A Review of Population Health Status in Northern Alberta

6

Synthesis Report

Canada Alberta Northwest Territories

Northern River Basins Study

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NORTHERN RIVER BASINS STUDY
SYNTHESIS REPORT NO. 6

A REVIEW OF POPULATION HEALTH STATUS IN NORTHERN ALBERTA

by

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EXECUTIVE SUMMARY

When compared to other countries, the environment of the northern river basins has not generally placed residents at great risks to their health. However, findings of the Traditional Knowledge Component reveal that a substantial proportion of the local people are concerned about the subtle link between the state of the environment and diseases such as cancer, diabetes, heart problems, diarrhea, asthma and other health problems in their communities.

Economic development has dramatically improved the quality of people's drinking water, nutrition, housing, clothing and general sanitation. As a result of these changes, today, there are small differences in the regional life expectancies. The indiscriminate use of water, soil and air, however, can cause irreversible damage to the environment and all living things, including humans. The top environmental issues related to health that were repeatedly raised by individuals and communities include water and air pollution, contaminants and the quality of the drinking water. In response to these environmental health concerns, the Northern River Basins Human Health Monitoring Program has been launched.

Safe supplies of food and drinking water are essential for protecting human health. While food and drinking water sustain us, they are usually the major way contaminants enter our bodies. At present, our knowledge about the potential human health risks and the environmental contaminants is extremely limited. Developing better heath information related to contaminants should be a major direction for future research and monitoring.

INTRODUCTION

The people of the Northern River Basins Study Area are fortunate to live in a beautiful environment and to be among the healthiest people. When compared to other parts of the world, the environment they live in has not generally put them at great risks to their health. A substantial proportion of the local people, however, are concerned about the subtle link between the state of their environment and diseases such as, cancer, diabetes, heart problems, diarrhea, asthma, and other health problems in their communities.[1]

A study commissioned by Environment Canada on the public's perceptions of environmental issues found that the respondents considered the environment to be first and foremost a human health issue, although concern for plant and animal life was also very high.[2] A majority of people believed that pollution was affecting their family's health. More than 90 percent believed that there probably were many environmental hazards causing serious health problems. The respondents were particularly concerned about chemicals in water and air, and about protecting the drinking water supply.

The preoccupation with environmental health issues has not changed over the past decade. Along with people everywhere, local residents of the Northern River Basins Study Area have come to realize that development and the quality of the environment cannot be separated. The indiscriminate use of water, soil and air can cause irreversible damage to the environment and all living things, including humans. The top environmental issues related to health that were repeatedly raised during the study, in community gatherings, surveys, scientific forums and individual discussions, include water and air pollution, contaminants and the quality of the drinking water. In its simplest form, the recurring questions *"Can we eat the fish?"*, *"Can we drink the water?"*, *"Can we breathe the air?"*, *"Can we use the land?"* prompted the Study Board to establish the Human Health Committee to champion our understanding of health and the environment.

One of the major tasks of this Committee was to identify environmental issues and human health concerns and to ensure that they are thoroughly examined. The second objective of the Committee was to initiate a study of the health status in the Alberta portion of the study area. Recognizing the importance of the human health concerns, the Minister of Health, launched on October 28, 1994 the Northern River Basins Human

Health Monitoring Program. This is a two year, $300,000 companion study. The results of this population health assessment are expected by late 1996.

GENERAL HEALTH

Economic development has dramatically improved the quality of people's drinking water, nutrition, housing, clothing and general sanitation. As shown in Figure 1, there is a strong relationship between a country's economy and population health status. People in developed countries experience a longer life span than those who live in less developed places. Over the past seventy years, development contributed to the significant increase in the life expectancy of all Albertans (see Figure 2). Today, there are small differences in the life expectancies on a regional basis. People living in northern Alberta have a slightly shorter life expectancy than that of people living in the central and southern part of the province (see Figure 3).

