HEALTH AND THE ENVIRONMENT:

RISK PERCEPTION SURVEY IN CORNWALL

by

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Abstract

One objective of the "Ecosystem Recovery on the St. Lawrence" project is to assess the community's perception of the impact of contamination of the St. Lawrence River on their quality of life. More precisely, the Health Sciences component of the project has been assigned the task of evaluating the public's perception of health risks associated with contamination of the St. Lawrence River. The survey presented in this paper was designed to evaluate the perception of residents of Cornwall regarding various environmental health risks associated with the Cornwall area and the St. Lawrence River; compare their perception of certain environmental health risks to the perception of the general Canadian population found in the Health-Risk Perception in Canada report; identify their main sources of information on environmental health risks and compare them to those of the Canadian population; evaluate the level of confidence in various sources of information regarding environmental health risks and compare it to the Canadian population; obtaining a general idea of their attitudes and opinions concerning a variety of environmental health risk perception issues; gather data on behaviours related to health risks; and collect personal and demographic data.

To obtain this information, a random sample telephone survey was conducted on 497 adults living in Cornwall. The results reveal that the respondents are significantly more concerned about health risks to themselves and their family from river water, air pollution, chemical pollution, PCB or dioxin, and tap water, than to the Canadian public in general. A significantly lower percentage of the respondents perceive chemical pollution, PCB or dioxin, pesticides in food and bottled water to be a high health risk to the Canadian public than in the "Health-Risk Perception in Canada" survey conducted across Canada. The most important source of information regarding health issues and risk is the media, but the greatest confidence is to medical doctors. In general, the respondents feel that Cornwall is an unhealthy place to live, are concerned about the health risks from chemicals, but feel they have very little control over the risks to their health.

The majority of respondents do not eat sportfish from the St. Lawrence River mainly because of concern about water pollution. The respondents that do eat sportfish mostly consume yellow perch. In addition, about three-quarters of respondents do not swim in the St. Lawrence River for various reasons. The most common reported medical conditions are asthma, arthritis, allergies, heart conditions, diabetes and hypertension.

Multivariate analyses reveal that the less educated, older sportfish consumers who have been living in Cornwall for several years are less likely to associate environmental pollution with health problems.

This survey identifies the major concerns of the residents of Cornwall and is useful to direct risk communication. Recommendations are made based on the results of this survey.

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I dedicate this thesis to my beautiful smiling grandmother Thelma Dicaire, who taught me the importance of learning and showed me how far perseverance can lead.

Je t'aime beaucoup, Grand-mère!

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1. Introduction

1.1 History of Cornwall

Situated on the north shore of the St. Lawrence River, between Montreal and Kingston (see Figure 1), the city of Cornwall and the township of Cornwall are home to approximately 54,000 people[1] . It was settled in 1784 by United Empire Loyalists, British immigrants, and French settlers[2 3] . The industrialization of Cornwall began in the 1840s with the construction of the Cornwall Canal that permitted ships to bypass the Long Sault Rapids[2]. Between 1871 and 1891, the town's size more than doubled with the establishment of the Toronto Paper Manufacturing Company in 1883, known today as Domtar Fine Paper. Another 50% growth of the population occurred between 1921 and 1931 with the foundation of Courtaulds (Canada) Inc. in 1924[2]. In the 1950s, the building of the St. Lawrence Seaway further contributed to Cornwall's growth[3]. Today, an excellent transportation network serves this city with Highway 401, the CN mainline, the St. Lawrence River and the Seaway International Bridge to the United States[2]. The primary economic base of Cornwall is paper products, textiles and chemicals. Many industries are found in Cornwall: Domtar Inc., ICI Forest Products, Cornwall Chemicals, Courtaulds Fibres (closed in 1992), Cornwall Water Treatment Plant, Cornwall Water Pollution Control Plant, Moses-Saunders Power Dam. Many smaller industries are also present.

1.2 Pollution in Cornwall

The St. Lawrence River, which runs from the Great Lakes Basin to the Gulf of the St. Lawrence, is one of the great rivers of the world. It plays a major role in international shipping and transportation and its huge volume of freshwater serves many populations and industries. The stretch of the St. Lawrence River that brushes the shores of Cornwall crosses an international boundary and bisects a First Nation's reserve found on Cornwall Island[4]. Unfortunately, decades of use and abuse have severely affected the waters. Pollution in many areas has discouraged swimming and fish consumption and impaired drinking supply and aquatic life support. In fact, elevated fecal coliform levels often exceed the Provincial Water Quality Objective in the summer months and force beaches in this area to close periodically.

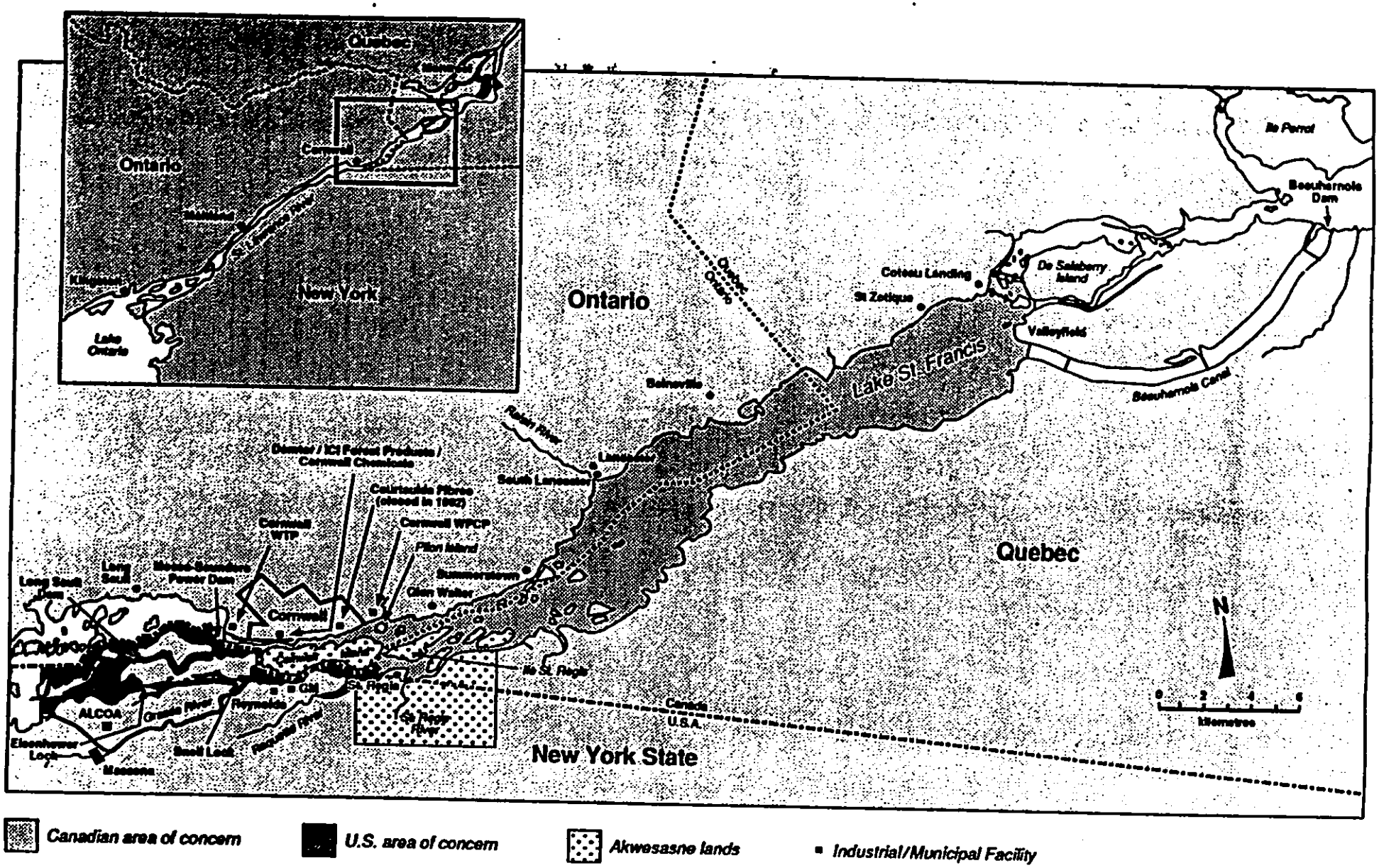

Figure 1 The St. Lawrence River area of concern and locations of the Cornwall RAP and Massena RAP. (with permission[6])

Mercury and PCB levels in fish exceed the Great Lakes Quality Agreement Specific Objective for the protection of wildlife that consume fish. Although the quality of the treated water in Cornwall meets the Ontario Drinking Water Objective, some traces of contaminants manage to find their way into analyzed samples[5].

The industries in Cornwall have contributed their share of harmful effluents to the St. Lawrence River. To add to this problem, many pollutants in the Cornwall section of the St. Lawrence River have flowed in from the Great Lakes and from the United States. As a result, the Cornwall-Massena area of the river suffers from elevated levels of inorganic substances such as mercury, lead, zinc, cadmium, chromium, copper, and arsenic; and organic substances such as Mirex (a pesticide), polynuclear aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), phenolics, oils and greases, dioxins and furans[4-6]. The ubiquitous presence of industries in Cornwall suggest that elevated levels of sulphur dioxide, carbon monoxide, nitrogen oxides, ozone and suspended particulates could be found in the air[7]. The health effects of exposure to low doses of these substances over an extended period of time are still unclear.

1.3 Health Effects of Contaminants

1.3.1 Inorganic Compounds

1.3.1.1 Mercury

Although mercury exists naturally in the environment, industrialization has dramatically increased the amount of this metal. It was widely used as a slimicide in pulp and paper mills such as Domtar Inc. until 1970, and is still being used in the manufacturing of chlorine and caustic soda by ICI Forest Products. This unwanted by-product is disposed of in liquid effluent and air emissions mainly by ICI Forest Products. Before its closure in November 1992, Courtaulds Fibres was the second most important discharger of mercury in Cornwall. Domtar Fine Papers, Cornwall Chemicals and the Cornwall Water Pollution Control Plant release far less mercury[6].

Concentrations of elemental mercury in drinking and swimming water are usually too low to have an adverse effect on human health. However, when humans consume fish, birds or mammals that are in contact with the St. Lawrence River, they are exposed to methylmercury, the most toxic form. This exposure occurs through biomagnification which brings methylmercury from microscopic plants to humans by route of the food chain. It begins when bacteria in bottom sediments convert elemental mercury to methylmercury. As mercury tends to bioaccumulate in tissues with each level in the food chain, forage fish, top predator fish, birds and mammals contain higher concentrations of mercury. The concentrations are highest in older and bigger fish, birds or mammals[6].

Elevated levels of methylmercury can affect brain function and the physical and mental development of fetuses[8], ranging from slight developmental delays to severe cerebral palsy[9]. Methylmercury can cause brain damage in cases of adult poisoning[9], and even fatalities in extreme cases[10,11].

Because of these effects on health, the Ontario Ministry of National Resources and the Ontario Ministry of Environment and Energy created a Guide to Eating Ontario Sport Fish[12]. This guide is based on guidelines established by Health Canada and recommends restricted consumption of most sportfish species.

