UNEP 2013); however, it will take several years before change will be detected, and its implications on Arctic ecosystems still remain a top research priority.

Mercury exists in several different chemical species; the forms through which it is released and the chemical processes that transform mercury between its various species determine mercury's transport to and fate in the Arctic (AMAP 2011). Elemental mercury, the only metal that is liquid at room temperature, also exists as gaseous elemental mercury (GEM), whose properties enable long tropospheric residence times (months or up to a year), permitting it to be efficiently transported through the global atmosphere (Outridge et al. 2008; Morel et al. 1998). As dissolved gaseous mercury (DGM), elemental mercury is also one of the four main mercury species found in seawater (Mason and Fitzgerald 1993). Two species of inorganic mercury include reactive gaseous mercury (RGM), a water soluble species that exists in a gas phase, and particulate mercury (HgP), which adsorbs to dust particles; due to scavenging and surface adhesion processes, these species have shorter atmospheric lifetimes (days or weeks) and thus exist in low concentrations in the atmosphere and are more readily subjected to deposition (Outridge et al. 2008). As such, RGM and HgP are also found in seawater, and since inorganic mercury species are the forms that are readily methylated, Mason and Fitzgerald (1991) hypothesized that the balance between inorganic mercury reduction and methylation could indicate the amount of bioavailable mercury in the ocean.

Whereas these other forms of mercury are inorganic, two organic, methylated mercury species are also found in seawater, freshwater, estuarine water and sediment,

which include monomethylmercury, (MeHg, henceforth termed 'methylmercury'), and dimethylmercury (Me₂Hg). The latter has been proven volatile and unstable, capable of rapidly decomposing into MeHg (Sunderland et al. 2009), and as a result of bond thermodynamics and kinetics, it is unreactive (cf. Morel et al. 1998). Thus, Me₂Hg is not considered as much of a biological concern as MeHg. Methylmercury is the only mercury species that bioaccumulates in biota over time and biomagnifies through aquatic food webs (Morel et al. 1998), and as a result, trace level mercury concentrations in the water can ultimately reach potentially dangerous levels in top trophic level predators (Loseto et al. 2008a). It is this organic form of mercury that is of utmost concern as the mechanisms and locations of mercury methylation are not fully understood; its toxicity and prevalence in biotic systems, combined with the Arctic's capacity as a global mercury contamination sink (Macdonald et al. 2000) pose concerns for the health of northern ecosystems and subsistence consumers.

2.4.2 Natural and Anthropogenic Sources

As a naturally occurring element, mercury is ubiquitous in the environment, yet sources of mercury are both natural and the result of human activities. Natural mercury inputs to the atmosphere include volcanic eruptions, forest fires, degassing of particulate from land (particularly naturally mercury-rich geological formations) and water surfaces, and particulate and volatile compounds emitted through biological processes (Morel et al. 1998). Different mineral conditions between the eastern Canadian Arctic, dominated by the Pre-Cambrian Shield of igneous and metamorphic rock, and western Canadian Arctic, where unmetamorphosed Post-Cambrian volcanic and sedimentary rock prevail, are potential contributors to mercury in the environment (cf. Wagemann et al. 1995). Anthropogenic mercury sources include waste handling and treatment, pulp industries, metal production,

coal, peat and wood burning, chlor-alkali industries, and hydroelectric development, and it is present in cosmetics, thermometers, fluorescent lightbulbs, batteries, and electronic devices (Morel et al. 1998; Wheatley 1997; AMAP 2011; UNEP 2013). While the majority of Hg emissions result from industrial point sources, mercury pollution is global and capable of affecting remote Arctic regions where few local contaminants sources exist (Rigét et al. 2005; Hermanson 1998; Morel et al. 1998). However, municipal sewage disposal into lakes is a source of mercury into the environment (Hermanson 1998), which presents a very real local anthropogenic source of mercury to Arctic communities as such inputs are likely to increase over time.

Natural processes governing mercury release into and removal from the environment were generally in balance until an increase in anthropogenic activities, largely from the Industrial Revolution (c. 1850), mobilized previously unavailable mercury through extraction, industrial processing, and burning as in the case of fossil fuels (Wheatley and Wheatley 1988; AMAP 2011). Lake sediment records suggest that atmospheric mercury inputs tripled over the past 150 years (Morel et al. 1998), and there is evidence of increased mercury in Canadian Arctic marine mammals since the beginning of major industrial developments (Muir et al. 2005b). Over the past two decades, there have been suggestions that anthropogenic mercury emissions may be declining, as Arctic atmospheric mercury concentrations have shown no recent increasing trend (cf. Macdonald et al. 2005; Leitch et al. 2007). Conversely, global mercury emissions to the atmosphere may actually be increasing despite emission reductions in North America and Western Europe (Rigét et al. 2007; cf. AMAP 2011): steadily rising anthropogenic emissions from Asia have been reported over the past several decades, comprising over 50% of the global anthropogenic mercury source (cf. Sunderland et al. 2009). This may simply reflect shifts in the source contributions of mercury emissions instead of overall global increases; yet the cause of such

high mercury burdens and large variability is unclear (Leitch et al. 2007) as Arctic biota continues to be exposed to rapidly increasing levels of mercury (Rigét et al. 2007; Macdonald et al. 2005). Increasing trends of mercury in western Arctic marine mammals suggest that, rather than increasing trends in atmospheric mercury concentrations, changes have occurred in the Arctic's biogeochemical mercury cycle (Stern and Macdonald 2005; AMAP 2011). This is troubling, because mercury's environmental pathways, processes, and the means by which it is transformed remain inadequately understood.

2.4.3 Transport and Cycling in the Abiotic Environment

Due to GEM's long atmospheric residence time, it is capable of long-range transport via air currents and can reach the Arctic within a matter of days before sunlight-mediated chemical reactions convert GEM into RGM and HgP, enabling mercury to leave the air and be deposited onto land, water, snow and ice (cf. Graydon et al. 2008; AMAP 2011). While more is known about atmospheric mercury dynamics than oceanic processes (AMAP 2011), the atmosphere is a less dominant means of mercury loading in the Arctic Ocean compared to other oceans (Outridge et al. 2008; Sunderland et al. 2009).

Globally, the evasion of DGM from seawater to the atmosphere represents an important part of the mercury cycle, as GEM deposited from the atmosphere to water bodies is counter-balanced to some extent by the revolatilization of DGM back to the atmosphere (Southworth et al. 2007). DGM is highly concentrated in surface waters (Morel et al. 1998) and the transport of mercury across the air-seawater boundary is dependent upon the concentration gradient of GEM in the atmosphere and DGM in surface seawater (Outridge et al. 2008). However, the Arctic Ocean is not thought to be a significant location of DGM evasion due to the presence of sea ice: DGM formation is due to microbial reduction and photoreduction of oxidized RGM; the presence of sea ice would decrease

photoreduction thus limiting the DGM-GEM exchange, at least seasonally (cf. Outridge et al. 2008). Yet evasion may be locally significant in the Arctic at locations of open water such as flaw leads and polynyas during the winter, and in summer months this process may be significant when there is reduced ice cover (Outridge et al. 2008; St. Louis et al. 2007). Abiotic pathways such as riverine discharge, oceanic transport, loss of sea ice, direct terrestrial inputs (due to coastal erosion and/or melting permafrost) and biotic processes such as changes in food web structures and feeding habits, biomagnification and bioaccumulation through food webs, and contaminant transport through migration of biota are suggested to be more important influences on mercury distribution and trends (Hare et al. 2008; Leitch et al. 2007).

The Arctic Ocean behaves differently compared to other oceans worldwide, as its inputs are dominated by river runoff, sediments and organic carbon (cf. Leitch et al. 2007). Mercury transported to the Arctic Ocean via rivers and groundwater is in dissolved and particulate forms; HgP binds strongly with soil organic matter that is vulnerable to erosion with high rates of water flow, thus mercury is mobilized by the increase in surface run-off (Leitch et al. 2007). Total sediment loading from rivers to the Arctic Ocean are dominated by the Lena and Ob Rivers from Russia, and the Mackenzie River from Canada; as the largest river discharging into the western Canadian portion of the Arctic Ocean, the Mackenzie River is the dominant source of suspended sediment, which includes HgP, and is the principal source of mercury to the highly dynamic Beaufort Sea (Leitch et al. 2007; Outridge et al. 2008).

The top 50 m of the Arctic Ocean water column, comprising the polar mixed layer, is important for atmospheric mercury exchange and ice interactions (Macdonald et al. 2005); sea ice, through its accumulation of atmospherically deposited mercury or by its incorporation of sediment containing mercury, is a potential means of transporting mercury

within and out of the Arctic Ocean (cf. Outridge et al. 2008). However, within the mercury mass balance of the Arctic Ocean, sea ice was determined to be an unlikely route of significant Hg transport (Outridge et al. 2008). Furthermore, recent mercury increases in Arctic Ocean biota cannot be explained primarily by atmospheric loadings (cf. Hermanson 1998; Rigét et al. 2007;) or other import pathways, indicating that variability in biotic mercury is not primarily driven by mercury mass increases or decreases in the Arctic Ocean (Outridge et al. 2008). Data from both the Arctic Ocean (Outridge et al. 2008) and Hudson Bay Marine System (Hare et al. 2008) show systems that are close to steady-state for total mercury inputs and outputs with rates of increase that are substantially lower than rates of biological mercury increases, meaning that other processes are occurring in biotic reservoirs causing the massive increases in mercury that are not reflected elsewhere in the system. Furthermore, the abiotic mercury mass in both systems is several orders of magnitude higher than the biotic mercury mass, yet this seemingly small mercury inventory is available for methylation into the bioavailable MeHg.

2.4.4 Mercury Methylation

The presence of methylated mercury species in the Canadian Arctic and its impacts on higher trophic predators and humans have long been known; yet the origins, processes and locations of methylation have remained elusive and perplexing. Methylation is thought mainly to occur in anoxic waters and sediments, although MeHg may be produced in oxic (oxygenated) surface seawater (Morel et al. 1998; Cossa et al. 2009). While sedimentary origins of MeHg are better documented, the impacts of riverine, atmospheric, coastal, or sedimentary MeHg inputs are also locally important (Cossa et al. 2009). Wetlands and sediment with low oxygen levels are the main sites of mercury methylation in Arctic freshwater and terrestrial environments (AMAP 2011).

Sources, cycles, and locations of methylation in the oceanic water column are currently under debate, as *in situ* methylation evidence is limited (cf. Cossa et al. 2009). While sediment MeHg sources remain a factor, they may not be as important for MeHg transport to marine food webs as initially thought, as active methylation processes do occur in the marine water column (cf. Sunderland et al. 2009). For ocean currents delivering mercury to Arctic marine food webs, surface waters to depths of 200 m are most important because this is the location of primary production and where most marine biota are found (Outridge et al. 2008). In marine waters, MeHg addition and removal is in a steady state (St. Louis et al. 2007), reflecting the amount of bioavailable mercury, rates of demethylation, and methylating microbial activity (cf. Sunderland et al. 2009). Particulate organic carbon (POC), produced by phytoplankton, removes surface RGM/HgP as it sinks to deeper water, consequently providing microbially-active subsurface waters with a source of bioavailable mercury; POC decomposition by heterotrophs may also provide a substrate for bacterial activity to stimulate mercury methylation (Sunderland et al. 2009).

Subsurface methylating bacteria may potentially make MeHg available to the food web, excrete MeHg into the water to be adsorbed or absorbed by plankton and thus transferred to subsequent trophic level species (Rigét et al. 2007; Orihel et al. 2008); yet mercury speciation, bioavailability, and biologically-related processes in the Arctic Ocean are still little understood. Methylation occurring in the water column may cause rapid changes in bioavailable mercury (Sunderland et al. 2009). Due to its pervasiveness and toxic properties in biota, MeHg is the mercury species of most concern because of its unique ability to bioaccumulate and biomagnify through food webs, especially considering its presence in higher trophic animals through which humans are exposed.

2.4.5 Biological Trends and Food web Transport

At higher trophic levels, MeHg is more commonly accumulated through dietary means (Morel et al. 1998; Braune et al. 2005) and efficient MeHg transfer may result from the lipid solubility of chlorinated MeHg, enabling partial retention in fatty tissues of animals (Morel et al. 1998), although MeHg is mostly stored in protein (Campbell et al. 2005). Animal membranes and lipids also readily absorb inorganic mercury (Braune et al. 2005), although it is not as readily bioaccumulated as MeHg (AMAP 2011). Extensive studies have investigated the relationship between MeHg and total mercury (HgT) in tissues of Arctic animals, in addition to examining temporal and spatial trends of HgT and MeHg across the Canadian Arctic, in which tissues they concentrate, and their transfer through food webs.

As homeotherms, mammals have greater energy requirements due to the necessity to maintain body temperature, thus their metabolic rate and caloric requirements are higher; since the rate of metabolically transforming or excreting contaminants is exceeded by contaminant uptake, they are further susceptible to bioaccumulation (Braune et al. 2005). In most marine mammals, such as beluga and ringed seal, highest total mercury concentrations were found in the liver, followed by the kidney, muscle, and blubber (Wagemann et al. 1995). On a spatial scale, Wagemann et al. (1995) first reported significantly higher mean total Hg concentrations in western versus eastern Arctic marine mammals, and partially accredited it to the aforementioned natural geological differences between the regions. A follow-up study stated that MeHg also follows this trend, with mean MeHg concentrations being significantly higher in ringed seal liver and beluga muscle, liver, and skin in the western compared to the eastern Arctic; these findings were also attributed to natural geology and contaminant levels in the area (Wagemann et al. 1998), which may result from the influence of Hg delivery by the Mackenzie River to the Beaufort Sea (Leitch et al. 2007). Additionally, in all animals, MeHg concentrations were found to exceed HgT

concentrations in skin and muscle, with the notable exception being the liver; blubber was not tested due to extremely low levels of HgT (Wagemann et al. 1998). Elevated mercury concentrations found to be common in predatory fish in the Mackenzie River Basin were attributed to fish age (Evans et al. 2005), which suggests the influence of bioaccumulation. Furthermore, mercury concentrations in fish tended to be higher in smaller lakes, perhaps due to higher summer temperatures, which may increase methylation rate, and higher inputs of mercury and MeHg from watersheds (Evans et al. 2005).

Most time series data over recent decades show increasing trends in mercury levels for marine species (beluga, ringed seal, polar bear, birds of prey), followed by predatory freshwater fish species (AMAP 2011). Temporal studies on beluga from 1981-2001 (cf. Lockhart et al. 2005) and seabirds from 1975-2003 (cf. Braune et al. 2005) have observed increased total mercury levels, yet no clear trend was evident for ringed seals between 1973-2003 (cf. Gaden et al. 2009). An ongoing study of western Arctic freshwater burbot showed that from 1984-2006, an increasing trend of mercury concentrations was found in liver and muscle (Stern 2007). Unlike aquatic environments, no significant increases in mercury levels have been recently reported for terrestrial wildlife (AMAP 2011). Spatial distribution is one factor contributing to the extent of contamination, and spatial differences in contaminant load vary with the extent of temporal scale; temporal patterns are also specific to certain areas (Braune et al. 2005; Muir et al., 2005b). Age and sex have been found to affect contaminant loading due to different energy requirements, foraging patterns and diet of each life stage (Loseto et al. 2008a, 2008b; Rigét et al. 2005); prey distribution can alter contaminant exposure in predators (Macdonald et al. 2005), as can abiotic factors such as sea ice distribution (Gaden et al. 2009), and migratory species, most notably fish and birds, can act as biovectors that transport contaminants to alternate sites (Blais et al. 2007). Furthermore, maternal mercury transfer can occur both transplacentally and during

lactation in marine mammals (Braune et al. 2005; Wagemann et al. 1998). Since MeHg readily crosses the placental barrier it, can be transferred during gestation, leading to increased foetal MeHg levels with subsequent declines in maternal mercury body burden (cf. Atwell et al. 1998). Belugas also undergo a summer moult wherein the two outermost skin layers and sometimes the third layer are shed; mercury levels have been observed to increase outwardly with each skin layer, thus belugas are able to shed some of their toxic burdens (Wagemann and Kozłowska, 2005). Birds, who incorporate high body burdens of mercury into the keratin of feathers, may significantly reduce their mercury levels during moult (cf. Atwell et al. 1998). There is no shortage of variables contributing to the understanding of the intricate interactions of mercury within biological systems.

Muscle tissue in higher trophic species is used for mercury and MeHg analysis because 97-100% of total mercury in muscle in the form of MeHg (Wagemann et al. 1998). Muscle (protein) may also be a more reliable indicator of dietary sources of mercury (Gaden et al. 2009; Loseto et al. 2008a) as it carries a higher body burden of mercury than other tissues because it is more abundant (Atwell et al. 1998). Hepatic tissue is subject to higher turnover and metabolic rates than muscle tissue (Campbell et al. 2005) suggesting that it may provide information only on short-term mercury exposure, despite the fact that liver has a higher overall concentration of mercury than muscle (Atwell et al. 1998). The proportion of MeHg versus total mercury varies between different taxa and tissues, and differences in metabolic rate and foraging ecology may influence different trophic transfer mechanisms of mercury, which may account for apex predators having higher mercury variability (Atwell et al. 1998).

Higher trophic level species tend to have higher levels of mercury in their tissues, yet it is uncertain to what extent it results from biomagnification through the food web, or bioaccumulation within these longer lived organisms over time (Atwell et al. 1998).

Mercury levels in certain tissues were found to bioaccumulate with age in some studies (cf. Wagemann et al. 1998; Gaden et al. 2009) but not in others (Atwell et al. 1998; Loseto et al. 2008a); in the latter cases, mercury accumulation in tissues was concluded to be a result of biomagnification through diet to a higher extent than bioaccumulation over time. Food web structure and length may be additional factors affecting bioaccumulation because increasing the amount of trophic positions could cause higher mercury concentrations in top predators (Loseto et al. 2008a). Predator and prey habitat selection, behaviour, metabolism, food web structure and length, and a host of other aforementioned factors all contribute to the movement of mercury and MeHg through Arctic marine food webs. Discrepancies between the correlations of mercury with age versus trophic position may be due to the tissues sampled, the organisms sampled, or possibly more complex inner workings of how specific tissues process mercury and MeHg within specific organisms. Ultimately, bioaccumulation and biomagnification are both processes that lead to extremely high levels of MeHg in top trophic species. Since MeHg has an affinity to accumulate in muscle/protein, meat is considered the most critical source of MeHg exposure in humans (Deutch et al. 2006).

2.4.6 Mercury and Humans

The epidemic of Minamata disease that occurred in Japan in the 1950s first brought the dangers of MeHg poisoning to the world stage. Methylmercury was released as industrial effluent into the water system in the city of Minamata, where concentrations in fish, and consequently humans, reached deadly and debilitating levels due to long-term exposure (cf. Choi and Grandjean 2008). The blood concentrations associated with adverse health effects were determined to be 200-500 ppb (parts per billion), which became the basis of determining tolerable weekly intake levels of MeHg by the World Health

Organization's 1972 guidelines and Canadian federal guidelines (cf. Wheatley et al. 1979). As a neurotoxin, MeHg is capable of crossing the placental barrier and the blood-brain barrier, causing neural impairment leading to neurodevelopmental deficits in children because the developing human brain is especially susceptible to MeHg (Choi and Grandjean 2008). This means that children exposed to MeHg *in utero* are subject to more serious effects; while infants born during the Minamata outbreak suffered serious neurological damage, adverse effects on brain function can occur at lower levels of MeHg exposure (cf. Choi and Grandjean 2008), such as neuropsychological and neurobehavioural effects (Wheatley et al. 1997). Signs and symptoms caused by the toxic effects include ataxia, paresthesia, sensory disturbances, tremors, and hearing, visual and motor impairment (Choi and Grandjean 2008; Wheatley et al. 1979). Additional studies have suggested associations between higher blood mercury levels and attention-deficit hyperactivity disorder, higher MeHg exposure level and cardiovascular effects in adults and children (potentially promoting or predisposing the development of heart disease), and possible impacts to the immune system (cf. Choi and Grandjean 2008).

Traditional foods consumed by northern indigenous people reflect species that are common in their environment, including fish, birds, and marine mammals; however each community has its own array of country foods unique to their region based on habitat distribution and seasonal availability of the different animals. Due to the high concentrations of mercury and MeHg in many of these Arctic species, as previously discussed, northerners have higher rates of exposure to mercury and MeHg through the consumption of animals that constitute their traditional diet (Chan and Receveur 2000) as mercury and MeHg are considered the contaminants of primary concern in country foods (Muir et al. 2005b).

A decreasing trend in MeHg concentrations occurred with decreasing latitude as Inuit communities – where fish and marine mammals constitute MeHg sources – have much higher MeHg levels than most Canadian First Nations communities south of 60°N latitude, where fish is the primary MeHg source (Wheatley and Paradis 1995). Within the Northwest Territories, a strong positive correlation between average community MeHg concentration and longitude existed, showing a west to east pattern with the lowest levels in the Yukon First Nations followed by Dené, and the highest levels in Inuit in the eastern Northwest Territories (Wheatley and Paradis 1998), what is now constituted as Nunavut Territory. This is consistent with other findings that, compared to Caucasian, Dené, Métis and Other mothers, Inuit mothers have 6-12 times the contamination levels of mercury and MeHg, with women from Baffin Island having the highest levels among all Inuit (Van Oostdam et al. 2005; Chan et al. 1995), where mercury in adults and children exceeding the recommended health guideline for subsistence food (Chan et al. 1995). This is interesting to note, considering the spatial trends that found higher levels of mercury and MeHg in the western versus eastern Arctic (cf. Wagemann et al 1995; Wagemann et al. 1998).

From a purely nutritional standpoint, country foods contain a superior quality and amount of nutrients such as unsaturated fatty acids, protein, iron, zinc, magnesium, copper, selenium and vitamin A (Kuhnlein et al. 2003), and traditionally, when all parts of the animal were eaten, it constituted a complete diet (J. Oakes, pers. comm., January 2009). Dietary nutrients including fish protein, selenium and polyunsaturated fatty acids may also protect against some MeHg neurotoxicity (Khan et al. 2009; Van Oostdam et al. 2005). Fish especially provide beneficial nutrients and certain species that are high in omega-3 fatty acids should be preferentially consumed, in addition to younger fish and those not as high in the food web as they contain lower levels of MeHg (Choi and Grandjean 2008; cf. Evans et al. 2005).

For Inuit, country foods are not only an integral part of their nutritional health, but also their cultural identity, lifestyle, and socio-economic well-being (Usher 1973, 2000, 2002; Wheatley and Paradis 1995; Ris 1998; Dickson and Gilchrist 2002; Van Oostdam et al. 2005; Whittles 2005; Pauktuutit 2006; Donaldson et al. 2010; Harwood and Kingsley 2013). Their understandings of health are inseparable from the concept of environment, where respect and appropriate behaviour towards all aspects of the environment ensures the maintenance of mental, physical, social and spiritual well-being (Bielawski 1992; Stairs and Wenzel 1992; Wheatley 1994; Rybczynski 1997; Fienup-Riordan 1999; Brody 2000). For people with close associations to the land, change in one part of the environment affects other parts, and it becomes difficult to separate direct and indirect impacts; when it comes to abnormalities in country foods, it is difficult to distinguish between actual and perceived threats that cause modifications of eating habits which then impact health (Wheatley 1994; O'Neil et al. 1997a). Clinical human health assessment is based on direct effects of causal relationships between contaminants and health effects, regarding other effects as indirect; yet, for indigenous people, all effects, including social and cultural ones, are direct effects (Wheatley 1996). Additionally, there is limited definitive clinical evidence of MeHg poisoning at the levels found in Canada (Wheatley and Paradis 1995, 1996).

This in turn makes it difficult to justify advising indigenous people to change their diet based on potential negative health effects; instead, this potential direct risk has to be balanced against the real indirect risks of major social disruption and health effects that result from drastic changes to diet and lifestyle (O'Neil et al. 1997b; Wheatley and Paradis 1998; Poirier and Brooke 2000). Indigenous concepts of environment and health, perceptions of risk (which may prevail over actual risk), and difficulties in communication contribute to indirect impacts of MeHg contamination on the health and well-being of northerners, and it is argued that the social and cultural impacts of MeHg are a much

greater problem than direct clinical effects of exposure (O'Neil et al. 1997b; Wheatley 1997; Wheatley and Wheatley 2000). Perceptions of risk are influenced by many factors, including worldview and ideology, socio-cultural values, gender, culture, place, economic realities; further, risks appear greater when they are unfamiliar and not easily controlled (Elias and O'Neil 1995; Wheatley 1996; Masuda and Garvin 2006; Myers and Furgal 2006; Jardine et al. 2009). Additionally, perceptions of concern are linked to, and may be exacerbated by issues in the communication of contaminants messages (Wheatley 1998).

2.5 Communicating Contaminants Information

Past communication efforts in Arctic communities was primarily through a one-way approach, and poor risk communication resulted in fear, confusion misunderstanding, changes in diet and traditional lifestyles, and the associated socio-economic and health impacts (cf. Furgal et al. 2005). A prime example is the Inuit community of Salluit in Nunavik in the 1970s, where several individuals were found to have higher than expected mercury levels; before the community was notified, media sensationalism referred to the potential for Minamata disease and health advisories were issued against eating certain marine mammal tissues (without evidence as to the mercury source), which resulted in the cessation of country food consumption by the whole community (O'Neil et al. 1997a; Wheatley 1998; Poirier and Brooke 2000). Since then, the community was reassured that their food was safe, people regained trust in their ability to judge healthy versus unhealthy animals, and resumed eating traditional foods (Poirier and Brooke 2000). Inuit interpret contaminants messages through the perspective of their own observations and experiences (Wheatley 1996; Myers and Furgal 2006), reflecting the importance of reliance and trust in their own local knowledge (O'Neil et al. 1997a, 1997b; Egan 1998; Poirier and Brooke 2000). Despite being more informed about contaminants, skepticism and apprehension

remained for the people of Salluit regarding the reliability of invisible scientific information, which has been exacerbated by a growing understanding of the 'limitations' of scientific contaminants knowledge as exemplified by the lack of follow-up information after the initial incident, and a retrospective realization of the lack of consistent information at the time (O'Neil et al. 1997a; Poirier and Brooke 2000).

The Northern Contaminants Program (NCP) was established by the federal government in 1991 to address the issues of environmental contaminants in the Canadian Arctic, with the objectives to reduce or eliminate the presence of contaminants in subsistence foods and promote contaminant awareness in northern communities to enable informed decision making regarding traditional food harvesting and consumption (NCP 2011). NCP also incorporates research conducted through the International Polar Year Circumpolar Flaw Lead System Study (IPY-CFL) and ArcticNet. Since the events in Salluit, contaminant information disseminated to communities has evolved in an effort to ameliorate message sensitivity and appropriateness; however, past contaminant messages were not being retained by target audiences to reflect the level of importance as perceived by NCP (Myers and Furgal 2006), and NCP has since developed a mandate to examine contaminant communication. The approaches of physical sciences should further integrate with social sciences to recognize the importance of both direct and indirect impacts of MeHg exposure to propose a comprehensive approach to the development of public health policy (Wheatley and Wheatley 2000) in addition to an increased focus on coordinated contaminant risk perception and risk communication research (Furgal et al. 2005; Myers and Furgal 2006; Van Oostdam et al. 2009).

To better understand Inuvialuit perceptions of risk regarding contaminants, we must ensure that the disseminated information increases knowledge and awareness to facilitate rather than exacerbate the formation of risk perceptions that are appropriately

suited to perceived threats of contaminants (O'Neil et al. 1997b). At present, this necessitates that message content is received, understood, and applied to the extent deemed 'acceptable' by the communicators, such as NCP scientists, yet this standard has not been met. This view narrowly focuses on the common assumption that problems surrounding contaminant risk communication could be solved if researchers learned to explain themselves clearly and simply, which fails to understand the historical, cultural, and political context in which communication occurs, asserting colonial influence over indigenous power/knowledge systems (Elias and O'Neil 1995). This approach also limits the scope to only consider message content, ignoring the influences that communication processes (method, sources) have on perceptions of the message and perceptions of contaminants themselves. As "it is the medium that shapes and controls the scale and form of human association and action...it is only too typical that the 'content' of any medium blinds us to the character of the medium" (McLuhan 2006). This requires research to explore perceptions of contaminants communication – especially processes – apart from concepts of risk, since the medium influences and is ultimately a component of the message.

All NCP-related research must be communicated back to the communities involved (cf. NCP 2014), which commonly includes the dissemination of research results –pamphlets, handouts, reports, community meetings, and presentations – from individual projects by the lead investigator; the lack of communication guidelines means that any evaluative components and follow-up are done at the discretion of the communicator and are thus met with varying degrees of success. NCP also emphasizes the importance of building local capacity to contend with contaminant issues (cf. NCP 2014), however, this cannot be fully realized until elements influencing 'effective' communication are identified and understood.

For scientific contaminant information to be adequately disseminated in Northern communities, it is pertinent to discuss culturally appropriate modes of communicating

these results to different and necessary audiences (e.g. frontline workers, hunters, youth, elders). Local traditional knowledge is an integral part of the dialogue surrounding this project; however the focus moves beyond *what* (knowledge as content) and focuses more on *how* (knowledge as process). Traditional knowledge is inherently dynamic and 'living' in the sense that it encompasses cultural identity, practices and ethics, is place-based and contextual, and is experiential as it resides within each individual in addition to contributing to the larger collective knowledge of the community (Brody 2001). With climate change, Inuvialuit have their own knowledges, history, and observations, and are thus able to engage in dialogue with research because their own background enables them to better understand, trust, and communicate with science (cf. Riedlinger 2001b; Berkes and Jolly 2001; Nickels et al. 2005). However, this extensive historical background knowledge does not exist as such for contaminants issues, and compounded with the fact that contaminants – as studied through scientific research – are invisible, local engagement with this new information is more difficult and can thus influence the trust of contaminants messages and communication methods (Bielawski 1992; O'Neil et al. 1997a, 1997b; Egan 1998; Berkes 2009; Berkes and Berkes 2009). Despite less traditional knowledge about contaminant content or facts, knowledge about the ways or processes of communicating is abundant, and this knowledge has the ability to greatly impact the way in which communication about contaminants research is approached. Additionally, there remains the concern that contemporary science is interested in the assistance and knowledge of indigenous peoples when it best serves their purpose and fits in with expected results (Simpson, 2004); this may influence trust in, and perceptions of cross-cultural communication regarding contaminants or other scientific topics, and knowledge attribution and interpretation.

Chapter 3: The Community of Sachs Harbour

3.1 Preface

The experiences and perceptions of contaminants and communication processes that are encompassed by this thesis represent the voices of Inuvialuit from the community of Sachs Harbour, NT, on Banks Island in the Inuvialuit Settlement Region. Since knowledge is based in place and time, it is important to understand the historical and cultural context from where this knowledge comes, and the way of life it exists within. Furthermore, as the community is an important component of this study, context can provide insight into aspects of this particular community that may have influenced participants' experiences and perceptions.

The background presented here aims to provide a geographical, temporal, political, and cultural setting for this thesis, and describe essential community characteristics and significant events that may have shaped why Inuvialuit in this community responded to contaminants information and communication processes the way they did. In the final section, I describe the general history and tone of research in the western Canadian Arctic and the broad sentiments echoed by indigenous people about past research, and explain why I chose to work in Sachs Harbour, a community involved in ongoing Arctic research.

3.2 The Physical Environment

Banks Island is the westernmost island of the Canadian Arctic Archipelago (CAA), and is the fourth largest island in the archipelago with a landmass exceeding 70,000 square kilometres (Figure 3.1). Situated in the Northern Arctic Terrestrial Ecozone, it is largely characterized by the Banks Island Lowland ecoregion, although the community of Sachs Harbour is located within the smaller Banks Island Coastal Plain ecoregion on the island's

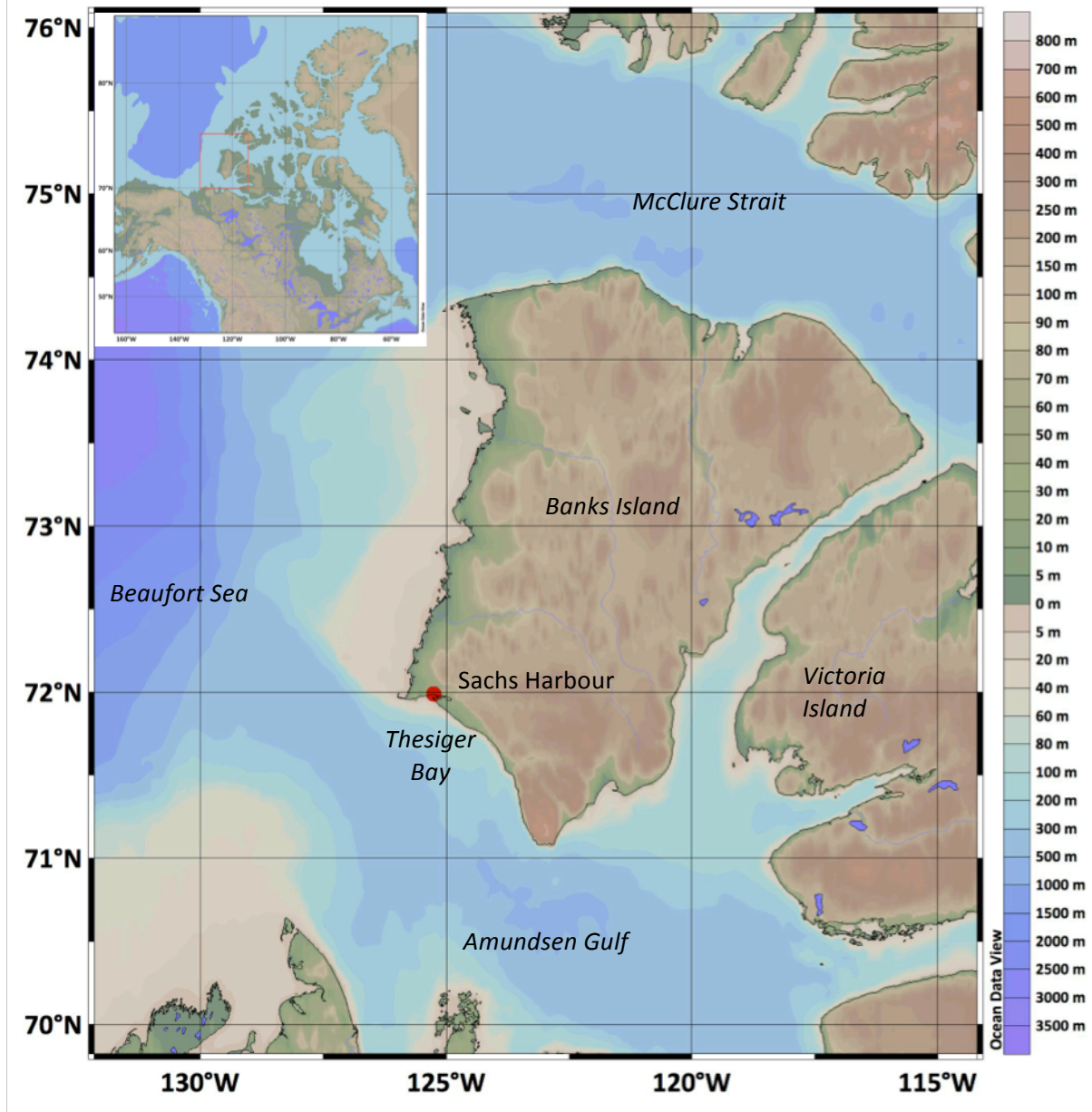


Figure 3.1. Map of Canada (inset) denoting the enlarged area of part of the Canadian Arctic Archipelago, comprising Banks Island and surrounding features, with the community of Sachs Harbour shown in red. Terrestrial elevation and oceanic depth are indicated according to the scale provided (created using Ocean Data View Version 4.5.5, Schlitzer 2013).

west side (Marshall et al. 1999). The island is surrounded by the Arctic Archipelago Marine Ecozone and the Arctic Basin Marine Ecozone further west, which borders the coastal plain ecoregion. Two of the coldest and driest in Canada, these regions experience mean annual temperatures of approximately -15°C , and an annual precipitation (rain and snow

combined) range of 100-200 mm (Marshall et al. 1999). Additionally, temperatures of the coastal plain are significantly affected by open water during the late summer and early autumn. The mean annual temperature for Sachs Harbour, recorded over the period of 1981-2010, was -12.8°C with a range of ±5.5°C (Environment and Natural Resources 2014).

Prevalent wetlands are typically horizontal, low-centre, lowland polygon fens with small, elevated peat mound bogs in the lowlands, and marshes occurring along the west coast (Marshall et al. 1999). Vegetation includes mosses, lichens, and a mixture of low-growing herbs and shrubs, which sustain terrestrial herbivores. Elongated ridges composed of glacial till occur on the island's east coast, whereas the remainder of Banks Island is mostly unglaciated tundra. Continuous permafrost and unconsolidated sands and gravel underlie the entire ecozone. The depth, prevalent ice wedges, and high ice content are characteristic of the island's permafrost, which contribute to regional geomorphological processes through the annual freeze-thaw of the active layer (Vincent 1982).

The western Canadian Arctic has experienced overall warming and increased climatic variability over the past 50 years (Zhang et al. 2000), resulting in changes to many aspects of the cryosphere – the seasonally or perennially frozen parts of Earth's surface (SWIPA 2011) – such as sea ice and permafrost. Increasing temperature trends contribute to an accelerated permafrost thaw rate, especially in the active layer, leading to permafrost degradation. Areas of permafrost have become exposed on Banks Island; this permafrost instability disrupts vegetation and sediment properties, contributing to thaw slumps and coastal erosion (cf. Cohen 1997; Riedlinger and Berkes 2001; Macdonald et al. 2005; Schindler and Smol 2006; Couture and Pollard 2007; Lantz and Kokelj 2008; Pearce et al. 2010).