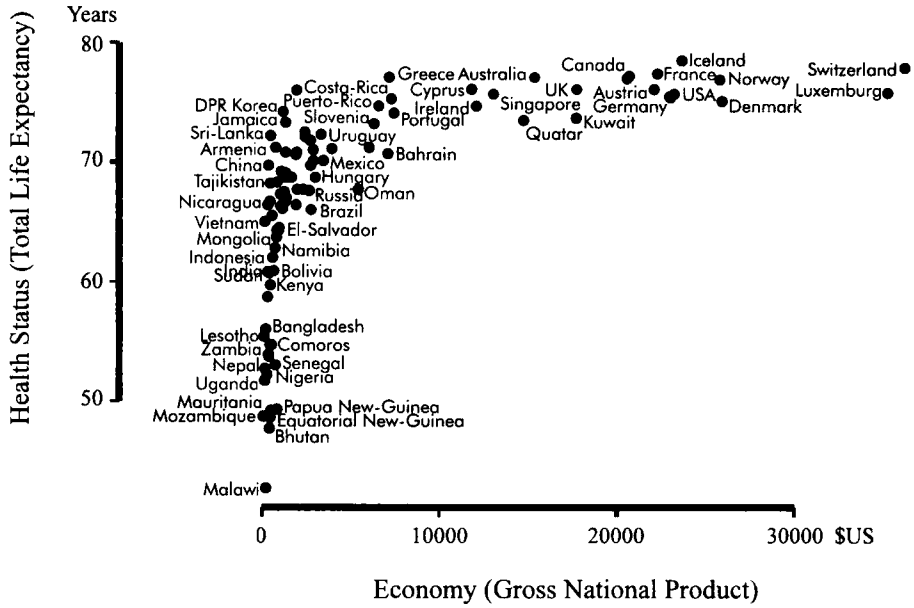
Although the life expectancy is steadily increasing, accidents, cancer, suicide, heart disease, stroke and respiratory disease remain the major causes of premature death in Alberta. Loss of life at an early age is reflected by the potential years of life lost (see Figure 4). Many of the concerns raised by the northern river basins residents are also found on this list. Not all major causes of death have close links with the environment, but some do. In particular, certain types of cancer are known to be partially linked to environmental factors.[3] Lifestyle choices such as drinking and smoking, along with genetic influences are among other important contributing factors in the causes of death.

Death in the first year of life or, infant mortality is an indicator of population health. Infant mortality is related to prenatal care, the mother's health, access to health care and congenital conditions or diseases. Slight regional differences may result both from the small number of infant deaths and the small number of babies born. The infant morality in the seven northern Alberta health regions is illustrated in Figure 5.