1.3.1.2 Lead

The main source of lead in the Cornwall area was Courtaulds Fibres, until its closure in 1992. Lead was used to line the tanks and piping and was found in its effluents. Another source is lead shotgun pellets used in waterfowl hunting areas. Cornwall has been identified as one of the ten zones in Ontario in which lead contamination of waterfowl is a problem. The contaminated waterfowl have adverse effects on bald eagles, and could also affect humans if ingested[6]. Lead emissions from gasoline are no longer a concern since only unleaded gasoline is now available.

High levels of lead in humans can lead to vomiting, diarrhea, convulsions and death in extreme circumstances[13]. Long-term or chronic exposure can change brain function and result in kidney difficulties[13]. Children seem especially susceptible to lead, as neurological and psychological impairment[13] that is probably permanent has been linked to elevated exposure to lead[14]. Lead is also suspected of playing a role in cancer[6].

1.3.1.3 Zinc

Courtaulds Fibres was also the most important source of zinc in Cornwall and in the Great Lakes basin as it used zinc in manufacturing rayon. Although this plant is now closed, other manufacturing plants and industries still discharge zinc. Domtar Fine Papers discharges the most zinc, followed by the Cornwall Water Pollution Control Plant, Cornwall Chemicals, ICI Forest Products and Stanchem. Zinc is moderately toxic to humans if ingested or if its fumes are inhaled[6].

1.3.1.4 Cadmium

Cadmium pollution mainly occurs as a result of industrial and municipal wastes. The highest concentrations were found near or downstream from Courtaulds Fibres[6]. It is also found in tobacco smoke and in the liver and kidneys of wild game such as caribou and moose. High levels of cadmium in humans can lead to lung problems, kidney problems[15], weakness, headaches, and nausea[8].

1.3.1.5 Chromium, Copper, Nickel and Arsenic

Chromium lines stainless steel tanks and piping used by industries, but effluents monitored in Cornwall industries did not reveal significant concentrations of this metal[6]. The highest levels of arsenic, chromium and nickel are in the sediments found near or downstream from Courtaulds. These metals may also flow in from the Great Lakes[6].

1.3.2 Organic Compounds

1.3.2.1 Polychlorinated Biphenyls

Polychlorinated Biphenyls or PCBs involve over 200 chemical compounds. They were useful in transformers, hydraulic fluids, fire retardants, paints and inks. Elevated levels became a problem in the Cornwall-Lake St. Francis area due to three industrial sites near Massena, New York: ALCOA, General Motors Foundry, and Reynolds Metals Co.[6] In fact, the highest PCB levels in all of the St. Lawrence River have been recorded in samples of river water, bottom sediment, forage fish, sport fish, waterfowl, snapping turtles and native mussels found between Cornwall and Valleyfield, Quebec. PCBs are persistent chemicals. They accumulate in the environment and bioaccumulate in the food chain. They are toxic in elevated concentrations. For these reasons, the manufacture of PCBs has been banned in Canada since 1978.

PCBs have been found in wild foods such as fish or game. This has consequently led to restrictions in consumption of several species of sportfish. The Guide to Eating Ontario Sport Fish gives detailed information on these restrictions[12]. Elevated amounts of PCBs may cause chloracne, skin problems, and changes in the liver, immune system, senses and behaviour[8]. They may also be associated with digestive problems and may be carcinogenic[6].

1.3.2.2 Polynuclear Aromatic Hydrocarbons

Polynuclear aromatic hydrocarbons (PAHs) result from incomplete combustion of fossil fuels, wood and tobacco. These compounds were found in the effluent of Domtar/ICI/Cornwall Chemicals, Courtaulds Fibres (closed in 1992), Courtaulds Films (closed in 1989), and the Cornwall Sewage Treatment Plant. Point sources that have the most impact are Reynolds Metals Co. and ALCOA near Massena, N.Y. PAHs have been associated with the presence of malignant liver tumors in fish[6], with some congenital malformations[16] and with immunosuppression[17]. These organic solvents can also cause severe disturbance in vitamin A metabolism[18]. Exposure to large quantities of PAHs may be linked to cancer[6]. The main risk remains occupational.

1.3.2.3 Dioxins and Furans

Dioxins and furans are found in the aquatic environment near pulp and paper mills that use chlorine bleaching. These substances are found in sediments downstream of Domtar. However, no guidelines or criteria exist for dioxins and furans in sediments. These compounds may cause cancer and reproductive failure in animals. They bioaccumulate and have been associated with hormonal disruption and developmental problems in humans. They are suspected carcinogens[6]. Elevated amounts of these substances may also cause chloracne, skin problems, and changes in the liver, immune system, senses and behaviour[8].

1.3.2.4 Oils and Greases

Various oils and greases have been observed in sediments of the Cornwall waterfront. These substances cause degradation of benthos. Most deposits along this area consist of thick, heavy fuel oil possibly from spills of ship fuel. The Cornwall Sewage Treatment Plant release light oils and greases that float and are broken down by bacteria. Some oils and greases may be toxic to humans[6].

1.3.2.5 Chloroform and Carbon Tetrachloride

Chloroform and carbon tetrachloride have been detected in the liquid effluent of Cornwall Chemicals. However, the concentrations in this area of the St. Lawrence River are not a concern as they are low or undetectable in the river water. These substances are suspected carcinogens[6].

1.3.2.6 Pesticides

As a result of agricultural activity, pesticides appear in the watersheds that drain into the St. Lawrence River. In 1979, the levels of DDT and its metabolites in the Cornwall area exceeded the Provincial Water Quality Objective. Other pesticides such as Mirex, hexachlorobenzene and dieldrin were found only in small quantities[5,6].

1.3.2.7 Phenols

Chlorinated phenols are thought to taint fish. Some were found in Domtar's effluent. These substances are poisonous to humans and may cause cancer[5].

1.3.2.8 Microbiological contamination

Direct human contact with microbiologically contaminated water has been associated with gastrointestinal illnesses (e.g. diarrhea), and infections of the respiratory tract, eyes, ears, nose and throat[19].

1.3.3 Air Pollution

Air pollutants such as sulphur dioxide, carbon monoxide and nitrogen oxides are common, especially in industrial areas. They affect mostly children and the elderly because of the higher vulnerability of their respiratory system[8].

1.3.3.1 Sulphur Dioxide

Sulphur dioxide is produced by oil and gas processing, ore smelting, and the burning of coal or heavy oils. In Canada, the urban air quality five year composite average meets the maximum desirable level established by Environment Canada's Criteria for Air Quality Objectives. This means that the levels of sulphur dioxides have no effects on health. At elevated levels, SO_2 can promote lung problems and hinders breathing[8]. It can also increase sensitivity in patients with asthma and bronchitis[7].

1.3.3.2 Carbon Monoxide

Carbon monoxide is produced from burning material which contains carbon. Significant sources of carbon monoxide emanate from motor vehicles, household heating, and industrial production. The levels of carbon monoxide in urban air in Canada meet the maximum desirable objective. At elevated concentrations, carbon monoxide causes physiological stress on individuals with cardiovascular and respiratory disease and may increase mortality[7]. Found at high levels indoors, carbon monoxide is a concern as it affects the oxygen carrying capacity in the body[8].

1.3.3.3 Nitrogen Oxides

Nitrogen oxides come from transportation and industrial fuel combustion. They meet Canada's annual maximum desirable objective. At elevated levels, they affect the lungs and the immune system and increase sensitivity in patients with asthma and bronchitis[7,8].

1.3.3.4 Ozone

The ozone layer is indispensable as it protects us from the sun's ultraviolet radiation that can cause skin cancer. However, at ground level, ozone is a toxic component of photochemical oxidant air pollution[20]. It impairs respiratory function and increases respiratory symptoms. It may also decrease the performance of some athletes[7].

1.3.3.5 Suspended Particulates

Dust, smoke, pollen, combustion by-products, industrial emissions from transportation, mining operations, thermal power generation plants and waste incinerators all contribute to suspended particulates in the air. Several urban centres in Canada have levels of suspended particulates that exceed the maximum acceptable level, causing decreased visibility. At higher levels, they result in an increase in the frequency and severity of lower respiratory symptoms[7].

1.4 Plans for Remedial Action

As early as 1909, Canada and the United States signed the Boundary Waters Treaty to care for waters that share the border. The International Joint Commission (IJC) was formed to advise both governments on environmental activities in these waters. In 1972, realizing the water quality problems of the Great Lakes, the IJC urged both parties to sign the Canada-United-States Great Lakes Water Quality Agreement. In 1985, the IJC identified 43 Areas of Concern in the Great Lakes basin where the environmental impact was the most important. Twelve of these are solely in Ontario, while five more overlap both Ontario and the United-States. The Canadian federal government and the Ontario provincial government signed the Canada-Ontario Agreement Respecting Water Quality (COA) in the Great Lakes.

The Remedial Action Plan Program was established in 1987 in a revision of the Canada-Unites States Great Lakes Water Quality Agreement. The Canadian federal government and the Ontario provincial government are responsible for each Area of Concern falling under their jurisdiction. The Cornwall-Lake St. Francis stretch of the St. Lawrence River is governed by the St. Lawrence RAP.

1.4.1 Ecosystem Recovery on the St. Lawrence Project

A project called "Ecosystem Recovery on the St. Lawrence" is managed by the Institute for Research on the Environment and Economics (IREE) of the University of Ottawa. It has brought together a multidisciplinary team "to identify and propose courses of action needed to rehabilitate the Cornwall basin of the St. Lawrence River and facilitate the sustainable redevelopment of the community in the Cornwall-Akwesasne region"[4]. The activities of the Ecosystem Recovery on the St. Lawrence project complement and extend investigations being conducted by the St. Lawrence RAP.

1.5 Rationale for Environmental Health Risk Perception Survey

One of the objectives of the Ecosystem Recovery on the St. Lawrence project is to assess the Cornwall-Akwesasne community's perception of the impact of the contamination of the St. Lawrence River on their quality of life. The task of evaluating the public's perception of health risks associated with the contamination of the St. Lawrence River has been assigned to the Health Sciences component of the project. The survey presented in this paper aimed at evaluating the environmental health risk perception associated with the contamination of the St. Lawrence River, as well as with air pollution, chemicals, drinking water and fish consumption, in order to fulfill part of the evaluation.

1.6 Importance of Risk Perception Studies

Risk perception studies aim at understanding how people think about and respond to risks. They are useful to assess what the public's concerns are, and whether these concerns reflect reality.

One of the most important contributors in the area of risk perception, Paul Slovic[21], states that

> "...[risk perception] research should aid policy-makers by improving communication between them and the public, by directing educational efforts, and by predicting public responses to new technologies,...events,...and new risk management strategies...". (p.281)

It is important that the information on environmental health risks reaches the residents of Cornwall. To effectively communicate this information, policy makers must: 1) understand their attitudes, opinions and perception of environmental health risks; 2) know their source of information; 3) rate their confidence level in this information; and 4) correlate their behaviour to this information. In fact, consulting the public is the first step in the process of risk communication and is essential to its success[22-25]. The results of this study will provide useful information to policy makers to improve environmental health risk communication.

1.7 Survey Objectives

The survey was conducted to:

1 evaluate the Cornwall residents' perception of various environmental health risks in the Cornwall area and the St. Lawrence River

2 compare their perception of certain environmental health risks to the Canadian population's perception

3 identify the Cornwall residents' main sources of information on environmental health risks and compare it to the Canadian population's sources of information

4 evaluate the level of confidence attributed to various sources of information regarding environmental health risks and compare it to that of the Canadian population

5 obtain a general idea of their attitudes and opinions to a variety of environmental health risk perception issues

6 get data on the Cornwall residents' behaviours related to health risks

7 collect Cornwall residents' personal and demographic data to enable subgroup analyses.