Historically, Banks Island was surrounded by multiyear sea ice that would become part of the mobile polar ice pack during the winter, with 93% of multiyear sea ice surviving

the summer melt in the Beaufort Sea (Maslanik et al. 2011; Babb et al. 2013). Flaw leads formed as this multiyear pack ice moved away from coastal fast ice, creating recurring and interconnected polynyas in the Amundsen Gulf throughout the winter season (Barber et al. 2010). In recent years, however, arctic sea ice has been subjected to dramatic alteration, where multiyear ice has been replaced by a first-year sea ice regime (Maslanik et al. 2011). This has consequently resulted in changes in ice distribution, a thinner ice pack, loss of older ice, and a decline in sea ice extent (Riedlinger and Berkes 2001; Sou and Flato 2009; Maslanik et al. 2011; Galley et al. 2013; Kwok et al. 2013), with a record low in minimum arctic sea ice extent occurring in September 2012 (Blunden and Arndt 2013). Timing of ice freeze-up and break-up have also changed; ice around Banks Island used to freeze in late September, but recent years have seen open water until November (Riedlinger and Berkes 2001; Nichols et al. 2004). Ice break-up used to be characteristic in late June-early July, but now occurs earlier each year; while in Sachs Harbour in May 2011, I personally witnessed the start of open water on the south shore of Banks Island.

3.3 Historical Overview: Culture, Community, and Politics

3.3.1 Early History

Inuvialuit, meaning “Real People” in the Inuvialuktun language, are the indigenous people of the western Canadian Arctic who have lived in this region since long before living memory (Anderson and Bonesteel 2008; Arnold et al. 2011). Their ancestors are believed to be Thule Inuit who migrated eastward 800 years ago from current-day Alaska and inhabited Banks Island following its occupation by Pre-Dorset peoples over 3,500 years ago (Arnold et al. 2011). Likely the result of the Little Ice Age (approximately early 14th to mid-19th century), Banks Island remained deserted for several centuries as ancestral Inuvialuit sought refuge and extended their territory throughout the mainland Mackenzie River Delta,

although the island was occasionally used as a hunting ground for muskoxen from the 1650s to 1920s (Jenness 1969; Arnold et al. 2011; Parks Canada 2013).

3.3.2 Nineteenth Century European Exploration

Observed from northeastern Melville Island, Banks Island was christened “Banksland” by a member of the first Parry expedition in 1820, although Europeans did not actually visit the island until Captain John Franklin of the British Royal Navy led an expedition to discover the Northwest Passage during 1825-1827 (Arnold et al. 2011). In 1850, two British Navy ships, the *H.M.S. Enterprise* and the *H.M.S. Investigator*, the latter under the command of Captain Robert McClure, were employed to search for the lost Franklin Expedition of 1845. Unsuccessful, the *Enterprise* returned to England, while the *Investigator* became trapped in ice in Mercy Bay on northern Banks Island in 1851; after two years frozen in the pack ice, it was abandoned in 1853 (Arnold et al. 2011; Parks Canada 2013). Soon discovered by muskox hunters from Victoria Island, news spread among Inuvialuit about this icebound vessel and its cache of food and equipment; it became an important source of iron for knives and arrow points, and was often visited by Inuvialuit over the following 20-30 years (Arnold et al. 2011).

3.3.3 The 20th Century Fur Trade

“Without Inuvialuit realizing it, in 1870 their territory becomes part of the new Dominion of Canada” (Arnold et al. 2011). Content to let the police and missionaries meet the health and educational needs of Inuvialuit – including the development of a Native Education system in 1908 and the subsequent establishment of residential schools in 1919 – the southern Government paid little attention to its northern regions, maintaining an

official policy of encouraging them to retain their traditional way of life (Anderson and Bonesteel 2008).

Whaling had been the mainstay of Inuvialuit over the generations, but with the decline of the whaling industry came the development of the fur trade in the early 20th century (Usher 1970). Trade routes had been established prior to European arrival, as trapping and trading were also long-standing traditions, but these routes were limited to the mainland (Arnold et al. 2011). Thus, a skilled group of mainland Inuvialuit trappers began sailing to Banks Island each fall to trap white fox (Arctic fox) throughout the winter, and became known as “Bankslanders” (Ford 1999). In the 1920s, mainland competition increased from non-Inuvialuit trappers for the dwindling white fox, and Banks Island became a desirable destination due to the animals’ abundance (Arnold et al. 2011). However, to protect indigenous trapping rights and prevent non-native competition, Banks Island became a game preserve in 1920, allowing only Inuvialuit to hunt and trap on the island (Arnold et al. 2011). The harvest increased sharply in the early 1920s, and by 1929, the Island was the most productive white fox trapping area in North America (Usher 1970).

The Bankslanders returned each year, bringing their families with them, and established a series of over-wintering base camps that began the Inuvialuit settlement of Banks Island (Arnold et al. 2011). Eventually, in 1953, these families came together at the natural harbour on the island’s sheltered southwest shore to permanently establish the year-round community of Ikaahuk, “where you go across to” (Ford 1999; Arnold et al. 2011). Many of these families still reside on the island, and elders vividly recall their trips on the schooners and the heydays of trapping. Although the community’s traditional name, Ikaahuk, is still employed, its use has been eclipsed by the moniker “Sachs Harbour,” named after Vilhjalmur Stefansson’s schooner *Mary Sachs* of the 1913-1918 Canadian Arctic

Expedition who ran aground in the natural harbour in August 1914; this name first appeared on official maps in 1946, and became official in 1955 (Gray 2009).

3.3.4 Increasing Interest in the Western Arctic

White fox fur was especially fashionable prior to World War II, but demand and price steadily declined following the war that resulted in times of severe hardship for Inuvialuit (Usher 1970). Increased opportunities for wage employment arose in the mid-1950s, which changed the economic structure; although Inuvialuit continued trapping, income was largely supplemented by employment where and when possible (Usher 1970), such as unskilled, seasonal labour at mining camps (Anderson and Bonesteel 2008). The settlement on Banks Island was viewed as a useful position for military purposes: joint Canadian-American wartime defence cooperation continued postwar, with the establishment of numerous meteorological stations in the Arctic, including one on Banks Island in 1948 (G. Smith 2009). Subsequently, the advent of the Cold War prompted strategic considerations for asserting Canadian sovereignty over the CAA, and to ensure the loyalty of northerners in the event of war (Usher 1970). In 1954, a system of 63 radar stations – the Distance Early Warning (DEW) Line – was jointly developed by Canadian and American governments to detect bomber aircraft deployed from the USSR. The line stretched across the Arctic from Alaska to Greenland, with sites located along the Canadian Arctic coast – several of which were on Inuvialuit land – yet Inuvialuit were not consulted prior to the program’s implementation, nor with regard to actual site locations (Anderson and Bonesteel 2008). Since the fur trade was losing profitability and wage employment was scarce, many Inuvialuit were hired for site construction and operation (Usher 1973; Arnold et al. 2011). Despite the benefits of employment opportunities, however, the DEW Line also brought long-lasting environmental and human health problems: abandoned fuel drums,

fuel spills, asbestos in buildings, and PCBs in electrical equipment (Arnold et al. 2011).

During the early 1960s, DEW Line construction employment was ending, concurrent with a resurgence of good fur harvests and increased fur prices on the mainland (Usher 1971).

Relations between Sachs Harbour Inuvialuit and the small white population who worked at the weather station or as RCMP officers were mostly positive; in the 1960s, the white community comprised transient single white males that stayed in Sachs Harbour for one or two years (Usher 1971). Thus, the tenor of community life was set by the Bankslanders, not the outsider-dominated dynamic that was characteristic of many other northern communities (Usher 1971). During his time spent on the island, Usher (1970; 1971) noted the significance of personal relationships and the importance of visiting as a fundamental social activity within the small community, and how this promoted a strong sense of solidarity and common identity that enabled individuals to speak to outsiders on behalf of the community. This solidarity also manifested in community action with the formation of the Trappers' Association in 1963 to control access to game rights on the island, and a community association in 1965. The latter put enough pressure on government authorities to build a school in the community to prevent the familial separation that occurred by sending children to school in the Mackenzie Delta (Usher 1971; 1973).

Although trapping was still an important part of life, it began to take place closer to Sachs Harbour with fewer trappers spending months in camps on the land; the presence of a school, wage employment, the introduction of electricity, snowmobiles and household improvements made time in the community more desirable (Usher 1971). Until the school was built, federal investments in education, housing, utilities and health care was largely absent from Sachs Harbour; this changed after 1967, when large-scale government services and administration came to the community, bringing both benefits and unanticipated

consequences (Usher 1971). For the past several thousand years, Inuvialuit had regarded themselves as “stewards of the North;” with mounting concerns about government-sponsored development of oil, gas, and mineral resources in the western Arctic, they recognized the need to protect and advocate for the sustainability of their land and resources on which their livelihood was traditionally supported (Anderson and Bonesteel 2008). In 1970, a dramatic and controversial series of events unfolded when oil exploration crews proposed seismic work on Banks Island, and a conflict of interest arose between them and the local trappers (Usher 1971).

3.3.5 Banks Island Seismic Conflict

The Banks Island Seismic Conflict represents a failure in communication and consultation between the Bankslanders, oil companies, and the Canadian government. Bankslanders had been granted exclusive trapping rights to the entire island by the Department of Indian Affairs and Northern Development (DIAND); yet with the 1970 discovery of oil at Atkinson Point near Tuktoyaktuk and the subsequent frantic pace of development, DIAND issued oil exploration permits that covered the entirety of Banks Island later that same year (Usher 1971; IRC 2009). Neither the oil developers nor the Bankslanders were aware of the others’ situation, and there was no communication between the two groups despite both entities being represented by the same government department. The community’s response to the sudden notification of seismic work was initial surprise, followed by days of informal discussion among themselves; as people’s appreciation of the issue grew, a collective consensus of opposition emerged. The community’s worries, outlined by Usher (1971), included concerns for how seismic activity would affect the island’s ecology and their own economic well-being as trappers; anxiety about the implications of oil development for the future of the community and their way of

life; and outrage over the lack of prior consultation about the possibility of oil development, which was viewed as an invalidation of their traditional rights. They feared the destruction of their traditional values, autonomy, the land and wildlife; their economy and way of life was rooted in the land, and the land was being threatened (Usher 1973). These issues were raised at subsequent meetings with oil company representatives and government officials, who promised Bankslanders that 'further tests' would be conducted before the trapping season began in October (when seismic work was also set to begin), that the seismic operation would be continually monitored, and that proposed land use regulations would be adequate to prevent any harmful consequences of seismic work on wildlife (Usher 1971).

In 1970, the Committee of Original People's Entitlement (COPE) – the first native land rights organization in the North run by and for the people of the western Arctic and Mackenzie Delta themselves – was formed in Inuvik in response to increased political awareness of developmental pressures and government interference that threatened Inuvialuit traditional lifestyle and sovereignty (Usher 1973; IRC 2009). COPE became involved in the Banks Island Seismic Conflict, and the community sought legal advice; Bankslanders remained unsatisfied with the assurances of the Minister of DIAND, believing they did not address their fundamental issues and reservations about oil development. The Minister, however, remained resolute in the adequacy of his promises to diminish the community's fears (Usher 1971). Subsequently, in consultation with COPE and their lawyer, Bankslanders notified the Minister that they would await a definitive statement regarding his vague assurances, and if no satisfactory solution was reached within three weeks, a court injunction would be sought to halt the oil exploration until adequate safeguards were in place (Usher 1971; IRC 2009).

Since previous meetings were stalemates, Bankslanders assumed a subsequent meeting in August 1970 would resemble the others where nothing significant would be

resolved; they were informed of the meeting a few days in advance while still awaiting a statement from the Minister (Usher 1971). The Bankslanders sought COPE representation at the meeting, but neither COPE executives nor their lawyer were able to attend due to the quick announcement of the meeting. As such, from the community's point of view, "it appeared a contest between two adversaries: the government and the oil companies on one side, using glib assurances and big words, and themselves on the other side, unrepresented by anyone who really understood what was going on" (Usher 1971). While doubtful that this was a conscious intent on the government's behalf, there remained strong feelings among the community and COPE executives that such representation was deliberately excluded (Usher 1973).

From the Bankslanders' viewpoint, the result of the meeting was that they were essentially told there was no use in fighting the oil exploration project, and that the prior assurances given were the best solution to their concerns (Usher 1971). Realizing they had neither the finances nor the ability to pursue court action against both the government and oil companies, they decided not to proceed with the injunction; the community's resistance was broken, and their resentment and mistrust towards the government increased. Real communication and consultation between such vastly different economic ventures (trapping and oil development) that represent different worldviews was viewed to be nearly impossible (Usher 1971). The concept of consultation became imbued with the notion of government or industry propaganda and associated power relations, whereas "real equality between natives and outsiders" would see consultation replaced by negotiation with both sides bargaining as equals; a lands claim settlement was viewed as the means to establish these rights, and develop a structure within which Inuvialuit had access to their own research, information and representatives (Usher 1973).

3.3.6 Inuvialuit Final Agreement

The Banks Island oil crisis led to the establishment of Federal Territorial Land Use Regulations in 1971 to manage land access in the Northwest Territories, to control the environmental impacts of developments on crown land, and give local administrations a voice in land development (Arnold et al. 2011). Increasing numbers of Inuvialuit felt that recognition of their title to the land was of critical importance if they were to influence development in the North, in which COPE played a prominent role (Usher 1971). Their main objectives were “to provide a united voice for all original peoples of the N.W.T. and to work for the establishment and realization of the original peoples’ rights” (Usher 1973). COPE’s governing principle was that the land belongs to the people, and whoever wanted to use it should settle the matter with the people; additionally, no development should proceed without such a settlement and recognition of aboriginal rights, which would grant the people a strong bargaining position, control over their land, and the ability to receive compensation from the development of their land by industry, government, or others (Usher 1973). In 1973, the Supreme Court of Canada made a landmark decision to support the concept of aboriginal title to land in the case of *Calder v. Attorney-General of British Columbia* (1973); it was the first time that the existence of collective aboriginal rights to the land was acknowledged by the Canadian legal system, and furthermore, that this title existed outside of colonial law (Kulchyski 1994). This came as a surprise to the Government of Canada, who subsequently created the Comprehensive Claims Policy to establish a process for aboriginal groups to claim title to their territory and prevent further testing of aboriginal rights in court where these rights were not resolved by treaty or other means (IRC 2009).

Formed in 1971, the national Inuit organization, Inuit Tapirisat of Canada (ITC; re-named Inuit Tapiriit Kanatami (ITK) in 2001), began land claims work for the Nunavut

Proposal; COPE was a regional organizer, and from 1974 to 1976, COPE made significant contributions to the Land Use Occupancy Studies required to support the claim for land title in the western Arctic (IRC 2009). However in 1976, months after submitting the claim to the Prime Minister, ITC withdrew the Nunavut land claim proposal citing that it needed to be rewritten. Since the western Arctic was confronted with more pressure to develop than the eastern Arctic, COPE decided to proceed with a regional land claim, which meant that COPE volunteers visited each Inuvialuit household to listen to peoples' views, explain the new situation and their rights, and request the people's support (Usher 1973; IRC 2009). Voting was set up to assess if COPE had Inuvialuit endorsement to pursue a regional land claim on their behalf; 98.5% of Inuvialuit voted in favour of a land claims settlement, and Inuvialuit Nunangat ("the land of the Inuvialuit") became the first Inuvialuit-specific land claims proposal submitted to the Minister of DIAND in May 1977 (Anderson and Bonesteel 2008). The four main goals of the COPE submission were preserving traditional Inuvialuit culture, maintaining land and resource sustainability, establishing Inuvialuit involvement in future economic development, and receiving sufficient compensation for any elimination of their land rights within the claim (Anderson and Bonesteel 2008).

Despite careful preparation, the process of negotiating the land claim was lengthy and fraught with delays. In August 1977, DIAND stated that the proposal was "not really what the Inuvialuit wanted and was not in their best interests," failing to give the proposal serious deliberation; in response, COPE prepared to take court action, but then decided to try to reach an agreement with a newly appointed DIAND Minister (IRC 2009). In July 1978, a Joint Position Paper containing all of the major elements of the final agreement was signed between the DIAND Minister and President of COPE. Inuvialuit then began setting up the framework to implement the final agreement, which included the establishment of the

Inuvialuit Development Corporation (IDC) in 1978, and the Inuvialuit Game Council (IGC) in 1983 (IRC 2009; Arnold et al. 2011).

Following the signing of the Joint Position Paper, the Agreement-in-Principle (AiP) was to be ratified, but COPE was recommended to attend a government interdepartmental meeting to present a preview of the AiP to gain support for their claim. Instead of support, they were met with the response that they didn't need the land claim and that the government would take care of them; COPE replied that they would go to court as the government was not taking them seriously and was not "negotiating in good faith" (IRC 2009). After investigating COPE's finances and realizing they were financially fit to sue, the DIAND Minister proposed resuming negotiations; COPE agreed only if certain people on the government's negotiating team were replaced (IRC 2009). Serious negotiations then began, and the AiP was signed in Sachs Harbour on October 31, 1978.

Negotiations stalled during the 1979 federal election, when the DIAND Minister from the new Conservative government stated he would not continue with the negotiations as they had started under the previous Liberal government; frustrated, COPE delegates thought they were negotiating with the Government of Canada, not any one political party (IRC 2009). COPE re-educated each new federal and territorial government as they came into power over the subsequent six years in addition to educating the public, private sector, native organizations, and the oil industry (IRC 2009). The Liberal Party returned to power in 1980 with the intention to resume negotiations; however, deliberations stalled again when COPE learned that the new DIAND Minister and federally-appointed negotiator sided with industry lobbyists and planned to gut crucial elements of the AiP (IRC 2009). In 1982, four years after the AiP signing, a new federal negotiator visited several Inuvialuit communities and met with COPE delegates to resume deliberations.

Finally, after 14 years and having gone through six DIAND Ministers and three federal negotiators, the Inuvialuit Final Agreement (IFA) was approved by Ottawa, ratified by the Inuvialuit through a two-thirds majority vote, and signed in Tuktoyaktuk on June 5, 1984 (IRC 2009). The IFA was the first comprehensive land claim agreement signed in the Territories and only the second one signed in Canada at that time; it cannot be modified by the Canadian Parliament without Inuvialuit approval due to its protection under the Canadian Constitution (Arnold et al. 2011). Included in the IFA are provisions for fishing, trapping, hunting, language, game management, and subsurface resource rights (Anderson and Bonesteel 2008). Unlike the treaties of the 19th century, “which functioned mainly to achieve a final solution to the surrender of native land in exchange for money, reserves, and interim services,” the IFA is a living document with provisions to protect Inuvialuit culture and identity amid a changing northern and Canadian society, preserve traditional lands and wildlife, and be equal, significant participants in the northern and national economy (IRC 2009; Arnold et al. 2011; cf. Section 3.4.4). As COPE’s work negotiating the comprehensive land claims settlement was completed and its efforts realized through the creation of the Inuvialuit Settlement Region (ISR; Figure 3.2), the organization was dissolved and then reconstituted as the Inuvialuit Regional Corporation (IRC) to enable the IFA to be implemented (Anderson and Bonesteel 2008; Arnold et al. 2011).

3.3.7 Inuvialuit Settlement Region – Land Title Recognized

Thirty years after the official IFA signing, Inuvialuit culture is alive, and the commitment to the IFA objectives remains at the forefront (IRC 2009). COPE envisioned that, through a land title settlement, Inuvialuit would receive monetary compensation from any party wanting access to the land, and that Inuvialuit could then use the money to provide their own services and start their own businesses (Usher 1973). The realization of

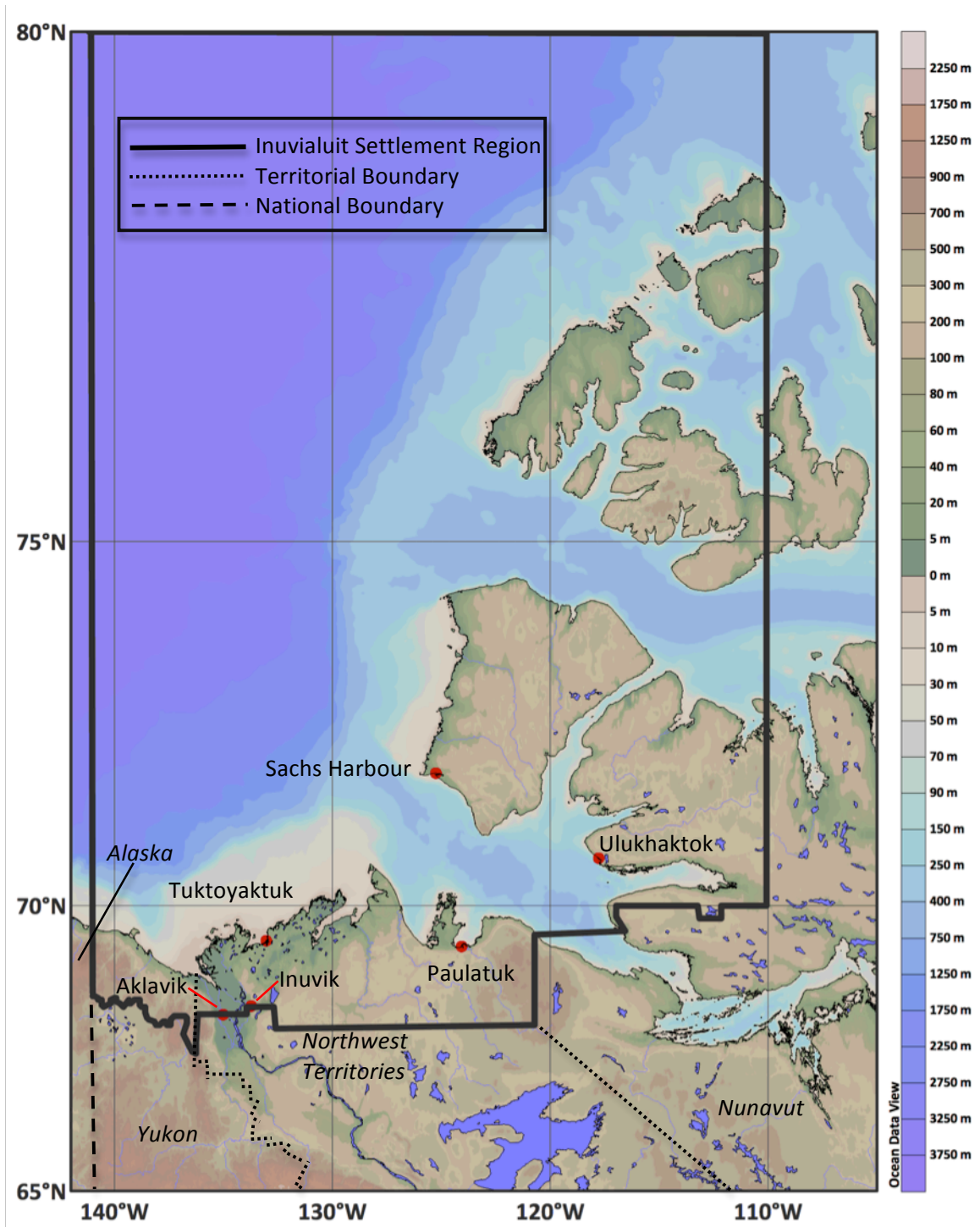


Figure 3.2. The Inuvialuit Settlement Region (ISR) of the Northwest Territories and Yukon's North Slope region, established through the Inuvialuit Final Agreement (IFA). The ISR is continuous with the Nunavut territorial boundary to the east and the Alaskan boundary to the west. The six Inuvialuit communities are denoted in red (created using Ocean Data View Version 4.5.5, Schlitzer 2013).

the IFA enabled the IRC – the established land claim beneficiary corporation – to be responsible for receiving and managing the benefits from the land claim agreement (Anderson and Bonesteel 2008). The IDC became the for-profit business branch of the IRC, through which land claim capital could be effectively invested to ensure a sustainable legacy for all Inuvialuit; 100% Inuvialuit owned, IDC includes companies in the sectors of energy services, transportation, management and real estate, northern services, and manufacturing and industrial services (IRC 2009).

Fish and wildlife resource management subsequently became a shared responsibility between Inuvialuit and the territorial and federal governments under five co-management bodies that have come to be respected and recognized for their effectiveness, as outlined below: Fisheries Joint Management Committee, Environmental Impact Screening Committee, Environmental Impact Review Board, Wildlife Management Advisory Council NWT, and Wildlife Management Advisory Council North Slope (IRC 2009; Arnold et al. 2011). Harvest studies in Arctic Canada conducted prior to the IFA signing were done over short periods and were moderately successful, thus IGC established the Inuvialuit Harvest Study in 1986 to build on existing studies to provide a more complete picture of Inuvialuit wildlife harvesting, resulting in a ten-year comprehensive record of harvest activities (IHS 2003; IRC 2009). A landmark user-group agreement between Inuvialuit and the Inupiat of Alaska to jointly manage their shared polar bear population was signed in 1988, re-affirmed in 2000, and is one of IGC's most significant accomplishments (IRC 2009). Commercial whaling that occurred from 1848 to approximately 1915 severely depleted the Bering-Chukchi-Beaufort bowhead whale population; Inuvialuit subsistence hunting continued until a 1937 international agreement prohibited bowhead whale harvesting, which restricted Inuvialuit subsistence practices (Cosens 1997, COSEWIC 2009). Formed in 1949, the International Whaling Commission

banned commercial whaling but permitted subsistence harvesting in 1950, which was later revoked in 1977 (Cosens 1997). Repeated requests from Inuvialuit throughout the 1960s-1970s to regain hunting privileges prompted scientific studies of whale population health and resulted in the creation of a bowhead whale licensing system in 1979, and aboriginal rights to traditional food sources became protected under the 1982 *Constitution Act* (Cosens 1997). The subsequent signing of the IFA enabled joint federal-Inuvialuit management of marine mammal subsistence harvest quotas, validating the cultural significance and identity of Inuvialuit as whale hunters (Ris 1998), which was especially important considering the overall harvesting shift from marine to terrestrial food sources (Usher 2002). In September 1991, Inuvialuit hunters from Aklavik successfully harvested a bowhead whale that marked a cultural and political triumph by being the first hunt of its kind in over 70 years (Ris 1998). The importance of creating and maintaining protected areas for wildlife in the ISR resulted in the creation of three National Parks and four migratory bird sanctuaries, of which the locations and boundaries were established with Inuvialuit input, and are cooperatively managed by IGC in conjunction with Parks Canada and Environment Canada (Anderson and Bonesteel 2008; IRC 2009).

Many members of COPE started the Northern Games in 1970 to promote the socio-cultural traditions of Inuvialuit (Usher 1973); the Northern Games Society keeps the games running each year, bringing together athletes from around the circumpolar region for over four decades (IRC 2009). Drum dancing is experiencing resurgence, as is printmaking and carving (Arnold et al. 2011). Efforts to record and preserve oral histories is ongoing, bolstered by the emphasis on teaching Inuvialuktun by incorporating it into the language curriculum at all ISR schools (IRC 2009; Arnold et al. 2011).

The North Warning System and 13 minimally attended radars replaced aging DEW Line technology in 1980, and although these programs brought service people into northern

communities, which contributed to community economies, they failed to provide sustained or large-scale employment (Anderson and Bonesteel 2008). While these projects contributed to the development of community infrastructure, such as buildings, roads, airports, hydroelectricity, and sewage disposal systems, they also left a legacy of environmental damage with only recent attempts at site cleanup (Anderson and Bonesteel 2008); IRC and the Department of National Defence signed a cooperation agreement for the restoration and clean-up of DEW Line sites in the ISR in 1996 (IRC 2009).

Inuvialuit have regained control over their land, wildlife, and resources, with the IRC functioning as a regional, ethnically based governing body with limited scope and authority, as the IFA did not contain provisions for regional or self-government (Anderson and Bonesteel 2008). IRC lacks the legislative powers that would make it a true government with the ability to make and enforce laws and policies to protect Inuvialuit land, resources, language, and culture, be accountable to its people, and provide suitable programs and services (Arnold et al. 2011). Regarding section 35 of the *Constitution Act*, 1982, the 1995 Inherent Right Policy recognized that aboriginal people have inherent rights to self-government (Anderson and Bonesteel 2008; AANDC 2010). Since existing land claims cannot be re-negotiated to address the right to self-government because of the comprehensive land claim policy created in 1973, the IRC is currently negotiating an Inuvialuit Self Government Agreement with the governments of Canada and the Northwest Territories (Anderson and Bonesteel 2008; Arnold et al. 2011).

3.4 Sachs Harbour Today

3.4.1 Demographics

Sachs Harbour is the most northerly and smallest of six communities in the Inuvialuit Settlement Region under the IFA, and remains the only community on Banks

Island (Figure 3.3). Population fluctuations are especially noticeable in a small community, as it is not uncommon for residents to move away for school, work, or extended family visits for a period of time and then return. According to the 2006 Census Community Profile, the Sachs Harbour population was 122, indicating a 7% growth from the 2001 census (Statistics Canada 2006). Since details from the 2011 census were not yet available when I was interviewing participants in the community, I conducted my own census with local assistance, as I needed to determine the number of interviews that would attain a representative sample of 25-30% of the Inuvialuit adult population (cf. Section 4.4.1). The small community size and the fact that everyone knows each other facilitated the enumeration of people living in each dwelling, including those who were over the age of eighteen. As of April 2011, the Sachs Harbour Inuvialuit population was 100 according to my unofficial census, with 71 adults of which 41 were male and 30 were female. This contrasted with the official results, which indicated a population of 112 (Statistics Canada 2011; results were released after project completion), because my census comprised only Inuvialuit; as such, it was an accurate population account during the time of this study.

3.4.2 Economy

Banks Island was known as the white fox capital of the world from the late 1920s until the decline of the fur trade in the mid-1970s (Usher 2002); however, white fox trapping is no longer the economic basis of the community, which has switched to a mixed economy that includes hunting, trapping, fishing, wage labour, social assistance payments, and domestic arts and crafts production (Berkes and Jolly 2001; Anderson and Bonesteel 2008). Several people continue to set traps near the community during the winter, and Sachs Harbour hosts the annual White Fox Jamboree for three days each May. Starting in 1981, a commercial muskox harvest occurred in October-November, employing the



Figure 3.3. Westward aerial view of the entire Sachs Harbour community in June 2011.

majority of the community with jobs such as herders, butchers, and shearers (Nagy et al. 1996; Whittles 2005). The average commercial harvest during the first few seasons was 124 muskox per year (range: 0-260), which – in conjunction with the rapid population increase – grew to an annual quota of 5,000 muskox since 1991 (Nagy et al. 1996). While some meat was kept for Sachs Harbour and other Inuvialuit communities, the remainder was sent to southern Canadian cities and marketed internationally, while the qiviut – the muskox’s soft insulating fur – was turned into wool for retail sale (Whittles 2005; Anderson and Bonesteel 2008; W. Esau, pers. comm., April 2010). Harvest by-products and raw materials were given to the community for use as bedding skins, material for clothing and handicrafts, and sled dog food (Whittles 2005). The harvest promoted traditional community resource sharing, reinforcing the preservation of land-based knowledge and

skills through teaching these practices to subsequent generations of Inuvialuit (Whittles 2005). Although successful in the past, the destruction of the abattoir by severe storms prevented the harvest for a few years, and the decision to cease the harvest and tear down the abattoir occurred in 2013 (J. Carpenter, pers. comm., May 2014). A few families in Sachs Harbour also run outfitting operations for sport hunters vying for muskox or polar bear.

Community affairs and services are handled through the Hamlet Office, Hunters and Trappers Committee, and Community Corporation, which provide administrative, managerial, and public service jobs such as water delivery, sewage pick up and construction. Other wage employment is provided through the local Housing Corporation, telephone and Internet infrastructure maintenance, government jobs (Parks Canada, Environment and Natural Resources), health centre, airport, school, Ikaahuk Co-op, and private business. Inuvialuit beneficiaries also receive transfer payments from the IRC as determined through the IFA (IRC 2009) and various individuals represent Sachs Harbour on Inuvialuit regional boards, committees, and co-management bodies. Occasional employment is also provided through industrial, academic, or government research programs that require field assistants or wildlife monitors. However, many families still make part of their living off the land, as subsistence hunting, trapping, and fishing remain an integral part of community life and Inuvialuit identity (Usher 2002; IRC 2009).

3.4.3 Wildlife and Country Food

Banks Island and surrounding waters are home to a diverse array of wildlife, including the world's largest single muskox herd – encompassing approximately one-third of the world's population (Whittles 2005) – endangered Peary caribou (cf. COSEWIC 2004), ringed seal, bearded seal, beluga whale, polar bear, Arctic wolf, Arctic (white) fox, Arctic hare, lemmings, ermine, snowy owl, ptarmigan, the largest nesting population of Lesser

snow geese in the western Arctic (Whittles 2005), Canada geese, brant geese, king eider and other sea ducks, tundra swans, sandhill cranes, raptors, loons, seabirds, shorebirds, gulls, terns, Arctic char, lake trout and other fish, and an assortment of insects and marine invertebrates (SHCCP 2008). Occasional species include bowhead whale, walrus, wolverine, and grizzly bear (SHCCP 2008), although the latter are becoming more common, and have been found to hybridize with polar bears; the first known wild-born polar-grizzly was shot near Sachs Harbour during an expedition led by Roger Kuptana in 2006 (R. Kuptana, pers. comm., July 2009). In 1997, bowhead whales were listed as 'endangered' by the Committee on the Status of Endangered Wildlife in Canada (Cosens 1997), but their status has been changed to that of 'special concern' as of 2009 (COSEWIC 2009).

In addition to the significant socioeconomic, political, and climatic changes Bankslanders have seen over the past 50 years, there has also been increasing variability in wildlife populations. The most notable changes are with regard to muskox and caribou, which are the community's primary meat sources (Nagy et al. 1996). Concerns about how oil and gas exploration would affect wildlife populations and distributions (cf. Section 3.3.5) prompted the first aerial surveys of both species in 1972 (Gunn et al. 1991). Archaeological records and oral history indicate that muskox were once abundant on Banks Island, suffered a population decline in the late 19th century, and remained in low numbers until the 1970s (Gunn et al. 1991). Since then, their population has dramatically increased from hundreds in the 1950s to thousands in the 21st century: 1972 estimates put the population at 3,800; the most recent survey conducted in 2001 estimates a population of 68,788 non-calf animals, however, the current population size is unknown (Parks Canada 2003; SHCCP 2008). Muskox have become an important source of food, fur, and qiviut for the community, and are hunted almost year-round with no current harvesting quota (SHCCP 2008). Conversely, Peary caribou were once very abundant on the island with a known historical

population high of 12,098 non-calf animals in 1972; population size sharply declined to 436 non-calf animals in 1998 with little recovery seen during the last population survey in 2001 that counted 1,196 non-calf caribou (Parks Canada 2003; SHCCP 2008, cf. Nagy et al. 1996). Possible causes of the population decline include predation by wolves, adverse changing climate conditions, migration to other islands, and competition with muskox (Gunn et al. 1991; Nagy et al. 1996; Parks Canada 2003; SHCCP 2008). Consequently, although the caribou harvest season is year-round, an annually assessed restricted hunting quota is in place, and meat from harvested caribou is shared throughout the community (SHCCP 2008).

Table 3.1 lists the main animals harvested on Banks Island and the seasons when hunting primarily occurs.

Table 3.1. Annual cycle of harvesting activity for primary terrestrial and marine mammals, birds, and fish species on Banks Island (after IHS 2003; SHCCP 2008; personal communications).

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Muskox												
Caribou												
Polar Bear												
Furbearers*												
Geese/Ducks/Swans												
Fish**												
Beluga Whale												
Seals												
Ptarmigan												

* Furbearers include Arctic fox, Arctic wolf, and Arctic hare.

** Fish include land-locked and sea-run Arctic char, lake trout, Arctic cod, and whitefish.

Although not hunted for food, Arctic fox, Arctic wolf and Arctic hare are still harvested for their fur (Usher 2002; SHCCP 2008), which is used in conjunction with muskox fur for crafts, footwear, and clothing. These items are sold or traded locally and regionally, with tourists and transient workers in the community, and showcased at various northern arts festivals and boutiques throughout the territory.

Polar bears in the Amundsen Gulf and Beaufort Sea were severely overharvested due to unregulated hunting prior to the establishment of harvest quotas in 1968, as no information existed about the size of the Canadian polar bear population (Stirling 2002). It is now known that two populations exist in this area, with the Northern Beaufort population inhabiting the west coast of Banks Island and Amundsen Gulf; as of 1987, this population had recovered to 1200 animals (Stirling 2002), and modeled average population estimates for the years 2000-2006 was approximately 980 (Stirling et al. 2011). Annual sustainable quotas have increased from 36 bears in 1968 to 65 bears in 2011, with harvests consistently being below the maximum yield (Stirling et al. 2011). Polar bears are locally hunted for their fur in addition to being a source of income through sport hunting outfits (SHCCP 2008), and many elders consider the meat a delicacy.

Migration patterns of geese, seabirds, tundra swans, and sandhill cranes are closely linked to the availability of open water and the timing of freeze-up, with their arrival occurring in mid- to late May and departure in September (SHCCP 2008). Many sea ducks, gulls and loons use the southeastern Beaufort Sea flow lead as a temporary staging ground before dispersing either inland or further eastward to the central Arctic (Dickson and Gilchrist 2002). During their short period on Banks Island, snow geese are the primary species sought, although Canada geese, brants, King eider, and tundra swans are also harvested, and bird hunting largely overshadows the harvesting of other wildlife. Community members set up camp near the nesting grounds for weeks at a time during the harvest season, although these areas are becoming increasingly difficult to access due to the inability to cross rivers that are experiencing earlier thaw (W. Gully, pers. com. May 2011). Snow geese and their eggs are very important food sources, with excess meat being frozen or dried to last until the following year (SHCCP 2008). Duck and goose down is also collected for use in clothing, pillows, and blankets. Non-migratory ptarmigan are a well-

liked food source that are hunted in autumn, although harvest numbers vary annually in conjunction with their fluctuating population levels (SHCCP 2008).

Fishing occurs almost year-round, using gill nets and rods during open water periods, and ice fishing in the winter. Arctic char is a very important food source, both fresh and dried, and is harvested in both its larger sea-run (marine) form and smaller land-locked (freshwater) form. Lakes on the island support other important subsistence fish such as lake trout and whitefish, while Arctic cod is the other significant marine species harvested (SHCCP 2008). The first record of non-endemic sockeye and pink salmon on Banks Island occurred in 1993 when the fish were caught in the Sachs River estuary near the community, representing a considerable extension of their known range (Babaluk et al. 2000). Salmon have continued to be sporadically harvested with sea-run char catches (T. Lucas, pers. comm. August 2009). Rising water temperatures from climate change may increase the frequency of Pacific salmonid occurrences in Arctic waters, with potential concern for their impact on Arctic char populations (Babaluk et al. 2000).