Birth weight is an indicator of the health status of newborn babies. Low birth

ECONOMY AND HEALTH STATUS

Selected WHO Member Countries, 1991-93

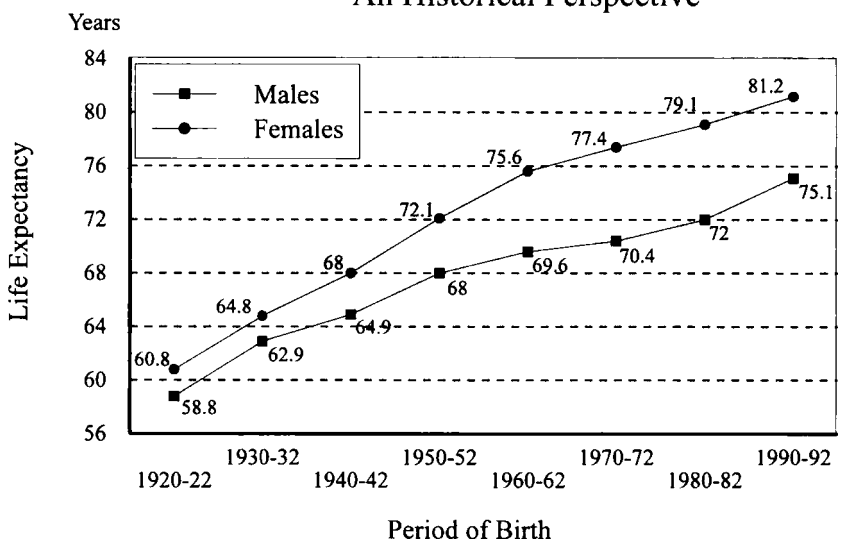


Source: World Health Organization

Figure 1

LIFE EXPECTANCY IN ALBERTA

An Historical Perspective

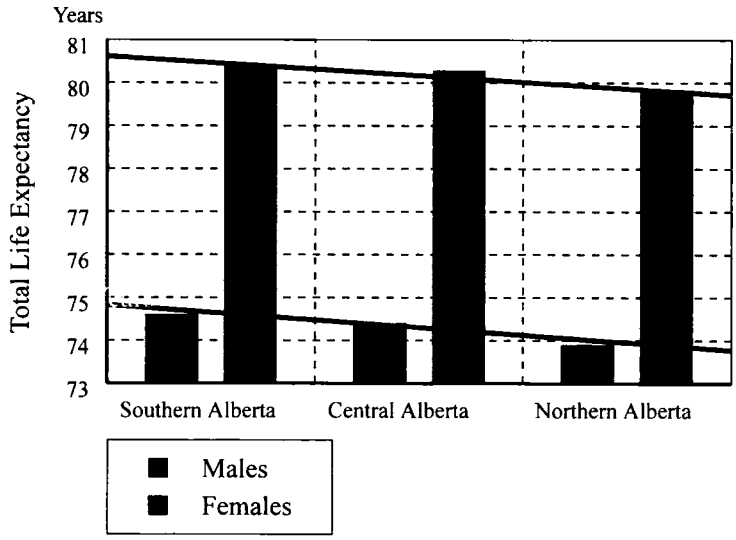


Source: Alberta Health

Figure 2

LIFE EXPECTANCY IN ALBERTA

Regional Differences, 1990-92

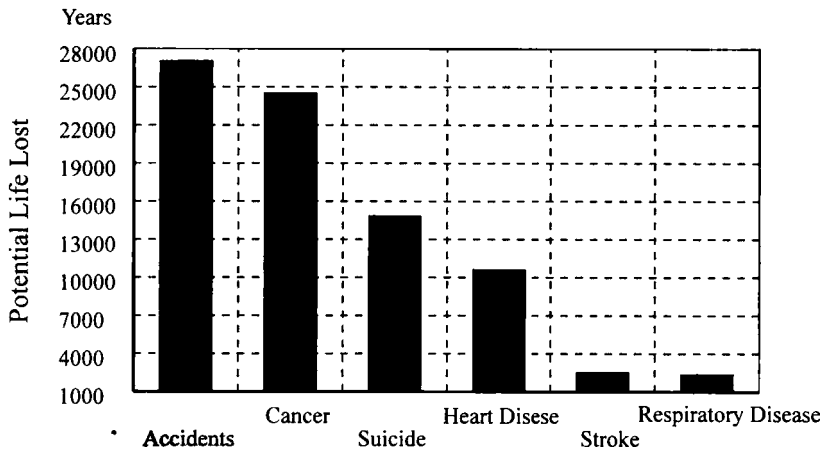


Source: Alberta Health

Figure 3

POTENTIAL YEARS OF LIFE LOST IN ALBERTA

Major Causes of Premature Deaths, 1992

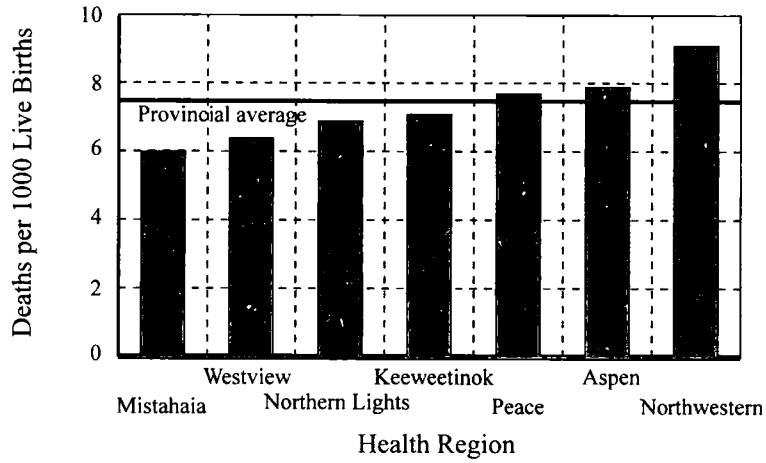


Source: Alberta Health

Figure 4