2. Current State of Knowledge on Risk Perception

2.1 Definitions

The dictionary of Epidemiology[26] defines risk as:

> "The probability that an event will occur, e.g., that an individual will become ill or die within a stated period of time or age. Also, a nontechnical term encompassing a variety of measures of the probability of a (generally) unfavourable outcome." (p.115)

In this context, perception is not the physical sensation of the elements of the environment, but rather the "quick, acute, and intuitive cognition" or "a capacity for comprehension"[27]. It is synonymous to "discernment".

The term "environment" is in itself vague and is affected by serious conceptual problems. It might refer to phenomena related to the population, to the natural resources, or to pollution[25]. The dictionary of Epidemiology[26] defines "environment" as being "all that which is external to the individual human host. [It] can be divided into physical, biological, social cultural, etc., any or all of which can influence health status of populations."

The World Health Organization (WHO) defines "health" as "a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity."[26]

It is clear to see that the expression "environmental health risk perception" is extremely complex and subject to numerous interpretations. Using this expression as an indicator in a survey renders measurement and interpretation of the results difficult. However, this is commonly done in public polls.

2.2 *Psychometric paradigm*

A review of several important studies in this field is presented in this section. It focuses on the most important and influential contributions to the field of risk perception. Research in this area was prompted by the need for policy-makers to weigh the benefits against the risks when making decisions[28]. Hence, this research helps risk analysis and policy-makers by: a) enabling them to understand and anticipate public responses to hazards; and b) improving the communication of risk information among lay people, technical experts, and decision-makers[21]. From a public health perspective, understanding the risk perception of people permits better communication regarding health risks, thus guiding the individuals into making wiser decisions as to which course of action to take based on the risks and benefits of each alternative[29]. Strategies were needed to study the perceived risk. Using the psychometric paradigm, which involves psychosocial scaling and multivariate analysis techniques, can be helpful in understanding, quantifying and predicting responses to risks[21].

There are different approaches to quantitative representations of risk under the psychometric paradigm[21]. An important pioneering effort dates back to 1969 with the "revealed-preference approach" to risk assessment originated by Starr[30]. It assumes that, by trial and error, society has arrived at an "essentially optimum" balance between the risks and benefits associated with an activity[21,31]. It takes historical or current risk and benefit data to show patterns of acceptable risk-benefit trade-offs. By measuring risk as the expected number of fatalities per hour of exposure to an activity, and benefit as the average amount of money spent on an activity, Starr studied the relationship between risk and benefit across various activities.

From his analyses, he attempted to identify an "acceptable level of risk". He concluded that:(a) the acceptable risk is proportional to the third power of the benefits; (b) the public's acceptance of risk is 1000 times greater from voluntary activities than from involuntary activities with the same level of benefit; (c) the acceptable level of risk is inversely proportionate to the number of persons exposed to that risk; and (d) the level of risk accepted for voluntarily accepted hazards is similar to the level of risk from disease[30].

The revealed-preference approach has been criticized by several authors but remains important in this area. One of its advantages is that it deals with public behaviour rather than attitudes. However, it assumes that past behaviour is indicative of present preferences[28]. Starr defended this position by stating that social preferences and financial costs are sufficiently enduring to be used as predictors[30], but later acknowledged they fluctuate in time[32]. This approach also implies that the public has complete information and can use it adequately. However, psychological research in decision making does not support this assumption[33]. Other authors have demonstrated that the quantitative conclusions of this approach are highly sensitive to the measurement of risk and benefit from historical data[34].

The "expressed-preference approach" soon followed as the contribution of Fischhoff, Slovic, Lichtenstein, Read and Combs in "How Safe is Safe Enough? A Psychometric Study of Attitudes Towards Technological Risks and Benefits"[35]. This method directly assesses the public's attitudes or perceptions towards risks and benefits associated with various activities[21,31]. It uses psychometric analysis of questionnaire data.

In this study, 76 members of the League of Women Voters were presented with a list of 30 activities and technologies and asked to rate each item for its perceived benefit to society, its perceived risk, the acceptability of its current level of risk, and its position on each of nine dimensions of risk: voluntariness, immediacy, known to exposed, known to science, controllability, newness, chronic, common/dread, and severity of consequences. The results showed only a slight systematic relationship between perceived existing risk and benefits of the 30 items ($r=-0.20$) Approximately 50% of the participants tended to view the current risk levels as unacceptably elevated.

Risk did correlate with benefit when the current risk levels were adjusted to the acceptable risk levels. The nine descriptive attributes of risk were highly intercorrelated and could be reduced to two dimensions; one that discriminated between high and low technology activities, and one that reflected the certainty of death given that adversity occurs. "[G]reater risk was tolerated if that risk was voluntary, immediate, known precisely, controllable, and familiar." (p. 143). These two dimensions made acceptable risk judgments highly predictable. In comparing the revealed-preference approach to the expressed-preference approach, they stated that:

> "Balancing the results of these various approaches...depends upon one's conceptualization of the policy-making process. A definitive revealed-preference study would be an adequate guide to action only if one believed that rational decision making is best performed by experts formalizing past policies as prescriptions for future action. A definitive expressed-preference study would be an adequate guide only if one believed that people's present opinions should be society's final arbiter and that people act on their expressed preferences." (p. 149)

The expressed-preference method proved to be useful for several studies and is still widely used today[31,35-43].

In other studies, Weinstein[55] studied college students' perceptions of susceptibility to health and safety risks and the factors that determine the subjects' susceptibility, as well as their actual standing on objective risk factors. He found that the subjects were not biased about hereditary risk factors, but were pessimistic about environmental risk factors. His findings also shed some light on why risks thought to be controllable are likely to evoke unrealistic optimism about susceptility to health and safety risks, as few admitted to actions or psychological attributes that increased their risk. Except for "smoking", correlations between behavioural risk factors and perceptions of susceptibility were weak.

In another study with college students, Weinstein[56] examined how they compared their own chances of experiencing different health- and life-threatening situations with the chances of their peers. His results revealed that they consistently considered their own chances to be below average. Unrealistic optimism increased according to their perceived controllability, lack of previous experience with the situation, and the belief that the problem appears during childhood.

Weinstein also found that beliefs about risk likelihood, beliefs about risk severity and worry about the risk all played a role in the students interest in reducing their risk. The more optimistic they were, the less worried they were, therefore the less likely they were interested in reducing their risk. Weinstein's studies are important contributions in understanding what lies behind people's perceptions about risks to their health and safety.

2.3 Risk Perception of Health Issues

Harding and Eiser[31] used this approach as they wanted to characterize the perceived risks and benefits of some health issues. They obtained judgments on the perceived risk, perceived benefit, and certain risk characteristics such as "likelihood of mishap", "likelihood of death", "acceptability", "responsibility", "voluntariness", "social approval", "fault", "immediacy", "risks known", "risks known by science", "avoidance", "new or old", and "calm/dread", from 159 subjects from 3 different colleges on 15 health related issues. They also collected demographic details such as the sex of the respondents, their seat belt usage, their smoking status, and their birth order to look at the influence of these variables on risk perception. They found a similar relationship between risk and benefit as Fischhoff et al.[35], with a regression line of r=-0.43. However, this relationship varied depending on the activity or technology. For example, activities and technologies relating to surgery revealed a positive relationship between risk and benefit. Perceived likelihood of mishap, likelihood of death and the calm/dread characteristics adequately predicted perceived risk. Knowledge of risk involved, acceptability of the risk, and societal approval of the risks were only poor predictors of perceived benefits. Inclusion of the demographic information did not improve the prediction of perceived risk or perceived benefit, but did have an influence on specific activities. Birth order and use of seat belts were not useful, but sex, expert status, and smoking status played an important role on certain activities. These results make generalization of solutions difficult as they show that population heterogeneity matters for the perception of risk.

2.4 *Risk Perception of Technological Development*

Gardner and Gould[36] studied the public perceptions of the risks and benefits of technology to attempt to understand public reactions to technological development. They addressed limitations of previous studies such as the representativeness of the samples, additional correlates of perceived risk, and they judged acceptability, and qualitative aspects of perceived benefits. A total of 1021 randomly selected individuals from Connecticut and Arizona were interviewed in person. They treated the "person" rather than the "technology" as the unit of analysis, unlike some previous studies[35,44]. This allowed them to add additional variables such as sociodemographic data and analyze whether these have an effect on perception of risk, benefit, and acceptability of the current safety standards. They also included three important qualitative aspects of benefits : safety and security, pleasure and satisfaction, and contribution to basic human needs. The interview consisted of questions on six technologies: automobile travel, air travel, nuclear weapons, nuclear power, handguns, and industrial chemicals. Seven-point scales were used to rate risk, benefit, estimated number of deaths, risks understood, catastrophic potential and dread. "[T]he results confirm[ed] that members of the general public tend to define "risks", "benefits", and "acceptability" in a complex, multidimensional manner"(p.236). They also found that the acceptability judgments of the public are more influenced by the perceived risks, benefits and other characteristics than by sociodemographic variables.

2.5 *Cross-Cultural Risk Perception*

Some cross-cultural studies have been conducted to compare risk perceptions of people living in different countries. Keown[37] compared risk perceptions of Hong Kongese and Americans. In his study, Hong Kong students were asked to rate 30 hazards and quantify a subset on six risk characteristics: voluntariness of risk, immediacy of effect, knowledge about risk, chronic vs catastrophic, common vs dread, and severity of consequences. He compared their responses to the responses of American students from a prior study.

Keown found that Hong Kong students rated 10 hazards significantly higher: heroine, crime, food colouring, caffeine, food preservatives, railroads, bicycles, space exploration, commercial aviation, and non-nuclear electrical power; and 5 others significantly lower than the American students: DDT, DNA research, alcoholic beverages, oral contraceptives, pesticides. He explains the cultural, environmental and governmental differences that might account for many of these differences.

2.6 Occupational Health Risk Perception

Occupational health risk perception has also been a focus of interest in this area. Sjöberg and Drottz- Sjöberg[38] studied the knowledge and risk perception among nuclear plant employees. Interviews were conducted with 236 employees, 83% men and 17% women, belonging to 10 different professions. The interview consisted of background data, opinions about nuclear power in general, risks in the work environment, and satisfaction with work conditions and salary. After the interview, the participants completed three questionnaires on judgments of general risks and specific radiation risks, including risk definition questions, general radiation knowledge questions, specialized radiation knowledge questions for radiation protection personnel, and the KSP questionnaire that measures anxiety and worries. They found that most employees were satisfied with the measures of safety, with the exception of those hired temporarily through external contracts. Perceived risk correlated negatively with knowledge about risk-related matters, but did not correlate with anxiety. Job satisfaction was related to perceived conventional job risks, and to a lesser extent to nuclear risks. The participants' definition of the concept of risk was related to their risk ratings. Participants tended to define risk in patterns. The four most important ones were: 1) pure probability definition; 2) probability and combination definition, where risk was seen as both defined mainly as probability and as a combination of probability and consequence; 3) pure combination definition; and 4) consequence and combination definition.