While not as commonly seen in the summer waters surrounding Banks Island as compared to other ISR communities, beluga whales are a highly valued subsistence species for maktak (skin and blubber) and making dry meat. Beluga whales from the Beaufort Sea stock usually spend the spring in the southeast Beaufort Sea, aggregate in the Mackenzie River estuary and near the Tuktoyaktuk Peninsula in July, and travel in August to their summer ranges in the Amundsen Gulf and offshore Beaufort Sea (Harwood and Kingsley 2013). No beluga whales were harvested in Sachs Harbour from 1988-1997 (IHS 2003) although occasional sightings have occurred since, with a successful harvest of two belugas in September 2008, marking the first time in living memory that whales were taken in the harbour instead of at sea (L. Amos, pers. comm., August 2009). Most recently, belugas were

sighted in July 2014, with one harvested in August (E. Esau, pers. comm., August 2014). When belugas are unavailable, the community relies on maktak ordered from the mainland.

An important subsistence species for Inuvialuit, seals are harvested for food, clothing and oil; bearded seal meat and rendered fat is preferred by many locals, although ringed seal meat is also eaten. Ringed seals are generally more abundant and yield a higher harvest than bearded seals (Harwood et al. 2012), and their fur is preferred for sewing clothing and footwear. The smallest of the pinnipeds (seals, sea lions, and walruses; T. Smith et al. 1991), adult ringed seals in the Beaufort rarely exceed 68 kg (150 lb), in contrast to the large bearded seals that can weigh upwards of 340 kg (750 lb) at their heaviest in winter (SHCCP 2008). Both ringed and bearded seals are ice-breeding species, although preferences in sea ice type and concentration differ between species (Jones et al. 2014). Ringed seals remain closely associated with sea ice for most of the year, preferring stable, annually forming landfast ice that promotes snow accumulation to facilitate the construction of subnivean lairs; these hollowed out shelters beneath the snow are used for resting, birthing, and protection from predation by Arctic fox and polar bears (Smith and Stirling 1975; Hammill and Smith 1989; T. Smith et al. 1991). Unlike ringed seals, bearded seals avoid regions of thick, continuous landfast ice, preferring leads and polynyas where ice is in constant motion (Burns 1981). As mating, birthing, molting, and resting occur on sea ice, bearded seals travel great distances to maintain close association with seasonally-moving ice year-round (Burns 1981).

3.4.4 Identity

Inuvialuit perspectives on wildlife, food and their supporting ecosystems differ from most Western societal views, as Inuvialuit do not see themselves as separate from their environment (Berkes and Berkes 2009; cf. Bielawski 1992; Stairs and Wenzel 1992;

Rybczynski 1997; Fienup-Riordan 1999; Brody 2000). Because relationships with, and respect for the land, sea ice, and animals have been cultivated through generations, the environment is intrinsically linked to Inuvialuit culture, way of life, and forms the basis of what they are as people (Usher 1973). This notion of environment also relates to social and cultural surroundings that combine to create a sense of 'place,' which is central to one's identity (Twigger-Ross and Uzzell 1996; Gustafson 2001). Inuvialuit living in Sachs Harbour know about the land, wildlife, sea ice and weather on Banks Island (Riedlinger 2001a, 2001b), both historically and in its current state of change, as that is not only part of being Inuvialuit, but it is an important aspect of the collective identity of Bankslanders. As Usher (1973:14) observed during COPE's land claim struggles,

[n]ative people know that in order to be themselves, the land and the animals must be part of their life. In that sense, the land sustains them and their communities. Without the land, and everything it means, native people would lose that which makes them special in their own eyes.

Stairs and Wenzel (1992) proposed that harvesting is rooted within a socio-relational continuum where country food is the medium through which community and environment are integrated. Many studies on the biological, ecological, or health aspects of wildlife that encompass country foods acknowledged the nutritional, physical, economic, emotional, spiritual, social, and cultural importance of subsistence harvesting to the personal and community well-being of Inuvialuit (e.g. Ris 1998; Dickson and Gilchrist 2002; Usher 2002; Van Oostdam et al. 2005; Whittles 2005; Donaldson et al. 2010; Harwood and Kingsley 2013). Thus country food and associated land-based activities act to unify the relationships between Inuvialuit, their environment, and community social structure, all of which are inter-connected sources of Inuvialuit identity.

Generations of Inuvialuit relationships with and reliance on the environment and wildlife created cumulative community-based knowledge of local trends, patterns, and

processes, the ability to recognize the onset of change, and appropriate socio-cultural conduct (Rybczynski 1997; Fienup-Riordan 1999; Riedlinger and Berkes 2001; Pauktuitt 2006; Berkes and Berkes 2009). This body of living knowledge and tradition is passed down through generations, evolving to suit changing conditions through experience and adaptation, as Sachs Harbour Inuvialuit “have always adjusted and adapted to change: social, political, and economic as well as environmental” (Berkes and Jolly 2001). Adaptive capacity is part of their livelihood (Riedlinger 2001b), and Inuvialuit knowledge is a collective process that is rooted in Inuvialuit identity and place (McGregor 2004).

Despite a historically high level of adaptive capacity among Inuvialuit, societies that are closely linked to Arctic resources are particularly susceptible to environmental and climatic change, which Bankslanders have felt are beyond the natural expected scope of variability and fluctuation (Berkes and Jolly 2001; Riedlinger 2001b; Riedlinger and Berkes 2001; Nickels et al. 2005; Pearce et al. 2010). As aforementioned, the Arctic is undergoing unprecedented climatic variability, manifesting as changes in sea ice type, thickness, extent, and distribution (Sou and Flato 2009; Maslanik et al. 2011; Galley et al. 2013; Kwok et al. 2013); more frequent and intense extreme weather conditions and overall unpredictability (Riedlinger 1999; Hanesiak and Wang 2005; Raddatz et al. 2014); coastal erosion and loss of permafrost (Anisimov et al. 2002; Lantz and Kokelj 2008; Lawrence et al. 2008); changes in wildlife distribution, population, migration routes, the arrival of new species (Riedlinger 2001b; Corell 2006; Krupnik and Jolly 2010; Harwood et al. 2012), and – of particular interest to this thesis – alterations in contaminant transport pathways and bioavailability (Macdonald 2005; Stern et al. 2012; cf. Nickels et al. 2005; Barber et al. 2008; Carmack and Macdonald 2008).

Bankslanders are already adapting to take advantage of new opportunities and mitigate risks of climate-related change, such as substituting store foods for country foods

when the latter is unavailable, shifting hunting grounds and timing of harvesting, using alternative modes of transportation and hunting routes, reinforcing community infrastructure, taking precautions when traveling on the land, and creating elder-youth mentoring programs to promote intergenerational knowledge and skill transfer (Riedlinger 2001b; Pearce et al. 2010). Nevertheless, numerous barriers and limitations to adaptation exist that undermine adaptive capacity, and may lead to future vulnerability, especially with regard to the interactive effects that environmental change may have on economic, social and cultural aspects of Inuvialuit life (Wheatley 1998; Pearce et al. 2010). For example, although the consumption of country foods is encouraged for the myriad of aforementioned benefits, the presence of contaminants at high levels in certain organs of certain animals continues to be an issue of concern for the implications to human health; yet concepts of health cannot easily be extricated from Inuvialuit notions of environment, society and culture (Wheatley 1996; 1998; Kuhnlein et al. 2003; Van Oostdam et al. 2005; Donaldson et al. 2010). The relationship between the Sachs Harbour community and their environment is being affected, which by extension affects their concept of identity.

3.5 Framing the Notion of Research in Sachs Harbour

3.5.1 Context of Northern Research

To address the mounting concerns of environmental change and interconnected impacts on Arctic environments and peoples, there has been a surge in interdisciplinary research efforts over the past decades, enabled by the dramatic changes to research practices and priorities that ensued from land claims settlements (Korsmo and Graham 2002). Not only does the term ‘research’ have different contextual and methodological connotations among the diversity of disciplines in the sciences and humanities, but indigenous communities have not often had positive experiences with research (Korsmo

and Graham 2002). Historically, 'research' has been "one of the dirtiest words in the Indigenous world's vocabulary" (L. Smith 1999) because as an extension of colonialism – replete with power imbalances, cultural marginalization and assimilation – it has undermined and appropriated indigenous knowledges, lands, and cultures (Simpson 2004). A general overview of major research endeavours in the Canadian North, with a consideration of indigenous sentiments toward research, serves to illustrate Inuvialuit experiences with research preceding and following the establishment of the ISR, and situate the community of Sachs Harbour within this broader context.

3.5.2 Research in the Canadian Arctic

Arctic exploration has occurred for centuries, but only in the late 19th century did exploration begin to become more of a systematic science of observations and measurements, as "the notion of a sparsely populated wilderness where science could be carried out with a minimum of interference made the isolation of the Arctic particularly attractive" (Korsmo and Graham 2002). These ideas, and the scientific goals to explore polar phenomena that were beyond the capabilities of any single nation, led to the first International Polar Year (IPY) of 1882-1883, where 12 nations carried out synchronized geographical, meteorological, and geomagnetic studies at various Arctic and Antarctic stations (Barr 1983).

In 1913, the Canadian government sent a large scientific expedition, the Canadian Arctic Expedition, comprised of two distinct parties: the Northern party carried out geographical explorations of the expanse of the Canadian Arctic Archipelago from Coronation Gulf (south of Victoria Island) to the North Pole, while the Southern party conducted anthropological, geological and biological studies on the mainland and neighbouring islands (Jenness 1969; Gray 2006). Stefansson's Northern Party, whose base

was near the southwest corner of Banks Island, discovered four of the last major new islands in the Canadian High Arctic between 1915-1916, and determined what constituted the polar continental shelf through consistent ocean depth soundings (Gray 2009). Leaving a lasting impact on Banks Island, the expedition hired many locals, engaged in trading, and introduced new equipment that assisted the burgeoning local white fox trapping industry, while the abandoned schooner *Mary Sachs* became a focal point for campsites (Jenness 1969; Gray 2006).

Twenty-five years following the first IPY, 44 nations were involved in the second IPY of 1932-1933, which broadened the research scope with the addition of atmospheric observations (Rapley et al. 2004). Research served national interests during World War II and the Cold War, which meant that contact with Inuvialuit and other northerners coincided with strategic site locations (Korsmo and Graham 2002), such as the meteorological station established on Banks Island in 1948 (Smith 2008) and mainland DEW Line sites that employed Inuvialuit for construction and operation (Arnold et al. 2011). However, in some instances, northern aboriginals were the unsuspecting subjects of wartime medical experiments (Korsmo and Graham 2002), although there are no documentation or oral history accounts of Inuvialuit being subjected to testing.

The third IPY of 1957-1958 – later termed the International Geophysical Year (IGY) because the scope of study included areas outside the polar regions – brought together 67 nations, incorporated large-scale, synchronous deep-ocean observations, and exploited numerous technologies that had been developed during World War II (Rapley et al. 2004). Although northern research developments arguably improved community services and resource management as northern settlements became more centralized, communities had little or no say, as they were not “equal partners in science” (Korsmo and Graham 2002). Intentional or not, past research frequently marginalized, not assisted, northern people

(Riedlinger 2001a). During the 1960s, Inuvialuit grew increasingly aware of government-sponsored exploration for oil, gas, and mineral resources, and, as Usher (1973:7-8) noted, the associated influx of outsiders:

In the last eight or ten years, another strange new group of people arrived in the North. These were the investigators. They came from government, universities and private industry. Like geese, they arrived in spring to do research, make surveys and ask endless questions about practically everything in peoples' lives. At first, local people thought that surely all these experts coming in and studying their problems should also be able to help solve these problems. Maybe these expert investigators and researchers had the answers, maybe they would take care of things. But again, like geese, they went south in the fall time, and too often nobody in the North ever heard the results of all their surveys and questions. People began to feel they were just being used, but they didn't know what for. As individuals, some of the investigators were good, others weren't, but on the whole, it got harder and harder to understand what all these people were doing and what would come of it. Native people got tired of helping the investigators and answering their questions when they never got any return for it, either for themselves or their communities. In the end, maybe all these studies and surveys just held the people back, because if they hadn't looked to the investigators for answers, maybe they would have realized sooner that they had to depend on themselves.

The political mobilization of northern indigenous peoples seeking autonomy and land rights, such as COPE, brought forward their frustrations about research practices on their homeland and concerns that such research might contribute to projects that could drastically alter the northern environment, wildlife and economy (Korsmo and Graham 2002), of which the Banks Island seismic conflict is a prime example (cf. Section 3.3.5). However to support Inuvialuit land claims, extensive amounts of research was required to document traditional and cultural connections to the environment, and over time, social scientists established relationships with communities to collaboratively facilitate this process (Korsmo and Graham 2002). As a result, the process of negotiating and settling land claims, and the initiation of self-government agreements have changed how research is conducted in the north (Korsmo and Graham 2002). For example, in 1964, DIAND created a research centre in Inuvik to provide scientific support in the Northwest Territories, which transferred from federal to territorial authority in 1984 coinciding with the IFA, and

officially became the Aurora Research Institute (ARI) in 1995 (ARI 2014a). ARI handles all research licensing for the Northwest Territories, acting as intermediaries for researchers and communities with a focus on community needs and concerns (Korsmo and Graham 2002). Guidelines for ethical and responsible research have been developed by various organizations (c.f. ACUNS 2003; Brant Castellano 2004; Schnarch 2004; ITK and NRI 2007; ARI 2011) to emphasize conducting research *with* instead of *on* indigenous people and their communities (Castleden et al. 2010). Regulatory bodies such as ARI assist in maintaining community approval, ethical guidelines, requirements for research projects, protection of intellectual property, and researcher accountability, which represents an institutional shift in the control of research (Korsmo and Graham 2002; Castleden et al. 2010).

Whereas the physical sciences had previously been far removed from community collaborations, negotiated research relationships have since become more commonplace, indeed necessary. The Northern Contaminants Program (NCP), founded in 1991 “in response to concerns about human exposure to elevated levels of contaminants in fish and wildlife species that are important to the traditional diets of northern Aboriginal peoples” (NCP 2011), is co-managed by federal, territorial, and regional agencies and committees, in addition to Inuit, Dené, Métis and Yukon First Nations organizations. NCP researchers are required to consult and collaborate with communities, acknowledging traditional knowledges and building local capacity through their projects.

Not all physical science ventures are conducted in the vicinity of northern communities however. The Canadian Coast Guard Ship (CCGS) *Des Groseilliers* was frozen into the permanent pack ice of the Beaufort Sea to provide the platform for the 1997 Surface Heat Budget of the Arctic (SHEBA) study, designed to investigate the relationships of Arctic ocean, sea ice, and atmospheric processes over a full annual cycle (Welch 1998). Although direct community collaboration is limited in such a study, it is still required that

results are provided for interested communities. Perhaps “the first truly inter-disciplinary integrated research program in the Canadian Arctic Ocean,” the Canadian Arctic Shelf Exchange Study (CASES) was conceived and carried out in partnership with Inuvialuit and provided opportunities for Inuvialuit youth to participate in arctic marine sciences (Snow 2008). From 2001-2006, CASES advanced the understanding of freshwater/saltwater interactions, air/sea/ice processes, and the relationships between marine ecosystems and geochemical fluxes, the results of which will assist the IGC and co-management bodies in their resource management decisions (Snow 2008). ArcticNet, a Network of Centres of Excellence of Canada, was also formed in 2003 to facilitate partnerships between researchers and managers in the physical, human health, and social sciences, Inuit organizations, northern communities, the private sector, and federal and provincial agencies to study climate change and associated impacts with a focus on the coastal Canadian Arctic (ArcticNet 2012).

Although Canada was involved in all three previous IPYs, the fourth IPY of 2007-2008 saw Canada playing a leadership role. This was also the first IPY to acknowledge and include the human dimension of Arctic environments (Rapley et al. 2004). Among many projects is the Circumpolar Flaw Lead (CFL) study, which constituted the most ambitious Arctic climate change project undertaken in Canada, involving hundreds of Canadian scientists (CPC 2012). International and Inuvialuit collaborations developed through CASES contributed directly to CFL and ArcticNet (Snow 2008). During IPY-CFL, the CCGS *Amundsen* overwintered in the perennially occurring flaw lead in the southeast Beaufort Sea-Amundsen Gulf, in the vicinity of Banks Island (Barber et al. 2010). Ten teams – physical oceanography; ocean-sea ice-atmosphere processes; light, nutrients, and primary production; pelagic and benthic food webs; marine mammals and sea birds; gas fluxes; carbon and nutrient fluxes; contaminants and aquatic marine ecosystem health; modeling;

and traditional knowledge – worked together to understand how climate change is affecting the flow lead system and what this means for the future of the Arctic and Inuvialuit (Barber and Barber 2009). ArcticNet has maintained the research and collaborative momentum generated through IPY-CFL.

3.5.3 *Why Sachs Harbour?*

Banks Island has been the site of a multitude of past research initiatives that exist in the collective memory of Sachs Harbour residents, in addition to current ongoing projects. Many people with whom I spoke remember the 1970 oil crisis and the seismic research that occurred both on Banks Island and near other Inuvialuit communities, as it was both a source of employment and contention. Several Bankslanders were also heavily involved in COPE, and are currently involved in IGC and the five co-management bodies established under the IFA. Individuals have worked with researchers as wildlife monitors and field assistants in tagging and aerial surveys for population counts and diet assessments of muskox, caribou, Arctic wolf, Arctic fox, Arctic hare, geese, beluga whales, and polar bear, or by supplying samples from subsistence harvests (c.f. Hiruki and Stirling 1989; Harwood et al. 1996; Nagy et al. 1996; Babaluk et al. 2000; Larter 2001; Larter and Nagy 2001; Parks Canada 2003; Kay et al. 2006; Stirling et al. 2011; Larter 2013). Numerous people participated with researchers and the International Institute for Sustainable Development (IISD) to document Inuvialuit observations of climate change and create a documentary video entitled *Sila Alangotok: The Weather is Changing* (Ford 1999; Riedlinger 1999; Berkes and Jolly 2001; Riedlinger 2001b; Riedlinger and Berkes 2001; Nichols et al. 2004).

The idea for this project was conceived towards the end of IPY-CFL under ‘Team 8: Contaminants’ to gather insight into Inuvialuit perceptions of contaminants and how the results of contaminant studies were communicated. Since this project is about

contaminants communication, I could have worked in any of the six ISR communities that were involved in IPY-CFL. Because of their past experiences with research, and for reasons outlined below, I chose to work in Sachs Harbour.

Influential Sachs Harbour community members such as John Keogak and Lawrence Amos were heavily involved in the planning and organization stages of IPY-CFL, while Joey Carpenter was one of four members of the 'Team 10: Traditional Knowledge' Steering Committee. Two out of three wildlife monitors hired to work alongside researchers on the *Amundsen* – Vernon Amos and Trevor Lucas – were from Sachs Harbour. Several community members contributed to the traditional knowledge studies, including notable elders such as Edith Haogak, Lena Wolki, the late Martha Kudlak, and the late Andy Carpenter Sr., and even more residents participated in the Inuit Health Survey that was conducted as a separate part of IPY. Sachs Harbour was one of the crew-change site during CASES, and IPY-CFL (and continues to be so for ongoing ArcticNet projects), transferring researchers and coast guard personnel from the CCGS *Amundsen* to their connecting flights heading south, and vice versa, as people finished or started their leg of the expedition. As such, people in Sachs Harbour were familiar with the presence of researchers as they passed through the community, and when they came to give presentations and updates on their research. While still deciding which community to work with, I was fortunate to be invited on one such community tour destined for Sachs Harbour. There, I had the opportunity to personally speak with John Keogak, asking his thoughts about whether the community would be interested in my proposed project. His support, combined with email discussions and the subsequent support of Joey Carpenter solidified my decision, which was further affirmed by community members, the Sachs Harbour HTC, and Hamlet Council during my first extended visit. I chose to work in Sachs Harbour, but more importantly, the community of Sachs Harbour decided that my project was important and valuable to them.

As discussed in this chapter, the amount, type, and context of research that has been conducted in Sachs Harbour, on Banks Island, and in the surrounding waters is substantial, and these experiences will influence the community's perceptions of contaminants and how contaminants, and other research, is disseminated. While the views expressed in this thesis represent Inuvialuit in Sachs Harbour, all Inuvialuit are connected by their collective history, struggles for autonomy and land rights, wildlife and environmental management, food sharing practices, and identity. Therefore, I suggest that the insights about communication processes and procedures, as learned from the community of Sachs Harbour in this case study, can be applicable to other communities in the ISR and across the Canadian Arctic to facilitate the dissemination and understanding of contaminants issues and research.

Chapter 4: Methodology

4.1 Research Design

A research plan or design incorporates an interconnected association of philosophical worldviews (paradigms), strategies of inquiry (approaches to inquiry), and research methods (Creswell 2007; 2009). This project is qualitative and exploratory in design, and is distinguished by a social constructivism paradigm, grounded theory and case study approaches to inquiry, and open-ended interviewing methods. It also adopted community-based, collaborative principles, to emphasize the importance of context and knowledge sharing because by sharing, knowledge is viewed as a collective benefit (L. Smith 1999). Furthermore, I consciously took a relationship-oriented approach to research, which focuses on establishing respectful, trustworthy relationships with the people from whom you wish to learn (Fienup-Riordan 1999; L. Smith 1999; Reason and Bradbury 2001; Simpson 2004; Khanlou and Peter 2005; Castleden et al. 2010; D'Alonzo 2010). The following are descriptions of my research paradigm and methodological approach. Detailed descriptions of the research methods are provided in Section 4.4.

4.1.1 Social Constructivist Worldview

The paradigm of social constructivism holds the assumptions that individuals seek to make sense of the world in which they live and engage; they interpret and construct meanings of their interactions and experiences, which are rooted in historical, cultural, and social perspectives (Creswell 2009). Research based in this worldview asks broad questions and explores diverse viewpoints about a situation, whose meanings are constructed by participants. Process and context play important roles in understanding how participants perceive and interpret a phenomenon. Researchers intend to elucidate

these meanings to develop a theory, while simultaneously recognizing that their own cultural and personal experiences, relationships with participants, and research context influence their interpretations of participant meanings (Creswell 2007). By adopting this paradigm, I also embrace the framework of empowerment, and acknowledge my involvement in this project alongside participants. Additionally, I espouse the need to explicate the gaze of the research process, and challenge the *researcher/researched* power dynamic in the creation and attribution of knowledge (cf. Reason and Bradbury 2001; Kindon 2003; Simpson 2004; Charmaz 2005; Khanlou and Peter 2005; Wickett 2007; D'Alonzo 2010).

4.1.2 Grounded Theory and Case Study Approach

A strategy of inquiry that fits well with social constructivism is grounded theory, where “concepts and theories are *constructed* by researchers out of stories that are constructed by research participants who are trying to explain and make sense out of their experiences and/or lives, both to the researcher and themselves” (Corbin and Strauss 2008). First developed by Glaser and Strauss (1967), a grounded theory approach has been used in a variety of disciplines such as sociology, nursing, education, psychology and social justice studies (Charmaz 2005; Creswell 2007). This strategy is characterized by systematic yet flexible guidelines for collecting and analyzing qualitative data to enable the development of inductive theory that is grounded in the data themselves (Charmaz 2006), and is both a process of inquiry and a product of inquiry (Charmaz 2005). Researchers try to understand what happens in the research setting and in the lives of participants by immersing themselves in the situation, exploring how participants describe their accounts and actions, and inquiring what analytical understanding can emerge from the data – the participants’ points of view (Charmaz 2006; Creswell 2009); it is thus a suitable strategy to

explore participants' perceptions of environmental contaminants and research communication processes.

Researchers following grounded theory principles begin with data that are constructed through observations and interactions assembled about the topic of inquiry. Data are then teased apart, organized, and integrated through coding processes, where codes – the terms or labels assigned to words, phrases, or concepts (Corbin and Strauss 2008) – that represent the data content are assigned to sections of data (Charmaz 2006). Coding and analysis begin with the completion of the first interview (the first data sample), providing ideas for further exploration in subsequent data collection (Corbin and Strauss 2008). Thus, the process of constant comparison ensues as the participant's perspectives from the first interview (and the researcher's accompanying codes) are compared to each successive interview; through coding and making continual comparisons with other data segments, an analytic grasp of the data begins form, endeavoring to elevate raw data to a conceptual level and classify the complexity of reality (Charmaz 2006; Corbin and Strauss 2008; Bazeley 2011; cf. Section 4.5). Coding is usually accompanied by annotating and analytic memoing; annotations are useful for making brief notes about a word or segment of text or to comment on a particular aspect of discourse, while recording reflective thoughts or ideas about the data and codes are done as memos (Bazeley 2011). This enables the development of tentative categories – broader ideas that best fit and interpret the data – which coalesce as additional data is coded, compared, and interpreted, and become more theoretical with further analysis; the research then “culminates in a ‘grounded theory,’ or an abstract theoretical understanding of the studied experience” (Charmaz 2006:4).

A constructivist grounded theory approach described by Charmaz (2005) includes and emphasizes a diversity of worldviews, realities, contexts, and complexities, and promotes an awareness of researcher reflexivity by acknowledging observed realities and

one's interpretation of them while simultaneously locating oneself in these realities.

Principles of this approach were beneficial in informing the process of my data collection, coding and analysis.

Case studies involve the in-depth exploration of an event, activity, program, process, issue, or one or more individuals over a sustained and set period of time within a bounded context or setting (Creswell 2009). Various studies suggest its use as a strategy of inquiry, a methodology, a type of qualitative research design, an object of study, in addition to being a product of inquiry (cf. Creswell 2007). A case study approach has been used in many disciplines such as psychology, medicine, law, education, and political science, with origins developed through sociology and anthropology in the early 1900s (Creswell 2007). For this research, the community of Sachs Harbour is the case example where grounded theory is used to explore and provide an in-depth understanding of the processes that contribute to Inuvialuit perceptions of scientific research and communication, using the topic of Arctic contaminants as a case study.

4.1.3 Relationship-Oriented Framework and Knowledge Sharing

From the first stages of development, this project has been characterized by the importance of creating relationships centred on trust, reciprocity, and respect with Sachs Harbour Inuvialuit. Relationship-based knowledge sharing and knowledge co-creation can shift the power dynamic away from viewing participants as *subjects/objects* from which information can be *extracted*, and works to blur the distinction between the roles of *the researcher* and *the researched* (cf. L. Smith 1999; Reason and Bradbury 2001; Kindon 2003; Simpson 2004; Khanlou and Peter 2005; Castleden et al. 2010; D'Alonzo 2010). This enables the research to be grounded in Inuvialuit principles such as oral history and traditions, humour, storytelling, and reciprocity (Riedlinger 2001). By spending extended

periods of time in the community (cf. Section 4.2.2), relationships have opportunities to truly develop based on trust and acceptance, which are foundations for supported and successful research (Fienup-Riordan 1999). This is especially important for northern communities where past research has often overlooked community concerns or appropriated their knowledge, resulting in mistrust and wariness towards research that resonate through generations (L. Smith 1999; Castleden et al. 2010). As such, I strove to earn the trust, respect, and support of the community, as they were important principles for this project (Gallagher 2003).

4.2 Developing the Project

4.2.1 Initial Project Planning

Due to the large amount of research currently being conducted in Canada's Arctic, many northerners are seeing increasing numbers of researchers in and around their communities. While there are regulatory bodies in place to issue research licenses, permits, and assess the applicability of the research to the region in the Northwest Territories (Aurora Research Institute) and Nunavut (the Nunavut Research Institute), some northern residents find that much of the research still takes place without regard to how it may impact the community (Clifford-Peña 2008). Community involvement is essential for effective and responsible "community-environment" research, as perceptions of contaminants are connected to historical, cultural and socioeconomic characteristics at a local scale (Pearce et al. 2009). Therefore, it was imperative for this project that I consult directly with community members to determine if my project ideas could be of benefit and value, and to request their approval and feedback in developing the project (cf. Fienup-Riordan 1999; Castleden et al. 2010; D'Alonzo 2010).

Prior to beginning this project, I had the opportunity to travel to Sachs Harbour as part of an ArcticNet Community Tour in March 2009. There I first met John Keogak, and while interviewing him for a colleague's ArcticNet project, I inquired if he thought the community would be receptive to a project exploring local perspectives about contaminants and research communication; he expressed interest on behalf of himself and the community, as "contaminants were not a very well-discussed issue" there. Subsequently, I consulted with both John Keogak and Joey Carpenter via email about optimal times to return to Sachs Harbour to meet more residents, express my emerging thoughts about project possibilities, discuss community interest and ideas, and start a dialogue about collaboratively developing a project together.

4.2.2 Importance of Time in Sachs Harbour

This project was purposefully conducted to enable substantial time in the community to build relationships, rapport, and trust, which were previously stated to be of significant importance, yet overlooked in many research undertakings. Upon advice from John Keogak and Joey Carpenter, I returned to Sachs Harbour in mid-July 2009 and spent one month getting to know people, becoming acquainted with the different community organizations, and getting a feel for how things were done in the community. I put up posters at the Co-op, Hamlet office, HTC office, Community Corporation office, Aulavik National Park office, health centre, and airport to explain who I was and what the project was about, and to invite people to participate. Even if the posters were not read in their entirety, the picture of me was recognizable enough that I became known as 'the lady on the poster,' which enabled me to start up conversations with many different people.

It was additionally important that no interviews were done during the first trip, as this emphasized that I was not coming into the community with set ideas. Rather, this time

provided the opportunity for two essential things: 1) discussing ideas with residents to form the overall concept of the project and 2) establishing the foundations of mutually respectful relationships with individual members of the community. These interactions with the community raised important issues, and provided valuable input and feedback regarding contaminants knowledge and research communication; this directly influenced the project objectives and helped develop the foundation for my overall research questions.

Each time I was in the community, I asked when people would like me to return – if there were specific periods to avoid or times that were preferable. Following my initial visit (July 20-August 21, 2009), I returned to Sachs Harbour five additional times during various seasons: November 1-20, 2009; March 28-May 26 2010; November 5-December 5 2010; April 10-June 18 2011; February 11-March 10 2012. I was able to see and participate in various activities by being present in the community during different seasons, and my presence during the winter and non-peak research months gained appreciation from many locals; this improved the content and quality of my research and reinforced my respect for and relations with the community.

These periods of time spent in the community also promoted my accessibility and strengthened connections with people, which encouraged them to participate in the project, and facilitated more open and relaxed conversations. Once it was established that I would be interviewing interested residents during my trips to Sachs Harbour (and several people had been approached in this regard), most of my time spent there was not requesting interviews; rather, I worked on integrating myself into daily community life. Listening to stories and observing social dialogue provided insight into local ways of communicating, and situated what I was learning (both informally and through interviews) in a broader community context (cf. Section 4.4.4). Reciprocity was also very important, and helped foster relationships with residents; by visiting people whether or not they were involved in

the project, participating in various community events, attending sewing classes, fixing computers, and bringing assorted supplies with me each time I returned, I did my best to give back to the community in meaningful ways.

4.3 Identification of Project Participants

This study employed the concept of purposeful sampling, which is used to select participants that will best contribute to a detailed understanding of the research query under investigation (Creswell 2007; 2009). This can best be achieved when good rapport has been established with potential participants so they can not only provide “good information” (Creswell 2007), but can do so openly and honestly.

As I was interested in exploring the diversity of residents’ perceptions about environmental contaminants and contaminant research communication, I used a maximum variation sampling strategy to identify interview participants. This approach increases the likelihood that different perspectives on the topic will be discovered while also identifying commonalities (Creswell 2007). I focused on maximizing the representation of a diversity of characteristics such as gender, age, and experience with research and researchers. By spending my first community visit getting to know people and talking to them about project ideas before inviting individuals to participate in an interview, I was able to develop relationships with many people who were then agreeable to being interviewed during subsequent visits. While I experienced initial difficulties in securing interviews during my second and third trips, many people came forward after I had returned several times; the majority of interviews were conducted during my fifth trip, and all focus groups were done during my sixth visit to the community.

Snowball sampling (Miles and Huberman 1994) was also used when people identified others whom they thought would be interested in the project, and thus

recommended that I approach them for interviews. Staying in the community for extended periods of time also allowed for opportunistic sampling to occur, a method that takes advantage of the unexpected and enables more flexibility (Miles and Huberman 1994), and on a few occasions I was approached by people who expressed interest in participating. When snowball or opportunistic sampling methods were used, I ensured that participants' characteristics contributed to maximum variation.

Through focus groups, I focused my inquiry into participant perceptions of mercury, with the intention of presenting information about mercury with which participants could engage, ask questions, and explore ways this subject could be communicated to the community. To achieve maximum variation in interviews, I had already spoken with most of the residents who had previous experiences with research, and only two interviewees with this characteristic decided to participate in focus groups; the remaining interviewees either did not wish to be involved in focus groups or were physically unavailable. Thus, although a maximum variation sampling strategy was intended for focus groups, it was not fully realized, as the majority of participants had no prior experience with research.

Gender, race, age, culture and place have been found to influence risk perceptions (Slovic 1999; Finucane et al. 2000; Masuda and Garvin 2006); yet concerning the factor of gender, it is impractical to assume that gendered impressions exist within smaller, more isolated and culturally homogenous Indigenous communities due to the limited research that has been done (e.g. Elias and O'Neil 1995; O'Neil 1998), especially when gender was not specifically considered (Jardine et al. 2009). As I am working with Sachs Harbour Inuvialuit, race, culture, and place stratification were deemed superfluous. Since the age (adults aged 18 and older) and gender of other participants was noted, I thus stratified the focus groups according to age and gender to allow the possibility of exploring if these characteristics contributed to different perceptions of concern regarding contaminants.

Given the history of research and exploration on Banks Island, age and gender may also influence how they view research communication and the idea of research itself.

4.4 Description of Research Methods

4.4.1 Semi-Structured, Open-Ended Interviews

Semi-structured, open-ended interviews are used in many types of qualitative studies. For this project, participant interviews were conducted to explore 1) individual perceptions and understanding regarding contaminants that they had retained through any and all previous research communication efforts, and 2) individual impressions of and experiences with research and researchers. As one of the main points of interviews was to illuminate participants' perceptions of what *contaminants* meant to them, I did not offer any clarification or correction on the meaning of *contaminants* during interviews. Subsequent focus groups then narrowed the scope, where a specific contaminant – mercury – was discussed in detail and used as an example with which to explore research communication processes in an interactive setting.

A semi-structured interview guide (Table 4.1) provided a basis for the interviews, but there was no prescribed order in which questions were asked. Instead, interviews were conducted as conversations where participants identified the scope and direction of the discussion, which was then guided by their understandings and perspectives of the topics (Huntington 1998). This often led participants to expand on their experiences, which brought unanticipated but valuable insight to light. To thoroughly explore the topics, I probed for details, examples and explanations where possible. Correspondingly, participants spoke of their experiences and opinions freely and in detail – rich in context, contradiction, and complexity.

Table 4.1. Semi-structured interview guide consisting of semi-directive, open-ended questions.

Method	Question
Semi-directive interview	1 What have been your experiences with scientific research conducted in and around Sachs Harbour?
	2 In your experience, how have researchers communicated their study results? Has this been effective?
	3 What does the word 'contaminant' mean to you?
	4 How do you perceive contaminants in your daily life?
	5 In your experience, how have researchers communicated their findings on contaminants?
	6 What have you learned about contaminants from researchers?
	7 How do you think communication about contaminants could be more appropriate for the community?

As each participant was different, so was each interview, and open-ended questions “provided the flexibility needed to adjust the interview to meet the characteristics of each interaction” (Huntington 1998). There were no time limits to interviews, which lasted as long as the participant wished, and were generally between 30 minutes and two hours. Interviews were video- (32%) or audio-recorded (69%) according to the participant’s wishes, with the exception of one interview that was recorded through note taking.

Creswell (2007) suggests involving 20-30 participants to achieve data saturation, and my target range for a representative sample was 25-30% of the community. Nineteen participants were interviewed during four community visits between November 2009 and June 2011, representing 27% of the Sachs Harbour adult population at the time of interview completion in June 2011 (cf. Section 3.4.1). Interview participants included six females (mean age = 48) and 13 males (mean age = 45), and ranged in age from 18-76. Elders were given the opportunity to be interviewed in Inuvialuktun through a translator; however, all interviews were conducted in English. Interviewees were compensated according to local research protocols.

Subsequent to each interview, I wrote and reflected on what had transpired, jotting down emerging thoughts and questions for further inquiry. I noted the participant's overall demeanor, emotions, body language, and any changes that occurred during the course of the interview, in addition to pauses and moments of silence. Sometimes things left unsaid were as important, if not more than what was discussed, and these instances prompted reflection and scrutiny. Sarcasm or double-entendres were not always noticeable in the voice but could be read in the eyes and on the faces of participants; these and other visual cues were especially important to document for interviews that were only audio-recorded.

4.4.2 Focus Groups

Compared to individual participant interviews, Hopkins (2007) claims that focus groups as a research method have received criticism due to the perception that they provide merely superficial understandings of a given subject. Realistically, one can expect that different research methods will result in different forms of data, with focus groups being "unique and important formations of collective inquiry" (Kamberelis and Dimitriadis 2005). For this project, semi-structured focus group interviews (Creswell 2007) were conducted following the completion of participant interviews. The informal group discussion atmosphere mirrored that of the interview structure, where participants were encouraged to speak freely about their opinions, perceptions, and experiences.

In contrast to interviews, however, focus groups facilitate dynamic interactions that represent collaborative understanding, as participant dialogue provides insight into socially constructed (instead of individually created) meanings (Kamberelis and Dimitriadis 2005; Berg 2007). Focus groups have the added advantage of giving participants more time for reflection as they listen to others, allowing each person to re-think or amend their initial account if they feel it was warranted, and express their agreement or disagreement with the

statements of others (Lofland 1971). Therefore, dialogue between participants facilitated the exploration and identification of communication processes beneficial to disseminating research about mercury, which enhanced an understanding of participant impressions of research communication as discussed during individual interviews; focus groups also provided the opportunity to observe interactions and exchanges between participants. Important insights, issues, and meaning associations that I had not considered were thus able to occur naturally due to the characteristics of focus group dynamics (Berg 2007).