INFANT MORTALITY RATES IN NORTHERN ALBERTA

Regional Differences, 1992-94

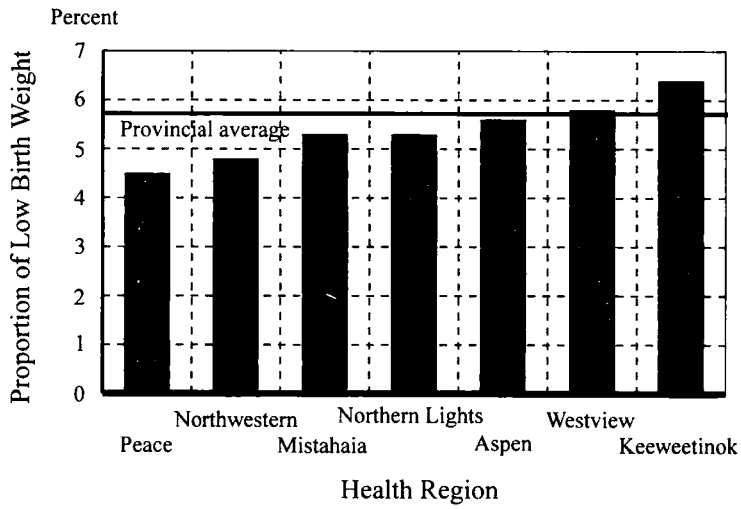


Source: Alberta Health

Figure 5

PREVALENCE OF LOW BIRTH WEIGHT BABIES

Regional Differences, 1993-94

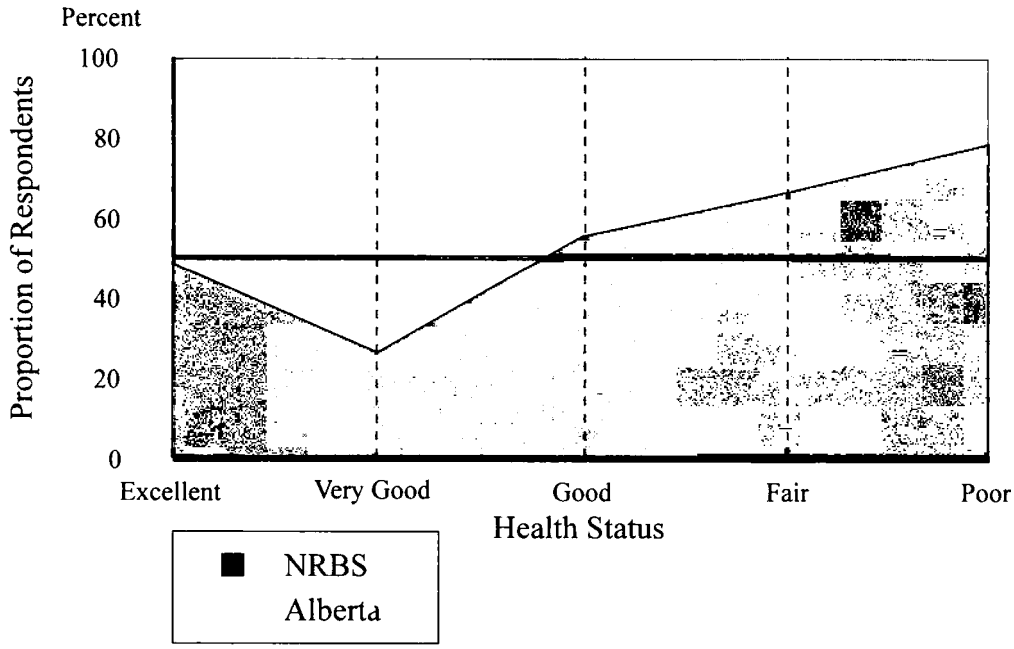


Source: Alberta Health

Figure 6

SELF-REPORTED HEALTH STATUS

Comparison of Selected Northern Communities and Alberta



Source: NRBS and Alberta Health

Figure 7

weight babies are more likely to have health problems, developmental delays, learning and behavioral differences. The proportion of low birth weight babies in the seven northern Alberta health regions is illustrated in Figure 6.