2.7 Risk Perception of Nuclear Waste

Nuclear waste has prompted a lot of research in the risk perception field. The Yucca Mountain site for a proposed nuclear waste repository in Nevada is a good example[45]. The public's perception of risks of nuclear waste has led to a 30-year struggle over the disposal of spent fuel from commercial nuclear reactors. Under the Nuclear Waste Policy Act passed in 1982 and amended in 1987, Yucca Mountain, Nevada was designated as the only potential site for evaluation for a waste storage facility. This put a lot of pressure on the U.S. Department of Energy to resolve the problem. However, public perception of the risks of a nuclear waste repository, and political opposition, have halted this project and have hindered further development of nuclear power. There is great discrepancy between the public's perception and the views of the technical community. Officials and experts believe that underground isolation of nuclear waste is safe and are incredulous towards public opposition. They dismiss public perception as irrational and ignorant, while the public feels victimized believing that the scientists and engineers that created nuclear technology were not accompanied by effective risk management. It is clear from this situation that understanding public perception of risk from radiation, nuclear power, and nuclear waste is crucial for getting over this impasse. In their study, Slovic, Layman and Flynn used mental imagery to obtain insight into risk perception. Word associations to the term "underground nuclear waste repository" were collected through four telephone surveys done in Nevada, Phoenix Arizona, and southern California. A total of 3334 individuals were selected by random-digit dialing and response rates ranged from 72% to 84%.

The 10000 word associations revealed that the term was associated with negative consequences or negative concepts for more than 56% of the total number of responses. The five most important categories were: dangerous/toxic, death/sickness, environmental damage, bad/negative, and scary. Positive associations were rare, accounting for less than 1% of the responses. Many responses reflected distrust in governmental agents. They concluded that their results were indicative of a serious public aversion to nuclear waste. Because the feelings of dread, revulsion, and anger were so strong, future communication from technical experts will have to be very potent to influence public perception. Such a breakdown of trust is not easily remedied.

Mitchell[39] did a study of perception of risk and credibility at toxic sites in order to compare the risk perceptions and the responses to risk communications of four agency personnel groups and three groups of neighbours of Superfund sites in Michigan. Psychometric techniques of hazard rating and hazard profiles were used. The responses of agency personnel were similar to experts' responses in previous studies. However, responses of a group of neighbours revealed prior experience with toxic sites. A hypothetical scenario was also given to the participants for specific toxic site risk messages. Results from this part showed that there are important differences in credibility of information sources between the agency personnel and the groups of residents. In general, all groups had very little trust in the Superfund program, indicating that problems of credibility and program inadequacy cannot be resolved by improving risk communication.

2.8 Canadian Studies

In Canada, a nation-wide survey on risk perception of prescription drugs was done by Slovic et al[41] in 1991. This survey contained three parts: 1) a general attitudinal and demographic questionnaire addressing topics such as the nature and perceived frequency of drug side effects, the adequacy of actions by government regulators, drug manufacturers, physicians and pharmacists, perceived causes of drug side effects, opinions to a scenario regarding a drug crisis, attitudes towards precaution and warning information, and word associations to the words "prescription drugs"; 2) risk/benefit perceptions in which 33 items were rated from 1 to 7; 3) personal information about respondents such as age, sex, education, region of residence, native language, health status, cigarette smoking, occupation, income, marital status, medicine usage, interest in news items on health and medicine, health consciousness, attitude toward risk taking, fate, and medicines.

Out of 2874 eligible persons contacted, 1261 individuals were interviewed in person, yielding a response rate of 44%. In general, prescription drugs were seen as highly beneficial with low risks, except for sleeping pills, antidepressants, and tranquilizers. Side effects were usually associated with sensitivity of the patient or wrong doing by the physician, rather than problems with manufacturing, testing, or regulation. Risks associated with prescription drugs were better tolerated when there existed evidence of safety and efficacy, and when warning information was present. This supports earlier findings that the public is much more acceptant of risks when they are voluntary, known, and immediate.

2.8.1 Environmental issues

Environmental issues are important to the Canadian public. In 1992, the Communications Division of Environment Canada conducted an opinion survey and found that more than 90% of respondents stated that they were somewhat or very concerned about the environment[7]. Furthermore, another poll entitled "Canadians and the Environment" taken by the Angus Reid Group in 1991 revealed that 83% of respondents felt that environmental problems were already affecting health. Despite this fact, 45% of respondents remained optimistic that the state of the environment would improve in the next ten years. Another 33% felt that the environment would be in worse shape than today in ten years.

According to a survey done in 1992 by Environment Canada's Communication Division[7], the three most important concerns of the respondents were the pollution of water (34%), the depletion of the ozone layer (33%), and air pollution (25%). Canada's Health Promotion Survey in 1990 done by Health and Welfare Canada revealed that 42% of Ontario respondents perceived that environmental pollution had little impact on personal health, while 23% felt that it had an important impact on health. Only 8% thought it had a very important impact, and 15% thought it had no impact at all. The other 11% did not know[7].

The most recent Canadian study on health perception, the "Health-Risk Perception in Canada" survey, was conducted by Health Canada in 1993[43]. This study's results of the questions pertaining to environmental health issues are compared in detail with the results of the Cornwall survey in Chapter 4 of this paper.

3. Study Design

3.1 Description of the Cornwall Survey

The type of survey used for this study was a descriptive, cross-sectional sample telephone survey. The survey tool and a description of the methodology was submitted to the Faculty of Medicine, Research Ethics Committee. The recommendations of the Ethics Committee were taken into account and incorporated in the questionnaire.

The survey was adapted from the Health-Risk Perception in Canada[43] survey done by Health Canada (previously Health and Welfare Canada) (see appendix A). The questionnaire was obtained from them and most questions related to environmental health risks were extracted from this questionnaire. As it is well documented that environmental health risks are an important issue to Canadians[7,25,43], it was not found necessary to scale them against other types of risks. For comparability purposes, the wording and format of the questions taken from the survey were not altered. Some questions specifically relating to the Cornwall area were added. These added questions are of particular interest to the Ecosystem Recovery on the St. Lawrence project.

The introduction of the survey was comprised of a greeting and identification of the interviewer, and of the University of Ottawa. A brief description of the survey and its purpose followed. The person was then informed of how much time the interview would take and was reassured that there was no selling involved. This was followed by a paragraph on voluntary participation, and freedom to refrain from answering any question or withdrawing at any point. Confidentiality of the responses was emphasized and guaranteed. They were then asked whether or not they would participate. Once they accepted, the interviewer proceeded to select a respondent in the household. This method will be described further on in the text. The selected respondent was asked whether he or she wished to conduct the interview in French or English. If the respondent was different from the person who answered the phone, the introduction was repeated to allow the respondent to choose to participate or not.

The questionnaire was divided into six parts:

1 - Word Associations
2 - Risk Perception
3 - Risk Perception - Section on Cornwall
4 - Sources of Information and Level of Confidence
5 - Attitudes and Opinions
6 - Personal, Behavioural and Demographic Data

3.1.1 Part 1 - Word Associations

Research has shown the usefulness of word associations to reveal various aspects of the ways that people perceive risks[40,41,43,46,47]. Galton[46] explains this method well:

> "My method consists in allowing the mind to play freely for a brief period, until a couple or so of ideas have passed through it, and then, while traces or echoes of those ideas are still lingering in the brain, to turn the attention upon them with a sudden and complete awakening; to arrest, to scrutinize them, and to record their exact appearance." (p. 150)

In fact, this method permits to focus the attention on concepts and generate perceptions. In this study, the respondents were asked to think of the word "chemicals" for a moment and then state the first word or image that came to mind. The same procedure was repeated for the words "risk" and "pollution". In order to avoid influencing the respondents' answers to the rest of the survey, word associations were asked at the beginning of the interview. Some might argue that the word associations might influence the answers to the rest of the survey, but in order to compare the data with that obtained by the Canadian survey, it was necessary to follow the same order as the Health-Risk Perception in Canada Survey.

The words "chemicals" and "risk" were taken from the Canada Survey. The word "pollution" was added for the purposes of the Ecosystem Recovery on the St. Lawrence Project.

3.1.2 Part Two - Risk Perception

The items related to the environment were extracted from the "Risk Perception" section of the Health-Risk Perception in Canada survey. Out of 23 items, seven items were retained: chemical pollution in the environment, pesticides in food, tap water, bottled water, outdoor air quality, PCB or dioxin, and depletion of the ozone layer. An eighth item, "river water", was added for the purposes of the Ecosystem Recovery on the St. Lawrence project. For each of these items, the respondents were first asked to give their opinion about the health risk to themselves and their family, and then to the Canadian population as a whole. This comparison enabled us to see if the respondents considered themselves more or less at risk than the Canadian population in general. The choice of answers were: almost no health risk, slight health risk, moderate health risk, or high health risk.

3.1.3 Part Three - Risk Perception - Section on Cornwall

This section addressed specific issues related to the Cornwall area. The items included "water of the St. Lawrence River", "outdoor air quality in the Cornwall area", "fish caught in the St. Lawrence River", "mercury in the water or in the fish", "PCB in fish", and "tap water in the Cornwall area". Respondents were asked to rate the health risk for themselves and their family using the same scale as in part two. Some of these items are similar to items in the previous Risk Perception part of the questionnaire. This was done intentionally to see if there would be a difference in response when a general enquiry about outdoor air quality was made more personal, for example "outdoor air quality in Cornwall" .

3.1.4 Part Four - Sources of Information and Level of Confidence in these sources

Part Four was divided into two parts. One part dealt with the sources of information on health issues and risks, and the other with the level of confidence the respondents have in these sources of information. The sources of information listed were news media, private industry, medical doctors, municipal government, provincial government, Health Canada, Environment Canada, Agriculture Canada, public interest or environmental groups, university scientists, and friends and relatives. To assess the sources of information, they were asked to state whether they obtain almost no information, a little information, a fair amount of information or a lot of information from each source. They were then asked whether they have almost no confidence, a little confidence, a fair amount of confidence, or a lot of confidence in each source. This part was taken directly from the Health-Risk Perception in Canada survey and was not altered. This information is important to determine public sources of information on health issues in Cornwall, and whether residents trust these sources.

3.1.5 Part Five - Attitudes and Opinions

This section includes statements grouped by content category. These statements were also taken from the "Health-Risk Perception in Canada" survey. The first group involves statements on local and global environmental health risks:

> There are serious environmental health problems where I live.
>
> I believe my community is becoming a healthier place in which to live.
>
> The land, air, and water around us are, in general, more contaminated now than ever before.
>
> The greenhouse effect is a serious problem which could lead to harmful changes in the environment and in people's health.

The second group of statements addresses general opinions about health risks from chemicals:

> Use of chemicals has improved our health more than it has harmed it.
>
> Most chemicals cause cancer.
>
> I don't worry much about chemicals because there are just too many other things in my life that I have to deal with.
>
> I try hard to avoid contact with chemicals and chemical products in my daily life.

The third group of statements contains miscellaneous questions:

> People can offset health risks from pollution by improving their lifestyle such as exercising and eating properly.
>
> Experts are able to make accurate estimates of health risks from chemicals in the environment.
>
> I feel that I have very little control over risks to my health.
>
> Chemicals are either safe or dangerous. There is really no in-between.

These miscellaneous statements were chosen for specific reasons. The three statements concerning chemicals were chosen as chemicals are an important issue in Cornwall. They address three different issues, the first being lifestyle, the second, confidence in experts, and the third, the effect of level of exposure to chemicals. This last statement is a "middle of the road" statement as it does not lean on one specific opinion of the effects of chemicals.