A semi-structured, flexible discussion guide (Table 4.2) narrowed the scope of interview questions to focus more specifically on mercury. Participant perceptions of contaminants were first discussed in a similar manner to interviews – where individuals were not given information about contaminants – in addition to their impressions on communication. The focus then narrowed to specifically discuss individuals’ perceptions of mercury, one of the contaminants of primary concern in the scientific community, which was used as the basis to talk about participants’ suggestions for future dissemination strategies (Pufall et al. 2011). In these conversations, I provided information and answered

Table 4.2. Semi-structured focus group guide consisting of semi-directive, open-ended questions.

Method	Question
Focus group	1 What does the word <i>contaminant</i> mean to you?
	2 In your experience, how have researchers communicated their research on contaminants? Can it be improved? How?
	3 When you hear the word <i>mercury</i> , what do you think of? What images come to mind?
	4 Is mercury something that you think about? Why (or why not) is this important to you?
	5 What would you want to know about mercury?
	6 What would you tell people in Sachs Harbour about mercury? How would you tell them?
	7 How should researchers inform people in Sachs Harbour about mercury?

participant questions about mercury, as this was necessary to the discussion surrounding communication processes.

Four focus group discussions took place in Sachs Harbour during February-March, 2012. Hopkins (2007) states that the required number of participants has often been a defining feature of focus groups, with these numbers being highly variable depending on the source. Instead of concentrating on attaining high numbers, he suggests that groups with fewer participants run smoother, with more chances for individuals to share their knowledge. For this project, focus groups comprised between two and four people, excluding myself, with a total of six male and six female participants (Table 4.3). Group discussions were audio- or video-recorded in accordance with participants' wishes. Out of 12 focus group participants, two had also been interviewed; therefore, a total of 29 people (19 interviews plus 10 additional focus group participants) were involved in the project, representing 41% of the community.

Table 4.3. Focus group demographics, numbers, and recording method.

Focus group	Gender	Age range	No. of participants	Recording method
1	Female	36-70	3	Audio
2	Male	18-35	4	Video
3	Female	18-35	3	Video
4	Male	36-70	2	Audio

4.4.3 Informal Conversations

Casual conversations with people in town began before initiating interviews and focus groups, and provided many opportunities to discuss relevant issues with people informally and often spontaneously; this facilitated knowledge sharing in a setting more comfortable for them and respected their desire to not participate in an interview. As Fontana and Frey (2005) note, "a natural field setting, such as a street corner or a

neighborhood tavern, can be conducive to casual but purposive inquiries.” From everyone with whom I spoke, I requested their consent to make notes on compelling comments, observations, or concerns that were raised. Seventeen additional people became involved in the project this way, bringing the total to 46 participants. It was especially engaging when conversations arose in a group setting where issues of community interest could be raised, debated, and verified by discussants. These rich conversations provided additional avenues of query to pursue with interview participants, who could then interact with information provided by their peers.

4.4.4 Reflections and Observations

Journaling about my experiences with community members and living in the community was helpful in my understanding of the context in which these topics and issues exist in the community; I became aware of how the community ‘operated’, what issues took priority over others, and what topics were readily discussed or not. I was able to observe how people communicated with each other, contrast that to their interactions with me, and then compare that over time as I continued to visit the community. Furthermore, continually documenting my personal experiences over the course of the project – challenges, frustrations, anxieties, surprises, excitement, etc. – was insightful to realize the growth I had undergone as a researcher.

4.4.5 Verification and Member-Checking

All interviews and focus group discussions were transcribed verbatim. Once transcribed, participants were provided the opportunity to review their transcripts and provide clarification, feedback, and additional information as they saw fit. Each participant was emailed his or her interview, and several opportunities were provided for transcript

validation in person during my time in the community. Eleven interviewees (58%) were verified, six of which revised or clarified points in question, and added further details to an answer. In some cases this led to additional follow-up questions; I recorded these exchanges and verbally repeated them to the participant to confirm the accuracy of wording and meaning. Ten of the interviews were reviewed in-depth on a one-on-one basis during my visits to the community, and one was verified via email.

A check for internal validity of my interpretations of interview data was facilitated via a process of 'member checking' (Creswell 2007). I described my preliminary interpretations to the ten interviewees that were validated in person, providing them the opportunity to assess the accuracy and credibility of my initial analyses. I also held two gatherings that were open to the entire community, where I presented my ideas and interpretations of the data and received community feedback. Due to time restrictions, focus group transcripts were unable to be verified with those who participated. Additionally, verification for reliability in code construction and application was done through a process of inter-coder reliability and validity checks using QSR International NVivo 9 qualitative data software (NVivo 2010).

4.5 Coding and Analysis

Following transcription, coding and thematic content analysis of interview and focus group transcripts, and key excerpts of my field journal were performed using the program NVivo 9; the process is described here chronologically. Codes were not established *a priori*; rather, code development began with the first three interviews, and preliminary codes aligned closely with the major topics discussed. First Cycle coding processes that were deemed appropriate for this study included Attribute, Magnitude, Simultaneous, Structural, Descriptive, Initial (also called Open), Values, Holistic and Provisional Coding, and were

employed during the initial coding phase; see Saldaña (2011) for in-depth descriptions of coding typologies. As qualitative data analysis is an iterative process rather than a linear progression (Creswell 2007; Saldaña 2011), analysis occurred throughout the project using the method of constant comparison (Charmaz 2006). I noticed recurring concepts about contaminants and research communication through analyzing my journal and subsequently created codes that reflected these ideas mentioned by participants. Particularly when discussing aspects of communication, participant views about research and researchers became evident, which generated a new series of codes. During several passes through the initial three and an additional four interview transcripts, I applied the new codes developed through my journal analysis, and expanded existing codes to incorporate the variety of responses observed in interviews; these were then applied to the remaining interviews after they were conducted, transcribed, and entered into NVivo.

In the same way that First Cycle coding processes were employed through constant comparison of the data corpus, Saldaña (2011) notes that some content analysis using Second Cycle coding methods may occur simultaneously with First Cycle methods in addition to being employed in the later stages of coding. Focused Coding was employed in this manner to categorize information based on conceptual similarity, and enable comparison across participants' data to evaluate the transferability and comparability of newly developed code categories (Saldaña 2011). This method facilitated the designation of participant responses regarding contaminant perceptions according to perceptions of contaminant *sources, locations, and movement*. As a separate concept, *what are contaminants?* expresses the diverse complexity of participant associations with the word 'contaminants'. Similarly, Focused Coding helped identify three separate but inter-related aspects of participants' perceptions and recommendations regarding research communication: *content, methods, and sources*.

Once completed, focus groups were transcribed, entered into NVivo, and the elements of focus groups that were in common with interviews were assessed with regard to the established coding scheme. For the aforementioned aspects of participant perceptions of contaminants, interview and focus group results are first presented as separate response frequencies, and then combined. Additional codes were created to encompass the conversations regarding mercury that were unique to focus groups. Participants were classified and analyzed by attributes – characteristics that serve as response modifiers – that can be demographic (e.g. gender) or descriptive (e.g. highest level of education completed) in nature. For this project, demographic attributes consisted of *gender* and *age*, in addition to the descriptive attribute of *overall impressions of research and/or researchers*; Figure 4.1 displays the age and gender distribution of all participants and attribute classifications are provided in Table 4.4. Although inquiring into participants’ past and present involvement with research ensured I had a representative sample of the population – from people who had no prior involvement with research to those who were

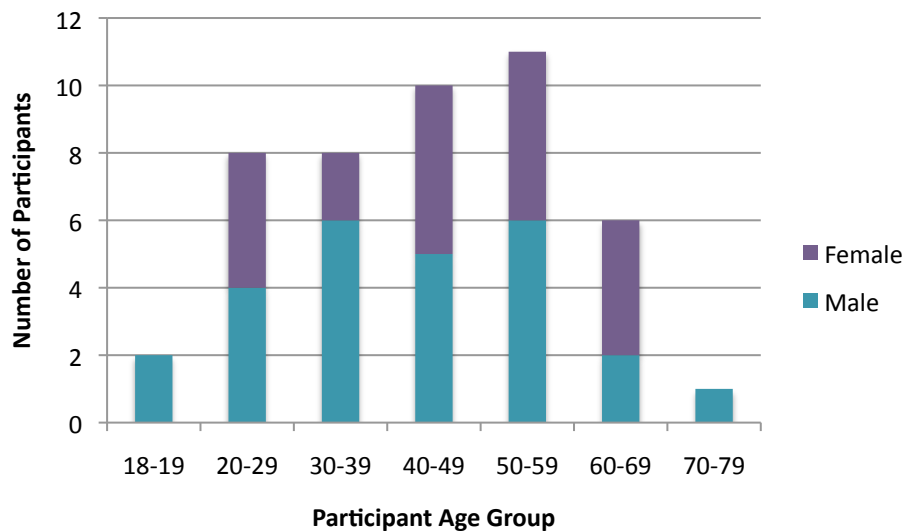


Figure 4.1. Age and gender distribution of all participants (n=46) from interviews, focus groups, and informal conversations.

Table 4.4. Participant attributes and associated attribute classifications.

Attribute	Classification
Gender	Female
	Male
Age Group	18-19
	20-29
	30-39
	40-49
	50-59
	60-69
	70-79
Overall Impression of Research and/or Researcher	Positive
	Indifferent
	Negative

very involved in research initiatives – this descriptive attribute was not included in the current analysis for this thesis.

As previously mentioned, distinct participant *impressions of research and/or researchers* became evident through conversations and interviews with participants when the topic of communication was discussed. Thus, I developed affiliated codes (*positive, negative, and indifferent impressions*) and journalled about participants' mood, tone, and body language that I had observed during our discussion. After transcripts were coded, attributes were determined through code frequency analyses, where the more frequently occurring code suggested the participants' overall impression; this was then compared to my journal reflections for affirmation or contradiction, and the representative descriptive attribute was subsequently assigned. Depending on the type of analysis done, *impressions of research and/or researchers* was utilized as either a code or an attribute. To explore the association with age and gender, *impressions of research and/or researchers* was analyzed as an attribute for interview and focus group participants both separately and combined; when considered with research communication perceptions and recommendations, it was

analyzed as a code through a matrix coding query. Since discourse regarding communication perceptions and recommendations was ubiquitous in interviews, focus groups (prior to interacting with mercury information), and informal conversations, results are presented based on participant gender. The only aspect of participant perceptions of contaminants explored by gender and age is their perception of concern or lack thereof, which is presented for all participants.

The recurring concepts of respect and time became apparent when reviewing data coded under communication and research/researcher impressions. They were developed as their own separate codes, which were then applied to the data, and matrix coding queries were run to confirm the associations and explore the distribution relationship of respect and time with communication and research/researcher impressions. Results from these queries are presented, where respect and time are viewed as codes operating at the same level as those with which they are compared. However, this comparison also supports the designation of respect and time as Second Cycle Pattern Codes (Saldaña 2011), as they are identified as emergent themes that are connected to, and ascribe meaning to aspects of both communication and research/researcher impressions.

4.6 Ethical Considerations

4.6.1 Research Ethics and Licensing

Prior to beginning any work in the community, research ethics protocols were submitted, which received human ethics approval by the Joint-Faculty Research Ethics Board at the University of Manitoba, and annual licenses to conduct research in the Northwest Territories were issued through the Aurora Research Institute in Inuvik, NT. Additionally, ethical principles outlined by the Association of Canadian Universities for

Northern Studies (ACUNS 2003), and guidelines for conducting research in the Northwest Territories (ARI 2011) were followed.

4.6.2 Knowledge Attribution

To promote collaboration, transparency and accountability in the ethics approval process, copies of the aforementioned research ethics protocols, licenses, and associated reports were given to the Sachs Harbour Hunters and Trappers Committee (HTC) and the Inuit Research Advisor for the ISR for their review and support. Draft copies of the project information sheet and informed voluntary consent forms were sent to the Sachs Harbour HTC, the Inuit Research Advisor for the ISR, and the Inuvialuit Regional Corporation for input, questions, comments, and approval. Both documents highlighted the importance of knowledge attribution (non-anonymity) as an emancipatory process to acknowledge the value of personal perceptions and experience; this approach received very positive feedback in the community.

As this project aimed to empower local residents in the engagement of contaminants research and have their voices on the subject heard, participant identification was promoted; however, it was neither mandatory nor did it prevent participation. Participants were consulted about their wish to remain anonymous or be identified, and two out of 29 participants (one interviewee and one focus group participant) decided to remain anonymous. All participants were aware that they could change their mind about this choice at any point. Since participant identification directly credits knowledge, experience, and expertise to the individual, it would be contrary to the objectives of this project if participants were to remain anonymous by default. They were also encouraged to participate as much or as little as they wish, and were free to join or cease their involvement in the project at any time.

When quotes appear throughout this thesis, participants' names are attributed to their knowledge if they were able to verify their interview transcripts. The source remains anonymous if this verification process was not completed (distinguished only as an interview or focus group source) unless I independently requested permission to use a specific passage, explained the context in which it was being used, and the participant approved its use. This process was also used with individuals who shared their knowledge during informal conversations. Text contained in { } style of brackets indicate clarified information for pronouns (it, they, this, etc.), commonly used in participants' answers to questions.

4.6.3 Limitations and Bias

Qualitative research is interpretive, and thus analysis is an interpretive act that relies on the researcher to make informed and impartial judgments (Corbin & Strauss 2008). Limitations and biases in qualitative research are therefore related to how the information is interpreted. A researcher may pay selective attention to information that supports a particular theory while disregarding other data. Researcher inexperience may contribute to a lack of awareness of the multifaceted nature of participant responses, undermining their ability to identify hidden meanings; conversely, responses may be over-analyzed to the point where an excess of meaning or importance is ascribed; the researcher must remember to focus on learning the meaning that participants ascribe to the issue in question, not the meaning that the researcher brings to the inquiry (Creswell 2009).

Since qualitative research often involves long-term, sustained, and sometimes intense experiences with participants, personal friendships may naturally develop between participants and researchers as the latter spends time in the community engaging in local activities (Gearheard and Shirley 2007). These relationships are espoused in this thesis, as they help create the foundation for both successful research projects built on community

trust and acceptance (Fienup-Riordan 1999). However, the researcher must be mindful to not bias their research interpretation by overly identifying with participants or with a subset of views that participants bring forward. No analysis is neutral, as “what we know shapes, but does not necessarily determine, what we ‘find’” (Charmaz 2005). To this end, I have attempted to represent the views of Sachs Harbour Inuvialuit in good faith, acknowledge their diversity of views through representative quotes, and identify that my involvement in the project through discussions about mercury communication during focus groups had a bearing on participant responses. Echoing the words of Peter Usher (1971:v):

The social scientist is expected to employ accepted scientific methods in collecting and analyzing his data. His hypotheses must be testable and his arguments logical, and he must not dismiss alternative explanations without proper examination. This does not mean, however, that his analysis is ‘objective’ or value free. Indeed it cannot be, nor ought it to be so. The ultimate application of social science is in the solution of social problems, and these can be neither identified nor solved without reference to personal and societal values.

Rare is the social scientist who, having been closely involved with the subjects of his investigation, does not also have very deep feelings about them. He has been a guest, and to some degree perhaps a member, of their community. If he perceives that the community and its way of life are valued by its members, and if he himself values these things, he will naturally be concerned for the continued well-being of that community. This does not invalidate his research findings, so long as he has abided by the scientific obligations outlined above. Since I have been associated with the community of Sachs Harbour over a period of six years, I have not written a value-neutral report. I can only express the belief that my biases have not caused me to obscure or ignore pertinent data or conclusions.

Chapter 5: Results

5.1 Preface

This chapter provides a descriptive documentation of Sachs Harbour Inuvialuit perceptions of contaminants, their views on communication processes, and impressions of research and researchers; an interpretive discussion occurs in the following chapter. To ensure the community's perceptions and experiences are presented as accurately as possible, quotes from interviews, focus groups, and conversations are provided to enable the people to speak for themselves. For context and reference, information about past research projects – emphasizing contaminants and Sachs Harbour/Banks Island – is provided here.

Beginning in 1986, ARI has compiled a compendium series of research conducted in the Northwest Territories (ARI 1996a); Table 5.1 provides an overview of the annual total number of research projects licensed since the compendia became electronically available in 1994. Research sections that have remained unchanged since 1994 include *Biology*, *Contaminants*, *Health*, *Physical Sciences*, *Social Sciences*, and *Traditional Knowledge*, with all licenses issued by ARI. Also included in the compendia are archaeological permits issued by the Prince of Wales Northern Heritage Centre, wildlife research permits issued by the Department of Environment and Natural Resources Canada, and fisheries scientific licenses issued by the Department of Fisheries and Oceans (ARI 1996a). At the time of writing, the 2011 compendium did not include fisheries licenses, and the 2012 compendium did not include fisheries licenses nor wildlife permits (ARI 2014b), thus the number of projects in all categories are underrepresented for those years.

Table 5.1. Research licenses issued by the Aurora Research Institute (ARI) in Inuvik, NT, from 1994-2012, comparing the number of total and contaminant-related projects conducted on Banks Island and surrounding waters to projects conducted in the ISR (ARI 1996a, 1996b, 1998, 2000, [2000?], [2001?], [2002?], [2003?], [2004?] 2009a, 2009b, 2009c, 2010, 2012, 2014b).

Year*	Total Projects	Total Contaminant Projects	Total Projects in ISR†	Contaminant Projects in ISR†	Projects on Banks Island‡	Contaminant Projects on Banks Island‡
1994	310	19	78	4	2	0
1995	122	5	66	2	7	0
1996	171	6	55	3	5	1
1997	164	7	49	4	8	1
1998	166	13	54	4	6	2
1999	140	7	51	2	8	0
2000	155	9	61	4	8	0
2001	206	4	89	4	11	0
2002	213	8	95	5	12	3
2003	240	12	96	5	15	1
2004	286	11	105	7	19	3
2005	353	18	97	7	15	3
2006	243	25	105	15	14	3
2007	289	28	122	9	16	3
2008	261	23	111	12	16	1
2009	285	37	109	11	23	3
2010	313	36	130	11	23	3
2011◊	215	21	72	4	11	2
2012Δ	197	26	66	4	9	1

* The ARI compendium series began in 1986, however online records are only available beginning in 1994.

† From 1994-2003, the regional abbreviation *IN* stood for *Inuvik* and classified projects occurring in the Inuvik region, which comprised ISR communities. Since 2004, *IN* stands for *Inuvialuit*, as the regional abbreviations have been changed to represent land settlement areas; hence the usage of ISR in this table.

‡ Projects conducted on Banks Island include those conducted within the community of Sachs Harbour, and in the neighbouring waters of the Beaufort Sea and Amundsen Gulf.

◊ Compendium does not include fisheries licenses.

Δ Compendium does not include fisheries licenses or wildlife permits.

For all project licenses and permits, the region (or regions) in which the research is to occur must be specified. In 1994 and 1995, the compendia consisted of research projects conducted in both the western and eastern Canadian Arctic, with the regional abbreviation *IN (Inuvik)* encompassing the northwest area of the NWT (c.f. ARI 1996a, 1996b). As of 1996, research license compendia for the eastern and western Arctic ceased to be

combined, and from 1996-2003, *IN (Inuvik)* comprised the Inuvialuit and Gwich'in land claim regions (ARI 1998, 2000, [2000?], [2001?], [2002?], [2003?], [2004?]). Since 2004, regions in the compendia have been defined according to land claims settlements, and from 2004-2012, *IN (Inuvialuit)* comprised research projects conducted only in the Inuvialuit Settlement Region (ARI 2009a, 2009b, 2009c, 2010, 2012, 2014b). For simplicity, the term *ISR* has been used in Table 5.1 to include projects that were conducted in all *IN* regions, as they incorporate projects conducted in Sachs Harbour or on Banks Island.

Due to the multidisciplinary nature of many research projects, not all projects that involve contaminants research were located in the *Contaminants* section of each compendium. To determine the number of contaminant projects in a given year, a text search for the keywords *contaminant, mercury, lead, cadmium, organochlorine, and persistent organic pollutant* identified contaminant-related projects in other research section, which were combined with the number of projects listed under the *Contaminants* section in the compendium. Projects that listed the regional abbreviation *IN* were enumerated to determine the number of projects annually conducted in the *ISR*. Projects conducted in Sachs Harbour or on Banks Island were catalogued using those location names in text searches, in addition to searches for *Amundsen Gulf* and *Beaufort Sea* to identify projects that occurred in Banks Island waters. For results yielded by the latter two queries, project location descriptions were subjectively examined to determine their proximity to Banks Island; projects were excluded if their description contained specific or exclusive references to mainland locations and associated water bodies. Contaminant-related projects were then cross-referenced with projects fitting the specified region criteria to determine the number of contaminant-related projects in the *ISR* and Sachs Harbour/Banks Island.

5.2 Perceptions of Contaminants

5.2.1 What 'Contaminant' Means

Sachs Harbour Inuvialuit perceptions, opinions, and understandings about *what contaminant means* are multiple and highly variable, both among participants and for individuals themselves. Participant associations with the word 'contaminants' are illustrated in Figure 5.1, presenting the number of times that a certain category of responses was mentioned among all narrative text from interview sources, focus group sources (prior to contaminant and mercury information being provided), and combined sources, as a percentage. These data are not normalized, and future analyses will examine responses per participant and number of mentions per number of participants. While these results do not account for the influences that interview length or number of participants may have on the frequency that a certain response is mentioned, the aim is to provide an overall picture of how often participants associated contaminants with different categories.

Contaminants are viewed broadly to include local, observable concerns such as oil or fuel spills, garbage, or health anomalies in wildlife, and local, invisible items such as preservatives and pesticides in store-bought foods, and pollution, mercury, and persistent organic pollutants (POPs). For some participants, hearing the word 'contaminant' evokes sentiments that *something is wrong, should not be here*, or feelings of fear. Further examples of how contaminants are perceived include melting permafrost releasing methane gas, statements that their drinking water supply is contaminated, tranquilizers used to dart bears, and a connection to climate change. In interviews, the most frequently mentioned contaminant association was *oil/ fuel/gas* (29.6%), contrasted with *parasites/disease* in focus groups (16.9%); however, *mercury or POPs* were the second most frequently mentioned in both groups (15.3% in interviews; 15.3% in focus groups), and the variability

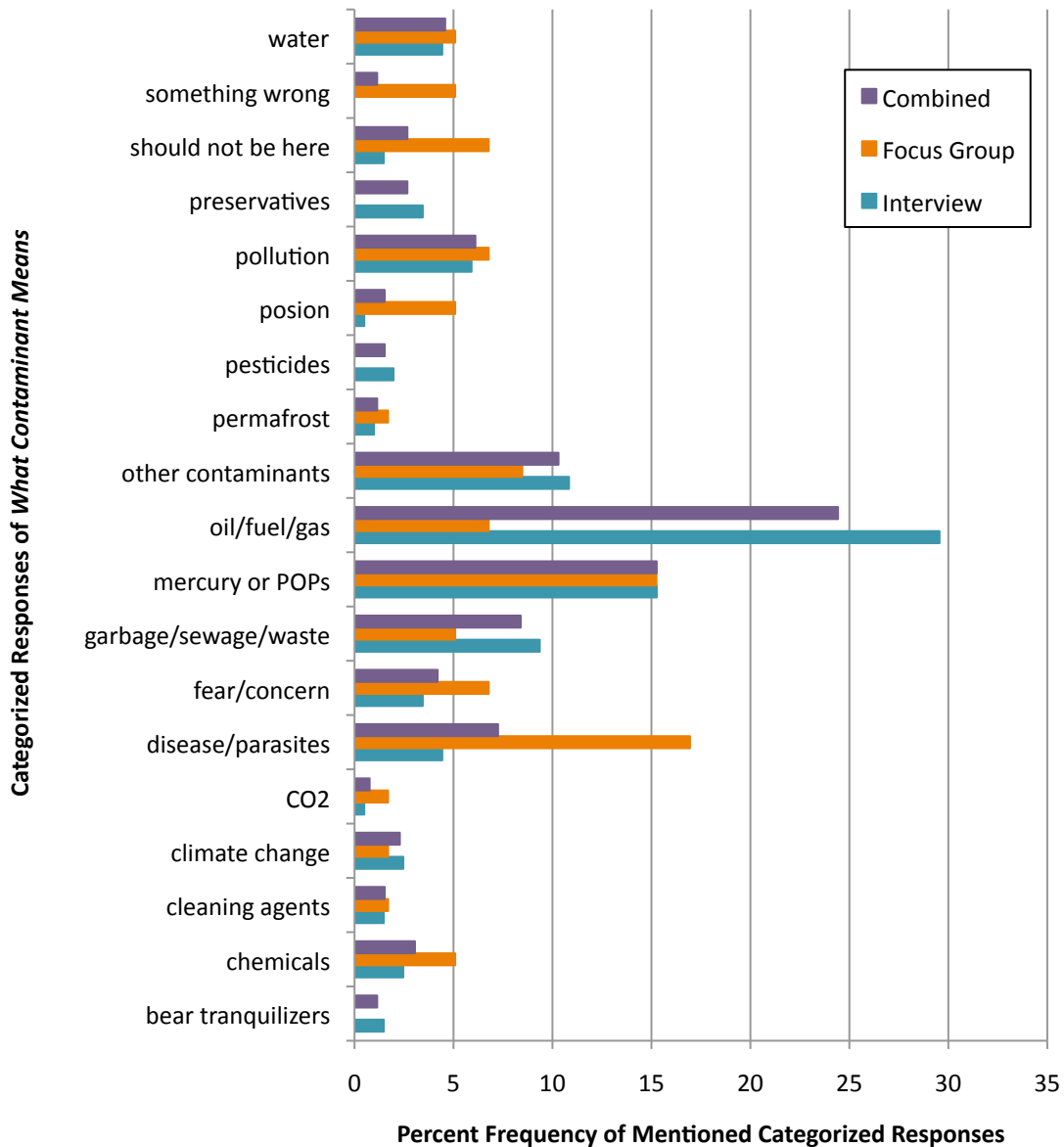


Figure 5.1. Percent frequency of categorized responses for *what contaminant means* among all mentions in pooled interview text (n=203 mentions), focus group text (prior to discussing information about contaminants, mercury, and communication; n=59 mentions), and combined text (n=262 mentions), regardless of age or gender.

represented by *other contaminants* was third (10.8% in interviews; 8.5% in focus groups).

Combined results are consistent with interview responses, indicating the most frequently mentioned associations of *oil/ fuel/gas* (24.4%), *mercury or POPs* (15.3%), and *other contaminants* (10.3%); these three categories account for 50% of all combined responses.

Other contaminants include instances when participants did not specifically describe a contaminant as anything that fit into the existing categories, and items or concepts that were mentioned only once, such as asbestos, acid rain, paint, nuclear waste, household appliances, flooding, and the muskox abattoir. Some participants articulated more abstract concepts when they thought about contaminants, such as research, food, animals, and people.

Contaminants? Um, {what comes to mind when I hear the word 'contaminants'}, that, I don't know; I've never really thought about that. Um, I, research comes to mind, that's the first thing I think of, because there are so many different contaminants here in the North and every level of the food chain and, and in the atmosphere, um, we're just finally starting to see some research initiatives right now to address contaminants and the concerns with contaminants. – *Vernon Amos*

Mmm, no, {I don't know what kinds of contaminants are up here}, but I do know there is some. Like, you don't have, you can't have a place unless, like there's...okay there's the cleaning supplies, there's oil and gas, there's fuel, and um, there's contaminants in the, like the stoves, the fridges, TVs, like, it's all connected and it's all contaminants. Like there's not just only one contaminant, there's many different kinds. – *Interview 12*

Huh, the only thing come to me {when I hear the word 'contaminants' is} about, uh, pollution. Yeah. You know, our world is polluted already, you know? Climate change... Yes, climate change and contaminants are the same thing, same thing. – *Lena Wolki*

Well the thing with contaminants is you can't really see them, right? – *Interview 17*

Um, mostly think about the elders, because a lot of the elders they grew up eating country foods like polar bears, ringed seals, uh, caribou, like uh, lot of people, older people too they still uh, they still eat ringed seals like, from the ocean there, like uh, makes you think about if there's any contamination in the ocean, like, all the ice-breakers and the drilling ships out in the ocean, makes you think about, is there any contamination, like any fuel or anything going in the water. – *Trevor Lucas*

[I]f there's not very many bears in a certain season, and if you get a few bears that are already darted, they don't want to eat it, or, you know, touch it because it could affect, you know, our, because of the contaminants... – *Interview 16*

[T]here's other contaminants, for me I call it physical contaminants where people can actually see contamination in the ground or wherever, um, that's a different story. But um, that's, for me, that's the way local people see contaminants as to see, to see it physically. – *Interview 10*

Hm, {when I hear the word 'contaminants', what comes to mind is}, like pollution, garbage, asbestos, air quality, water quality, um... just um, things don't belong where they're not supposed to be, like, like oil spills on the ground, or, just garbage on the land. – *Bridget Wolki*

Yes and no, I see it {Co-op food} as being contaminated because it's really weakened down our people, eh. People were a lot healthier long ago when uh, they were living off the land, um, but then again, it's kind of hard to explain it, even just to think of it, it's just mindboggling... – *Focus Group 2*

Well, there are so many {different kinds of contaminants}; um, mercury is one of the, the bad contaminants, the, it's one of the worst ones that persist, and any of the long-range transport and, and POPs, persistent organic pollutants, um, there's so many things now that are out there... – *Vernon Amos*

Mmm, {when I hear the word 'contaminants', what comes to my mind are} the animals. The people, the animals, the contaminants, um, the people, the animals, the land. You want to preserve your land; you also want healthy animals to survive. Um, it's a big word. Like, 'contaminants': you just hear it and you're like, 'oh no'... I, you know, it's just that one word. It's not like danger; it's not like any other word. Like, you could use any other word in the dictionary and it's not like that one word because it hurts; it hurts you as a person as well as your surroundings as well as your lifestyle, it hurts your ancestors, it hurts your generations that, your younger generations that are, are, you know, they're here to stay. – *Interview 12*

5.2.2 Contaminant Locations, Sources, and Movement

Participant perceptions of *what contaminants are* covered a wide array of associations, which are further explored here as to their thoughts about contaminant sources, sinks, and pathways. Multiple perceptions exist regarding where contaminants are located, where they come from, and how they are transported; while discussed here as three separate categories in order to elucidate emerging patterns, participant quotes demonstrate their integration and inter-relationships. Participant perceptions of *where contaminants are* (location) are illustrated in Figure 5.2, presenting the number of times that a certain category of responses was mentioned among all narrative text from interview sources, focus group sources (prior to contaminant and mercury information being provided), and combined sources, as a percentage. These data are also not normalized,

rather showing an overall picture of the frequency of participants' perceptions of contaminants locations.

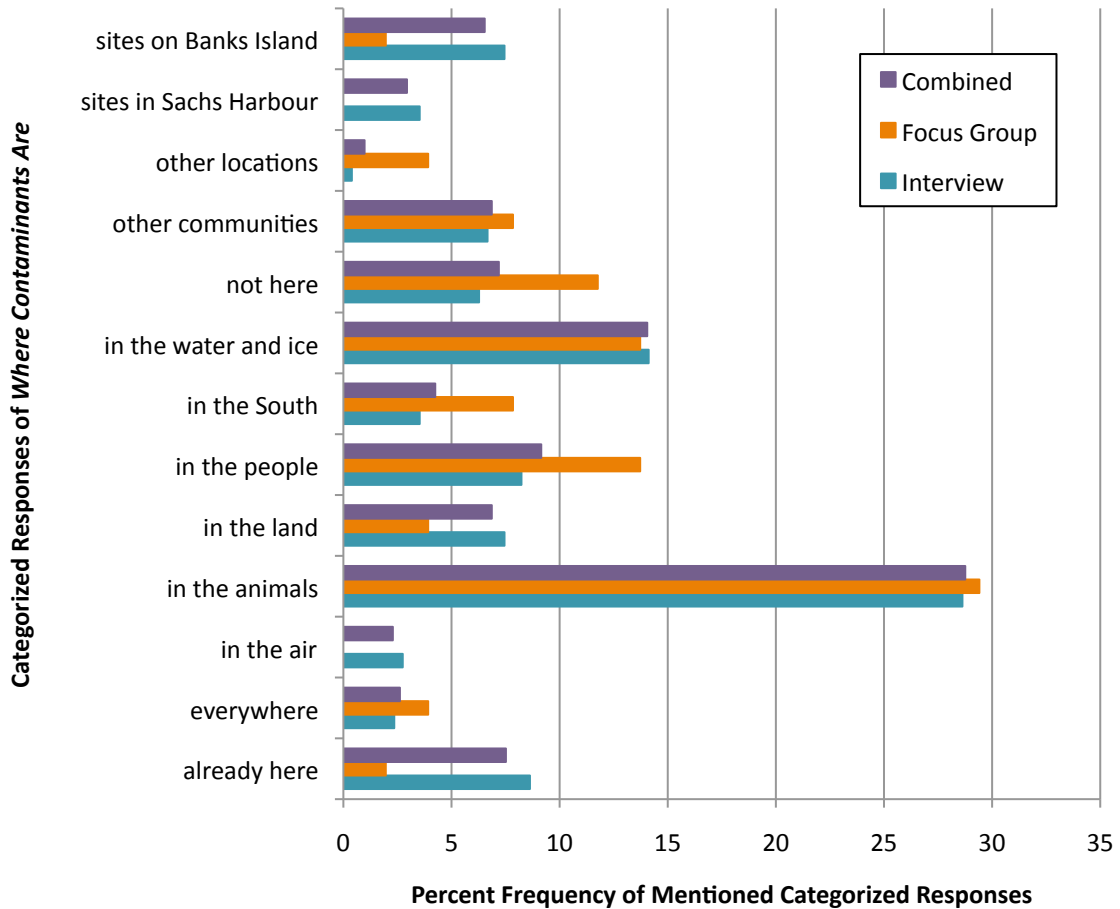


Figure 5.2. Percent frequency of categorized responses for *where contaminants are* among all mentions in pooled interview text (n=255 mentions), focus group text (prior to discussing information about contaminants, mercury, and communication; n=51 mentions), and combined text (n=306 mentions), regardless of age or gender.

To Sachs Harbour Inuvialuit, contaminant locations were classified as the following: *everywhere* (contaminants are everywhere, in everything); *in the air* (air, atmosphere); *in the animals*; *in the land* (the land, soil, earth, ground, permafrost); *in the people*; *in the South* (southern latitudes of Canada; USA; Mexico); *in the water and ice* (water, ice, ocean, lakes, also includes permafrost); *other communities* (other northern communities and places that are not on Banks Island, such as the Mackenzie Delta and Yukon's North Slope); *sites in*

Sachs Harbour (contaminants are found in certain places in the community); *sites on Banks Island* (places on the Island where contaminants are found that are distinct from being in Sachs Harbour, 'the environment'); and *other locations* (energy saving light bulbs and hormones in processed meat).

In addition to these locations, some participants expressed distinct views about where contaminants are, classified as *already here* (the view that there are contaminants already in Sachs Harbour, up North, the Arctic is a sinkhole for contaminants) and *not here* (the view that Sachs Harbour is 'clean' or 'safe,' contaminants haven't reached Banks Island yet, do not see contaminants anywhere). However, having one of these views did not determine one's associations with different contaminant locations; for example, some participants who mentioned contaminant locations in Sachs Harbour or on Banks Island also held the overall view that contaminants were *not here*.

In the community, locations often associated with contaminants were places where there had been a fuel spill or leakage, such as the beach and harbour area and a section of land near the RCMP detachment, or machinery that leaked oil or gas. The most frequently referenced location on Banks Island that participants associated with contaminants was Johnson Point, a now-remediated oil and gas exploration site built in the 1960s, situated 270km northeast of the community. Lakes associated with 'skinny' fish, places where oil barrels or garbage are scattered on the land, the abandoned weather station, and areas where other seismic work occurred are also considered locations where contaminants are found on the island.

Overall, perceptions of contaminant locations were most frequently mentioned as being *in the animals* (28.8%), *in the water and ice* (14.1%), and *in the people* (9.2%), accounting for 52% of all combined responses. Interview response categories ranked almost identically (28.6% *in the animals*, 14.1% *in the water and ice*), with the third most

frequently mentioned perception of contaminants being *already here* (8.6%), with *in the people* (8.2%) having a margin of difference of one response. Focus group responses followed a similar pattern, where *in the animals* (29.4%) was most frequently mentioned, followed by the tied responses of *in the water and ice* and *in the people* (both 13.7%).

When I think of it, I always think that we live so far from everything that there's no, everything is, should be clean, the animals, the land. – *Focus Group 4*

[I]t's also the local people that have responsibility to clean up after themselves, even if it's around their own house, you know, if you spill like half a quart of oil by accident, you're, to me, you're supposed to shovel that into a garbage bag, tie the garbage bag up, bring it up to the dump, where it belongs, there's a place for that. And, I see a lot of half broken down machines around town and stuff like that; it's really, not very clean. And, I think that might be an issue for contamination around the community itself. – *Interview 17*

Our island, our island is like kind of safe right now, but um, maybe other places. – *Lena Wolki*

Well contaminants has been really, uh, voiced in the past, like, the past few years, because the Arctic is a big sink hole for contaminants, and I think that's an important thing to study, you know, cos a lot of contaminants come up here and, you know, we don't know how it's affecting everything or anything... if there's any, any contaminants in anything then I think we should know about it, and, you know, because our life depends on what we have up here. And if things are contaminated, you know, it's going to get into our systems too. – *John Keogak*

And to see, um, um, the beluga whales, um, having a higher level of um, contaminants in the Beaufort Sea, and the um, Mackenzie Delta here the um, all the pollutants coming down from the river, these, these uh, these beluga whales are consuming um, fish and whatever, whatever comes down from the river, like you know, um, um, somehow it gets into the system. And, that's my understanding of why they um, the um, beluga whales' mercury levels are higher than other areas of the Arctic. – *Interview 10*

Well, I think it's {the Johnson Point site is} still a concern, because I went to Ulu {Ulukhaktok} for a meeting in August of 2010, we did a site inspection of Johnson Point from, there's about five of us from Sachs that went up there, picked up some people from Holman, or Ulukhaktok, and we went and did a site inspection. It's a lot cleaner than what it was, but there, I still found some garbage on the ground and, I don't know. I don't know if it was, not fine-tooth comb cleaned, but it's cleaner than what it was. So there's no more fuel tanks, no more trailers, no more old tractors and, no more garbage. – *Bridget Wolki*

Not really any contaminated things around here. – *Geddes Wolki*

Yeah, I think it's um, quite important that we learn from our elders, like, they, they've been around and they don't know what contaminants are, right? Like, they didn't have to grow up with it and now we're dealing with it every other day, being up, up North. – *John Lucas Jr.*

I don't think I've ever seen contaminants, like, in the food we eat. But I know, like, there's mercury in the water and there could be like, other contaminants that, because we eat fish and seal, and in return, it's a chain reaction. Everything, like from the smallest species to the largest gets eaten, with the chain, right? Chain reaction. So, if they come from the sea or if they're on land, like in the soil or in the water. I think everything has some sort of contaminants... because whatever goes in the ocean, whatever goes in the land, whatever goes in the air, it all comes up to the Arctic. – *Interview 12*

Some contaminant locations – such as the air, animals, land, the south, water, and sites in Sachs Harbour or on Banks Island – were also considered to be contaminant sources, depending on how they were talked about by participants. Whereas locations were discussed as static places where contaminants can be found, sources are referred to in a dynamic sense, as being causative agents of contamination. Participant perceptions of *where contaminants come from* are illustrated in Figure 5.3, presenting the number of times that a certain category of responses was mentioned among all narrative text from interview sources, focus group sources (prior to contaminant and mercury information being provided), and combined sources, as a percentage. These data are also not normalized, rather showing an overall picture of the frequency of participants' perceptions of contaminant sources.