In a recent survey on health in Alberta, people were asked to rate their health status compared with others of their age.[4] The Traditional Knowledge Component Group also conducted a survey in selected northern communities, asking respondents to rate their health on a scale of one to five.[1] A comparison of the Alberta and Northern River Basins Study results shows that approximately the same proportion of respondents rated their health as being "excellent" (see Figure 7). However, a larger proportion of the northern residents reported their health "somewhat poor" (fair) and "poor." Such regional differences in self-reported health status may result from a combination of health determinants including the economic and social environment, physical environment,

personal health practices, individual capacity and coping skills, and health services.

CONTAMINANTS IN FISH

Safe supplies of food and drinking water are essential for protecting human health. While food and drinking water sustain us, they are usually the major way contaminants enter our bodies. Contaminants accumulate in single-cell micro-organisms and increase in concentration at each step in the food chain. The main way in which people are exposed to contaminants is through contaminated food, such as fish, meats, poultry, eggs, milk and diary products. The presence of contaminants in the food chain is a concern for many local people in the study area who rely extensively on traditional foods for subsistence.

During the study period, over 3,000 fish representing 25 species were submitted for various chemical analyses by the Northern River Basins Study scientists. Most of the analysis (91 percent) came from six species. These six species are burbot, mountain whitefish, longnose sucker, northern pike, walleye and goldeye.

Computerized databases required by an in-depth human health risk assessment are currently being developed. While an extensive review of contaminants in fish has not yet been completed, a preliminary assessment of the data by Alberta Health in collaboration with Health Canada, indicates that mercury and methylmercury, 2,3,7,8-TCDD and 2,3,7,8-TCDF, and toxophene should be reviewed from a human health perspective. Other contaminants such as PCB's, chlorinated phenolics and radionuclides were generally at low levels, within the human health consumption guidelines.

Mercury

Methylmercury, the organic form of mercury, comes from natural sources as well as industrial activities. A major source of methylmercury results from extensive flooding of land, for example, as a result of hydroelectric development. The inorganic mercury is converted to methylmercury by submerged micro-organisms.

People are exposed to mercury largely through the food chain, for example, by consuming fish that are contaminated by mercury. The organic mercury (methylmercury)

is more toxic than the inorganic (metallic mercury). When methylmercury is ingested, it rapidly enters the bloodstream and is distributed throughout the body. Certain organs, particularly the liver and kidneys, accumulate more of it than others. Mercury is slowly accumulated in the brain where in sufficiently high doses affects the brain's sensory, visual, auditory and coordinating functions. A developing fetus may be affected in many ways; possible effects include retarded physical growth and coordination, and cerebral palsy as well as delaying the development of intellect and behaviour.

Some initial observations on mercury with relevance for human health are:

- Mercury was found in filets or liver of all fish species sampled in the Athabasca, Peace and Slave river systems.

- Mercury levels in fish tissue continue to be generally stable relative to the mid '80s.

- Mercury was highest in predatory fish (e.g., pike, walleye, goldeye, pike and burbot) relative to bottom feeders (e.g., white fish and suckers).

- Mercury concentrations in walleye vary among geographic sites with an increasing trend toward the mouth of the Athabasca and Peace rivers.

- Mercury levels in some of the fish species studied have been found to exceed the Health Canada guideline limit for human consumption.

Existing fish consumption restrictions (mercury) in the study area extend to walleye in the mainstem of the Athabasca River. From a health perspective it is generally recommended that a balance be found between traditional foods, which can provide an excellent source of protein in the form of fish, and the potential danger to health due to mercury.[5,7] Certain types of fish with generally lower levels of mercury, such as suckers and white fish, may be favoured over those with high levels, such as walleye, pike,

goldeye and burbot. Pregnant women and children under the age of 15 should not consume fish contaminated with mercury.