3.1.6 Part Six - Personal, Behavioural and Demographic Data

Questions on the respondent's sex, age, level of education, smoking history, and present smoking status were asked to get a good sense of the lifestyle of the sample.

In the past, studies have asked respondents whether they wear a seatbelt or not when in a motor vehicle in an attempt to identify risk takers. However, as seatbelt use is mandatory in Canada, it is unreliable to use this as a criterion to identify risk takers. Instead, respondents were asked whether they participate in activities that others consider risky.

Asking respondents to rate their own health is generally a good indicator of their level of health. This question was therefore included in the questionnaire.

Two questions on medical conditions of residents in the household were included to get an idea of the health problems in this community. This was by no means meant to measure the prevalence of medical conditions in Cornwall. It was simply an attempt to understand what people perceive as medical conditions. They were also asked to reveal what they think might be the cause of this condition. This revealed public perception regarding causes of health problems.

A section on fish consumption was incorporated in the questionnaire. This was meant to measure a behaviour that is directly related to their perception of health risks associated with environmental contamination. Respondents were first asked whether they eat fish caught in the St. Lawrence River. If they answered no, they were asked why. If yes, they were asked the frequency of consumption and the types of fish consumed. They were also asked if there are any kinds of fish that they refuse to eat and why. These questions help understand why Cornwall residents eat or do not eat fish from the St. Lawrence River. If they avoid fish, is it because they are worried about contamination, or simply because they do not fish, or do not like to eat fish? Do they eat fish cautiously, aware that the bigger the fish, the greater the contamination? Do they discriminate between the types of fish because they know that certain types are more contaminated than others? For similar reasons, the respondents were asked whether they swim in the St. Lawrence River. It was also interesting to find out whether they are familiar with and use the "Guide to Eating Ontario Sport Fish"[12]. This guide is published every two years by the Ontario Ministry of Natural Resources. It gives detailed descriptions of all the fish found in the lakes and rivers of Ontario, which types of fish are more likely to be contaminated in which areas and the average level of contamination for various sizes of a certain type of fish. In accordance with Health Canada guidelines, the Guide specifies the amount of fish that may be safely consumed per meal, and the frequency with which a particular fish can be consumed.

The final questions ask employment status, occupation, language preference, number of years (or months) respondents have been living in Cornwall, and total household income for descriptive purposes.

For parts 2,3,4 and 5, dots were put on the questionnaires systematically beside one of the items. The interviewers were instructed to begin this part at the item beside the dot and come all the way back to that dot. This ensured a rotation of questions to eliminate the possibility of one question influencing another due to order.

3.2 Limitations of this type of study

The data obtained by a survey such as this one are useful for pubic health administrators in assessing the needs of the population. Because information is collected at a given point in time, the assumption that it remains static must be made. The information may be biased by media coverage at the time of the survey or by a recent event in the area of study. In addition, the problems of defining "environmental health risk perception" limit the measurement and interpretation capabilities as discussed in Chapter 2.

3.3 Target population

The City and township of Cornwall were chosen as a target population as the Ecosystem Recovery on the St. Lawrence Project is studying the Cornwall-Akwesasne area. The target population was limited to the city of Cornwall and its township to facilitate sampling. This survey could be extended to the surrounding townships at a later date.

3.4 Survey population:

The sampling unit was the household, and the unit of analysis was men and women 18 years of age and older that have a telephone in their household.

3.5 Sampling frame

The Cornwall telephone directory was used as the sampling frame. Twenty five percent of the telephone numbers were taken from the telephone directory, and seventy five percent of them were generated through random numbers to reach unlisted and some new telephone numbers[48].

This approach gets some numbers that are no longer in service but consultation with an experienced survey centre revealed that it still yields a good hit rate. It is obvious that this method does not get households with no telephones. However, Statistics Canada reports that telephone coverage in Canada was 98.5% according to a "Household Facilities and Equipment Survey" done by Statistics Canada in May 1987[49]. No coverage households tend to be young, male, single, of low income, and less educated than the general population. This does introduce some bias in the survey data but of little importance. There might also be some duplication of households in the directory when 2 or more individuals in that household are listed.

Computerized random digit dialing (RDD) was not chosen as an option since it is far more expensive than the telephone directory approach. It is also more difficult to obtain and install, and requires the purchase of data banks from Bell Canada. The hit rate is also very low with RDD, meaning that several phone calls are required to reach one household.

3.6 Sample size

Assuming a random sample, and knowing that the population of people 18 years of age and older in Cornwall (city and township) is approximately 41000 based on the 1991 Census, the sample size needed would be 381. This was calculated using EPI Info Version 5.0, a word processing, database and statistics system for public health and epidemiology on microcomputers[50], for a confidence of 95% and an estimated proportion of 50% ± 5% of the population that would agree to the following question:

"There are serious environmental health problems where I live"

The program uses the following formulas:

$$S = \frac{Z^2 (P (1 - P))}{D^2}$$

where S = sample size for infinite population
P = estimated proportion
Z = percentile of standard normal distribution
D = half of the width of the desired sample confidence interval

It then adjusts this sample size to reflect a finite population by using this formula:

$$SS = \frac{S}{1 + \frac{S}{population}}$$

Using a similar questionnaire, Health Canada obtained a response rate of 54.5%. Therefore, the total sample size, adjusted for non-response, would be: 381 + (0.455)(381) = 555. For the purpose of this study, a sample size of 500 was sought for feasibility.

3.7 Sample Selection

A probability sample was selected. Sampling without replacement was used. Using random number tables of numbers from 1 to 74 coinciding with the number of pages in the Cornwall directory, a page number in the telephone directory was selected. The random number tables were all generated by EPI Info. Another random digit table with digits from 1 to 4 was used to select the column from which the telephone number was taken. Using a ruler and a third random number table of numbers from 1 to 25.9 to agree with the length of the page, the telephone number corresponding to the measurement with the ruler was selected. If this number was non-residential, the telephone number directly above it or below it was chosen randomly based on another random digit table of 1s and 2s where 1 meant up and 2 meant down. If there was no telephone number above it or below it, then the last telephone number on the column to its left or right will be taken, even if on another page. If two or more non-residential telephone numbers were located above or below the selected non-residential telephone number, they were considered as only one telephone number and the next telephone number directly above or below this block of numbers was chosen randomly. Once a telephone number was extracted from the telephone directory, it was kept and three other numbers were generated by replacing the last three digits with three digits taken from a random number table ranging from 000 to 999. This method resulted in a ratio of 3 random telephone numbers for each telephone number extracted from the telephone directory, for 2000 numbers in total. By keeping the same prefix (first three digits) of the telephone numbers, the number of telephone numbers not in service was significantly decreased.

3.8 Selection of a Respondent

One respondent per household was selected by asking the person answering the telephone to give the first name or initial of each adult and subsequently consulting random number tables to select one person. Different random number tables were generated for different number of adults in the household.

For example, if there are three adults in one household, then the random digit table of numbers from 1 to 3 was consulted. The number indicated, in this case "1", resulted in the selected respondent. No substitution could be made. Once the number on the random digit table was used, it was crossed off and the next number would be used for the next household containing three adults.

Example:	Name	Respondent
(1)	Walter	X
(2)	Winnifred	
(3)	Sophia	

3.9 Pilot

The questionnaire was tried out on a few people to measure the time it takes to administer it and to work out any problems in fluidity. It also provided examples of answers to the open-ended questions for coding purposes. In addition, the questionnaire was distributed to colleagues and experts for feedback.

3.10 Time period

In order to conduct 500 interviews of 15 to 20 minutes each, it was estimated that a total of 250 hours would be required. Consultation with a few experienced survey centers has revealed that 2 interviews per hour is the average for a survey of this length.

3.11 Recruitment of interviewers

A job offer was posted at the University of Ottawa, Guindon Hall and at the Canada Employment Centre for students. To be able to complete the interviews within 4 to 6 weeks, 5 interviewers were needed. They were expected to do 100 interviews each, mostly in the evenings for about 3 hours per evening. They were to be bilingual and have a clear and pleasant voice on the telephone. Candidates were asked to come for an interview and were rated on the clarity and pleasantness of their voice, their level of bilingualism, and their integrity. A recent copy of their resume was collected. During the interview, the resume was looked over, the project and what would be expected of them were briefly explained, and the candidate's previous interviewing experience was discussed. They were asked to explain how they would work the interviews into their schedules. A few scenarios were given: how they would deal with a respondent that kept sidetracking from the interview, and how they would handle an irate person. A discussion period followed in which they had the opportunity to ask more questions about the project or any other questions they may have had. Half of the interview was held in French, half in English, to assess their level of bilingualism. A total of 7 interviews were conducted and 5 interviewers were selected. After four weeks of data collection, one interviewer resigned and another proved to be unsatisfactory. As a result, another job offer was posted in early May at the Canada Employment Center for Students. Six more interviews were conducted and two new interviewers were selected and trained using the method as described below.

3.12 Training of interviewers

A two-hour training session was given to the interviewers prior to beginning the survey. This enabled them to familiarize themselves with the questionnaire and the procedure to follow. It also gave them an opportunity to practice it. They were able to ask any question and make any comment regarding the procedures and the questionnaire itself. A training manual (see appendix B) was provided to ensure uniformity and consistency. A sample of the log book was used for the training session. The log book containing the list of telephone numbers as well as the questionnaires were given to them.

3.13 Wages for the interviewers

As the average number of interviews per hour is 2, the interviewers were paid $8 per **completed** interview. They received $2 for a refusal from the selected respondent. A calling card number from the University of Ottawa was given to each interviewer for the duration of the study. This permitted a third party billing approach, and also yielded a record of each telephone call in order to control quality.

3.14 Methodology for administering the survey

A list of 400 telephone numbers was provided to each interviewer in a log book. The interviewer dialed the telephone number and recorded the result in the log book: number is not in service, non-residential number, person who answered the phone does not speak English or French, refusal by the person who answered, refusal by the selected respondent, no answer, busy signal, answering machine, selected respondent not in, completed interview with selected respondent, or other. For numbers not in service, non-residential numbers, person who answered does not speak English or French, refusal by the person who answered, and refusal by the selected respondent, no follow-up was necessary. For no answer, busy signals, answering machines and for when the respondent is not in, 2 more trials were attempted at different times and on different days. After three trials, no further follow-up was made.

3.15 Progress Report

Each interviewer was called at the end of each week to verify progress.

3.16 Quality Control

To ensure that the interviewers were indeed calling the telephone numbers in the log books and to verify the length of the interviews, a copy of the telephone bill resulting from the calling card used by the interviewers was obtained. This was cross-referenced with the interviewers' log books.

3.17 Data Entry

The data from the interviews was first entered on the questionnaires by the interviewers. They were then entered by one individual on EPI Info 6.

3.18 Data Cleaning

To ensure that the data entry was as accurate as possible, the Check program in Epi Info 6 was used. This program permits entry validation by allowing range checking, skip patterns and by enabling the identification of legal values. These techniques minimize errors during data entry. Some data cleaning was also done by running frequency tables, and identifying variables that were not properly coded based on the information on the questionnaires.

3.19 Data Analysis

The data was analyzed with the BMDP statistical package as well as EpiInfo Version 6. Frequency tables were generated for each variable. The questions in Part Two were compared to see if there were any differences between the perceived health risks to the respondent and his or her family, and the perceived health risks to the Canadian public for each environmental item. To compare proportions of respondents that perceived a high health risk to themselves and their family with the proportions that perceived a high health risk to the Canadian population in general, the Epitable program in EpiInfo6 was used. Comparisons of proportions were done using a chi-squared test.