To Sachs Harbour Inuvialuit, sources of contaminants include the following: *air* (can contaminate through breathing); *animals/country food* (can contaminate people or other animals through consumption); *cleaning products* (household cleaners, detergents, shampoo etc.); *climate change*; *development/exploration* (mining operations, oil exploration, seismic work, oil and gas companies, industry cause contamination); *DEW Line*; *don't know/not sure*; *forest fires*; *garbage dump*; *local sources* (specific sources in the community or on the island that cause contamination); *natural sources* (natural contaminants already

present in the land or water); *oil/fuel spills/leaks* (oil or fuel spills on land contaminates the land while spills in the ocean contaminates the water, includes large-scale spills and small leakages); *other countries*; *plane/barge/ship* (contamination occurs through increased air/water traffic and the waste water/sewage that they dump); *pollution*; *questioning?* (wondering where it is from, how did it get here); *sickness* (disease causes contamination); *the land* (contaminants get into other thing from the land, melting permafrost causes contaminants to be released into the land or water); *the South* (contaminants come from

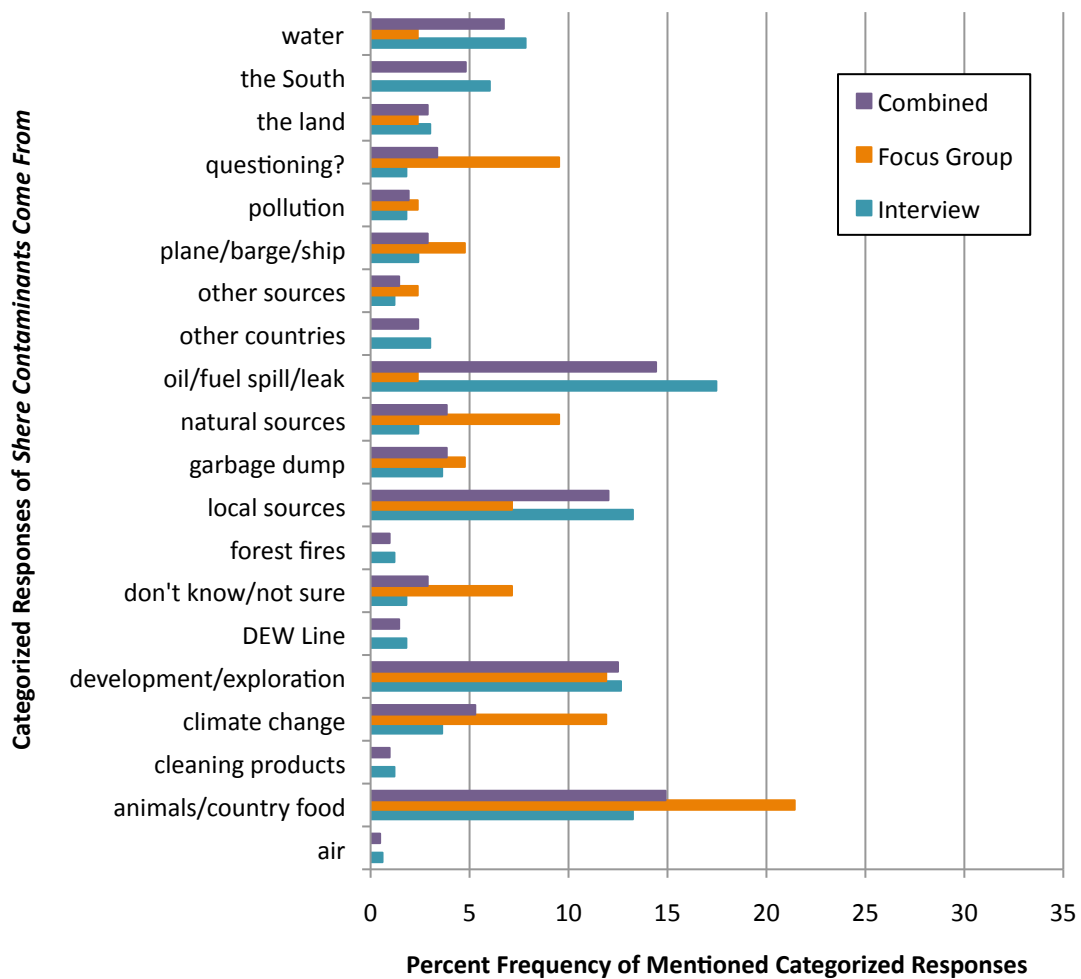


Figure 5.3. Percent frequency of categorized responses for *where contaminants come from* among all mentions in pooled interview text (n=166 mentions), focus group text (prior to discussing information about contaminants, mercury, and communication; n=42 mentions), and combined text (n=208 mentions), regardless of age or gender.

southern latitudes); *water* (flooding, contaminates freshwater and marine animals, comes from the Mackenzie River and Delta); and *other sources* (tanning solution, 'man-made' sources, and 'global' sources).

Local sources identified as sources of contamination coming from the community include vehicle exhaust, oil leaking from vehicles, furnaces, the RCMP detachment, and the people themselves. Sources viewed to contaminate the remainder of Banks Island involve Johnson Point, the abandoned weather station, the muskox abattoir, and oil drums left on the land.

Overall, perceived sources of contamination were most frequently mentioned as coming from *animals/country food* (14.9%), *oil/fuel spill/leak* (14.4%), with *development/exploration* (12.5%) and *local sources* (12.0%) having a margin of difference of one response; these accounted for 53.8% of combined responses. Interview responses most frequently mentioned associations of *oil/fuel spill/leak* (17.5%) with where contaminants come from, followed by tied responses of *animals/country food* and *local sources* (both 13.3%) and *development/exploration* (12.7%). Most frequently mentioned associations in focus groups were *animals/country food* (21.4%), followed by tied responses of *climate change* and *development/exploration* (11.9%).

[I]t's not only these people, these researchers and development companies that have to be mindful of their actions, it's also community members; it's very important... they don't clean up after themselves, they leave stuff sitting in the snow bank for days, they leave half broken down machines sitting in their yard, you know, if they don't have the money to fix it, sell it to somebody else or bring it to the dump, don't just leave it in your yard. There might be half a tank of gasoline or half a tank of oil in there and if, for some reason that tank fails, where's the oil going to go? On the land. You know? That's about the biggest problem, issue that I have with contamination around Sachs. – *Interview 17*

Like we're so, as far as pure and clean up here, let's see, I think of contaminants, it's like foreign to me, it's, why is it here? It should never be here in the first place.
– *Focus Group 4*

[T]here's other contaminants – airborne contaminants, whether it be from industrial or natural – and there's contaminants, for me there's contaminants in the environment itself like that was here before other contaminants came here.
– *Interview 10*

To me, it {the land} seems pretty safe {from contaminants}, alright. Uh, one reason is there's not too much industry up here, um, but I think everyone that do come up here should still follow all the, you know, uh, procedures and, you know, keeping our land from getting, uh, any, any uh, contaminants, whether it's on land or in the rivers or creeks or the lakes, you know. – *Interview 16*

I guess a lot of the people from around up here, they're uh, you know, we eat a lot of food from the ocean eh? And um, like maktak's getting more contaminated and species of fish and, I guess it's causing more cancers in the natives up here... the Mackenzie River for sure brings a lot of it from down south. – *Jim Wolki*

I think like, um, like being so far north, and we are an island separated from the mainland, I, I think we don't, I don't think that we have to worry too much about contaminants because, uh, you know, like, um, like vehicle-wise, you know, we don't have that much vehicles and um, we don't have that many houses that burn fuel and, um, you know, it's always windy so we always have fresh air[.] – *Interview 15*

[W]here most contaminants come from? Yeah, I'd think like mostly local, and from like Johnson Point they had like, like a bunch of fuel tanks and whatever up there for like how long. So yeah, I'm pretty sure that might, might've done some contaminating. – *Interview 18*

Every day, especially in the winter time, when you go to Co-op or out here you could see all of it on the ground, like from trucks leaking yellow or red, black... just contamination from vehicles not being up-kept or maintained properly. And smoke from chimneys, yeah. – *Bridget Wolki*

Yeah, because everybody, when they come to town {after hunting}, they don't automatically bring their game into the freezer, they let it sit outside on the snow, let it cool down, partially freeze, let the rest of the blood come out of the animal, uh, so it's not so tough when you go to eat it, then they put it in their freezer. In that amount of time, like say if there was contaminants where you harvested the animal and you skinned it and prepared it, then you bring it home and there's more contaminants around your house, that's, that's pretty potent. – *Interview 17*

And our {Banks Island} fish I worry less about, than the Delta anyway, because from the Delta, them they got so many stuff coming from downstream from the Mackenzie {River}, and it goes into the ocean[.] – *Interview 14*

And um, when they do research on polar bears and seals they find lot of contaminants in them, right? And we're at the top of the food chain, we eat polar bear and seals, right, so it's very important that they figure out where the contaminants come from. – *John Lucas Jr.*

Whereas sources were referred to as *where contaminants come from*, mechanisms of travel were considered as *what contaminants come by/through*. In contrast to the variety of contaminant locations and sources identified by participants, contaminants were perceived to travel through *air* (being air-borne), *water* (being water-borne), and *food webs* (moving through plants, animals, and humans). Contaminant movement through *water* was the most frequently mentioned means of travel, followed by *air* and *food webs*, as outlined in Table 5.2, which presents the number of times that a certain category of responses was mentioned among all narrative text from interview sources, focus group sources (prior to contaminant and mercury information being provided), and combined sources, as a percentage. These data are also not normalized, rather showing an overall picture of the frequency of participants' perceptions of contaminant movement.

Table 5.2. Percent frequency of categorized responses for perceptions of contaminant movement among all mentions in pooled interview text (n=40 mentions), focus group text (prior to discussing information about contaminants, mercury, and communication; n=10 mentions), and combined text (n=50 mentions), regardless of age or gender.

	Interviews	Focus Groups	Combined
Move through water	45.0	60.0	48.0
Move through air	32.5	20.0	30.0
Move through food webs	22.5	20.0	22.0

Well, um, for me, airborne contaminants, um, they're usually uh, how can I put it, um, they're usually dispersed, they're, they're not really concentrated and they, they move in quickly and uh, can move out uh, just as quickly if they're transported in the atmosphere[.] – *Vernon Amos*

Well they {contaminants} travel by currents in the ocean and currents in the air, in the sky... The whole area, the whole waters have to be marine protected area, you know, to a certain extent, so it doesn't become so contaminated that we have to have um, water from somewhere else or have to purify the water just to drink it, cos it, you know, it gets into the animals and there's lakes and rivers and everything; they're all connected. – *Interview 11*

{The animals get the contaminants in them} [t]hrough the air, the water, persistent organic pollutions, like lead and mercury and... it's up here, so if the animals are polluted or contaminated, we must be too, in some sense. – *Bridget Wolki*

And uh, goes from small part of the food chain and then somehow it builds up, it accumulates or something, into the bigger carnivores[.] – *Focus Group 2*

Well I was thinking, like, if it's in the water, so like, the plants in the ocean would be absorbing it and then the fish would be eating that, like the smaller plankton ones and then, it just keeps going from there... it keeps on moving up. – *Focus Group 3*

5.2.3 Concern About Contaminants

Sachs Harbour Inuvialuit perceptions of concern or worry about contaminants varied between genders and age groups. *Concern* about contaminants was classified as worry about affects, impacts, and results of contaminant exposure, worry about if and how contaminants impact daily life, and concerns about wildlife, environmental, and human health. Conversely, *no concern* about contaminants was classified as the absence of worry about possible affects, impacts and results of contaminant exposure, and that contaminants are not perceived as a threat. Table 5.3 summarizes the overall number of times that male and female participants mentioned *concern* or *no concern* about contaminants, as percentages. Since statements of concern, or lack thereof, were ubiquitous in discussions about contaminants, the combined views of all participants – narrative text from interview sources, focus group sources (prior to contaminant and mercury information being provided), and notes from informal conversation sources – are represented. These data are not normalized, as the aim is to provide an overall picture of how often men and women mentioned concern with regard to contaminants.

Table 5.3. Gendered perceptions of concern regarding contaminants, expressed as percent frequency of mentioned categorized responses among all mentions in all narrative text sources, regardless of age (n=20 women; n=26 men).

	Concern	No Concern
Women	25.5	6.4
Men	37.6	30.6
Total	63.1	36.9

The combined frequency of mentions about contaminant *concerns* or *no concerns* from men accounted for an overall higher response frequency of 68.2%. When responses were separated by gender, 55.1% and 44.9% of men expressed *concern* and *no concern* respectively, while women revealed a marked difference of 80% and 20% respectively.

The overall percent distribution of the number of times participants mentioned contaminant *concern* or *no concern* depending on age is shown in Figure 5.4, inclusive of all participants (n=46) and all narrative text sources. In all age groups except the youngest (18-19) and oldest (70-79), which were comprised of only men, perceptions of *concern* were mentioned more frequently than perceptions of *no concern*. The largest difference in perceptions occurred in age groups 40-49 and 50-59, with participants mentioning *concern* more often than *no concern*. Participants aged 20-29 and 40-49 were equally represented by women and men; female:male gender ratios for the remaining three groups were 1:3 (aged 30-39), 5:6 (aged 50-59) and 2:1 (aged 60-69). These data are not normalized, as the aim is to provide an overall picture of how often participants in different age categories mentioned concern with regard to contaminants.

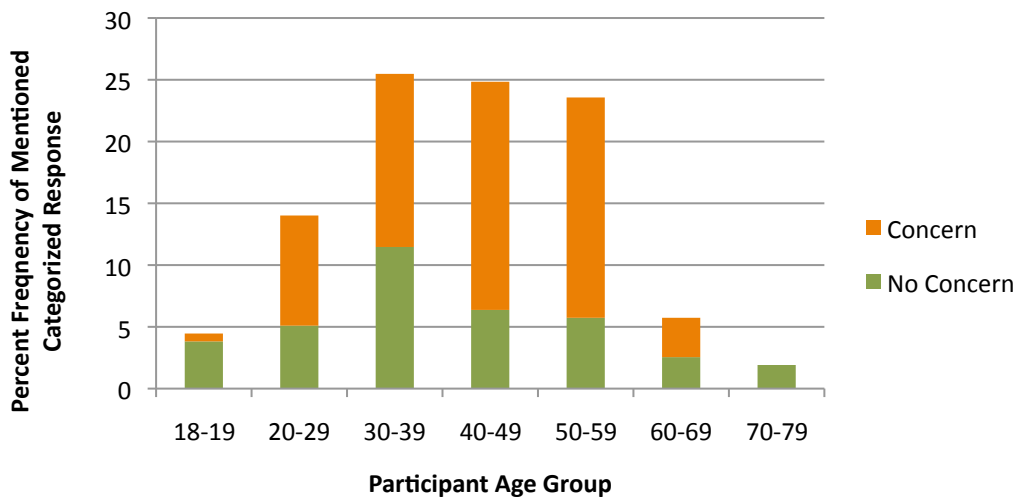


Figure 5.4. Distribution of participant *concern* or *no concern* about contaminants according to age group, regardless of gender, expressed by percent frequency of categorized responses from all narrative text sources.

Concern or lack of concern also varied for individuals themselves; some participants were concerned about certain aspects of contaminants – such as the implications for future generations – while remaining less concerned about others – such as how country food is still safe to eat at present.

Well definitely it's important that we carry on our diet {of eating country food}, but there's a point I guess in some time where um, we might have to stop eating it; or the information that's being brought to the Inuvialuit about contamination could actually drive the Inuvialuit away from their own diet. That's the scary part.
– *Interview 10*

[I]f there's any contaminants in anything then I think we should know about it, you know, because our life depends on what we have up here. And if things are contaminated, it's going to get into our systems too. – *John Keogak*

[U]p here it doesn't affect us too much, we still eat, uh, traditional foods, like anything we harvest, we eat quite, quite often. – *John Lucas Jr.*

Well it's, it's {contaminants are} more on my mind now I guess, cos uh, when I eat maktak now, um, they say that the outer skin is really, that's where a lot of the contaminants are. So I take off, like, a lot of the outer skin part when I eat it... but contaminants haven't really changed the way I eat. – *Jim Wolki*

[T]o me, it's {contaminants are} not so much {a concern} in land because there's not much industry right now, but I'm sure in the next few years, in the future to come there will be some problems[.] – *Interview 16*

Not so much contaminants {that I'm concerned about}, well, that's a small part, but um, {I'm concerned about} basically just the health of the animals and how, how the animals and contaminants are, are changing with our changing climate, because we all know it's warmer, things will happen faster, um, that's true with transport levels and concentration levels and, and basically it speeds everything up to a point where things are happening so fast now we can't really grasp what's really happening.
– *Vernon Amos*

I'm even interested in contaminants because it's going to hurt my culture, it's going to hurt me, it's going to hurt the things that I hunt for, the, it's going to hurt the people that I love, you know. It's a big word. But it, it hurts. It hurts in all aspects. Contaminants hurt in all aspects. You could get cancers and you could get all these things wrong with your body, but then again you could get all these things wrong with the environment and all these things wrong with the animals and, you know. Nobody wants to be hurt. It's a hurtful, it's a hurtful, um, word even. Contaminants. You hear it? Contaminants. It's hurtful. And most aspects of them all is, you know, we have generations coming up and if we're not careful then, you know, the, our generation, like our younger generations are not going to have this beautiful place to live. – *Interview 12*

5.3 Impressions of Communication

5.3.1 Perceptions and Recommendations

Discussions about research communication occurred in interviews, focus groups, and in informal conversations, therefore the views of all participants (n=46) are considered here. While the subject of contaminants was the main focus of communication discussions, participants also spoke of their experiences, opinions and impressions of research communication in general. Whether positive, negative, or neutral in nature, participant responses regarding their *perceptions of* past and current research communication, and *recommendations for* future research communication were classified into three categories: communication *content*, *methods*, and *sources*. While the categories were assigned for analysis purposes, participant responses often spanned more than one category, offering a rich description of their impressions.

Communication *content* refers to subject matter or message – perceptions about *what* was communicated and recommendations about *what* people would like to know. Participant impressions regarding *content* include references to technical information, language, and jargon; the presence or absence of a subject matter being discussed; research findings, results, and topics; information that has been learned or would like to be learned; the amount of information; and levels of understanding and being informed. The following are *perceptions of content*, in their own words:

No, I never, I never hear about that {researchers talking about contaminants}, nothing, I never hear about that. – *Lena Wolki*

Yeah, well, uh, a lot of the stuff they're {researchers are} doing is real technical stuff, uh, and uh, we understand that uh, that most of us don't under-, we can't interpret {the jargon in} their readings and their, their findings, uh you know, we have an idea of what they're doing and the importance of what they're doing... with technical and science stuff they can, yeah hoodwink us you know, with all this technical stuff and we'll be, don't know what's going on. – *Joey Carpenter*

[T]oo much information is not a good thing all the time, there's people that will interpret it wrong, or they don't have the, the prior education and that to really see what they're {researchers are} trying to say[.] – *Manny Kudlak*

Well, I find with contaminants, they all have acronyms, and sometimes I get mixed up between the acronyms... like I get confused, like I don't know if it's PCP or PCB or PCC or, it could be all the same thing to me, you know! And, if you start describing one, then you go off to the other one, and you're using acronyms that are quite similar, I just think it's the same thing. – *Interview 17*

Contamination? No they hardly talk about that I think. Yeah... Sometimes {I remember what researchers talk about in meetings}... I don't even keep track... Sometimes they {researchers} talk about it {contaminants} once in a while... They hardly talk about contamination now... Maybe later on. – *Geddes Wolki*

I felt that um, the scientists, they, they use uh, scientific terms and uh, words that we don't understand. – *Interview 11*

Yeah {researchers have come up and specifically talked about contaminants in the North}. Well contaminants has been really uh, voiced in the past, like, the past few years... Right now I don't think people really understand what, what is really happening, and what, uh, contaminants are... how dangerous they can be, and it's just, I think people lack of information and understanding what, you know, what it is they're really dealing with. – *John Keogak*

Well, when they {researchers} come back they and tell us, all they tell us is, "hey native, you can't eat your native foods anymore because they're contaminated". – *Interview 14*

Examples of participant *recommendations for content* encompass the following:

Like, not so much information, but enough information in there to make people aware... Like just something explaining what it is and, like, what it'll do. – *Focus Group 4*

Yeah, I think it's {specific information about contaminants is} what the community needs, you know; and like if an animal's contaminated there's things, you know, we should know about it. Like when they do studies on polar bears and they drug them, you know, they let us know that this is, like, you check with the researcher, find out what time the thing was drugged, and you know, and whether it's safe to eat the animal or not. Yeah, I think eh, to know what's contaminated, I think it's very important... And if we don't know anything about something, you know, {we're} not interested in it. But I think more information on the, um, what the effects of contaminants could be, and, you know, might open some eyes to people. – *John Keogak*

[I]t would probably be a bit easier {for people in the community to understand} if you changed some of the words and stuff. – *Focus Group 4*

[U]nless you're talking specific traditional stuff – that's when people get involved – but if you're just talking science for two hours, like, who cares after the first half hour, you know? It's too much talking, and, you gotta make it not so dry so people will be more, um, interested and not lose interest. – *Interview 11*

{I'd like to know about contaminants in} the food, I think, like our food, our country food; that would be good cos, like, um, what I said before, like I, I know there's some people that, um, do studies on the, the fish, and, um, I'm sure if there was something that they found, you know, they'd tell us, but you know, just, that would be good, yeah. – *Interview 15*

Communication *methods* comprise the means through which people receive information – perceptions about *how* research is communicated and recommendations for *how* communication could be improved or made more accessible to the community.

Participant *perceptions of communication methods* consisted of research reports, presentations, meetings, newsletters, posters, and involvement in research initiatives:

[T]hat's how I mostly see it, is researchers come up and they have meetings with community, they put up signs, and um, like do a presentation I guess, of their findings. – *Jim Wolki*

Because I feel that we have so many meetings and the last time, um, nobody came for it... it's like people are tired of meetings. Surveyed to death. – *Anonymous*

Um, no. No, {the information from researchers is not at a level that people in the community can understand}. Um, the technical jargon, um, people get lost reading that right away and then they lose interest, they, they might read the report but their understanding of it, they, they don't know what's going on, really. – *Vernon Amos*

Well, I would become more involved {in research} but, I just don't get it. I don't get it. Like I, how can a person stand it, like, sit in a meeting for hours? I don't get it. Or, I don't mind, like, listening to presentations... but I'm like, I am lost. It's not my way of knowing. – *Interview 12*

Yeah. It's good when they {researchers} have little meetings once in a while and tell us what they're doing, you know? Yeah. Sometimes they do that, yeah. – *Geddes Wolki*

It's good, you know, when the people come up here, you know; it's always good to sit down and, face-to-face, you know, and have a good discussion. And a lot of the researchers find that out, you know, that when they come up here and talk to the

people they, they know what to focus on, you know, just, just by talking to the people. – *John Keogak*

I think the communication on contaminants is pretty good right now, like, um, it's very beneficial that people see, like, newsletters or quarterly, um, reports done, people like the information, it's very valuable. – *John Lucas Jr.*

And um, sometimes it takes, um, more than one quick meeting, uh, for people to fully take in what's being discussed and what, uh, they {researchers} want from the people, from the Inuvialuit. – *Interview 11*

This is pretty much my first time, I, I don't usually go to meetings and stuff. So I wouldn't know too much on that. – *Focus Group 4*

It's good, it's {the science communications have been} good, but it's just a matter of um, I guess uh, people understanding why science is doing this. Like when you have {CCGS} Amundsen, they, they see Amundsen all, all winter, and I guess most people don't understand what they {researchers} were doing out there {on the sea ice}, even though science is trying to explain. If you're not living this life, the science life, and you're hearing it just from, you know, a one-time blurb, how are you gonna, how you expect, uh, the people to grasp it? And, you know we're not, we're not everyday scientists concentrating on a certain thing every day, you know? Like, it's just like us, we, if we're out on the land continuously, we're gonna know everything about the land. And if a southerner comes up here and try to do the same things we do, or even just to understand, is, is hard. – *Interview 10*

I think a lot of people will read them {research reports}, but they're, I mean the paper can't talk back and answer questions. – *Interview 14*

Recommendations for communication methods expanded on how communication was perceived to include views regarding the use and amount of text and pictures; the use of social media, magazines, radio, and television; and informal ways of interacting such as communicating through visiting:

[L]ike taking the students or kids with them on everything they do, like just create that interest so someday our kids will be doing this research and it'll make more sense to us when our own, our own kids are telling us this stuff and, and I guess people will get more interested when they see, oh that their daughter or their son is off checking this and that out. – *Manny Kudlak*

Maybe make a pamphlet and then just, you know, have contact information about questions that they have, maybe something like that... Gotta find, I guess, a way to tell them that, how this, this, contaminated, there's gotta be some way to tell them without like, without being controlling. – *Focus Group 2*

I guess {getting together} one-on-one with people, I think they'd {researchers would} cover it {their findings} more than going to a meeting, yeah. Cos like I said, not everybody goes to meetings, not everybody cares to go to meetings... When you do one-on-one it's a good, you know, some of the elders, um, you got to get, to explain to them more cos, you know, some of them, they don't go out to meetings or anything like that. That way, at least you know, like, you're getting, getting to, through to most of the people, eh? And yeah, I think that would be better. – *Jim Wolki*

Cos, in a meeting, not everybody is going to the meetings, so you miss, like, 80% of the population. So, what good is just telling a few people when you could do it like on, on a newsletter or, you know? – *Anonymous*

Like a slideshow... anything with lots of pictures and less words would be good. Or something, like something interactive I guess, where everyone gets to participate, or a little game, or little competition, maybe make a game out of it. – *Focus Group 2*

Personally I think you should create a group on Facebook, everybody's in Facebook, that way you get people's input... or a website. Create your own website... Another way of getting, like, people more aware is um, ICS {Inuvialuit Communication Society}, they have that show, Umatimnim, and a lot of the people watch that on APTN channel, yeah. – *Bridget Wolki*

I mean, uh, Tusaayaksat, it goes out to all the Inuvialuit anyway, pretty much every beneficiary who's over eighteen. – *Focus Group 4*

Well, in my culture, we, we tell stories. So, instead of putting it into a presentation you could tell a story, because people like to listen to stories... Probably, when you go visit people, they ask you to come in and have coffee. Rather than having a meeting to discuss it, because, you know, you could get a big group but it's more, we're more closer like that as a people. Because somebody tell you "come in and have tea or coffee", you would, and just sit and talk about the, you know, how it {contaminants} would be affecting like, the life of the native person and his surroundings... I think if you go post that you're coming up and go visit everybody's house, get to know them and talk to them about this, rather than holding a presentation, because some people learn differently... go and have a little group setting, because it's, it's easier for a few, like maybe about four or five than a whole big group... You don't get as much out of it {a large group at a presentation}, and that's what I think they {researchers} don't understand. – *Interview 12*

Just so we can have something to picture in our minds so we're not just trying to wrap our heads around words all the time. – *Focus Group 3*

Having, you know, like, not like a big research report but, you know, just one or two pages of information, maybe that's another option, and maybe talking to the person one-on-one... Especially I think in this town, that would work good, because, like, not everybody's involved and not a lot of people show up to meetings, so you could mail them your information and, you know, everybody in each household would, um, get a copy of it. – *Interview 15*

Yeah, one-on-one would be good {for researchers to talk about their projects}, I think, because people always can't go out to, to meetings that are set on certain dates and certain times, and a personal approach, I think, would have a better impact on research, rather than having a meeting that's so formal. – *Bridget Wolki*

Sources consist of where people received information from – perceptions about *who* communicated the message and recommendations for what sources could do improve communication to resonate better with the community. Participant *perceptions of sources* included the Inuit Research Advisor, organizations or agencies – such as the Hunters and Trappers Committee, Inuvialuit Regional Corporation, Department of Fisheries and Oceans, Canadian Wildlife Service, ArcticNet, and Fisheries Joint Management Committee – industry representatives and companies, and associations with researchers themselves. Because various communication *methods* were employed to communicate *content* by identified *sources*, participant *perceptions of sources* were often connected with *perceptions of methods* and/or *content*:

Yeah, it's a good, it's a good thing, yeah, they {researchers} keep in touch with the local people, they always come up and tell local people what they're doing, how long they're going to be studying certain things. – *Trevor Lucas*

Um, yeah I'm pretty concerned {about contaminant issues for future generations}, cos, um, it just seems like, you know, contaminants are coming up so much more now, like, like I'm not that old, you know, I'm like almost 30, but um, you know just from hearing things, like from my parents and from other people and from TV, like it seems like it's just getting worse, like more contaminants. – *Interview 15*

Even for a researcher to come up here and give us something, he's gotta be, or, he or she's gotta be, I would think, in the community for probably a whole summer, just to get to know the people. Be dedicated to the people and the community. That way too, win the trust of the people as well. If somebody just come in, that don't mean too much to the local people, all, for them it's just, "oh they're coming for a meeting and going again", you know?... It just can't be somebody that, like, one day in and one day out. Left with no feedback, you know? What's gonna happen, you know, with all this information? The community's left behind with nothing. – *Focus Group 4*

I think the HTC get most of the, um, research projects and then, they're the ones that have all the information; they're {researchers are} supposed to give the information, information back to the HTC after their projects are done. Yeah, then the HTC distributes the information throughout the community. – *John Lucas Jr.*

Well we {the HTC} usually post it {news or results of a study}, you know, in, in each, uh, each place that has a, like a, local stores, or the Hamlet or the Community Corp., and they post it, let the community know what's happening. – *Interview 16*

Yeah {I've heard other groups talk about contaminants}, there's a, there's a, what's her name, uh, Shannon O'Hara. She's uh, involved with contaminants I think, she's, might be, uh, connected with ArcticNet, but, that's different uh, than this other group, they were usually, uh older, uh, persons with uh, like leaders? Leaders in the communities uh, and with a long history of traditional knowledge uh, and they sat with uh, different regulators you know, DFO {Department of Fisheries and Oceans} and Fisheries and uh, CWS {Canadian Wildlife Service}. They all got, they all met their circle and circulate around the communities, and they uh, they used to explain their research findings, and then how it related to uh, country foods, but I haven't seen them group for like I say, years. So maybe it's, defunct or, I don't know, or they gave the responsibility to other people, I don't know. – *Joey Carpenter*

Uh, {I learned about contaminated beluga skin from} just studies I guess, like um, IRC {Inuvialuit Regional Corporation} has a harvest study eh, um, with all our animals that we have up here. – *Jim Wolki*

Well the community does get a lot of information through the HTCs, I mean the Corps {Community Corporations}, you know, and the IRC {Inuvialuit Regional Corporation} and things like that, that I don't think we're, we're short on information because we do get a lot of information reports from studies and things like that... I'm not sure {if a lot of people in Sachs are well informed about contaminants}. Because a lot of the information just goes to the HTC and Community Corps, you know, after they're done their research. – *John Keogak*

[T]he meetings that I have attended I was concerned about the, um, miscommunication, or lack of communication between scientists and Inuvialuit. Um, I felt that um, the scientists, they, they use uh, scientific terms and uh, words that we don't understand. – *Interview 11*

Just when they really have to, {that's when smaller groups of researchers come up to talk about their projects}, I think their, uh, consultation is to a minimum, like, "only when we really have to we'll go see you", because it costs so much to come up here, and, so it's, that's a big part of it, I think, in the expense department[.] – *Interview 14*

I used to be a wildlife monitor and all that before I got an office job and it was always fun going out with them {researchers} and, just looking over their shoulders and just seeing what they're doing and slowing them down, asking them questions and all that and, which they're always happy to answer, I guess. – *Manny Kudlak*

Before I did that {had an interest and got involved}, I never knew about, um, contaminants; I mean this was all science to me, and it blew me away; um, it took me a few years sitting on Fisheries Joint Management Committee to figure out the science of something; for me it's all technical stuff, and how the heck am I going to bring that back to the community? I'm still... I have an idea of how science worked; but, how to bring it back to the community and uh, let the community understand why it's important for science to do these stuff? – *Interview 10*

Source recommendations voiced by participants focused on ways for researchers to improve how they are perceived by the community, such as traveling to the community more frequently, developing a relationship with the community, and fostering community engagement and collaboration; advice also overlapped with *method recommendations* to spend more one-on-one time with people. Participants also expressed the desire for more Inuvialuit to become educated in science to promote their involvement on steering committees or research boards through the various IRC co-management bodies, and enable them to communicate research initiatives back to their people:

Hopefully the researcher will come back with new information or some new developments every time they come back to the community and make the community aware of them. That way the community will feel that they have a sense of ownership in that initiative and when the researcher wants to expand or build on that program, the community will be there and they'll know the developments.
– *Vernon Amos*

Um, they {researchers} could come up more, yeah. Yeah. I think that's the way to go. Yeah, more exposure, more, more um, meetings... it'd be nice if the researchers come up and do presentations before and after their projects, like, like present it to the members, community members, like, people like that kind of thing, like, very, very informative, if they {community members} have someone that they could talk to and question. That'd be the proper way to do it I think. – *John Lucas Jr.*

But uh, if you get um, the gist of it, you know, a summary along with the, like the big report it's good too, and whoever did that report should, come back to the community and go through it with the people, maybe that way they'll {people in the community will}, um be able to go through it, or understand it more too. – *Interview 11*

I think quarterly would be good {for researchers to come engage with people in the community}, you know, as the research goes on. If it's a two-year study, you know, three-year study, even a quarterly report or something. Yeah, let people know what's happening and, you know, whether there's any concerns that, you know, they should be, they should know about, and things like that. – *John Keogak*

I guess they didn't understand um, where I was coming from because it's not their culture, and I don't blame them. But it has a lot of weight when um, when uh, for students or people, that when information comes to them, when it's an Inuvialuk, it means a real lot... So if an Inuk or Inuvialuk was educated in, in, in these contaminants, um, and it was presented to them... to the Inuvialuit by another Inuvialuk I think that would have a lot of weight in people's, um, acceptance, or of the information that's being given to them. – *Interview 10*

Find a, find someone, yeah, like a role model, someone people, people like to hear and listen to, yeah. – *Focus Group 2*

As exemplified by the preceding quotes, participant *perceptions of and recommendations for communication content, methods, and sources* were inter-related; however, not all categories were mentioned with equal frequency, as compared in Table 5.4. In discussions about contaminant research communication, incorporating all narrative text sources, communication *methods* were mentioned the most frequently for both *perceptions and recommendations*, followed by *sources* and *content*. Responses among women and men mirrored the same pattern, with one exception – men mentioned *perceptions of sources* (28.5%) more frequently than *perceptions of methods* (25.9%). At 52.2%, communication *method recommendations* was mentioned the most frequently overall.

Table 5.4. Gendered percent frequency of all participant (n=46) mentions from all narrative text sources for the categories of communication *content, methods, and sources* for participant *perceptions of research communication and recommendations for research communication*.