The observed mercury levels along the rivers, fish movements, the type of fish and the dietary patterns of the local people are important factors to be considered in the development of new, health based fish consumption advisories. Considering the significant geographic variation of mercury in fish, and the types of fish contaminated, the applicability of the current health advisories and the geographic boundaries as well as the fish species should be re-evaluated and adjusted based on the new information generated by the Northern River Basins Study.

Dioxins and Furans

Waste water from pulp and paper mills contains many potentially hazardous chemicals. About 300 different chemical compounds including dioxins and furans have been identified in effluent from pulp and paper mills.[6] While they can originate from natural sources such as forest fires, most dioxins and furans are released in the environment by pulp and paper mills that use chlorine bleaching, combustion sources such as incinerators, burning wood, and motor vehicles. They have been classified as "toxic" to health and the environment under the Canadian Environmental Protection Act.

Much of the health concern about dioxins and furans stems from the result of animal toxicity tests. Animals exposed to 2,3,7,8-TCDD, the most toxic of the dioxins and furans, experienced weight loss, skin disorders, impaired liver function, impaired reproduction including birth defects, and cancer. It is difficult to assess the human health effects of the dioxins and furans. It does appear, however, that effects on humans are much more limited than effects on animals. The human health effects most consistently observed in occupational exposure settings are chloracne and other skin problems, as well as effects on the liver, immune system and behaviour.

The main way in which people are exposed to dioxins and furans is through contaminated food, such as fish, meats, poultry, eggs, milk and diary products. Air, soil, water and consumer products are minimal contributors to exposure.

Some general observations on dioxins and furans with relevance for human health are:

- On the Athabasca River, the highest dioxin and furan levels were found in 1992, within 50 km downstream from the town of Hinton. Levels returned to control values within 115 km.

- On the Peace River, the highest levels of dioxins and furans were seen in 1992, on the Wapiti River near the town of Grand Prairie and at the confluence of Smoky and Peace rivers.

- Significantly higher levels of dioxins and furans were seen in mountain whitefish than longnose suckers.

- Dioxin and furan concentrations in fish vary among geographic locations with a decreasing trend toward the mouth of the Athabasca and Peace rivers.

- There is a significant decline in dioxin and furan levels in fish throughout the basin relative to the late '80s.

- Dioxin and furan levels in burbot livers at two sampling sites nearest to Grand Prairie have been found to exceed the Health Canada guideline limit for human consumption.

Existing fish consumption restrictions for dioxins and furans extend to the upper reaches of the Peace and Athabasca river basins. In the Athabasca River (upstream of Whitecourt, Iron Point and Fort Assiniboine), Berland, Wildhay and McLeod rivers bull trout, burbot and mountain whitefish are affected. In the Wapiti, Cutbank, Kakwa, Smoky, Little Smoky and Simonette rivers the burbot and mountain whitefish are contaminated. From a health perspective, the current advisory recommends that only the fillet portions should be eaten; organs such as liver should be discarded. In the Athabasca River drainage

mountain whitefish should not be eaten more than one meal per week and in the Peace river drainage, mountain whitefish should not be eaten.

Considering the decreasing trends over time of dioxins and furans in fish and their geographic variation, the applicability of the existing health advisories and the geographic boundaries should be re-evaluated and adjusted based on the newly available information.

Toxophene

Toxophene is an organochlorine insecticide. This group of compounds also includes DDT, chlordane and lindane. Because of their particular structure, the organochlorines do not break down easily and therefore remain in the environment for a long time. As a result they have the tendency to accumulate in the food chain, potentially resulting in health risks in humans.

A total of 571 tissue samples were analyzed for toxophene using a detection limit of 0.05 ppm or 0.01 ppm. Among the samples analyzed using the higher detection limit 95 percent of the samples were below the detection limit. Only 5 percent of the tissue samples were above the limit. All of the walleye, goldeye and lake whitefish tissue samples were below 0.05 ppm. Burbot, mountain whitefish and pike accounted for all the positive samples. When using the 0.01 ppm detection limit, approximately 16 percent of the samples were above the detection limit. Mountain whitefish accounted for most of the positive samples followed by the longnose sucker and burbot.