To compare the results from Part Two on Risk Perceptions to the results obtained for the same questions by the Health-Risk Perception in Canada Survey, the Epitable program in EpiInfo6 was used. Comparisons of proportions were done using a chi-squared test. To compare the results of Part Five of the Cornwall survey with the results to the same questions in the Health-Risk Perception in Canada survey, chi-squared values were calculated from RxC tables to compare proportions. The calculations were done using EpiTable in EpiInfo 6. Multivariate analysis was done by running a stepwise logistic regression of variables using the BMDP statistical program.

4. Results[a]

4.1 Response Rate

A sample of 497 respondents were selected using the method mentioned above. Of these, 437 completed the interview, yielding an overall response rate of 62.6%. Table 1 reveals the statistics for all completed telephone calls.

4.2 Description of the Sample

To assist in the interpretation of the results of the survey, the demographic data of Part Six of the questionnaire are presented in Tables 2 and 3. The sample (Table 2) represents the Cornwall population well with regards to age and sex distributions. When asked if they considered themselves English-speaking, French-speaking or other, 57.5% responded that they were English-speaking. Only 12.6% considered themselves French-speaking, while 28.5% stated that they were bilingual (French and English). These data are quite different from those given for the Census since the Census questionnaire asked for the respondent's mother tongue. Table 3 reveals that a level of education of elementary or high school was achieved by 59.2%, followed by 25.8% having reached a community college level. University level was attained by 14.9% of the respondents. Although 53.5% of respondents said they smoked regularly at some point in their life, only 30.7% stated that they currently smoke. The majority of respondents, 70.9%, exercise regularly. More than fifty-four percent (54.7%) rated their personal health as good. The remaining respondents rated their personal health as excellent (20.6%), fair (20.1%) or poor (4.6%). Only 50.0% were currently employed. The other 50.0% were either student, retired, or unemployed. Only 254 out of 437 answered the question on family income. Of these, 46.3% have an annual family income of less than $50,000. The mean number of years lived in Cornwall was 28.2 years, ± 19.52 years.

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[a] The preliminary results of this project were presented at the "Ecosystem Recovery on the St. Lawrence conference in June 1994[53]. The final results were presented at the "Sharing Knowledge, Linking Sciences" International Conference on the St. Lawrence Ecosystem in May 1995[54].

Table 1. Telephone Calls Statistics.

	Total	% of Total	% of Non-Contacts	% of Contacts
Total Numbers Called	1151	100.0		
Non-Contacts	453	39.3	100.0	
Numbers not in	276		60.9	
Non-Residential	48		10.6	
No Answer	89		19.6	
Answering Machine	9		2.0	
Busy Signal	2		0.4	
Fax/Modem	27		6.0	
Cellular Phone	2		0.4	
Contacts	698	60.7		100.0
Household Refusal	190			27.2
Already Answered*	10			1.4
Language Problem	1			0.1
Respondent	56			8.0
Respondent not In	2			0.3
Incomplete	2			0.3
Complete Interview	437			62.6

*Another survey for the Ecosystem Recovery on the St Lawrence Project was started during the same time. They phoned potential respondents to see if they would participate in their mail survey before sending them the questionnaire. This might explain why some people stated that they had already answered the survey.

Table 2. Comparison of some Demographic Data with the 1991 Census Data.

Variable	N	Categories	N	Percent of Respondents	Population of Cornwall from 1991 Census (Percent)
Sex Distribution	435	Males	168	38.6	47.4
		Females	267	61.4	52.6
Age Distribution	436	18-24	81	18.6	13.0
		25-29	37	8.5	10.8
		30-44	133	30.5	30.6
		45-54	72	16.5	14.1
		55-64	52	11.9	12.6
		65 and over	61	14.0	18.9
Language	435	English-Speaking	250	57.5	64.5
		French-Speaking	55	12.6	27.8
		Bilingual (French & English)	124	28.5	4.2
		Others	6	1.4	3.4

Table 3. Demographic Data.

Variable	N	Categories	N	Percent
Level of Education	434	elementary school	52	12.0
		high school	205	47.2
		community college	112	25.8
		university	54	12.4
		graduate school	11	2.5
Smoking Status	437	Eversmoked Yes	234	53.5
		No	203	46.5
		Smoke Now Yes	134	30.7
		No	303	69.3
Regular Exercise	436	Yes	303	70.9
		No	127	29.1
Personal Health Rating	437	Excellent	30	20.6
		Good	239	54.7
		Fair	88	20.1
		Poor	20	4.6
Currently Employed	436	Yes	218	50.0
		No	218	50.0
Income	405	under $19999	60	14.8
		$20000-$29999	50	12.3
		$30000-$39999	35	8.6
		$40000-$49999	43	10.6
		$50000-$59999	37	9.1
		$60000-$74999	7	1.7
		$75000 and over	22	5.4
		Refused	151	37.3
Mean Number of Years in Cornwall:				28.20 ± 19.52

4.3 Univariate Analysis

4.3.1 Word Associations

In the Part One of the questionnaire, the respondents were asked for their associations to the words "chemicals", "risk", and "pollution". Table 4 displays the responses to the word "chemicals". The number one answer was pollution, representing 19.1% of the responses. Domtar followed, with 12%. Negative terms such as bad, scary, gross, etc., made up 6.9% of the cases. Words such as laundry detergent, soap, or specific names of cleaning agents like Comet made up 6.5% of responses under the "cleaning agents" category. Terms relating to danger, such as hazardous or dangerous fell under the "dangerous" category and made up 6.1% of the responses. Chemical companies and manufacturing plants were either specifically mentioned (other than Domtar) or words such as industries, factories, were used in 6.0% of responses. The complete list of word associations is enumerated in Table 4. It is interesting to note that a positive term, "useful", was only given by one person, or 0.2% of respondents. Water and river, both associations of interest to the Ecosystem Recovery on the St. Lawrence project, were stated by 1.2% and 1.0% of respondents respectively.

Associations to the word "risk" are listed in Table 5. A percentage of 21.7 of respondents associated the word risk with danger. Illnesses or the term "health risk" were stated by 16.1% of the sample. In this category, the word illness or disease was mentioned, or a specific disease such as cancer or heart attack was named. In 6.1% of responses, people made simple associations or gave simple definitions of the word risk. Answers such as "risky", "hazard", "high risk" all fell in this category. Accidents were named in 5.4% of the interviews. The word chance or the expression "taking a chance", and the words environment or pollution both appeared in 4.6% of responses. Domtar was named by 3.1% of respondents. Water and river were mentioned in 1.0% and 0.8% of responses. Two respondents, or 0.5%, associated the word risk with Cornwall. Two respondents had more positive thoughts about risk; one said minimal, the other one said safe. For the complete list, see Table 5.

Table 4. Associations to the Word "Chemicals"

Association	Frequency	Percent	Cumulative Percent
Pollution	78	19.1	19.1
Domtar	49	12.0	31.1
Negative Terms	28	6.9	38.0
Cleaning Agents	26	6.5	44.5
Dangerous	25	6.1	50.6
Chemical Companies, Manufacturing Plants	24	6.0	56.6
Chemical Products	23	5.6	62.2
Poisonous	18	4.4	66.6
Chemistry and Related Apparatus	17	4.2	70.8
Medicines, Drugs	12	2.9	73.7
Pesticides	12	2.9	76.6
Toxic	9	2.2	78.8
Acid/Burn	9	2.2	81.0
Air	9	2.2	83.2
Unhealthy	8	2.0	85.2
Gasoline	6	1.5	86.7
Environment	6	1.5	88.2
Fertilizers	5	1.2	89.4
Chemical Compounds	5	1.2	90.6
Toxic Waste	5	1.2	91.8
Water	5	1.2	93.0
Food	5	1.2	94.2
Accidents/Spills	4	1.0	95.2
Explosion/Reaction	4	1.0	96.2
River	4	1.0	97.2
Cars	2	0.5	97.7
Soil	2	0.5	98.2
Useful	1	0.2	98.4
Engineering	1	0.2	98.6
Smoke	1	0.2	98.8
Hospital	1	0.2	99.0.
Liquid	1	0.2	99.2
Earth	1	0.2	99.4
Sewers	1	0.2	99.6
Conservation Agent	1	0.2	99.8
Dust	1	0.2	100.0
Total	409	100.0	100.0

Table 5. Associations to the Word "Risk"

Associations	Frequency	Percent	Cumulative Percent
Danger	85	21.7	21.7
Illness/Health Risk	63	16.1	37.8
Simple Associations, Definitions	24	6.1	43.9
Accidents	21	5.4	49.3
Chance	18	4.6	53.9
Environment/Pollution	18	4.6	58.5
Life	15	3.8	62.3
Economic/Financial	13	3.3	65.6
Industrial Processes/Products	12	3.1	68.7
Domtar	12	3.1	71.8
Cigarette Smoking	10	2.6	74.4
General Prescriptions/Caution	9	2.3	76.7
Air	9	2.3	79.0
Sex	8	2.0	81.0
Uncertainty/Fear	8	2.0	83.0
Adventure/Challenge/Sports	7	1.8	84.8
Children	7	1.8	86.6
Games/Gambling	6	1.5	88.1
Fire/Explosions	6	1.5	89.6
Work/Job	5	1.3	90.9
War/Weapons	4	1.0	91.9
Water	4	1.0	92.9
River	3	0.8	93.7
Poison	3	0.8	94.5
Drugs	3	0.8	95.3
Love	2	0.5	95.8
Cornwall	2	0.5	96.3
World	2	0.5	96.8
Fish	2	0.5	97.3
Sun	2	0.5	97.8
Food	2	0.5	98.3
Minimal/Safe	2	0.5	98.8
Laundry	1	0.3	99.1
Rat	1	0.3	99.4
Population	1	0.3	99.7
Wires	1	0.3	100.0
Total	391	100.0	100.0

Table 6. Associations to the Word "Pollution"

Associations	Frequency	Percent	Cumulative Percent
Domtar	81	18.7	18.7
Air	62	14.3	33.0
Other Chemical Companies, Manufacturing Plants	30	6.9	39.9
Dirt/Dirty	21	4.8	44.7
Water	19	4.4	49.1
Infection/Disease/Unhealthy	19	4.4	53.5
Negative Terms	19	4.4	57.9
Cornwall	18	4.2	62.1
Smoke	17	3.9	66.0
River/Lake	16	3.7	69.7
Acid Rain	14	3.2	72.9
St Lawrence River	13	3.0	75.9
Cars/Vehicles	13	3.0	78.9
Environment	10	2.3	81.2
Danger	9	2.1	83.3
Asthma/Lungs	8	1.8	85.1
Garbage	8	1.8	86.9
Chemicals/Contamination/PCBs	8	1.8	88.7
Smog	7	1.6	90.3
Ozone Layer	5	1.2	91.5
Cigarette Smoking	4	0.9	92.4
Death	3	0.7	93.1
Risk	3	0.7	93.8
Poison	3	0.7	94.5
Sewers	3	0.7	95.2
Control	3	0.7	95.9
Big Cities	3	0.7	96.6
Improving/Exagerated	3	0.7	97.3
Accident/Dammage	2	0.5	97.8
Oil	2	0.5	98.3
Waste	2	0.5	98.8
Fish	1	0.2	99.0
Earth	1	0.2	99.2
Smell	1	0.2	99.4
Poor Living Conditions	1	0.2	99.6
Mix	1	0.2	99.8
Total	433	100.0	100.0

The word "pollution" was not in the Canadian survey but was of interest to the Ecosystem Recovery on the St. Lawrence project. Table 6 shows the complete list of associations. "Domtar" was the most common association, representing 18.7% of responses. "Air" came in second, with 14.3% of responses, followed by categories such as "Other chemical companies and manufacturing plants" with 6.9%, "dirt or dirty" with 4.8%, and "water" with 4.4%. Cornwall represented 4.2% of responses, "river or lake" 3.7%, and "St. Lawrence River" 3.0%. Fish was only mentioned by one respondent, or 0.2%. Only three respondents, or 0.7% thought that pollution was improving or was exaggerated.