	Perceptions of Communication			Communication Recommendations		
	Content	Methods	Sources	Content	Methods	Sources
Women	6.2	17.4	8.8	8.7	23.7	11.2
Men	13.2	25.9	28.5	9.3	28.5	18.6
Total	19.4	43.3	37.3	17.9	52.2	29.8

5.3.2 *Respect and Time*

Through dialogues with participants about components of research communication, the recurring notion of *respect* became evident, of which *time* was then distinguished as a specific aspect. Regarding research conduct and communication, perceived *respect* or lack thereof was identified in participants' statements, by considering the manner in which participants spoke and the tone they used, such as sarcasm, enthusiasm, praise, frustration,

hope, sincerity, and irony. Some previous quotes also referenced *respect* or *time* in addition to those provided here:

I think it's ignorance, that's a part of it, cultural tension. You know you just come from the south and, uh, don't know much about uh, people, you might have read something about Inuit or Inuvialuit and then, you know, formed this picture in your mind and go there and, "yeah, they're all like that" like you know? But, like I said earlier, you have to stay with them for a little while to, you know, and be accepting of each other, and, I think the Inuvialuit too have that a little bit, because of the treatment they had in the past, so they have a little stereotype against whites sometime too in that way, until you prove yourself otherwise, you know. These days, though, people work more closely with um, each other because they have to.
– *Interview 11*

So nowadays we don't really have to have an interpreter now, but *still*, even though there's a few {elders}, to let them know exactly what is being said, you know, like, from English to our language, to let them exactly understand what was, you know, being told to us, or, or that's being done up here, because uh, sometimes, some people, organizations or companies do come up here and um, I know a few of the elders, what few elders we have here, they sort of just agree and they say, "oh, yeah, yeah, I'll agree" because the leaders are agreeing, and some of them {elders} don't exactly know what was being said, you know, but they agree because the leaders agree. But to me, I, I'd still like to have uh, you know, someone that can be able to truly interpret to the elders about what exactly is happening... Some of these companies or organizations that do come, "oh, we don't have time for interpreter", or "it takes so much time", but to me, I said, "well if you don't have the time, don't bother coming at all", because you know, I mean, this is where we came from, our elders, our ancestors, they brought us here and, you know, without them we'd never be here, but to me, they're still part of our, I mean they're the biggest part of our community, and to me, if, you know, if they're misinformed or anything... in the past, a lot of the elders were reluctant to go to our meetings because there's really no interpreter, and when you don't fully understand what's, you know, what's, what the wording is, or what's happening, it, you, you feel, you find that you're not part of it.
– *Interview 16*

I think they {researchers} need the knowledge of our community before they start their project in order to get the whole people of Sachs Harbour to go with them on their project... I'm like, "why you come up here in the first place if you're not going to, you know, get to know the people and the land?" And it might be just for their, just for their own use or to graduate, but I think everybody should get to know the history behind Banks Island before they come up... And about the researchers just coming in and then just doing their work and leaving, you know, people feel slightly used. – *Interview 12*

Like, even if you finish your project and you were to come back and like, just like thank the people or whatever, like yeah, that would be pretty nice. Like not just get your info and then just leave and like, be like "thanks, see ya later". – *Interview 18*

When I travel with the government biologists to the communities, it's come to the point that I do the majority of the speaking and relaying. The government biologist can get up and say something, but the communities don't really trust them or respect them, but when I get up to speak, the people seem to trust me and what I have to say[.] – *Vernon Amos*

I think building a bond is really important because there is a big language barrier even, in the way that Southerner people talk and then the way we talk up here. Well, not just language, but just the way we talk to each other and stuff. And it's so formal, most people when they come up here, and most people don't feel comfortable with that, I think; most people want to be with people they think that are family or close friends. So there needs to be more trust, a relationship. – *Focus Group 3*

A distinct aspect of *respect*, the notion of *time* was directly discerned in participants' statements regarding perceptions about the amount of time required to conduct and disseminate research, the research planning process, time spent or invested in the community, and the idea of establishing relationships:

Researchers though, it's kind of hard to uh, we understand that a lot of them are starving students or whatever and they, they don't have the time to get back to here, that's probably why the oil and gas companies are a little more informative than students, or researchers... but it would be nice for them to come back and visit, even after the project is done, show they care about the community and that they're not just using it as a means to an end. – *Manny Kudlak*

More time needed to be spent with people, give the people some of your time, invest in people, build relationships. – *Focus Group 2*

[T]hey {researchers} should, they should make sure they have enough time, you know, for them to come up and, and explain clearly what they, what they're doing, what they're working on, and to be able to let these, uh, elders, or even some people that, you know, they're not as educated as some other people, so, be able to interpret and explain what, you know, what's going on with, with any project or, organization that's come up here to do work or whatnot... come to town, have a few days with our community, not just hello for a few hours and then they're gone again, "oh because there's no restaurant or no hotels or proper stuff", or whatnot, I mean, we're not as, uh, we don't have a restaurant and, you know, bank service here, but to me, I think people that do come up here, they should clearly stay for a day, few days, not just come and go, saying, "oh, I only got two hours or three hours or a day", or whatnot, so, it would be better if they, if people that do come up to do research is to, you know, make time and inform. – *Interview 16*

Well it does take more time {for researchers to engage with communities} but it's worth it in the end. Like, it is really worth it. – *Interview 12*

I don't, I don't think so. I don't think they {researchers} spend enough time {in town when they come up}, like, like one meeting, like how much, how much people do you think would show up? And then, well, other people would hear about it, but then, like not everybody... I think they {researchers} would, like, at least spend a bit more time {in the community}, like, like, I think most meetings, when people {researchers} come in for meetings, they like come in for like the day and then they leave the same day. – *Interview 18*

I think, eh, from, from my experience people that come up here in the last 40 some odd years is, the ones that, they, their findings, the ones we really believed in, the ones we really connected to, is, the researchers, when, if they stayed up here for a few months, not just a few days, or a few weeks, if they just come up here for a couple of weeks in the summer, and usually they uh, we hardly see them too because they go inland too, and uh, yeah, research's not done right in Sachs Harbour, you know, unless it, unless there's a human aspect to it, but they go out on the land, and they go to these areas and do their research and we usually don't have a chance to uh, really talk to them, you know. It should be more personal, it should be somebody that comes up here, for at least 6 months, really, it's, you know, that's the only way you come up with a real good true report of what's going, how it, how things are affecting people. – *Joey Carpenter*

Participant responses that mentioned *respect* and *time* were compared to responses mentioning communication *perceptions* and *recommendations* to explore their associations, outlined in Table 5.5. Perceptions of *respect* were less frequently mentioned in association with *perceptions of communication* than *recommendations for communication*, and in both instances, the association with *content* was the least frequently mentioned; the same was true for perceptions of *time*, which also included a non-existent affiliation with *content recommendations*. Associations of *respect* with *method* and *source recommendations* were equally frequent and highest overall, accounting for 66.6% of all *respect*-affiliated responses. *Method*, followed by *source recommendations*, were the most frequently mentioned overall associations with participant perceptions of *time*, constituting 60.3% of all *time*-associated responses. Considering communication *content*, *methods*, and *sources* regardless of *perceptions* and *recommendations*, *methods* represented the most frequently mentioned overall associations with perceptions of *respect* (45.8%) and *time* (53%), followed by *sources* (41.6 % *respect*; 42.6% *time*), and *content* (12.5 % *respect*; 4.4% *time*).

Table 5.5. Percent frequency of all participant (n=46) mentions from all narrative text sources that referenced *respect* and *time* in conjunction with communication *content, methods, and sources* for participant *perceptions of research communication and recommendations for research communication*.

	Perceptions of Communication			Communication Recommendations		
	Content	Methods	Sources	Content	Methods	Sources
Respect	4.2	12.5	8.3	8.3	33.3	33.3
Time	4.4	20.6	14.7	0.0	32.4	27.9

5.4 Impressions of Research and Researchers

5.4.1. Associations with Age and Gender

When discussing impressions of communication, as noted in the previous section, participant responses were often emotionally charged with positive or negative sentiments. Furthermore, participants also outwardly expressed positive and negative views about how or why research is conducted, and about their experiences with researchers. As explained in Section 4.5, *positive, negative, and indifferent impressions of research and/or researchers* encompass both participant responses and participant attributes. Figures 5.5a-c explore the associations between participant attributes of age, gender, and impressions of research; Figure 5.5a illustrates this relationship for interview participants (n=19), Figure 5.5b indicates the relationship for focus group participants (n=12), and the relationship between participant attributes of age, gender and *impressions of research and/or researchers* for all participants (comprising interviews, focus groups, and informal conversations; n=46) is demonstrated in Figure 5.5c.

Two-thirds of female interview participants (Figure 5.5a) were associated with overall *positive impressions of research and/or researchers*, while overall *indifferent and negative impressions were associated with one participant each*. All interviewed women younger than 50 years of age were associated with overall *positive impressions of research*

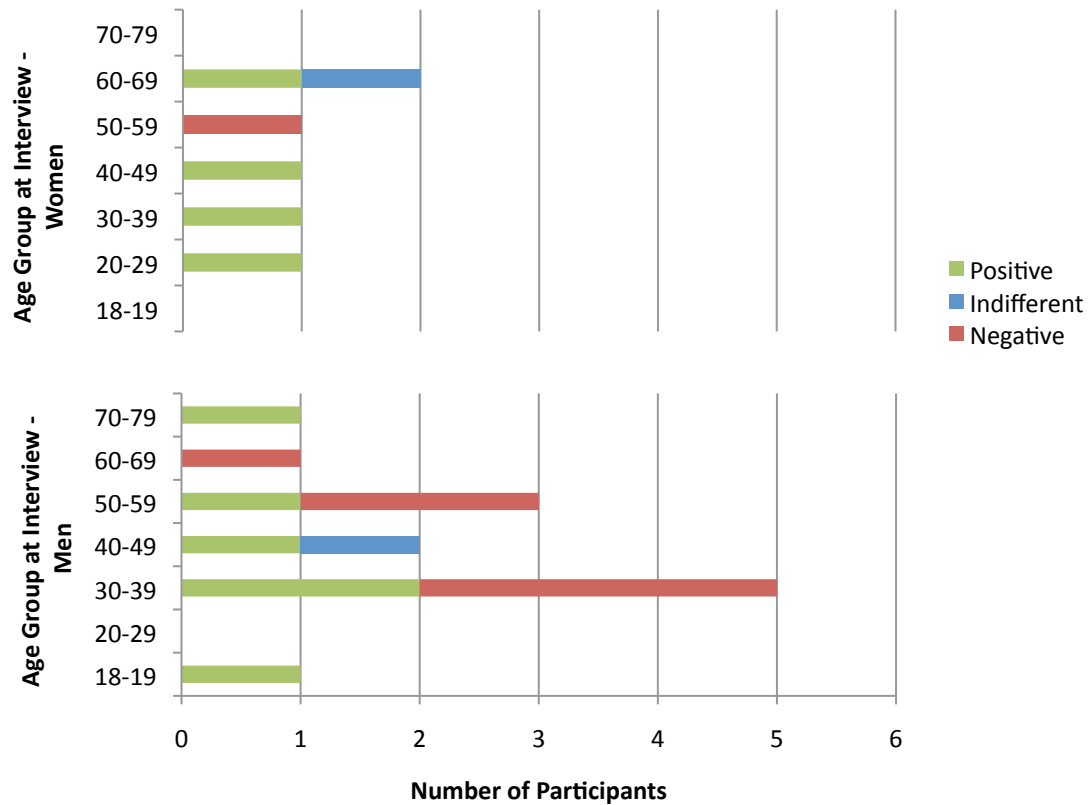


Figure 5.5a. Participant attribute distribution for overall *positive*, *indifferent*, and *negative* impressions of research and/or researchers according to age among female (n=6) and male (n=13) interview participants (n=19).

and/or researchers. An equal number (n=6) of male interview participants were associated with both *positive* and *negative* impressions, while one participant was associated with an overall *indifferent* impression. Overall *positive* associations were predominant in the youngest (18-19) and oldest (70-79) age groups, both represented by one participant each; overall *negative* associations predominated for participants aged 30-39, 50-59, and 60-69.

All participants in the focus group (Figure 5.5b) consisting of women aged 36 and older were associated with overall *positive* impressions, while two-thirds of participants in the focus group consisting of women aged 35 and younger were associated with overall *indifferent* impressions. All participants in the focus group consisting of men aged 35 and younger were associated with overall *indifferent impressions of research and/or researchers*,

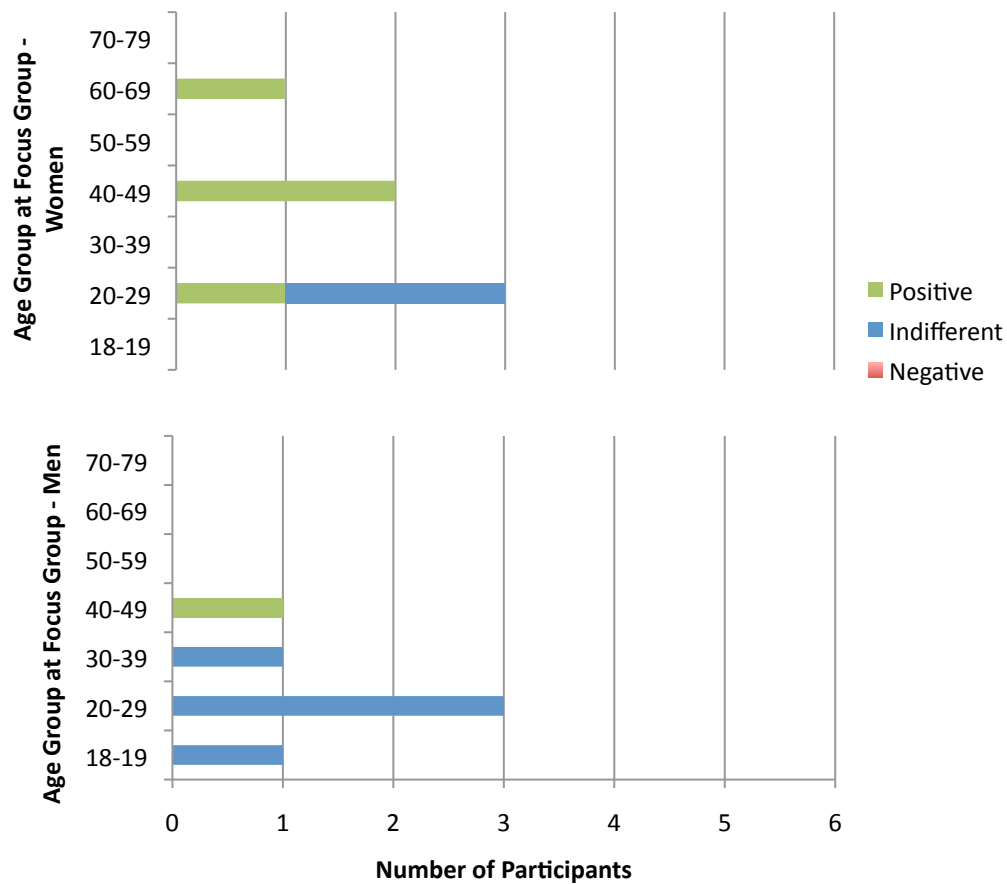


Figure 5.5b. Participant attribute distribution for overall *positive, indifferent, and negative impressions of research and/or researchers* according to age among female (n=6) and male (n=16) focus group participants (n=12).

while an equal number (n=1) of participants in the focus group consisting of men aged 36 and older were associated with overall *indifferent* and *positive* impressions. No female or male focus group participant was associated with overall *negative impressions of research and/or researchers*.

Participants involved in interviews, focus groups, and informal conversations comprise all participants (Figure 5.5c). Representing half (n=10) of all female participants, *indifferent impressions of research and/or researchers* was the predominant overall association; 35% and 15% of all female participants were associated with overall *positive* and *negative* impressions respectively. An equal number (n=9) of men were associated

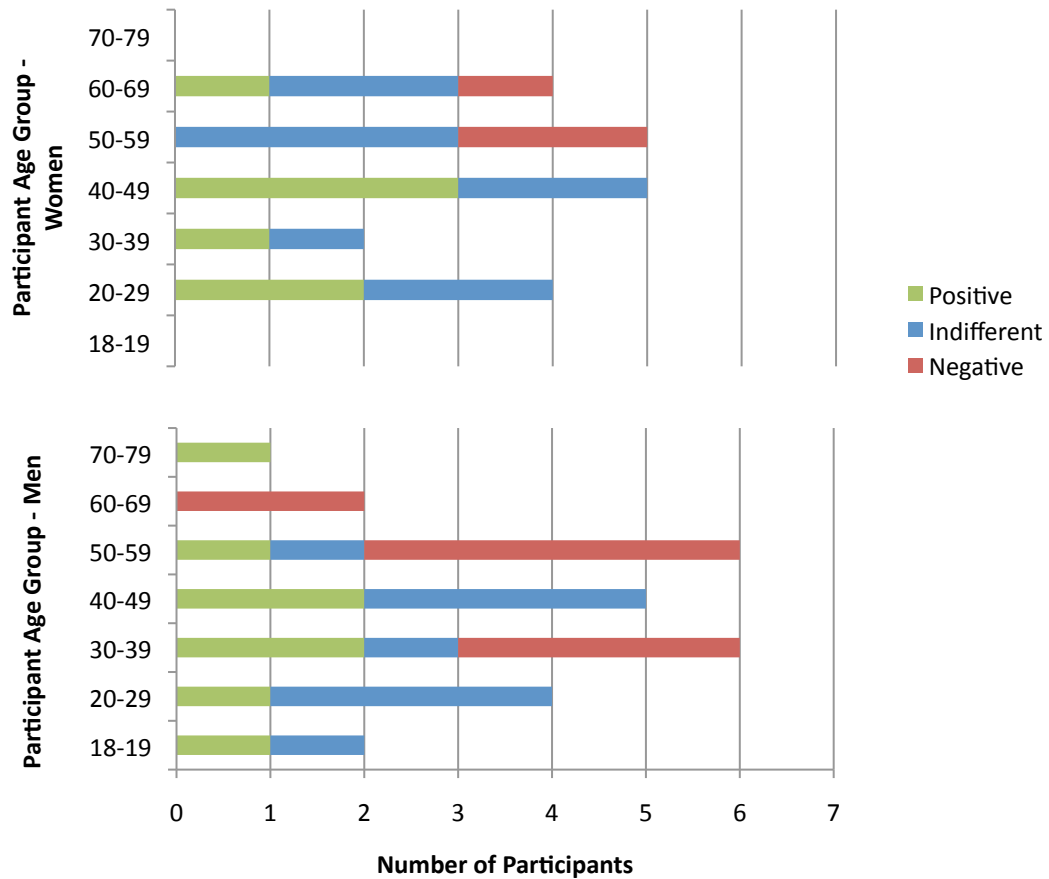


Figure 5.5c. Participant attribute distribution for overall *positive*, *indifferent*, and *negative* impressions of research and/or researchers according to age among all female (n=20) and male (n=26) participants (n=46).

with overall *indifferent* and *negative* impressions, accounting for 69% of all male participants; the remaining 31% were associated with *positive* impressions.

Considering all participants by age regardless of gender, *positive* impressions were more frequently associated with ages 20-29 to 40-49, the latter having the most *positive* impressions (n=5) of researchers. However, this age group also showed the same number of *indifferent* impressions; indifference suggested no noticeable pattern with age overall. *Negative* impressions were mentioned more frequently for older participants, predominantly for those aged 50-59 (n=6), although an equal number (n=3) of *negative*

impressions existed in age groups 30-39 and 60-69; these were the only age groups where *negative impressions of research and/or researchers* existed.

Overall attribute *impressions of research and/or researchers* for interview, focus group, and all participants (comprising interviews, focus groups, and informal conversations), combining age and gender, is summarized in Table 5.6. *Positive* impressions predominated for interview participants, whereas focus group participants were primarily associated with *indifferent* impressions. Although *positive, negative, and indifferent* impressions were more evenly distributed when considering all participants – which included people who were involved in informal conversations – overall *indifferent impressions of research and/or researchers* was the dominant association.

Table 5.6. Overall participant attribute *impressions of research and/or researchers*, comparing interview (n=19), focus group (n=12) and all (n=46) participants, regardless of age or gender, expressed as percentage.

Impression of Research and Researchers	Interview Participants	Focus Group Participants	All Participants
Positive	53	33	33
Indifferent	11	67	41
Negative	37	0	26

Disregarding participant age, gendered associations with overall *positive, negative, and indifferent impressions of researchers and/or research* attributes for all participants (comprising interviews, focus groups, and informal conversations) are summarized in Table 5.7. Women (n=20) were primarily associated with *indifferent* impressions, whereas men (n=26) were equally associated with *indifferent* and *negative* impressions. Combined, overall *indifferent* impressions predominated; however, associations with overall *positive* impressions outweighed overall *negative* impressions.

Table 5.7. Overall participant attribute *impressions of research and/or researchers* for all participants (n=46) according to gender (n=20 women; n=26 men), expressed as percentage.

	Positive	Indifferent	Negative
Women	15.2	21.7	6.5
Men	17.4	19.6	19.6
Total	32.6	41.3	26.1

5.4.2 Associations with Communication, Respect, and Time

Since some participant responses were emotionally charged when they spoke of their *perceptions of research communication and recommendations for research communication*, their statements about communication *content, methods, and sources* were compared against the number of responses that mentioned *positive, negative, or indifferent impressions of research and/or researchers*. Statements that referenced an aspect of *perceptions of communication or recommendations for communication* in addition to an *impression of research and/or researchers* were determined through a matrix coding query; Table 5.8 displays the percentage of commonly mentioned associations for all participants (comprising interviews, focus groups, and informal conversations), where communication *perceptions and recommendations* are viewed separately.

Table 5.8. Percent frequency of categorized responses for all mentions of communication *perceptions and recommendations* associated with all mentions of *impressions of research and/or researchers* among all narrative text sources for all participants (n=46).

Impression of Research/ers	Perceptions of Communication			Communication Recommendations		
	Content	Methods	Sources	Content	Methods	Sources
Positive	10.6	25.4	17.9	9.6	29.2	14.1
Indifferent	0.8	6.2	3.6	1.9	9.9	3.8
Negative	8.0	11.7	15.8	6.4	13.1	11.9
Total	19.4	43.3	37.3	17.9	52.2	29.8

Overall mentions of *positive* impressions predominated over *negative* and *indifferent* impressions in every category of communication perceptions and recommendations, and were primarily associated with mentions of *methods* of communication in both regards. *Indifferent* impressions, although primarily associated with *methods* of communication, were mentioned the least overall. *Negative* impressions were most frequently mentioned in association with *perceptions of communication sources* – representing the only instance in which *sources* were mentioned more frequently than *methods* – followed by *recommendations for communication methods*. Additionally, communication *methods* were most frequently mentioned in association with *impressions of research and/or researchers*, regardless of the nature of the impressions, followed by *sources* and *content*.

Participant statements that mentioned the notions of *respect* or *time* in addition to an *impression of research and/or researchers* were also determined through a matrix coding query. The results are provided in Table 5.9 as percent response frequency, and show that both *respect* and *time* were equally affiliated with *positive* and *negative* impressions.

Table 5.9. Association between all participant mentions of *impressions of research and/or researchers*, and *respect* and *time* for all narrative text sources, expressed as a percentage.

	Impression of Research and/or Researchers		
	Positive	Indifferent	Negative
Respect	47.7	5.3	47.4
Time	48.8	2.4	48.8

Although participant responses and attributes regarding *impressions of research and/or researchers* have been distinctly divided into *positive*, *negative*, and *indifferent* categories, individual participants often expressed a range of impressions. While these sentiments have been present in a few previous quotes, participant views listed here exemplify their multifaceted nature:

Well I used to go out on the land with a lot of researchers and I really do like them, they're all a bunch of interesting people that all have very, very deep knowledge and very good resources and stuff, it's just nice to see them come up again...But I think a lot of them are just up here for the adventure part, uh, whatever project they're doing, they don't really, they want to have a good story to go and tell their friends when they get back and, "well I went to the Great White North and I survived outside in 40 below" or whatever. – *Manny Kudlak*

People are still worried about, leery about researchers, because in the past, you know, they used to just come up and we don't even know what's going on, and they do their thing and they're gone; and, you know, we never hear nothing. So people in the community were always leery about researchers coming up here and just doing their work and leaving. – *John Keogak*

I think it's {research is} good, because, you know, like all the information that, that's going to help in the long run, it's going to make a difference, yeah... you know, it's {more research and more researchers are}, it's a good thing. Yeah, like personally I think it's a good thing. – *Interview 15*

You got to keep an open mind when there's projects and stuff, any, any projects, ah, will benefit the people and the environment... So it's very important that researchers come up quite often. – *John Lucas Jr.*

Researchers or research? I think there's, so many different ones {researchers} come from different, like... different fields and, some of them are a lot better than others, I guess you could say. And some of them keep coming back, like you guys, and some of them just go, go away once, twice, and then they're, all of a sudden they're 'experts' I guess you could say. – *Interview 14*

[R]esearchers keep coming and finding out things. That's good. I think they are doing a good job, those researchers anyway. Yeah, I don't mind with the, research, uh, they are finding out what things should be done and everything, eh? I don't mind at all about it, researchers. – *Geddes Wolki*

That all, that {bad impressions of research} all dates back to the oil boom in um, late 70s and early 80s where uh, the oil companies and the government with their researchers they came in and did whatever they wanted, really, uh, and then they left and then they never came back. Um, a lot of the older people still remember that, um, but a lot of younger people now, they're educated, they're not biased by what happened so they're, they're open to research now and they're, at least some of them are partially aware of what that research means to the community, but still, there's a lot of room for improvement. – *Vernon Amos*

It's seems to me that the researchers just want to get it over and done with and go back, to go back to wherever they came from. – *Interview 12*

I think they're {researchers are} really limited and, because, you know, we had researchers and research and, keep asking them and, a lot of them won't give information because of their... even though we're signatories to some of their research, it's really hard to get stuff {information} out them. – *Interview 14*

Well when they {researchers} do come up North, what I think they should do is take like a crash course, like a half-day, you know, one morning they sit down and say, “this is what to expect”, you know, “this is the environment you’re going to be in, these are the conditions of the community”, because each community is different, right. Like, in Sachs, there’s less than a hundred people, and, not everybody thinks the same way about the researchers. Other than that, I haven’t heard anything negative about them, everything’s been positive, like, they do respect the land, and if, if the wildlife monitor asks something of the researcher, I have full confidence that the researcher will do what he {the monitor} asks. – *Interview 17*

I don’t know, it kind of seems like they, if they {researchers} kind of cared, you know, they’d have like, a couple days meetings set up or whatever, not just here for the day and then they’re just gone. – *Interview 18*

Things that they’re {researchers are} seeing that, you know, might help us in, in a way to adapt to all these changes. And there’s, yeah, there’s been all kinds of research, and I think there should be more. – *John Keogak*

It’s {contaminants are} quite a big issue now, like um, before the land claims was signed, they had no regulatory bodies to, like, any kind of researchers or oil company could come up and do whatever they want, dump all their stuff all over, but since the land claims was signed, um, we have um, a lot of screening committees, make sure everything is screened before it comes up here, so they don’t ruin the environment and wildlife. – *John Lucas Jr.*

So I think um, when... when we first started um having um, um, people {researchers} coming up to our area long ago, ever since I was a kid, possibly even before, but they were doing studies or they were doing their job on the environment and we never knew; there was no explanation on what they were doing. Um, so there was, I guess uh, what do you call it, resentment from our people on science, so they weren’t uh, there was no communication. But now that we have land claims, and the Government of Canada’s obligated to um, work with the Inuvialuit, and this {working together} is what we’re doing. – *Interview 10*

Researchers aren’t really embraced here, because back then people felt really used, no direct acknowledgement for their knowledge, so there’s been an attitude change, people making a fast dollar off of our knowledge. It’s different now, times have changed, but the older generations are still wary. – *Bridget Wolki*

I don’t know, I think I become very jaded to them {the researchers} after I been lied to a few times and, I go and tell my friends what they tell us they’re going to do and then, they go around and do something else, it, it doesn’t really look good for everyone. I just, I’m very wary of these, uh, guys that come here and go out on the land and say they’re going to do this and then we know from past experiences they just do what they want and, by the time the community finds out or anyone finds out they’re usually long gone, untouchable again or whatever. – *Manny Kudlak*

Yeah, yeah, they just tell us what’s going on and leave, they, they don’t stick around, or, or don’t visit, but, I don’t know if it would be any help if they stick around in the community. – *Lena Wolki*

Well, things have changed a lot for, for how they, how researchers are with the community, it's more positive now, but still, it could be improved. But, you gotta understand that when you come here, you might be an outsider but they'll {they community will} still welcome you. – *Interview 12*

I think, um, what I've noticed is the older people, older workers, scientists, they're harder to change and accept; they want it the way it's always been for them, but the younger scientists and new people out of school, or you know, been working a few years, they, they're not so brainwashed by society, you know, they're more accepting of um, new ways of doing things and, I think those people are gonna be the easiest to, um, work with Inuvialuit... last few years I've noticed and I really like that when I see people come up and spend time within the community, and I think it's a real benefit for our people. – *Interview 11*

5.5 Contaminants Communication in Action

In the overall context of 18 years of research in the Inuvialuit Settlement Region, this chapter demonstrated Sachs Harbour Inuvialuit perceptions of what contaminants are, where they come from, and how they move to the places where they are perceived to be located, in addition to perceptions and recommendations regarding the content, methods, and sources of research communication, and the emergent notions of respect and time. Furthermore, participant impressions of research and researchers, which became evident through analyzing their views relating to research communication, were illustrated. While the information contained in this chapter was assembled from participant interviews, focus groups, and informal conversations, to enable a thorough discussion of the interrelationship between the preceding results, the discourse that transpired in each focus group must be elaborated upon.

The structure and purpose of focus groups for this project has been previously stated in Section 4.4.2. Their dynamic, interactive nature facilitated participant discussions through which opinions and understanding about contaminants, communication, and research and/or researchers were identified; such views have been included in this chapter. Unique to focus groups, however, was how the involvement of the researcher – myself –

created an active process of contaminants communication. After their initial impressions of contaminants, mercury, and communication were indicated; mercury information was provided to participants, with which they could interact to discuss how to convey such facts to other Inuvialuit. It was anticipated that participants would have questions regarding mercury or other contaminants, and the ensuing dialogue addressed their questions regarding where mercury comes from, how mercury and other contaminants get to the Arctic, how mercury gets into the animals, what happens if people or animals have mercury inside them, and why researchers study mercury. Concurrent with verbal explanations, I diagrammed the concepts of global distillation ('the grasshopper effect'), bioaccumulation, and biomagnification, and showed pictures to illustrate source points.

As a result of sharing this information, two participants (one male, one female, both aged under 35 years) expressed that their ideas about how mercury and contaminants move through animals (bioaccumulation and biomagnification) were confirmed; the fact that mercury exists as a naturally occurring element confirmed this perception for an additional two participants (both females aged over 36). Excluding these specific examples, all participants expressed that the information provided was new to them.

Regarding communication, participant recommendations included pamphlets, hand-outs/mail-outs, newsletters, writing something to submit to northern-focused magazines (e.g. Tusaayaksat, in-flight magazines published by airlines servicing the north), holding small meetings, talking to people one-on-one, creating trivia or interactive games, spending time in the community, and talking to students in the elementary school. Following the aforementioned discourse about mercury and other contaminants, participants in the second, third and fourth focus groups stated that the focus group itself was an example of how researchers could communicate their research. Participants also suggested that the information covered in the focus group be summarized on a pamphlet or handout, with an

emphasis on more pictures and less words, to be circulated throughout the community; this would enable individuals who partook in focus groups to explain the information to others:

I think, like you shouldn't just put a poster up on the wall, I think someone should be putting it up there that had something to do with putting information on it, so then people are aware that it's there, and when they look at it they can remember... Like, when I'm working at the Complex, every couple weeks we get like a whole bunch of, I guess it's junk mail, but it's a bunch of posters, information ones, and some of them are pretty useful, but if we put them up, we don't even know how to describe some of them, or whatever, so, like people look at them but they don't really take anything from it, so I think if you were to do posters, there should be a little event like this where you can explain it to at least a few key people in the communities, so they would be able to continue sharing the information. – *Focus Group 3*

Chapter 6: Discussion

6.1 Preface

Expanding on the results from the previous chapter, the contextually- and experientially-situated knowledge and perceptions that Sachs Harbour Inuvialuit expressed regarding contaminants are broadly explored as to possible meanings and origins of these associations. By using the topic of contaminants as a case example from which to discuss communication processes, participants were able to share their overall impressions of research communication, providing insight into how research and researchers are perceived as part of the communication process. These inter-relationships are further discussed within the emergent concepts of respect and time. The discussion finishes with my reflections on how focus groups – initially conceived as a forum in which participants could use mercury information to identify culturally appropriate content, methods and sources to communicate contaminants information to Inuvialuit – facilitated the establishment of baseline of mercury knowledge, and became a participant-identified example through which contaminants research could be communicated to the community.

6.2 Sachs Harbour Inuvialuit Perceptions of Contaminants

6.2.1 What Are Contaminants?

Results from this project contribute to the growing body of literature investigating perceptions of contaminants held by Inuit across Canada by being one of the few studies to document contaminant perceptions of Inuvialuit in the western Arctic. Interview, focus group, and informal conversations with participants indicated the variability of perceptions that Sachs Harbour locals had regarding contaminants, which were largely consistent with

previous findings from other Canadian Inuit communities (e.g. Usher et al. 1995; O’Neil et al. 1997a; Egan 1998; Poirier and Brooke 2000; Furgal et al. 2005; Myers and Furgal 2006; Tyrrell 2006; Oakes 2008; Clifford-Pena 2008).

Similar to an average southern Canadian, Inuit and Inuvialuit have a general awareness and understanding of contaminants (Usher et al. 1995; Poirier and Brooke 2000). In Arviat, NU, Tyrrell (2006) found that no consensus existed with respect to the cause or effect of contaminants, acknowledging that Inuit understandings of contaminants are complex; for Inuit of Salluit, Nunavik, contaminants were broadly viewed as “anything that might be perceived...as having a negative impact on their land and more crucially, on their relationship with it” (Poirier and Brooke 2000). Inuvialuit relationships with their environment may explain why *oil/fuel/gas* was the predominant overall perception mentioned when participants were asked to describe what they thought of when they heard the word ‘contaminants’; the controversy surrounding oil exploration and development on Banks Island in the 1970s remains a source of contention for many locals. The importance of the land and wildlife may also indicate why *garbage/sewage/waste* and *disease/parasites* were mentioned, since both categories refer to visible factors that impact the health of the land and wildlife (Myers and Furgal 2006). Albeit less frequently mentioned, the references to *climate change* also denote a visual association with contaminants as connected to the environment. The issues surrounding climate change are of paramount importance to Sachs Harbour Inuvialuit (as all Inuit), and the heightened awareness of a changing environment may contribute to the perception that climate change could be linked to contamination in the environment.

The majority of associations mentioned regarding contaminants were visible in nature, or had aspects of which could be visually or olfactorily experienced. *Cleaning agents* and *chemicals* can be ‘seen’ and ‘smelled’ insofar as canisters containing the material in

question can be seen and smelled; the results of *permafrost* melt and the 'smelly gas' released through the process can be perceived by the senses, as can CO_2 emissions from vehicles. Associations with *water*, *pollution*, *preservatives*, and *pesticides* can arguably have sensory elements; awareness of *preservatives* and *pesticides* in store-bought food leads to the association because the food itself is visible. Similarly, the association with *water* may be due to visible or invisible entities in the water, which itself is visible. Although not visible in Sachs Harbour, *pollution* may have been experienced by participants who have traveled to more densely populated southern cities, thus contributing to this association, or because *pollution* is a common and widespread concept; in many situations, *pollution* was used synonymously with 'contaminants'. Many of the references included in *other contaminants* also include visible associations. Because Inuvialuit traditionally relied on sensory experience to detect change and determine what is healthy and unhealthy in the land and wildlife on which they depended, it is unsurprising that *contaminants* are perceived in many cases to be associated with visible phenomena (cf. O'Neil et al. 1997a; Egan 1998).

Second most frequently mentioned overall, the predominant invisible association with contaminants was *mercury/POPs*, suggesting a notable difference in perceptions compared to other Inuit communities where mercury and POPs were not the prevailing views of what constituted contaminants (cp. Egan 1998; Poirier and Brooke 2000; Myers and Furgal 2006; Tyrrell 2006; Oakes 2008; Clifford-Pena 2008). For example, Myers and Furgal (2006) stated that approximately half of their sample population, which constituted participants from two Nunavut communities and two Nunatsiavut communities, were somewhat familiar of the concept of contaminants as studied by researchers. Since project participants were not given information about contaminants prior to being asked about their perceptions, this suggests that some contaminants information about mercury and/or

POPs may have been learned and retained through previous research communication efforts, by reviewing research proposals through the HTC board or other IRC co-management bodies, or by participating in research initiatives. Alternately, participants may have learned this information from secondary sources such as individuals who partook in the aforementioned activities. However, *pesticides* were never connected to, or identified as *POPs* despite the fact that pesticides comprise OC compounds known to persist and biomagnify in the environment (AMAP 2009).

Considering that *poison* was often used in the past as a translated term for contaminants into Inuktitut (cf. O'Neil et al. 1997a, Poirier and Brooke 2000; Leiss and Powell 2004; Myers and Furgal 2006), it was not often mentioned in association with contaminants in Sachs Harbour. When discussing how no Inuvialuktun word for 'mercury' exists, a participant in the first focus group mentioned the word *poison* and asked an elder how to say it in their language: "tuqunaq, something that kills." The fact that the association with *poison* is not very prevalent could be due in part to Inuvialuit fluency in English and a decline in the use of terminology that may provoke fear. It is perhaps ironic then, that feelings of *fear/concern* were mentioned in association with contaminants more frequently than *poison*, and that other sentiments that came to mind when participants considered the word 'contaminants' were also of an unfavourable nature: that it denoted *something wrong* and *should not be here*. While a lack of meaningful terminology to describe contaminants has been lacking in Inuit dialects (Leiss and Powell 2004), the same argument could be made when no language translation is necessary.

Albeit visible in nature, associations such as *food*, *animals*, and *people* included in *other contaminants* appear at first to be abstract; yet, these are not literal meanings of the word 'contaminants', rather they suggest *what contaminant means* at a cultural level. *People* are not considered to be a contaminant in and of themselves, but the association of *people*

with contaminants suggests that contaminants are viewed to have become an unwelcome part of their environment and society. This revisits the Salluit notion of contaminants being anything that negatively impacts the land or one's relationship with the land (Poirier and Brooke 2000); people, animals, and the land are interconnected aspects of a whole, and these relationships constitute what it means to be Inuvialuit (Usher 1973; Berkes and Berkes 2009; cf. Bielawski 1992; Freeman 1992; Stairs and Wenzel 1992; Rybczynski 1997; Fienup-Riordan 1999; Usher 2000). This relationship is further exemplified when considering Sachs Harbour Inuvialuit perceptions of the sources, locations, and movement of contaminants.

6.2.2 Movement of Contaminants between Locations and Sources

Perceptions of *what contaminant means* explored the numerous associations that participants had with the word *contaminants*. While the myriad of local perceptions may present as though there are high levels of confusion or misunderstanding, at least from the point of view of a researcher who studies contaminants, this is not necessarily the case. Although confusion, uncertainty, and misunderstanding do exist, this may be due in part to the complexity of reconciling traditional and experiential ways of knowing and being with technical scientific information that cannot be visibly validated and is thus perceived as untrustworthy (O'Neil et al. 1997a; Egan 1998). This can be further compounded by the content, source of, context, and manner in which they received the information. Instead of merely listing these perceptions, they are further considered as to their associations with contaminant sources, locations, and pathways to suggest a broader picture of Sachs Harbour Inuvialuit understandings of contaminants. Interpretations proposed here are of a generalized nature, and further in-depth analysis will be explored in future work.