There are currently no fish consumption restrictions for toxophene in Alberta. A health advisory, however, is in effect on the Slave river.

THE HUMAN HEALTH MONITORING PROGRAM

Traditionally, environmental guidelines and standards have been defined by first establishing an experimental threshold for the exposure of interest. A fraction of the threshold concentration obtained by applying a safety factor was denoted as the standard. Examples include standards for drinking water, surface water, air quality and contaminants in fish. The threshold was defined most frequently in relation to acute poisoning in

controlled animal experiments. The validity of these type of standards in the context of chronic diseases is questionable and there is a need for the development of new, human health based standards.

In order to find a balance that will best protect health we must identify and weigh environmental risks in a scientific manner. The concept of a continuum from the source of contamination to health effects is a basic feature of all contemporary risk models. Determining the risk posed by environmental contaminants to populations requires knowledge about the following fundamental components:

- source(s) of contaminants;
- transport of agents in the environment;
- exposure of individuals and communities to chemicals;
- dose received by those exposed (biological markers of exposure);
- early biological effects resulting from the dose (biological markers of effect);
- manifest health effects (disease, death).

By combining the field of epidemiology and toxicology into a process for estimating risks, scientists are able to develop and analyze risk management options to prevent disease and protect the health of the people.

The first phase of the monitoring program will seek answers in three major areas represented by environmental stressors, human exposure, and health status. In the first area, that of environmental factors, the study will attempt to review chemical, physical and biological agents from a human health perspective. These will be priorized based on their relative importance. In the second area, that of human exposure, the scientists will assess potential pathways of exposure such as drinking water, fish consumption and breathing the air. Thirdly, disease rates will be looked at to identify linkages, if any, between the health status of the population and environmental determinants.

RECOMMENDATIONS

- ***Develop better health information related to environmental contaminants.***

People living in the northern river basins are concerned about the subtle impact of environmental changes and contaminants on their health.

At present, our knowledge about the potential human health risks and the environmental contaminants is extremely limited. Developing better heath information related to contaminants should be a major direction for future research and monitoring. Particularly, the long term effects of low levels of exposure to contaminants should be investigated. Since one time health studies are not likely to yield results (in spite of the associated costs), this should strategically be accomplished through the ongoing monitoring and surveillance of both environmental and human health indicators including exposure, biological markers of exposure and effect, and health outcomes.

- ***Undertake periodic and systematic health risk assessments of contaminants in fish (and other traditional foods).***

The presence of contaminants in the food chain is a concern for many local people who rely extensively on traditional foods for subsistence.

A thorough health review of the data on contaminants gathered by the Northern River Basins Study should be a priority issue. Existing fish consumption advisories should be re-evaluated based on the new information. New health based standards should be developed as opposed to the current mechanistic approach. The approach should include periodic and systematic health risk assessments to detect trends and emerging issues. The provincial, territorial, federal and first nations governments should work together toward developing a common integrated process to share resources and provide accurate and timely information for the communities.

- ***Human health assessment be included in the future development projects.***

Local people are concerned about the health impacts of major development projects.

In making sustainable development a fundamental value in our society, the governments and corporations should ensure that health is being given appropriate consideration in all major development projects.

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Synthesis Report

The Northern River Basins Study was established to examine the relationship between industrial, municipal, agricultural and other development and the Peace, Athabasca and Slave river basins.

Over four and one half years, about 150 projects, or "mini studies" were contracted by the Study under eight component categories including contaminants, drinking water, nutrients, traditional knowledge, hydrology/hydraulics, synthesis and modelling, food chain and other river uses. The results of these projects, and other work and analyses conducted by the Study are provided in a series of synthesis reports.

This Synthesis Report documents the scientific findings and scientific recommendations of one of these component groups. This Synthesis Report is one of a series of documents which make up the Northern River Basins Study's final report. A separate document, the Final Report, provides further discussion on a number of scientific and river management issues, and outlines the Study Board's recommendations to the Ministers.

Project reports, synthesis reports, the Final Report and other NRBS documents are available to the public and to other interested parties.