4.3.2 Risk Perception

Part Two of the questionnaire assessed perceived level of health risk related to environmental issues. The respondents were first asked if they thought these issues held almost no health risk, a slight health risk, a moderate health risk, or a high health risk to themselves and their family. They were then given the same list and asked how much of a health risk they perceived each item to be to the Canadian public in general.

Table 7 and Figure 2 display the results obtained for the perceived health risk to the respondent and his or her family by river water, depletion of the ozone layer, outdoor air, chemical pollution, PCB or dioxin, pesticides in food, tap water and bottled water. Table 8 and Figure 3 shows the perceived health risk for the same items to the Canadian public.

More than 60%, or 62.4% of respondents think that river water is a high health risk to themselves and their family. Conversely, less than 40% think that river water is a high health risk to the Canadian population in general. Outdoor air is also a concern to residents of Cornwall, as about 45% of respondents perceive it to be a high health risk to themselves and their family, while less than 20% see it as a high health risk to the Canadian public.

Table 7. Perceived Health Risks to Respondent and Family from various environmental factors from the Cornwall Survey.

Environmental Factor	N	High Health Risk (%)	Moderate Health Risk (%)	Slight Health Risk (%)	Almost No Health Risk (%)	Don't Know (%)
River Water	439	62.4	27.3	6.8	2.7	0.7
Ozone depletion	438	54.1	28.8	8.9	2.3	5.9
Outdoor air	439	45.8	36.0	13.9	3.9	0.5
Chemical pollution	439	44.2	38.5	13.2	3.2	0.9
PCB or dioxin	439	33.0	29.6	11.8	5.5	20.0
Pesticides in food	439	24.1	35.3	27.8	10.0	2.7
Tap water	439	17.3	29.2	31.7	19.4	2.5
Bottled water	439	3.0	8.0	17.5	65.6	5.9

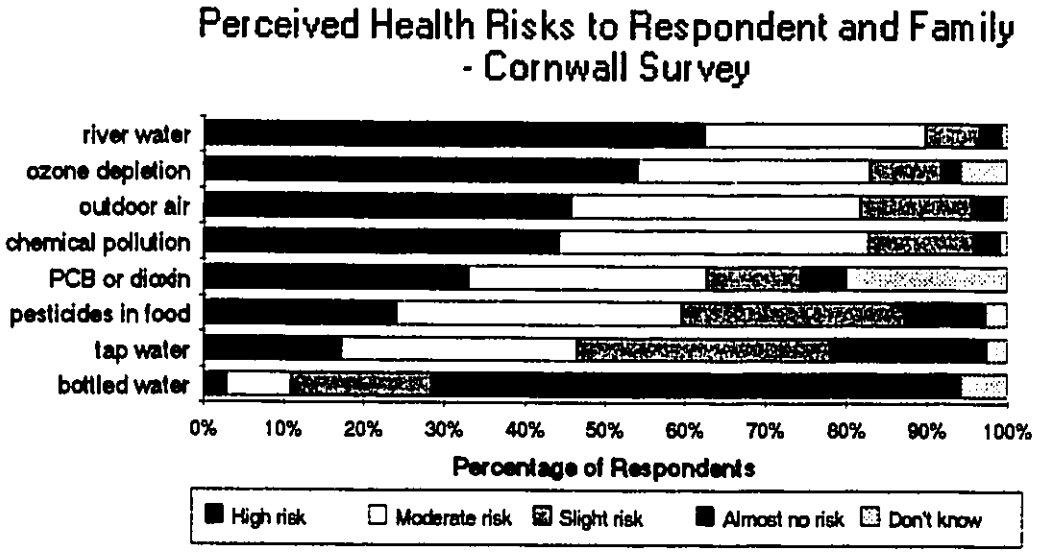


Figure 2. Perceived Health Risk to Respondent and Family from various environmental factors.

Table 8. Perceived Health Risks to Canadian Public from various environmental factors from the Cornwall Survey.

Environmental Factor	N	High Health Risk (%)	Moderate Health Risk (%)	Slight Health Risk (%)	Almost No Health Risk (%)	Don't Know (%)
Ozone depletion	436	53.9	29.8	8.0	2.3	6.0
River water	438	35.8	44.3	16.0	2.7	1.1
Chemical pollution	438	29.7	48.4	17.6	2.5	1.8
PCB or dioxin	438	24.4	32.4	16.9	5.5	20.8
Pesticides in food	438	21.0	41.3	27.4	6.6	3.7
Outdoor air	437	17.6	54.5	22.2	4.8	0.9
Tap water	438	12.1	32.6	30.4	22.1	2.7
Bottled water	438	2.1	8.9	16.9	65.8	6.4

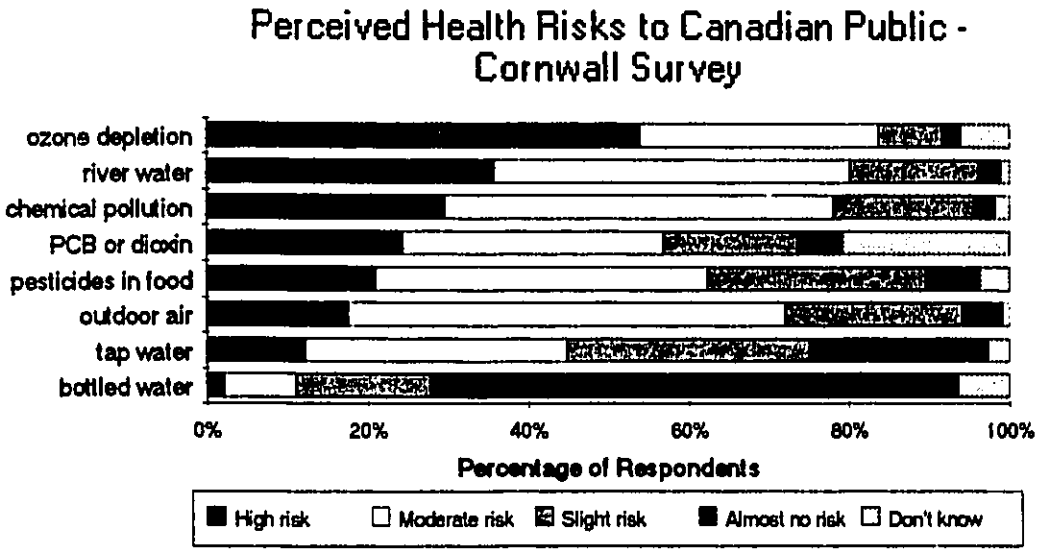


Figure 3. Perceived Health Risk to the Canadian Public from various environmental factors.

As shown in Figure 4, the percentage of respondents that answered "high health risk" to themselves and their family is greater for most items than the percentage of respondents who answered "high health risk" to the Canadian public. Chi-squared tests revealed that some of these differences are statistically significant ($p<0.05$), as indicated in Table 9. The results suggest that the residents of Cornwall perceived that the health risks to themselves and their family are greater than to the general Canadian public.

Table 10 and Figure 5 compare the percentage of respondents in the present survey with the percentage of respondents in the Canadian survey that perceived the items to be a high health risk to the Canadian public. The residents of Cornwall tend to perceive the items to be less of a health risk than the respondents in Health Canada's survey. Some differences are statistically significant ($p<0.05$), as indicated in Table 10.

4.3.3 Risk Perception - Section on Cornwall

A section on Cornwall was added as Part Three of the questionnaire.. This was done to compare the responses with responses from Part Two on risk perception. Results from this section can be found in Table 11 and Figure 6.

Almost 70% of respondents think that the water of the St. Lawrence River, fish from the St. Lawrence River, and mercury in fish or water are a high health risk to their health and their family's. Close to 60% view PCB in fish and outdoor air in Cornwall as a high health risk. About 30% think the tap water in Cornwall is a high health risk.

If we compare these responses to those given in part two, we can see from Table 12 and Figure 7 that when the items are more specific to Cornwall, a larger percentage of respondents perceived them to be a high health risk. When asked to rate river water in part two, a little over 60% of respondents saw it as a high health risk to themselves and their family. When the St. Lawrence River was specifically identified, this percentage raised to almost 70%. Similarly, when asked about PCBs or dioxin in part two, less than 35% responded "high health risk". When asked about PCB in fish in part three, close to 60% answered "high health risk".

Table 9. Comparison between Perceived High Health Risk to the Respondent and Family and to the Canadian Public from various environmental factors from the Cornwall Survey

Environmental Factor	High Health Risk to Respondent and Family (%)	High Health Risk to Canadian Public (%)	X^2	p
River water	62.4	35.8	61.93	0.000
Ozone depletion	54.1	53.9	0.00	0.950
Outdoor air	45.8	17.6	80.19	0.000
Chemical pollution	44.2	29.7	19.82	0.000
PCB or dioxin	33.0	24.4	7.92	0.005
Pesticides in food	24.1	21.0	1.24	0.266
Tap water	17.3	12.1	4.75	0.029
Bottled water	3.0	2.1	0.74	0.390

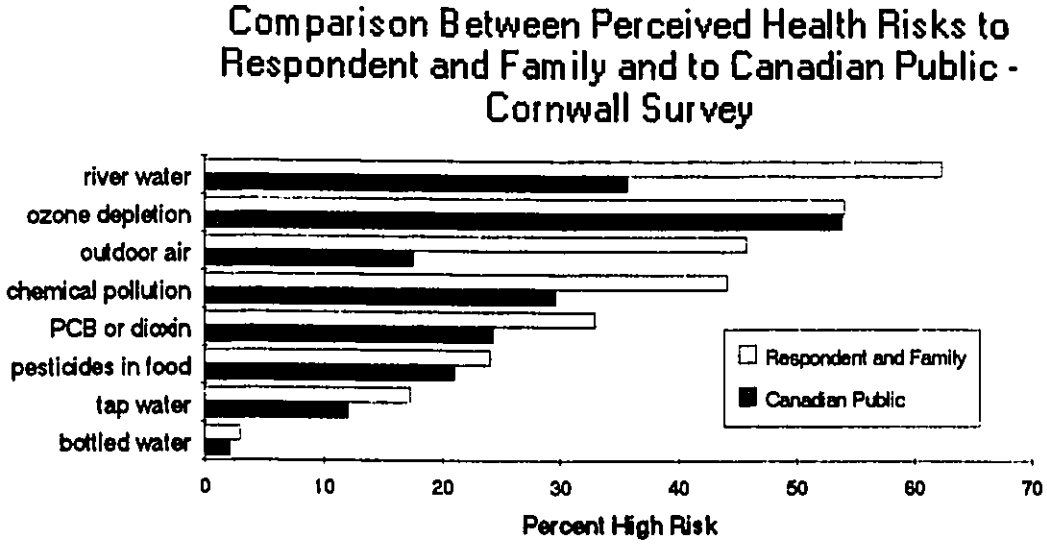


Figure 4. Comparison between Perceived Health Risk to the Respondent and Family and Perceived Health Risk to the Canadian Public.