Previous studies have found that, while Inuit have a general awareness of contaminants, they are largely unsure as to the origin of contaminants, how they are transported, and implications for wildlife and human health (Usher et al. 1995; Myers and Furgal 2006; Tyrrell 2006). In Sachs Harbour, participants also indicated a diversity of views that could mean a lack of consensus, however predominant perceptions were suggested. Contaminants were primarily perceived to come from *animals/country food*, *oil/fuel spill/leak*, *development/exploration*, and *local sources*; move *through water, air*, and *food webs*; and make their way into *the animals*, *the water and ice*, and *the people*. These interconnected sources, pathways and locations reinforce the importance of Inuvialuit relationships with the environment; *other contaminants* encompasses the concepts of *animals*, *food*, and *people* which are shown here to be largely be affiliated with contaminant locations sources, and movement. The concept map shown in Figure 6.1 suggests the interconnections between the most frequently mentioned contaminant sources, pathways, locations and perceptions. Of the four predominant sources mentioned, only *animals/country food* is not linked with the overall contaminant perception of *oil/fuel/gas*; the location of *water and ice*, while associated with the overall perception of *water*, is not connected with the predominant associations of *what contaminants are*. Participant mentions of maktak contamination links the location of *animals* with the overall association of *mercury/POPs*, which, along with *other*, are considered location-associated perceptions; *oil/fuel/gas* is a source-associated perception.

The awareness of atmospheric and oceanic transport combined with food web transfer proposes that contaminants are viewed to both be 'in' the *water, air*, and *animals* (location) and 'come from' the *water, air*, and *animals* (source). Although belugas are opportunistically hunted in the waters surrounding Banks Island, maktak is usually delivered from mainland Inuvialuit communities. Maktak was an often-mentioned source

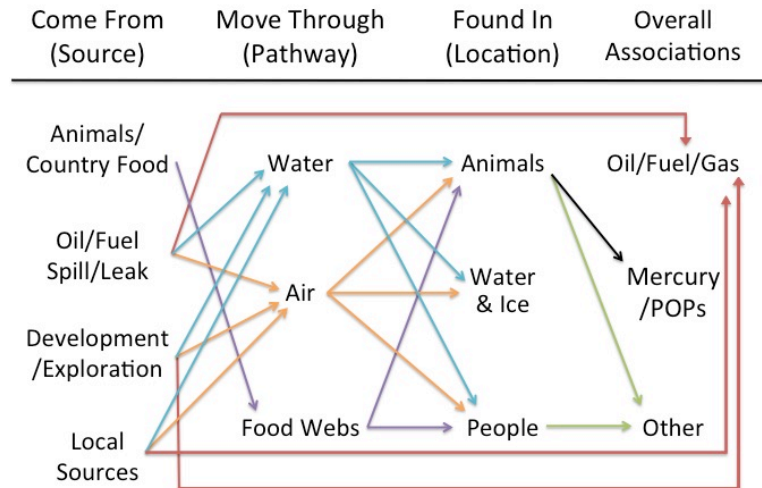


Figure 6.1. Conceptual connections between predominantly mentioned participant perceptions of contaminant sources, pathways, locations, and overall associations (*what contaminant means/what contaminants are*); arrows suggest transport pathways from source to location (*water = blue; air = orange; food webs = purple*), and associations between sources and locations with perceptions of *what contaminant means* (*oil/fuel/gas = red; mercury/POPs = black; other = green*).

of contaminants in *animals/country food* associated with having *mercury/POPs*, and beluga was identified as a location *in the animals* where contaminants could be found. Aquatic animals such as bowhead whales, ringed seals, bearded seals, and various fish were thought of to have more contaminants than terrestrial animals such as muskox and caribou, and were mentioned more often. Comparably, contaminants were more frequently mentioned as being located *in the water and ice* than *in the land*, and contaminant movement *through water* was the primary mode of transport mentioned. Beluga, however, was the only species that was associated with *mercury/POPs*, while concepts of contaminants in other animals were perceived to be related to *disease/parasites* or other unspecified or unknown agents. Snow geese presented a unique case, being the only avian and migratory species mentioned. For a couple of goose hunters, they were perceived to ingest contaminants from *pesticides* used on crops in their overwintering and staging grounds *in the South* and could thus be a source of contaminants to *people*. *Water* was also viewed as a source of

contaminants for aquatic animals – especially water from the Mackenzie River and Delta – in addition to *oil/fuel spill/leaks* that may be brought by ocean currents from sources in *other countries or the south*. *Air* was not mentioned as a contaminant source to the same extent as *water*, although contaminants such as those emitted through industrial activities (*development/exploration*) that use air as a vector for transport could make their way into humans and wildlife via inhalation.

Contaminant movement *through food webs* incorporated the views that *animals* were both contaminant sources and locations, in addition to being a major route through which *animals/country food* made their way into *people*. Participants described the process of animals eating each other, with top predators such as polar bears being perceived to have more contaminants than plankton; although the terms biomagnification and bioaccumulation were not used, several participants' descriptions indicated a conceptual understanding. Wildlife not commonly consumed by people, such as Arctic fox and Arctic wolf, were only mentioned in association with contaminants through the acts of predation and scavenging.

Frequently mentioned associations with sources relating to *oil/fuel spill/leak* and *development/exploration* may be reinforced by prior and ongoing experiences with and perceptions of these circumstances (cf. Poirier and Brooke 2000), such as the Mackenzie Valley Pipeline, the 1989 *Exxon Valdez* oil tanker spill in Alaska, proposed or existing mining projects, oil exploration in the Beaufort Sea, and the 2010 BP oil spill in the Gulf of Mexico. This latter event is of particular interest, being the overwintering grounds of socio-economic and culturally important snow geese, and suggests an instance where *the South* is also viewed as a location and source of visible contaminants that could be perceived to directly affect the livelihood of Sachs Harbour residents. *Local sources* such as Johnson Point identifies with past seismic work on Banks Island in addition to more recent

remediation efforts in which several locals were also involved. Some contaminant locations identified as *sites on Banks Island* or *sites in Sachs Harbour* were also considered to be *local sources* of contaminants, yet the way in which participants spoke of these associations indicated that they were more often considered as sources from where contaminants originate rather than places where contaminants are found. For instance, people were recognized as being a source of contaminants through their actions of leaving garbage on the land or not maintaining vehicles to prevent oil or gas leaks; similarly, Inuit in other communities also acknowledged their contribution to contaminants found on *the land* or in *the water and ice* and their responsibility to clean it up (Poirier and Brooke 2000; Tyrrell 2006).

Other communities mentioned as being contaminant locations were mostly situated within the Northwest Territories, with the exceptions of Alaska and northern Alberta that were associated with *oil/fuel spill/leaks*, and places in the eastern Arctic where a couple of participants recalled hearing about contaminants in breast milk. During the same period that Banks Island was confronted with seismic development, Tuktoyaktuk was also experiencing oil exploration, and as such it was mentioned in association with *oil/fuel spill/leak, development/exploration, and DEW Line* sources. Many participants had visited, resided, or worked in Tuktoyaktuk during the 1970s and thus experienced the industrial activity firsthand; however, Usher et al. (1995) anticipated but did not find a heightened awareness regarding contaminants and their effects, considering the community's prolonged exposure to industrial contaminants from the DEW Line site and petroleum manufacturing. In the fifteen years since their study, current awareness of contaminants regarding those activities has increased to some extent as suggested by Sachs Harbour participant responses. Communities in the Mackenzie Delta, such as Inuvik, Aklavik, Tsiigehtchic, and Fort McPherson are thought to be places where contaminants are found

due to their affiliation with the Mackenzie River, which is considered a *water*-related contaminant source. Contaminants coming from *the South* make their way into and through the river, and from there, into *the animals* and *the land* (cf. Leitch et al. 2007).

The association with contaminants being located on the mainland could also be connected to the idea that contaminants are *not here yet*; according to some participants, since Banks Island is separated from the mainland and does not have the same extent of industrial activity, contaminants are not thought to have crossed the Amundsen Gulf to make their way to Sachs Harbour. Although many people are aware of the industrial origins of contaminants from *the South* (cf. Tyrrell 2006), they are also perceived by some to remain *in the south* and thus have not yet reached the community. In the case of invisible contaminants, *not here yet* may also imply that because certain contaminants cannot be seen, they are therefore not present. Conversely, participants who expressed the view that contaminants are *already here* did so with reference to 'knowing' or 'hearing' that they are in Sachs Harbour or the Arctic in general; specific contaminants such as *mercury/POPs* were mentioned in some cases but not in others.

The concept of *climate change* as a source of contaminants suggests the possibility that climate change is causing the environment to become contaminated. While it is known that the impacts of increased climatic variability will alter contaminant transport pathways and increase contaminant bioavailability to wildlife and humans (cf. Kraemer et al. 2005; Macdonald 2005), connections this specific were not mentioned, with one exception; climate change was generally mentioned as a perceived contribution to the presence of contaminants in the Arctic. Climate change as its own phenomenon was ubiquitously accepted by participants as being caused by human actions in southern North America and other countries, yet because its impacts are already being felt in the Arctic, its association with contaminants suggests that contaminants could be perceived as *already here*, even by

those who otherwise perceive that contaminants are *not here yet*. Overall, the variability of responses indicates the existence of local and external, visible and invisible contaminant sources and locations.

6.2.3 Contaminant Concerns: Locations, Sources, and Perceived Control

In addition to being asked if they were concerned about contaminants or if contaminants impact their daily lives in any way, when participants spoke of *what contaminants are* their perceptions often included a statement regarding concern or lack thereof, which was related to their perceptions of contaminant locations and sources. Additionally, for those expressing concern or worry, there were different degrees of urgency depending on the perceived amount of control one had over the situation.

Concern regarding *local sources* of contaminants that were viewed as being the result of human activity elicited different responses depending on responsibility. Frustration was expressed with respect to others who did not care for their mechanical equipment, which could contaminate the land and water through fuel leakage; in this case, participants did not have control over the actions of others. Contaminants coming from furnace emissions or vehicle exhaust, on the contrary, were viewed more impassively, that they could or would not be avoided. Vehicles are often left running during the winter given the cold temperatures while houses consume increased amounts of fuel for heating. Emissions from the small number of vehicles and houses in Sachs Harbour were thus not mentioned with much concern, as they do not compare to the extent of emissions caused by and coming from *the South*. In cases where remediation has taken place, a level of control exists over the outcome. While Johnson Point is still considered to be a contaminant source and site despite remediation, its ability to contaminate is perceived to have reduced making it less of a concern. Additionally, the land is continuously monitored both informally by

hunters and formally through site inspections, enforcing a level of control over the area.

Contaminated land from fuel leakage associated with the RCMP detachment and beach area is also under a level of control as site clean-up has occurred, although the amount of time it took to have this issue addressed caused frustration and increased concern because of the perceived possibility that the oil or fuel would spread and sink into the land to the point where it could not be removed. Since remediation, concern for the area has lessened.

Contaminants coming *from the South* are beyond Inuvialuit control. For those believing contaminants are *not here yet*, the inevitability of their arrival was mentioned as a source of concern for the future. These responses were associated with participants being 'not really' concerned at present, and were often expressed in a dismissive tone. Even for those believing contaminants are *already here*, concern was often expressed calmly, and was connected to the ideas of increased vigilance and awareness; the expressed importance of research to learn about contaminants and inform communities could be a perceived means of control. Inuvialuit have developed coping mechanisms and have an inherent adaptive capacity to address their vulnerability and contend with impacts related to climate change (Berkes and Jolly 2001; Pauktuutit 2006; Pearce et al. 2010), giving them control over their actions and responses. Contaminant information that increases local awareness and potentially assists with decision-making was thought to be able to equip them with the means to deal with contaminant-related changes in their environment, and decreased their perceived concern.

Country food was overwhelmingly perceived as being healthy to eat because contaminant ingestion could be moderated, and because people could tell if an animal was sick or not. When eating maktak, one could remove and discard the outer layers of skin – where the contaminants were perceived to be located – thereby reducing their consumption of the contaminant. Cooking maktak or other country food was also mentioned as a way to

mitigate contaminant exposure. While concern was indicated in these situations, the fact that participants had a degree of control lessened the level of concern expressed, and the overall sentiments were stated in a casual manner. People also had the choice to exercise control regarding the food they consumed, and country foods were considered healthier than over store foods that could be contaminated with pesticides or preservatives. At present, even if country foods contained contaminants, the ability of people to recognize and judge healthy from non-healthy animals lessened the feeling of worry, and most animals on Banks Island, with the exception of fish in certain lakes, were viewed not to have anything wrong with them. The visual nature of these determinations reflect trust in their learned abilities to judge health and abnormalities are consistent with traditional ways of knowing, and corroborate previous findings citing the importance of validating information through sensory experience (O'Neil et al. 1997a; Egan 1998; Poirier and Brooke 2000; Tyrrell 2006).

Although contaminants can also be 'seen' in daily life through the presence of vehicles leaking oil, garbage on the land, and chimney smoke, multiple other socially important stressors take precedence over contaminant concerns on a daily basis. While this study did not inquire into these issues in Sachs Harbour, they have been documented in previous studies in Inuit communities (cf. Usher et al. 1995; Egan 1998; Myers and Furgal 2006; AMAP 2009; Krupnik and Jolly 2010).

Women and men – and individuals themselves – expressed both sentiments of concern and no concern, but references made by men were more frequently mentioned than that of women. However, their perceptions of concern were only slightly higher than perceptions of no concern, contrasted to a more noticeable distinction for women, where perceptions of concern were expressed four times as much as perceptions of no concern. Such gender disparity has been previously noted (cf. Finucane et al. 2000) but also

challenged (cf. Palmer 2003; Kahan et al. 2007; Jardine et al. 2009). In northern aboriginal communities experiencing multiple concurrent stressors, gendered perceptions were found to have a limited overall effect, although there were gendered differences in the way in which concern was described (Jardine et al. 2009). In comparison, perceived contaminant-related concerns propose a marked gendered difference in this study. However, the nature of responses did differ; heightened degrees of worry were mentioned more in association with concerns for the future than the present, which were mostly articulated by women. Male responses were more 'matter-of-fact' than emotionally charged when speaking of contaminant concerns, even when those concerns did include references to future generations of Inuvialuit. Despite male perceptions of concern being mentioned only slightly more frequently than no concern, and considering that males comprised a higher overall response frequency, mentions of concern outweighed lack of concern in all age groups except the youngest and oldest. Regarding the future, participants in age groups 30-39 to 60-69 expressed concern regarding the future generations of animals and people, whereas those aged 10-19 and 20-29 only mentioned concern for the future of animals.

Tyrrell (2006) argues that the issue of contaminants cannot be separated from other causes and effects of disease that affect both humans and animals. In Sachs Harbour, concern for the future of the animals was mentioned more often than concern for their own future, potentially reinforcing the concept that Inuvialuit health is dependent upon the health of the animals and the land (cf. O'Neil et al 1997a; Poirier and Brooke 2000). If the land and animals become too contaminated that they could no longer provide sustenance, Inuit in Nunavik expressed concern regarding the potential loss of identity (Egan 1998). Similarly for Inuvialuit, the certainty of the interconnection between animals, humans, and the land could come into question; contaminants present a concern for the future of Inuvialuit livelihood and identity:

For the future, that's where it's, if we, if they {country food} become so contaminated we can't eat them, that's going to be a real shame. Like, what kind of people are we going to be? Are we still going to be Inuvialuit? – *Interview 11*

6.3 Prior Knowledge About Contaminants

The understandings and perceptions presented thus far represent what participants have learned and retained from a variety of experiences, contexts, and sources, and in many instances, discussions about concern provided insights into how participants had come to learn about contaminants. Perceptions of contaminants as oil, fuel, and gas, whether as concepts, sources or locations, is most likely associated with many firsthand experiences with oil development and exploration on Banks Island and the ISR mainland in the 1970s. Younger generations would have learned this history, as it is intrinsically connected to the struggle and ultimate realization of Inuvialuit land title, in addition to being aware of current industrial development in the Arctic and the rest of Canada through the news and popular media.

Especially for more isolated communities, television and radio were common sources of information for many Inuit communities, and contaminants information has been transmitted through media broadcasts in the past (Usher et al. 1995; Furgal et al. 2005). While still very much in effect in northern communities, the pervasiveness of the Internet had broadened the availability of resource materials – including social media, newsfeeds, academic sources, activism groups, special interest groups, and a multitude of videos, blogs, and websites created by individuals – all of which can be accessed through online search engines. Much of the information available twenty years ago was considered fragmentary with people lacking the context in which to place it (Usher et al. 1995). Despite the surplus of information currently available, it is tailored to be quick and efficient, packaged as easily digestible newsbytes, updates, and headlines; information remains fragmented. News is

often over-simplified or sensationalized in print, online, and television media, (Usher et al. 1995; Myers and Furgal 2006), which can foster dialogue, debate, speculation, and rationalizing among people in the community. This can contribute to the process of generating their own explanations and information, which has been termed “contaminants gossip” by Usher et al. (1995), where information is transmitted between people, often becoming transformed, exaggerated, and miscommunicated in the process. It can especially intensify in situations where contaminant studies are being done in the vicinity of a community or when a news story about contaminants becomes prevalent (Usher et al. 1995).

When the April 2010 BP oil spill in the Gulf of Mexico was reported through the news media, I was in Sachs Harbour, and witnessed as it became a popular topic of discussion. Contaminants gossip was prevalent in the community and between ISR communities via social media websites, email, and telephone conversations. One resident received an email with a picture of an ‘oiled goose’ that was allegedly taken in one of the communities, although this was never verified. Questions and concerns arose that the geese were becoming contaminated with oil, leading people to wonder how this would impact the fast approaching goose hunting season. On multiple occasions, I was asked to find someone to “start researching the geese to see how much they’re contaminated.” The spill also led to heightened awareness of the impacts of an oil spill in the Arctic, fuelling conversations related to oil drilling in the Beaufort Sea.

Subsequent to the March 2011 nuclear reactor disaster in Fukushima, Japan, I was also in Sachs Harbour and observed similar contaminants gossip, albeit not as prevalent as talk about the oil spill. People wondered if radioactive fallout would be traveling through the air and ocean, and how fast it would be before they started noticing sick or deformed animals, or they themselves began to glow in the dark. Despite these sentiments,

contaminant perceptions mentioned in the ensuing interviews and focus groups included one only reference to nuclear waste.

While these two events illustrate specific instances of increased contaminants gossip that I was able to observe, it is also possible that contaminants gossip occurred when contaminants-related research took place in Sachs Harbour or elsewhere on Banks Island. However, the number of these projects is very low, ranging between 0-3 projects licensed per year, and it is possible that local awareness of these studies became subsumed by the overall amount of research projects (2-23) that occurred annually between the years 1994-2012 (cf. ARI 1996a, 1996b, 1998, 2000, [2000?], [2001?], [2002?], [2003?], [2004?] 2009a, 2009b, 2009c, 2010, 2012, 2014b). Furthermore, this project itself was one of three contaminant-related studies on the island licensed in 2009 and 2010, one of two in 2011, and the only one licensed in 2012 (cf. ARI 2012, 2014b). While this project purposefully aimed to engage people with contaminants information, I did not observe increased discourse or awareness regarding any other concurrent contaminant studies during my time in the community.

Informal local communication networks are characteristic of small, isolated northern communities, ensuring the fast transfer of information through daily interactions at work, home, while visiting, and hunting (Furgal et al. 2005). Contaminant information and perceptions are likely communicated in this manner, although the initial source of the information may inadvertently become lost. Several participants perceived beluga and maktak as being contaminated, but were not always certain from where they had received the information: "I must have heard it somewhere" or "science told us that." When eating maktak, "you're supposed" or "they say" to remove the outer layers of skin to avoid consuming contaminants. A few participants, however, perceived that this information had been known for a while, and identified traditional knowledge as the reason. At some point

this information was disseminated from a scientific source, because some participants specifically identified mercury as being the contaminant in beluga maktak tissue (cf. Wagemann and Kozłowska 2005). Invariably, this interesting situation presents a novel and important finding worth highlighting, where the original source has been obscured and scientific information has been retained and incorporated by some into the canon of traditional knowledge. In contrast, the following reference provides insight into a different way maktak contamination was viewed by past generations (cf. Usher et al. 1995):

So in, in our culture we never knew there was contamination; contamination for us was um, possibly whale meat or blubber that was, could actually kill everyone; that was contamination for us. {When} the blubber of the whale meat, or whale skin that people call maktak is not looked after properly, and it's, if you don't look after it properly...it's in the preparation process. We know that if you don't look after it properly it could kill you, so that was, that was our um, understanding of contamination. I mean we never knew, we never called it contamination, it was, there was no such word as contaminated. So this is all new to um, probably a larger population of the Inuvialuit. And I don't, I don't believe a lot of people understand contamination, like the difference of contamination. – *Interview 10*

With respect to the diversity of other contaminant associations, some information was learned from other people in the community, through HTC board meetings, and from television shows and documentaries. The latter source is how a few people learned that tuna was contaminated, and inferred that since tuna is a top predator, that could be the reason why beluga are contaminated. Associations with many visual or physical contaminants were made through personal observations and experiences on the land.

Although *mercury/POPs* were frequently mentioned contaminant associations, research or science was only a directly-cited *source* of this information for three individuals who have been highly involved in research initiatives, suggesting that the concepts of scientific contaminants were often not the same as local perceptions (Myers and Furgal 2006). However, many Inuvialuit perceptions of contaminants have scientific counterparts,

and Table 6.1 details the linkages between these different contaminant conceptualizations.

For example, household items such as computers or carpets may be thrown in the Sachs

Table 6.1. Comparison between a selection of associated Sachs Harbour Inuvialuit and scientific concepts of contaminants, reflecting different ways of knowing, learning, and categorizing.

Inuvialuit Perceptions	Scientific Conceptualizations
<i>POPs</i>	POPs
<i>Pesticides</i>	OC pesticides
<i>DEW Line</i>	PCBs (e.g. DEW Line)
<i>Other Communities In the South From the South</i>	Long-range transport from southern latitudes & small-scale local sources (e.g. DEW Line)
<i>Mercury</i>	Mercury
<i>Natural Forest Fires Development/ Exploration</i>	Natural mercury sources (forest fires, volcanoes) Anthropogenic mercury sources (smelting, refining, industry)
<i>In the Animals In the People</i>	Health concerns about mercury in Arctic wildlife and humans
<i>Garbage/Sewage/ Waste In the South From the South</i>	Long-range transport from southern latitudes & small-scale local sources (e.g. municipal sewage disposal into lakes)
<i>Oil/Fuel/Gas Oil/fuel Spill/leak Development/ Exploration Forest Fires</i>	Polyaromatic Hydrocarbons (PAHs) released through fossil fuel burning, oil spills, and naturally through burning organic compounds (e.g. wood)
<i>In the South From the South Local Sources Sites on Banks Island</i>	Long-range transport from southern latitudes & small-scale local sources (e.g. vehicle use, fuel to heat homes)
<i>Garbage/Sewage/ Waste Garbage Dump</i>	Brominated Flame Retardants (BFRs) released through sun exposure, incineration
<i>In the South From the South Local Sources Sites on Banks Island</i>	Long-range transport from southern latitudes & small-scale local sources (e.g. burning waste electronics or upholstery)

Harbour *garbage dump* (Inuvialuit *source perception*) where BFRs can be locally released through chemical reactions with sun exposure or incineration (scientific conceptualization). Although Inuvialuit never mentioned BFRs as being contaminants, and *garbage/sewage/waste* is not currently considered within the realm of scientific contaminants research, these connections indicate parallels between the different ways of perceiving contaminants that warrant further exploration, especially in regard to contaminant communication.

Nevertheless, participant requests that contaminants information be provided to enable them to contend with the uncertain illustrates a lack of awareness that such information already exists exactly for this purpose. As one participant succinctly replied when asked what had been learned about contaminants from researchers: “not much.” This suggests that information about contaminants as conceived and disseminated by researchers and affiliated organizations – with the exception of mercury in beluga maktak – has not been received nor retained by many Sachs Harbour residents.

6.4 Communication Impressions: More Than Contaminants Research

Since 1994, the number of contaminant-related projects throughout the Northwest Territories has been increasing at a steady rate, reflected to a lesser extent in contaminant-related projects in the Inuvialuit Settlement Region alone, according to research license records from the Aurora Research Institute (ARI 1996a, 1996b, 1998, 2000, [2000?], [2001?], [2002?], [2003?], [2004?] 2009a, 2009b, 2009c, 2010, 2012, 2014b). During this period, research on Banks Island and in the community of Sachs Harbour has also increased, with the total number of projects being higher than the number of contaminant-related projects in the ISR in all years except 1994 and 2006. Comparably, the number of contaminant-related projects conducted on Banks Island is very low with no appreciable change if examined on the same scale (0-3 projects per year). This may explain why, when

participants were asked about their *perceptions of* and *recommendations for* research communication about contaminants, their responses included references to other research projects with which they were somewhat familiar. In many cases, the different foci of research may be indiscernible, especially between projects within the same research discipline. Considering the small population of Sachs Harbour, the number of projects that are annually evaluated for approval by the HTC board combined with the efficiency of local communication networks would seem to indicate that people in the community would be aware of the amount and nature of research going on. However, community members often have many other things to do that may take precedence over attending research presentations or meetings:

Yeah, some of us have got like three, four jobs and we're busy morning to night, when we get up and, I guess they {researchers} get mad at us too when there's not enough people at their consults but they, they got to realize this is a tiny town where everyone's got more than one job or one thing going on. – *Manny Kudlak*

Other people echoed these sentiments, that even if they were aware of such upcoming events and interested in the subject matter, the demand for their attention is stretched thin. This further supports the suggestion that information about contaminants has largely not been received nor retained by many participants, and as a result, *impressions of research communication* were viewed broadly to encompass contaminants among other research.

Discourse regarding *impressions of research communication* also revealed emotionally-charged or value-laden views of research and researchers based on prior experiences; these views, in turn, often affected their *perceptions of* and experiences with previous research communication, and informed their *recommendations for* future research communication, contaminant-related or otherwise. The inter-relationship between communication and *impressions of research and/or researchers* also revealed the notions of

respect and *time* as important underlying principles that connect and permeate these impressions. Therefore, although contaminants were not always the subject matter discussed regarding communication impressions; they provided a case example through which to consider communication *content*, *methods*, and *sources*, in addition to offering the conceptual space within which to investigate the broader connections between aspects of communication and *impressions of research and/or researchers* through the notions of *respect* and *time*.

6.5 Communication as Content versus Communication as Process

6.5.1 Impressions of Content

Message content is often the focal point in communication strategies to ensure that correct and relevant information is provided to the target audience, but communication cannot be considered in isolation from the sources and methods used. Comparing the response frequencies between communication components for both men and women suggest their predominant area of focus is on communication *methods* followed by *sources*. From the perspective of participants, this suggests that the priorities for communication are *methods* and *sources*, both for *perceptions* about past communication efforts and for their *recommendations* going forward. *Content* is obviously important to the communication triad, but for Inuvialuit, the process of knowing and knowledge itself are not viewed as being separate (Berkes and Berkes 2009). Knowledge is situated less in what is said than in how it is said, what is done with it (Bielawski 1992), and from who the knowledge comes (cf. Egan 1998). Rather than solely considering 'knowledge as content', this emphasizes the dynamic nature of traditional knowledge as 'process' – as a way of observing, experiencing, discussing, interacting, and making sense of new information (Berkes 2009) – which supports participants' focus on communication methods and sources as they align with

Inuvialuit ways of knowing. If 'knowledge as content' correlates with message content, then 'knowledge as process' can be viewed parallel to processes of communication – the *methods* and *sources* through which knowledge is communicated. The previously cited quote regarding maktak contamination illustrates how knowledge is a culturally shared, experiential process (Usher 2000), and that the scientific concept of contaminants exists outside of their culture, although some integration is evident. Since contaminant messages appear to be interpreted through the lens of Inuvialuit experience, cultural worldview, and direct observation (Myers and Furgal 2006), the processes through which these messages are disseminated can thus affect the extent of content that is ultimately understood and retained.

Throughout discussions about research communication, many participants mentioned the importance of scientific research in the North and expressed interest in learning about contaminants and being informed. As they articulated, however, the barriers of technical language and jargon, and the lack of prior baseline information can hinder understanding and interest while increasing frustration (cf. Pufall et al. 2011). Participant recommendations for communicating in 'plain language' were expressed despite the requirement of plain language summaries in research reports from organizations such as NCP and ARI, and the promotion of plain language use in presentations given at regional or community workshops and meetings:

No, {the research reports aren't always easy to understand}, they're, I think they've got to be, do more layman's terms in there. One of your bosses was in the Hamlet, gave a big presentation, and we said, "okay, do it in layman's terms," and he had to do it all over again. Told him, "try not to use too many big words and this and that," yeah, so he did it over again[.] – *Interview 14*

While terminology is content-based, it comes across through the communication process, be it an organization sending out pamphlets or a scientist giving a presentation.

The gap created by differences in language and terminology used reflects the contrast in knowledge systems and ways of knowing, which is further exemplified in participant *perceptions* and *recommendations* regarding communication processes.

6.5.2 *Perceptions of Communication Processes*

Perceptions of how past and current contaminant and other research have been communicated include reports, presentations, meetings, newsletters, posters and involvement in research projects, which are also associated with *perceptions of communication sources*, such as industry representatives, research agencies or organizations, and individual researchers. The method of involving Inuvialuit in research projects aligns more with hands-on education, learning through example, observation, and experiential ways of knowing that are consistent with the concept of traditional knowledge as process (Berkes 2009). Communication *methods* such as reports, newsletters and posters are heavily text-based and are associated with communication *sources* through indirect, impersonal means. While presentations and meetings incorporate the physical presence of a communicator, information is still largely text-based, incorporating scientific graphs and tables through the near ubiquitous use of computer programs to present this information as a slideshow. A communicator's oration throughout a meeting or presentation could be considered suitable, considering that traditional knowledge is rooted in and transmitted through oral history, myths, lessons, songs and stories (cf. Fienup-Riordan 1999; Usher 2000; Furgal et al. 2002; Nichols et al. 2004; ITK and NRI 2007). Yet the simultaneous visual (slide text, graphs, tables, and pictures) and auditory (presenter's speech) methods, combined with the sheer amount of information, may overwhelm the senses to the point where information cannot be absorbed or retained, or the audience loses

interest; this may especially be the case for elders and people with little or no background knowledge in the subject matter:

You can't just come in for like, hour and a half, two hour meeting and then leave and think that, oh, everybody got it and like, everybody's up to par and we all read their material like, before they {researchers} came in, and, that's where it's lacking too, you have to have um, prior information. – *Interview 11*

So many researchers that uh, I don't really know what's going on sometimes. Good for them anyway, when they check all over, eh? – *Geddes Wolki*

While some people elect not to attend meetings or presentations, others make an appearance because they are aware of the time and cost that are invested to travel to the community. However, I was informed that during these meetings, “people nod their heads because they know that the researchers are saying important things, but it doesn't mean a whole lot to them, and they don't really understand” (D. Nasogaluak, pers. comm., August 2009). Two elders in particular regularly attended research presentations when they occurred in the community. In conversation, one stated that although they had gone to many presentations, she did not remember what was discussed; “it's so much information and it's so complicated,” and that “researchers talk so fast about so many confusing things and they don't stay long enough to answer questions” (M. Kudlak, pers. comm., May 2010). Although meetings and presentations are becoming increasingly commonplace for community and regional organizations, such as the HTC and IRC co-management bodies, some Inuvialuit are more engaged than others in these endeavours, and are thus more familiar with the methods used and the subsequent information conveyed. Prior knowledge or experience with the topic itself may encourage interest for locals to attend a particular presentation, such as one about climate change, as they may feel they can offer their own expertise to the discussion. Despite the expressed interest in learning about contaminants, however, the local capacity or technical ability to understand contaminant issues is often lacking:

[T]hey really have no grasp of, of contaminants and the levels of contaminants or even what contaminants are there, and again, that's, uh, jargon and terminology, you can't really explain what, what a contaminant is and have them to understand that. I don't know how that can change. You can only, uh, you can only simplify things to a certain point where anything else, you, you can't do it. You just need some technical ability or some technical understanding and usually that's not there. – *Vernon Amos*

Dissemination strategies and capacity building have largely focused on frontline workers – “Regional Contaminants Committee members, community health representatives, health promotion specialists, Inuit Research Advisors (IRAs) and people to whom community members go for information on environmental contaminants” – as stated in NCP's priorities regarding communications, capacity and outreach (NCP 2014). During the course of this project, three individuals held the position of Inuit Research Advisor for the ISR. The IRA who occupied the position when this project began assembled short, informal newsletters that were issued to all ISR communities; they highlighted the current research occurring in the area, provided the names of research project leaders and contact information, and offered brief explanations of some scientifically complex topics being studied, such as contaminants. While some participants stated they had seen these newsletters, they were not attributed to information learned about contaminants (Tyrrell 2006), while the IRA was referred to by name as a communication *source* in the context of community visits through IRC. The subsequent two IRAs were never mentioned, and although the third IRA also produced newsletters that contained information about contaminants, they had never been seen by anyone in Sachs Harbour with whom I spoke. Additionally, healthcare workers were never considered as a *source* of information, and some people expressed that they were not always sure where to go for contaminant information:

Huh, that's a tough one. I don't know, if I had, like, questions for them {researchers} and they're out of town, um, I don't really know who I'd go to because, like, I don't know who they're hooked up with here, like the HTC or the Community Corp., or the Hamlet or whatever. I don't know. – *Interview 18*

Through the Health Centre, we really don't get information on contaminants. There was a poster on contaminants that we had posted up here, I remember those, but we took it down after painting the place and never put it back up. It was a good poster, it showed the transfer of contaminants, but it didn't stimulate dialogue. People just noticed it and said, "gee, that's interesting" but no one ever expressed concerns about contaminants. – *Anonymous*

These examples provide further evidence for the need for community-specific projects that can identify if the research organization's objectives of contaminants communication efforts are being met (Furgal et al. 2005), and illustrate why Sachs Harbour community members at large may lack an overall understanding and awareness of contaminant issues – as conceived and communicated by researchers and associated organizations – as they have not been considered a target audience.

6.5.3 Recommendations for Communication Processes

Perhaps because newsletters, reports, meetings, and presentations have been adopted by a variety of Inuvialuit organizations and committees to facilitate working relationships and communication with various levels of government, industry, and scientific bodies, among others (cf. Usher 1973; Nadasdy 2003), they have become relatively familiar *methods* of communication. This may explain why some participants recommended that these *methods* could still be used for future research communication, despite moderate interest in and low retention of the information contained in the IRA's newsletters. In addition to reviewing research proposals, the Sachs Harbour HTC receives research reports, which are available to everyone in the community. Participants with prior experience on the HTC board, in addition to those without, cited a preference for short summaries (i.e. 1-2 pages) instead of reports in excess of 10 pages in length. For indirect *methods* such as reports, posters, pamphlets or newsletters, a reduction in the amount of text and an increase in pictures or visual aids were frequently recommended. Short excerpts submitted

to magazines published through airlines such as Canadian North and First Air were suggested because they are regularly read by passengers. Some participants advocated for newsletters to be put in everyone's mailboxes to ensure that the entire community has access to information, while others stated that newsletters or pamphlets distributed in this manner could be considered junk mail and discarded (cf. Pufall et al. 2011).

A case study conducted with several northern aboriginal communities by Jardine and Furgal (2010) communicated their study results using some of these methods, providing participants with visual images, summary posters and fact sheets synthesizing project information and basic results. However, in three of the four communities, these methods were used in conjunction with community open houses or workshops, and in the larger Inuit community of Nain, NL, the open houses were video-recorded by and for the regional television and radio stations. The availability of local infrastructure to support television and radio broadcasts such as this may depend on the community and region, as this was not the case for the other communities involved in the project (Jardine and Furgal 2010). Even though radio and television are already used to communicate contaminants information through various news outlets (Usher et al. 1995; Furgal et al. 2005; Myers and Furgal 2006; cf. Section 6.3), and although communities may be passively engaged with public media depending on the topic (Tyrrell 2006), some Sachs Harbour participants recommended the use of radio and television broadcasts through the Aboriginal Peoples Television Network (APTN) and the Inuvialuit Communication Society (ICS) to communicate research information. ICS in particular broadcasts *Uumatimnin*, a show watched by many people in Sachs Harbour, and publishes the magazine *Tusaayaksat* that is available to all Inuvialuit beneficiaries. Both were specifically referenced as potential ways through which to engage Inuvialuit in contaminants issues.

The exponential increase in the prevalence of social media over the past several years may suggest why participants also recommended creating websites or Facebook groups to update people in the community about research results and ongoing activities, as illustrated by this exchange from the second focus groups where participants made suggestions for how I could inform Sachs Harbour and other communities about mercury:

Focus Group 2-1: Put it on Facebook, like, put it on Facebook. Cos if people...

Focus Group 2-2: Make a group, yeah. Yeah, that would be really nice.

BR: And call it what, “the mercury group,” or what?

Focus Group 2-2: Something like that, you know, it doesn’t necessarily have to be that, but mercury awareness, or, and try to add everyone from the ISR in there if you could. I’d join that group.

Through these means, participants could engage with the research material and indirectly interact with researchers themselves, as many people in the community use the social media site. However, researchers or those providing information for updates could perceive this as an additional task on top of their communication requirements through funding and licensing agencies; the same argument could be made for establishing and maintaining websites. In fact, websites already exist to inform northerners about contaminants, such as *Niqiit* – a virtual course that follows two Inuit youth as they learn about contaminants in the environment, wildlife, and humans – developed by the Inuit Qaujisarvingat/Inuit Knowledge Centre housed through ITK (ITK 2014), yet people may not be aware that such sites exist. This raises the question of how northerners can become aware of these resources in the first place, especially if recommendations are being made for their creation. In my post-interview and post-focus group conversations with participants, I mentioned resources such as *Niqiit* for them to look into, but do not know what action was taken in that regard.

Since interviews and focus groups were being video- or audio-recorded, the possibility of making a video compilation available to people was also suggested:

Actually a movie of a group interview like this would be pretty interesting to learn about, from it because, you know, there's going to be some people who don't understand at all and there's going to be people who understand it very good. So, when they see all this talk, you know, they, they won't feel out of place, you know, they're gonna want to be more keen on it and, I dunno, um, I think this is pretty good, and I like it. – *Focus Group 2*

Video-hosting websites were also suggested as an online forum to post short movies made about research, as long as they are only a few minutes in length to keep people interested. Coincidentally, while in the community holding focus groups in February-March 2012, I was creating a video to highlight my research for the IPY *From Knowledge to Action* conference in April 2012; as a condition of receiving travel funding from the Association of Polar Early Career Scientists (APECS), recipients were required to submit short video 'FrostBytes' to be made available through the conference website and APECS YouTube channel (APECS 2012). Following the focus groups, I informed participants of these short films and requested feedback on my own video, which I posted on Facebook with a link to the APECS channel. Although this initiative was aimed at communicating and promoting research among conference attendants, it has the potential to benefit northern audiences as well.

Whether through television or radio broadcasts, online links to videos, websites, or social media, or physical pieces of paper containing information, many of these informal indirect methods of communication rely on the recipient to decide to interact with the information. Sachs Harbour participants were fully aware of this, remarking that even if they did not attend presentations, or read newsletters or reports, they appreciated knowing that such information existed and was available to them. This illustrates the need to provide different methods and opportunities through which interested individuals can learn about research initiatives and results (Jardine and Furgal 2010).

Comparable to findings by Pufall et al. (2011), other *recommendations for communication methods* were more direct in nature and corresponded with recommendations for what *sources* could do to improve communication. Instead of presentations, which were mentioned as being very ‘formal’ and ‘dry,’ participants suggested communicating through informal small groups sessions or gatherings to facilitate dialogue and allow for questions to be raised and addressed. Similarly, taking time to visit people in the community was recommended to communicate either one-on-one or to a few people at a time, in addition to the suggestion of using storytelling to explain the ‘story of contaminants’ (cf. Giles et al. 2010); such processes are extensions of the informal ways through which Inuvialuit communicate amongst themselves. Integral to Inuvialuit culture is the social context of their knowledge (Berkes and Berkes 2009), and these *recommendations* illustrate the important social, community-centred component of communication processes through which knowledge is transmitted. Thus, there is an emphasis on building relationships, and establishing trust and rapport with communication *sources*, such as researchers (Egan 1998). This process of gaining respect takes time, but the temporal investment in a community to build respect can affect people’s *impressions of research and/or researchers*, which in turn can affect their *perceptions of communication methods* as being respectful and appropriate, and can ultimately influence their perception and reception of the information presented.

6.6 Medium as part of the Message

6.6.1 Research/Researcher Impressions and Relationships with Communication

Participant *impressions of research and/or researchers* varied with age and gender, although no statistical analysis was performed to determine significance. Female participants appeared to have more *positive impressions* than men overall, although

indifferent impressions were more frequently mentioned than *positive impressions* for all women; *indifferent*, *negative*, and *positive impressions* were mentioned with almost equal frequency for all men. Regardless of age and gender, however, overall indifference was the dominant *impression of research and/or researchers*. Further studies will attempt to elucidate the influences that previous and current involvement in research initiatives have on these impressions, while also considering age and gender.

Whereas *indifferent impressions* predominated among participants, it was the least frequently mentioned association with *communication perceptions and recommendations*. *Positive* and *negative impressions* were most frequently associated with impressions of communication *methods* and *sources*, suggesting that participants with *positive impressions* had positive *perceptions* of communication processes and expressed affirming communication *recommendations*; oppositely, participants with *negative impressions* had negative *perceptions* of communication processes and expressed communication *recommendations* in tones denoting doubt that they would be considered. Since *impressions of research and/or researchers* became evident in the tone participants used to speak about *communication perceptions and recommendations*, this suggests that – regardless of participant *impressions of research and/or researchers* – views of research/researchers are important facets to consider in the perception of research communication processes. Inversely, since researchers are considered a *source* of information that use certain *methods* to communicate, value-laden perceptions of these communication processes in turn contribute to one's *impressions of research and/or researchers*. Additionally, the inter-relationship between these two mediums cannot necessarily be separated from how people ultimately receive, interpret, understand, and accept the content of a message, such as information about contaminants, as simplified in Figure 6.2.

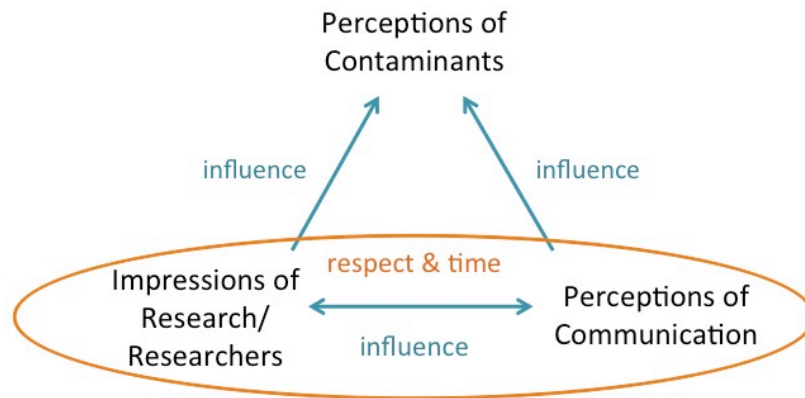


Figure 6.2. Directional relationship between the views of research/researchers and communication as important mediums that influence perceptions of information content, such as contaminants, which are themselves affected by the notions of respect and time.

The combined mediums of communication and associated research/researcher impressions thus influence a person’s perception of contaminants, inferring that processes are more important components of communication than message content. Therefore, the medium is part of the message in scientific communication (cf. McLuhan 2006), with implications for contaminants research communication due to the influences of respect and time, as emphasized by residents in Sachs Harbour.

Notions of *respect* and *time* were frequently mentioned in association with *perceptions of* and *recommendations for* communication processes; participants often stated that researchers did not spend enough time in the community, recommending that they would like to see researchers spend more time in town. *Respect* and *time* also held equally frequent responses for *positive* and *negative impressions of research and/or researchers*, suggesting that *respect* and *time* are important both to people who have positive and negative views. This may indicate that research/researchers were viewed as being respectful (*positive*) or disrespectful (*negative*), and spending suitable amounts of time in the community (*positive*) or not (*negative*), proposing that the mediums of communication and associated research/researcher impressions are based in relationships.

6.6.2 Importance of Respect and Time: Relational Aspects of Communication

From previous studies (cf. Egan 1998; Fienup-Riordan 1999; Jack et al. 2010), I was aware of the recommendation to build trustworthy relationships with participants for this project, which in my view meant remaining in the community for longer periods of time in which to do so. Egan (1998) emphasized the importance of relationships and time from her experience, where participants preferred to be interviewed by someone known to them that they trust, as it is more difficult to reveal details to a stranger. She further stated that “gaining trust and respect as a researcher in an Inuit community is a lengthy process, but the validity of results benefits all concerned” (Egan 1998). Time is needed to build mutual trust, and spending time in the community is valued with respect. Sometimes overlooked is the recognition of the “primacy of relationships as a foundation for research” (Ball and Janyst 2008), as personal friendships that form between researchers and community members are important to community acceptance and trust (Fienup-Riordan 1999; Jack et al. 2010).

This project was planned to facilitate extended periods of time to integrate into the community, build trust, respect, and relationships with people (Pufall et al. 2011); these values turned out to be important aspects of communication and researcher impressions as expressed by participants in interviews, focus groups, and informal conversations. The importance of time, as a facet of respect, became evident as an important aspect of participants’ *impressions of research and/or researchers* and views of communication processes. Many locals appreciated the extended periods of time that I spent in Sachs Harbour because it fostered respect, trust and friendship, thereby helping them feel more comfortable opening up and sharing their knowledge and experiences on a less superficial level. For example, locals still favourably remember Peter Usher from when he conducted his graduate work on Banks Island because of how much time he spent in the community

(cf. Usher 1970, 1971, 1973). When a researcher comes into the community and spends time among the locals for longer periods, they experience what the locals experience, they live here instead of just visiting for a few days, and they get a sense of how everything is connected, how traditional knowledge connects the land and the people (K. Lucas, pers. comm., September 2011). During one of my last community visits, one participant who was initially indecisive about an interview spontaneously agreed to participate because he had seen me in the community so often:

I think you got it {the way for researchers to communicate with people in the community} better than all the other ones {researchers}, actually. Because they just come up for meetings and you're one of the few ones that actually, getting to know the people and talk to them and, I find, in the first couple of years, I was kind of reluctant and, "I wonder if she's going to be here for a while and, and am I going to ever see her again after this time, and what am I going to get out of it, and what are we going to hear out of it," those kind of things. – *Interview 14*

An unexpected outcome, the way in which I conducted my project thus became an example, in the eyes of participants, of how research projects should be communicated.

Participants identified this approach as a valuable way to improve communications and engagement, as it enabled the perceptions and knowledge of locals regarding contaminants information and communication to be heard, valued, and attributed, thus advising other researchers how to disseminate their research cross-culturally in an appropriate and relevant manner. Additionally, this approach emphasized the social context that my research was occurring within by acknowledging how knowledge was communicated in the community itself (Riedlinger 2001a), as some recommendations were consistent with communication pathways employed within the community, such as spending time together visiting one-on-one or with a small gathering of people, informal conversations, and storytelling. Recommendations also highlighted the significance of place-appropriate communication strategies (Masuda and Garvin 2006), since place has

exceptional importance for Inuvialuit as the North is their ancestral homeland (Giles et al. 2010). Traveling to their community to discuss contaminants expressed respect, and enabled the information to be presented and received in a familiar and comfortable setting.

The importance of informal, smaller groups to discuss contaminants issues was highlighted and compared to more formal meetings and presentations, where communication is largely one-way (Furgal et al. 2005), which do not represent familiar, traditional ways of communicating among Inuvialuit. One-on-one conversations were also especially advocated for elders, where the effort of spending an afternoon talking over tea is greatly appreciated. Jardine and Furgal (2010) found that food sharing was an important element to enable cross-cultural knowledge exchange; the sharing of local foods fosters the maintenance of social relationships, community well being, and cultural identity (Stairs and Wenzel 1992; Wenzel 1995; Van Oostdam et al. 1999; Usher 2002; Suk et al. 2004; Whittles 2005; Tyrrell 2007; Donaldson et al. 2010). Thus, engaging with people over tea and dryfish while visiting not only facilitates communication, it also reinforces respect.

Communicating research results using such methods incorporates a significant time contribution, however the importance of time cannot be overlooked nor dismissed (Egan 1998; Jack et al 2010). While recognizing the funding constraints placed on researchers, participants emphasized the value of researchers spending more than a few days directly in the community interacting with locals. The formation of relationships and a sincere commitment to the community influence the trust and credibility of the researcher, and by extension, the trust and credibility of the information he or she imparts – the medium as message. Even if one's research is not done in proximity to a community, it is still encouraged that effort is taken to spend time in the nearest communities to inform people about the projects being conducted. Incorporating the necessary funds for longer

community visits into one's budget or funding proposal was suggested to prevent the occurrence of limited funds that all too often preclude such a trip.

6.6.3 Focus Groups: Research Method as Communication Process

Focus groups emphasized knowledge sharing and co-creation, as we endeavoured to make sense of contaminants information, assess how this information had been previously communicated, and collaboratively investigate ways to communicate that are relevant and appropriate for the community. By emphasizing and being aware of the fact that these discussions occurred within a specific social context, we could focus on how knowledge was being communicated within the community itself. This approach actively comprised recommendations to improve communication including smaller, less formal 'discussion-style' meetings with researchers; suggestions that researchers spend more time in the communities to build relationships that will help foster mutual communication over the long term; and working with community members to create locally relevant contaminants messages of which participants can take ownership and thus better circulate throughout their community (cf. Jack et al. 2010). This was achieved through building collaborative relationships that created the space in which meaningful processes of communication could occur.

Discussions and interactions with current contaminants research such as mercury enabled participants to engage with contaminants issues in ways that were understandable and applicable to them. The loosely structured, small, informal group discussions enabled participants raise questions, ask for clarification, and exchange ideas with other participants, which was how it was discovered that most focus group participants did not have any background information about mercury – this contributed to their confusion as to why mercury was 'such a big deal.' Working through mercury information and drawing out

diagrams of global distillation ('the grasshopper effect'), biomagnification, and bioaccumulation were immensely beneficial, as participants indicated they now had a better understanding about the context in which current research results were being presented. The inclusion of basic mercury facts on a pamphlet is thus for the benefit of everyone in the community, but also plays an important capacity building and communication role, which differentiates it from existing pamphlets and handout materials about contaminants. When people receive pamphlets from outside sources in the mail, they often have no context as to what it is about, and often no one in the community is able or available to explain the content. Examining mercury information in-depth with participants will enable them, in turn, to clarify questions that others may have about the information and diagrams in the community-developed pamphlet (S. Raddi, personal communication), thereby empowering individuals and reinforcing information retention because it is being shared by a familiar, trusted source from within one's own community and culture.

As exemplified through their use in this project, focus groups can thus be employed as a forum to develop communication content and method recommendations, such as pamphlets with more visuals than text that incorporated the diagrams discussed (cf. Pufall et al. 2011); identify priorities necessary for the successful communication of researchers disseminating scientific results to northern communities, such as the purposeful allotment of time; and build capacity for northerners to discuss scientific information within their own community, as demonstrated through the establishment of baseline contaminant and mercury information. Consequently, the process through which we explored communication became a means of communication in itself.

Chapter 7: Conclusions and Recommendations

7.1 Concluding Remarks

Information from qualitative research projects and their analysis can tell many stories (Corbin and Strauss 2008), and the insights gained through this project were numerous. Using contaminants research as a case study for science communication, this study demonstrated the concept that the medium is an important part of the message in science dissemination strategies (cf. McLuhan 2006), through the discovery that concepts of respect, time, and relationships impacted the inter-related impressions of communication processes and research/researchers (the mediums), which in turn influenced perceptions of contaminants among Sachs Harbour Inuvialuit. This was exemplified through focus groups – a medium of communication that became a message – where we considered participants' knowledge and perceptions of contaminants and impressions of research communication, and discussed how information on contaminants research such as mercury can be communicated to communities in accessible, understandable, and relevant ways.

Furthermore, we discovered the lack of contaminant baseline information for many focus group participants, which inhibited the incorporation of, and capacity to understand new information. Providing and discussing contaminant information enabled the creation of community-derived, locally relevant messages about contaminants (cf. Jack et al. 2010). While those directly involved in this process increased their own knowledge capacity and comprehension of contaminants issues, the messages that resulted from these focus groups can subsequently be shared with other residents, benefitting the greater community of Sachs Harbour. By emphasizing collaborative inquiry and focusing on the mediums that influence contaminant perceptions, this project can potentially increase local capacity to

contend with contaminant issues, encouraging Northern involvement and empowerment in Arctic research.

How this research was done is as important as what was accomplished, as I realized through focus groups that the way in which I conducted my project supported communication recommendations stated by participants. The amount of time I invested in the community allowed relationships to form, which enabled the development of trust and respect – i.e. positive impressions of research/researchers – with community members. In a cyclical fashion, this in turn facilitated deeper, honest dialogue. Relationships were reinforced each time I returned to the community, and several participants ultimately agreed to be interviewed simply because they saw me continuously returning to the community; with genuine mutual understanding and transparency, participants can be comfortable being open and honest about their experiences and knowledge because they know it will be respected, used in context, and receive appropriate recognition (D’Alonzo, 2010). Many participants expressed appreciation at the amount of time I spent in Sachs Harbour, as it indicated an investment in the community and showed that I cared about the people and their involvement in the project.

Contaminant perceptions that Sachs Harbour Inuvialuit expressed were largely consistent with previous findings from other Canadian Inuit communities (e.g. Usher et al. 1995; O’Neil et al. 1997a; Egan 1998; Poirier and Brooke 2000; Furgal et al. 2005; Myers and Furgal 2006; Tyrrell 2006; Oakes 2008; Clifford-Pena 2008). Participant perceptions and understandings of contaminants were variable and complex, influenced by their cultural, community, and political history, in addition to cultural identity and sense of place. Perceptions indicated a general understanding and awareness of contaminant issues (Myers and Furgal 2006); information about contaminants as conceived and disseminated by

researchers and affiliated organizations – with the notable exception of mercury in beluga maktak – was not received nor retained by many participants.

7.2 Avenues and Applications for Future Research

Final results from this project will be communicated to Sachs Harbour participants in person through small group settings. Future work will involve data normalization and statistical analyses of the previously specified results covered in this thesis, and explore the influences of gender and age attributes on contaminant perceptions (what they are, sources, locations, transport), in addition to the influences that prior experiences with research may have on perceptions of contaminants, communication, and research/researchers. Since this research aimed to provide insights into research communication practices, results and processes are applicable for research communication initiatives for various scientific disciplines. As a communication study about contaminants – an environmental and human health risk – findings can also be applied to future contaminant risk communication research. Since traditional knowledge is not a stagnant database of accumulated facts but rather holds cultural knowledge on social customs, contexts, ethics and worldviews, discussing the case example of contaminant research communication within a northern community context provided insight and advice for researchers in other disciplines on how to disseminate their research cross-culturally in an appropriate, relevant and respectful manner (cf. Elias and O’Neil 1995). Additionally, acknowledging the importance of history, cultural identity, politics, worldviews and sense of place can assist in the understanding of Inuvialuit perceptions of contaminants and associated concerns, which can also be applied to other physical and natural science disciplines.

7.3 Recommendations

Although I was able to spend extended periods of time in the community of Sachs Harbour, and several participants stated that this study is an example of how research in the North 'should' be done, this is not always realistic for every research project. Funding constraints, schedules, and conflicting obligations are some examples that can prevent spending lengthy amounts of time in a community to develop foundational relationships for research projects. In Sachs Harbour, participants were aware of this; they recommended extending one's trip by a couple of days on either end of a planned field season or community meeting to informally engage or visit with residents and become a familiar face. While extended visits are greatly appreciated, the quality of interaction is just as important, if not more so.

The argument can be made that the discipline of social science research receives more funding for research dissemination than physical science research: "for natural scientists, a willingness to contribute extra time and resources to engage in community life and collaborate with community members is a good start to gaining support and sparking local collaborations" (Gearheard and Shirley 2007). Due to the focus of social science research on human subjects, projects are commonly social in nature; therefore, regardless of weeks or months, social scientists often spend longer time periods interacting with people. As such, it is not that funds are necessarily lacking for physical sciences, rather that the designation of funds for research dissemination and increased amounts of time in northern communities does not often carry the same weight between disciplines. There needs to be researcher accountability to the community that is required through funding agencies, ensuring that negotiations between researchers and community members can come to an agreement for a given project about how much time the researcher or researchers should spend in the community, and the nature of community involvement.

This may depend on the duration or focus of the project; some natural science studies may have project elements that more easily align with local knowledge (e.g. queries about wildlife health or distribution, observations of climate change), promoting the engagement of community collaborators. However, more time and effort may be needed to establish community relations and protocols for research that may be perceived as more obscure (e.g. impacts of contaminants on human health, nutrient uptake of phytoplankton in sea ice).

Furthermore, there is an increasing need for integrative projects encompassing concurrent physical or natural scientific research of a phenomenon, social science or communication research and information dissemination about the phenomenon, and incorporation of local expertise and involvement from project conception to completion (Fernandez-Gimenez et al. 2007). Regardless of discipline, funding, or time, it is important that the research process and associated communication efforts are done respectfully and responsibly, enabling all collaborators to feel a sense of ownership in their involvement (Fernandez-Gimenez et al. 2007; D'Alonzo 2010). Projects emphasizing collaboration and knowledge sharing between Canadian Inuit communities and scientific research communities can contribute different perspectives and understandings about a phenomenon of mutual interest. While the communication that occurs between these parties is shaped by respective worldviews, experiences, and ways of knowing, the processes of investing time, establishing relationships, and building respect through collaborative research endeavours (irrespective of discipline) can influence the medium as part of the message for research communication between two groups of people for whom the Arctic is undeniably important.

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Appendix A – Community Poster Advertising the Project

Arctic contaminants: Exploring effective and appropriate communication between Inuvialuit communities and researchers

In collaboration with the community of Sachs Harbour, this project aims to discuss how scientific research results about contaminants are communicated to Inuvialuit communities, and explore how this information can be communicated in a way that is easy to understand and reflects what is important and applicable to people's lives.

You are invited to participate in this project:

- If you have been involved in past or current research on the Amundsen ship, in the community, or out on the land,
- If you have attended presentations or meetings by researchers where they talked about their research,
- If you are interested in contaminants in the Arctic environment.

This project will consist of **individual interviews and focus group discussions**, which will be **audio- or video-recorded**. Discussions will last as long as you are comfortable, and will take place in the community. Participants will be compensated for their involvement.

With your help, this research has the potential to influence how research is communicated to Inuvialuit communities, and increase knowledge and awareness of contaminant issues.

For **more information** or if you're **interested in participating**, please email [REDACTED] or call the Parks Office at [REDACTED]

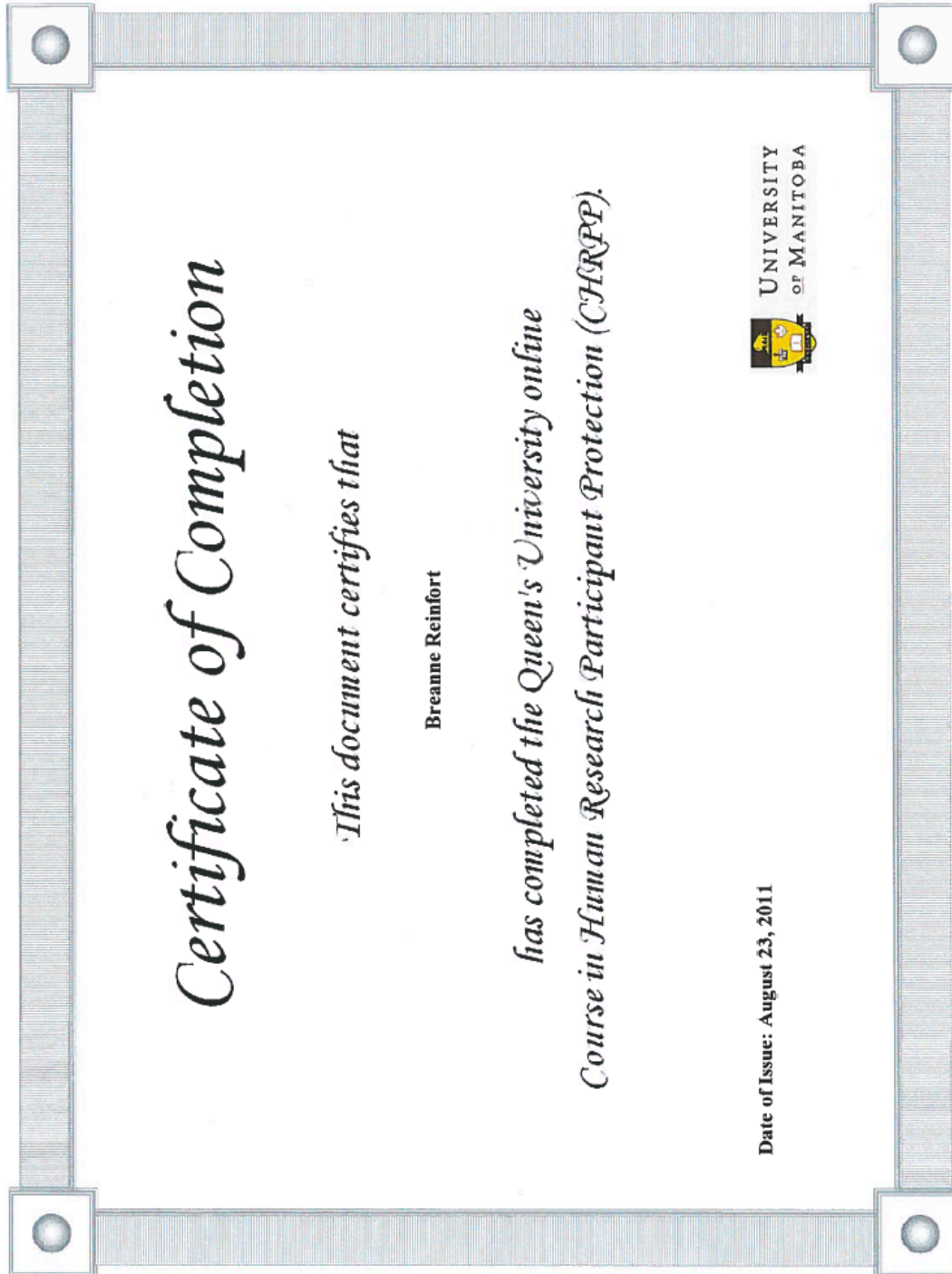
Breanne Reinfort, a graduate student in Environment and Geography at the University of Manitoba, will be carrying out the interviews and focus groups in Sachs Harbour. Breanne has an undergraduate degree in Zoology, has experience working with scientific research and community members in Churchill, MB, and Pangnirtung, NU; and has done community-based research in Winnipeg, MB.



This project is associated with larger research efforts such as the Circumpolar Flaw Lead System Study and ArcticNet, where research on contaminants in the Arctic has been done on board the CCGS Amundsen, a Canadian Research Icebreaker. Much of this research has taken place in the Beaufort Sea and has involved some residents of Sachs Harbour.

Timeline: Breanne is in Sachs Harbour in July-August 2009, October-November 2009, and will ask you what you think is the best time for her to return in 2010!

Appendix B – Tri-Council Ethics Course Certificate



Appendix C – University of Manitoba Ethics Approval Certificate

APPROVAL CERTIFICATE

18 June 2009

TO: Breanne Reinfort (Advisor G. Stern)
Principal Investigator

FROM: Wayne Taylor, Chair
Joint-Faculty Research Ethics Board (JFREB)

Re: Protocol #J2009:077
**“Arctic Contaminants: Exploring Effective and Appropriate
Communication between Inuvialuit Communities and Researchers”**

Please be advised that your above-referenced protocol has received human ethics approval by the **Joint-Faculty Research Ethics Board**, which is organized and operates according to the Tri-Council Policy Statement. This approval is valid for one year only.

Any significant changes of the protocol and/or informed consent form should be reported to the Human Ethics Secretariat in advance of implementation of such changes.

Please note:

- if you have funds pending human ethics approval, the auditor requires that you submit a copy of this Approval Certificate to Eveline Saurette in the Office of Research Services, (fax 261-0325, phone 480-1409), including the Sponsor name, before your account can be opened.

- if you have received multi-year funding for this research, responsibility lies with you to apply for and obtain Renewal Approval at the expiry of the initial one-year approval; otherwise the account will be locked.

The Research Ethics Board requests a final report for your study (available at: http://umanitoba.ca/research/ors/ethics/ors_ethics_human_REB_forms_guidelines.html) in order to be in compliance with Tri-Council Guidelines.

Appendix D - University of Manitoba Ethics Amendment Approvals

AMENDMENT APPROVAL

22 October 2009

TO: Breanne Reinfort
Principal Investigator

FROM: Wayne Taylor, Chair
Joint-Faculty Research Ethics Board (JFREB)

Re: Protocol #J2009:077
**"Arctic Contaminants: Exploring Effective and Appropriate
Communication between Inuvialuit Communities and
Researchers"**

This will acknowledge your e-mail dated October 21, 2009 requesting amendment to your above-noted protocol.

Approval is given for this amendment. Any further changes to the protocol must be reported to the Human Ethics Secretariat in advance of implementation.



UNIVERSITY
OF MANITOBA

Ethics
Office of the Vice-President (Research)

CTC Building
208 - 194 Dafoe Road
Winnipeg, MB R3T 2N2
Fax (204) 269-7173
www.umanitoba.ca/research

AMENDMENT APPROVAL

March 28, 2011

TO: Breanne Reinfort
Principal Investigator

FROM: Brian Barth, Chair
Joint-Faculty Research Ethics Board (JFREB)

Re: Protocol #J2009:077
**"Arctic Contaminants: Exploring Effective and Appropriate
Communication between Inuvialuit Communities and
Researchers"**

This will acknowledge your request dated March 21, 2011 requesting amendment to your above-noted protocol.

Approval is given for this amendment. Any further changes to the protocol must be reported to the Human Ethics Secretariat in advance of implementation.

Bringing Research to Life



UNIVERSITY
OF MANITOBA

Research Ethics and Compliance
Office of the Vice-President (Research and International)

Human Ethics
208-194 Dafoe Road
Winnipeg, MB
Canada R3T 2N2
Phone +204-474-7122
Fax +204-269-7173

AMENDMENT APPROVAL

July 16, 2014

TO: Breanne Reinfort
Principal Investigator

FROM: Susan Frohlick, Chair
Joint-Faculty Research Ethics Board (JFREB)

Re: Protocol #J2009:077
"Inuvialuit Perceptions of Contaminants and Communication
Processes in Sachs Harbour, Northwest Territories"

This will acknowledge your request dated July 14, 2014 requesting amendment to your above-noted protocol, including change of title to the above-noted title.

Approval is given for this amendment. Any further changes to the protocol must be reported to the Human Ethics Secretariat in advance of implementation.

umanitoba.ca/research

Appendix E - University of Manitoba Ethics Renewal Certificates



CTC Building
208 - 194 Dafoe Road
Winnipeg, MB R3T 2N2
Fax (204) 269-7173
www.umanitoba.ca/research

RENEWAL APPROVAL

March 11, 2010

TO: Breanne Reinfort
Principal Investigator

FROM: Wayne Taylor, Chair
Joint-Faculty Research Ethics Board (JFREB)

Re: Protocol #J2009:077
"Arctic Contaminants: Exploring Effective and Appropriate
Communication between Inuvialuit Communities and
Researchers"

Please be advised that your above-referenced protocol has received approval for renewal by the **Joint-Faculty Research Ethics Board**. This approval expires **June 18, 2011**. Any significant changes of the protocol and/or informed consent form should be reported to the Human Ethics Secretariat in advance of implementation of such changes.

Bringing Research to Life



UNIVERSITY OF MANITOBA | **Ethics**
Office of the Vice-President (Research)

CTC Building
208 - 194 Dafoe Road
Winnipeg, MB R3T 2N2
Fax (204) 269-7173
www.umanitoba.ca/research

RENEWAL APPROVAL

May 10, 2011

TO: Breanne Reinfort
Principal Investigator

FROM: Brian Barth, Chair
Joint-Faculty Research Ethics Board (JFREB)

Re: Protocol #J2009:077
**"Arctic Contaminants: Exploring Effective and Appropriate
Communication between Inuvialuit Communities and
Researchers"**

Please be advised that your above-referenced protocol has received approval for renewal by the **Joint-Faculty Research Ethics Board**. This approval is for one year only.

Any significant changes of the protocol and/or informed consent form should be reported to the Human Ethics Secretariat in advance of implementation of such changes.

Bringing Research to Life



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Office of the Vice-President
(Research and International)
Research Ethics and Compliance

Human Ethics
208 - 194 Dafoe Road
Winnipeg, MB
Canada R3T 2N2
Fax 204-269-7173

RENEWAL APPROVAL

January 30, 2012

TO: Breanne Reinfort
Principal Investigator

FROM: Wayne Taylor, Chair
Joint-Faculty Research Ethics Board (JFREB)

Re: Protocol #J2009:077
"Arctic Contaminants: Exploring Effective and Appropriate
Communication between Inuvialuit Communities and
Researchers"

Please be advised that your above-referenced protocol has received approval for renewal by the **Joint-Faculty Research Ethics Board**. This approval is for one year only.

Any significant changes of the protocol and/or informed consent form should be reported to the Human Ethics Secretariat in advance of implementation of such changes.



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FINAL RENEWAL APPROVAL

July 16, 2014

TO: Breanne Reinfort
Principal Investigator

FROM: Susan Frohlick, Chair
Joint-Faculty Research Ethics Board (JFREB)

Re: Protocol #J2009:077
"Inuvialuit Perceptions of Contaminants and Communication
Processes in Sachs Harbour, Northwest Territories"

Please be advised that your above-referenced protocol has received approval for renewal by the **Joint Faculty Research Ethics Board**. This approval is valid for one year only.

Any significant changes of the protocol and/or informed consent form should be reported to the Human Ethics Secretariat in advance of implementation of such changes.

Please be advised that this is the **final renewal** allowed. Subsequently a full application must be submitted.

umanitoba.ca/research

Appendix F – Aurora Research Institute Scientific Licenses

	Licence No. 14575 File number 12 410 852 July 20, 2009
2009	
Northwest Territories Scientific Research Licence	
<i>Issued by:</i>	Aurora Research Institute – Aurora College Inuvik, Northwest Territories
<i>Issued to:</i>	Ms. Breanne Reinfort University of Manitoba Centre for Earth Observation Science Department of Environment and Geography 463 Wallace Building, 125 Dysart Road Winnipeg, MB R3T 2N2 Canada Phone: Fax: Email:
<i>Affiliation:</i>	University of Manitoba
<i>Funding:</i>	ArcticNet Northern Contaminants Program (NCP) Social Sciences and Humanities Research Council of Canada (SSHRC) Northern Scientific Training Program (NSTP)
<i>Team Members:</i>	Co-investigators (20-40)
<i>Title:</i>	Arctic Contaminants: Exploring effective and appropriate communication between Inuvialuit communities and researchers
<i>Objectives:</i>	The short-term objectives of this study are to bring forward indigenous perspectives on contaminants, contaminant research, and how research is communicated in communities; in conjunction with community members, explore culturally relevant and appropriate means of communicating scientific results between Inuvialuit communities and researchers; using these means discussed, communicate contaminants research being conducted in the Beaufort Sea region as part of ArcticNet Phase II and IPY CFL studies to the community of Sachs Harbour; present these outcomes in the form of a participatory video. The long-term objectives of this study are to: develop a communication model to be used by future researchers to facilitate communicating their research with and addressing the concerns of Inuvialuit communities; empower community members to engage in contaminants research occurring in and around their communities.
<i>Dates of data collection:</i>	July 21 to August 21, and October 05 to December 18, 2009
<i>Location:</i>	Sachs Harbour
	Licence No.14575 expires on December 31, 2009 Issued in the Town of Inuvik on July 20, 2009
	* original signed *
	_____ Pippa Seccombe-Hett, Director, Aurora Research Institute

2010 Northwest Territories Scientific Research Licence

Issued by: **Aurora Research Institute – Aurora College**
Inuvik, Northwest Territories

Issued to: **Ms. Breanne Reinfort**
Freshwater Institute
Department of Fisheries and Oceans
501 University Crescent
Winnipeg MB R3T 2N6 Canada
Phone:
Fax:
Email:

Affiliation: University of Manitoba/DFO

Funding: ArcticNet
Northern Contaminants Program (NCP)
Social Sciences and Humanities Research Council of Canada (SSHRC)
Northern Scientific Training Program (NSTP)

Team Members: Co-investigators (contact principal investigator for a list of team members)

Title: **Arctic Contaminants: Exploring effective and appropriate communication between Inuvialuit communities and researchers**

Objectives: The objectives of this study are to bring forward indigenous perspectives on contaminants, contaminant research, and how research is communicated in communities.

Dates of data collection: March - May 31; June 14-August 31; October 4-Nov 26, 2010

Location: Sachs Harbour

Licence No.14681 expires on December 31, 2010
Issued in the Town of Inuvik on March 10, 2010

*** original signed ***

Pippa Seccombe-Helt,
Director, Aurora Research Institute

2011 Northwest Territories Scientific Research Licence

Issued by: **Aurora Research Institute – Aurora College**
Inuvik, Northwest Territories

Issued to: Ms. Breanne C Reinfort
University of Manitoba
Centre for Earth Observation Science
Department of Environment and Geography
463 Wallace Building, 125 Dysart Road
Winnipeg, MB
R3T 2N2 Canada
Phone:
Fax:
Email:

Affiliation: University of Manitoba

Funding: ArcticNet
Northern Contaminants Program
Social Sciences and Humanities Research Council of Canada
Northern Scientific Training Program

Team Members:

Title: **Arctic Contaminants: Exploring effective and appropriate communication between Inuvialuit communities and researchers**

Objectives: To develop a communication model to be used by future researchers to facilitate communicating their research with and addressing the concerns of Inuvialuit communities.

Dates of data collection: April 4, 2011 to December 12, 2011

Location: Sachs Harbour

Licence No.14860 expires on December 31, 2011
Issued in the Town of Inuvik on February 08, 2011

*** original signed ***

Pippa Seccombe-Hett,
Director, Aurora Research Institute

2012 Northwest Territories Scientific Research Licence

Issued by: **Aurora Research Institute – Aurora College**
Inuvik, Northwest Territories

Issued to: Ms. Breanne C Reinfort
University of Manitoba
Freshwater Institute
Department of Fisheries and Oceans
501 University Crescent
Winnipeg, MB
R3T 2N6 Canada
Phone:
Fax:
Email:

Affiliation: University of Manitoba

Funding: Northern Contaminants Program (AANDC)
Northern Scientific Training Program (AANDC)
ArcticNet
University of Manitoba

Team Members: Shannon O'Hara; Gary Stern; Chris Furgal

Title: **Arctic Contaminants: Exploring effective and appropriate communication between Inuvialuit communities and researchers**

Objectives: To understand Indigenous perspectives on contaminants, contaminant research, and how research is communicated and made accessible to communities; to discuss contaminants issues in the context of their applicability to the daily lives of community members, and in the broader context of local and scientific knowledge of climate variability and overall environmental research throughout the North.

Dates of data collection: March 23, 2012 to November 2, 2012

Location: Sachs Harbour, Northwest Territories

Licence No.15042 expires on December 31, 2012
Issued in the Town of Inuvik on March 26, 2012

*** original signed ***

Pippa Seccombe-Helt,
Director, Aurora Research Institute

Appendix G – Sachs Harbour HTC Project Support Letter



Sachs Harbour Hunters & Trappers Committee
PO Box 79
Sachs Harbour, NT
X0E 0Z0

Ph: (867)690 3028
Fax: (867)690 3616

July 9, 2010

Breanne Reinfort
MEnv Candidate
University of Manitoba
Winnipeg, MB
R3T - 2N6

RE: Arctic Contaminants: Exploring Effective Communications - 2010 -2012

Dear Breanne,

As per the above mentioned subject at a Regular meeting of the Sachs Harbour Hunters & Trappers Committee dated May 20, 2010 the board reviewed your application and supports your ongoing project here in the community.

Should you need further correspondence please contact us at the above listed phone number.

Best Regards,

(Originally Signed)

Lawrence Amos,
President of the SHHTC