Table 10. Comparison of Perceived High Health Risks to the Canadian Public from various environmental factors between the Canadian Survey and the Cornwall Survey.

Environmental Factor	Canada Survey (%)	Cornwall Survey (%)	X^2	p
Ozone depletion	59.0	53.9	3.60	0.058
Chemical pollution	53.2	29.7	75.15	0.000
PCB or dioxin	39.7	24.4	34.35	0.000
Pesticides in food	37.2	21.0	39.89	0.000
Outdoor air	17.6	17.6	0.00	0.992
Tap water	12.2	12.1	0.00	0.955
Bottled water	5.1	2.1	7.33	0.007

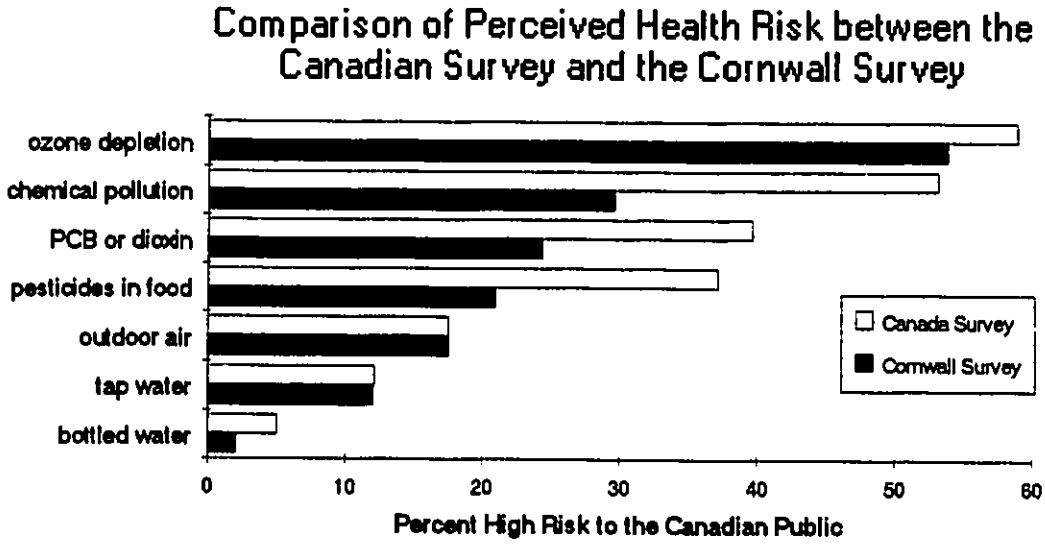


Figure 5. Comparison between Perceived Health Risk to the Canadian Public from the "Health-Risk Perception in Canada" Survey and from the Cornwall Survey.

Table 11. Perceived Health Risks in Cornwall area.

Environmental Factor	N	High Health Risk (%)	Moderate Health Risk (%)	Slight Health Risk (%)	Almost No Health Risk (%)	Don't Know (%)
Water from St Lawrence River	439	68.8	23.0	5.2	2.3	0.7
Fish from St Lawrence River	439	68.8	21.9	5.9	2.1	1.4
Mercury in fish or water	438	67.4	21.2	5.7	1.4	4.3
PCB in fish	438	57.1	21.9	4.3	0.7	16.0
Outdoor air in Cornwall	439	56.0	32.1	8.7	3.2	0.0
Tap water in Cornwall	439	29.4	26.4	26.9	14.8	2.5

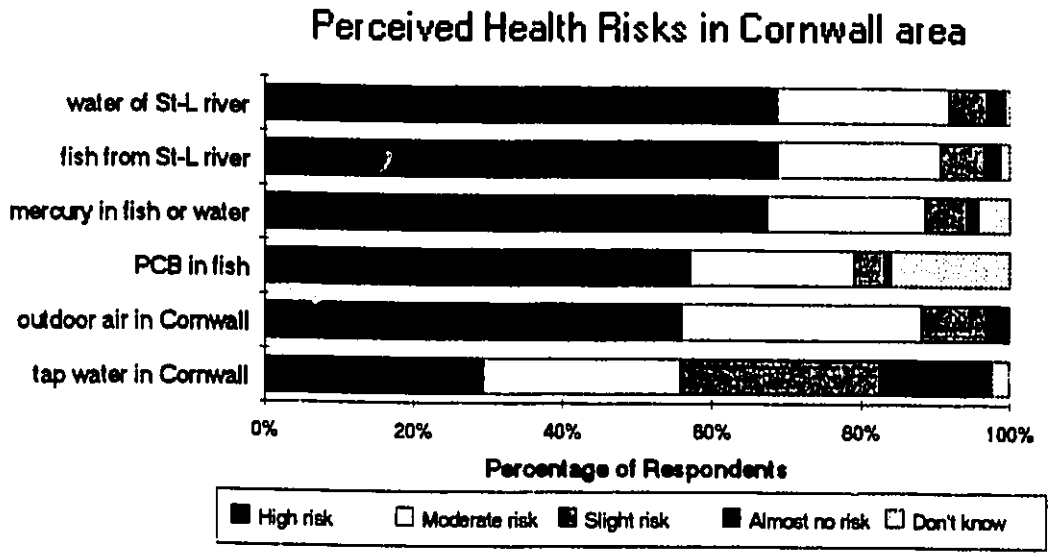


Figure 6. Perceived Health Risk to the Respondent and Family from various environmental factors in the Cornwall area.

Table 12. Comparison between Questions from Part Two on Risk Perception and Questions from Part Three on Cornwall

Environmental Factor Part Two	High Health Risk Part Two	Environmental Factor Part Three	High Health Risk Part Three	X^2	p
river water	62.4	St Lawrence river	68.8	3.96	0.046
PCB or dioxin	33.0	PCB in fish	57.1	51.22	0.000
outdoor air	45.8	outdoor air in Cornwall	56.0	9.23	0.002
tap water	17.3	tap water in Cornwall	29.4	17.88	0.000

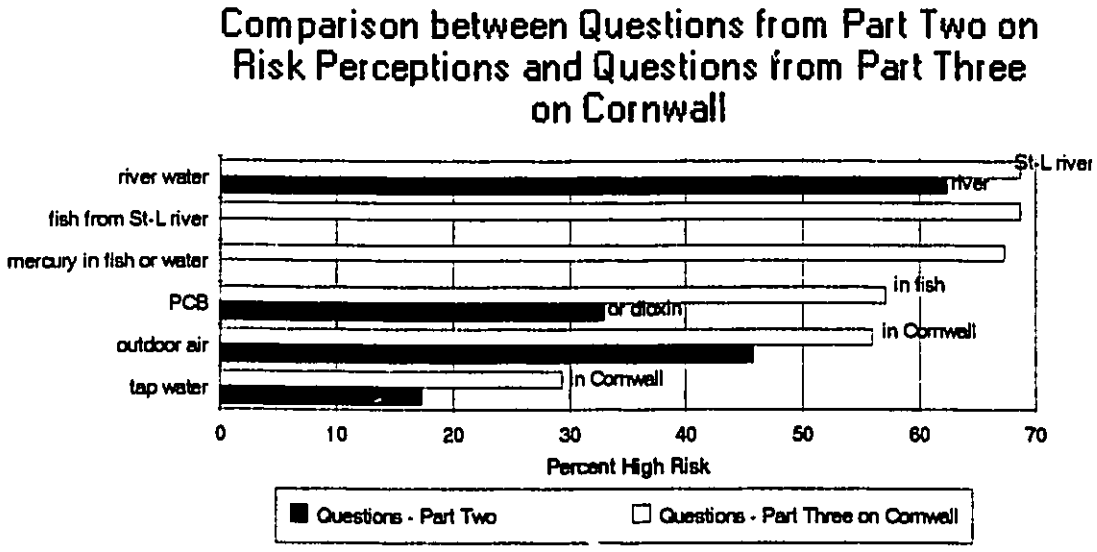


Figure 7. Comparison between similar questions from Part One and questions from Part Two.

4.3.4 Sources of Information and Level of Confidence

Part Four of the survey aimed at identifying the sources of information where residents of Cornwall get their information on health issues and risk, and how much confidence they have in these sources. Table 13 and Figure 8 show the percentage of respondents that said they got a lot of information, a fair amount of information, a little information or almost no information from the sources.

Not surprisingly, 38% of respondents get a lot of information of information regarding health and risk issues from the news media such as television, radio and newspaper. Environment Canada, public interest groups, medical doctors, Health Canada, and friends and relatives provide a lot of information to 19%, 17.5%, 15.4% 15.1% and 15% of respondents respectively. Respondents get the least amount of information from Agriculture Canada, the municipal government, the provincial government, university scientists and the private industry. The order of importance of the sources of information varies slightly between the Cornwall survey and the Canadian survey (see Figure 9). However, both surveys show that the main source of information about health issues and risk is the media, while the smallest source is private industry.

Table 14 and Figure 10 reveal that 33.6% of respondents have a lot of confidence in medical doctors, while 28.3% and 26.7% have a lot of confidence in Health Canada and Environment Canada respectively. The confidence level decreases regarding Agriculture Canada, university scientists, public interest groups, news media, friends and relatives, municipal government and provincial government. The least amount of confidence is given to private industry. The order of the level of confidence in these sources varies slightly with the Canadian survey (see Figure 11) but the sources at the most and least important sources remain the same.

Table 13. Sources of Information about Health Issues and Risk from the Cornwall Survey.

Source of Information	N	A lot of Information (%)	A Fair Amount of Information (%)	A Little Information (%)	Almost No Information (%)	Don't Know (%)
News media	436	38.0	41.1	15.1	5.3	0.2
Environment Canada	436	19.0	32.1	26.1	21.6	1.1
Public interest groups	435	17.5	28.7	26.7	24.8	2.3
Medical doctors	436	15.4	30.0	29.6	24.8	0.2
Health Canada	436	15.1	37.6	22.9	22.2	2.1
Friends and relatives	432	15.0	36.6	28.5	19.7	0.2
Agriculture Canada	436	9.4	27.3	28.2	32.1	3.0
Municipal government	435	6.2	20.7	34.7	37.5	0.9
Provincial government	435	5.1	23.4	33.6	37.0	0.9
University scientists	434	4.1	18.7	24.2	50.0	3.0
Private industry	436	2.5	14.7	28.9	53.4	0.5

Table 14. Level of Confidence in Information Sources from the Cornwall Survey.

Source of Information	N	A Lot of Confidence (%)	A Fair Amount of Confidence (%)	A Little Confidence (%)	Almost No Confidence (%)	Don't Know (%)
Medical doctors	432	33.6	38.2	18.8	8.8	0.7
Health Canada	431	28.3	37.8	23.0	9.3	1.6
Environment Canada	430	26.7	38.6	23.7	9.3	1.6
Agriculture Canada	429	21.4	36.6	27.3	11.9	2.8
University scientists	428	19.2	37.4	24.3	14.7	4.4
Public interest groups	431	16.2	32.0	31.8	17.9	2.1
News media	435	15.2	49.7	25.5	9.0	0.7
Friends and relatives	432	13.9	39.1	31.0	15.3	0.7
Municipal government	432	8.8	26.6	35.2	28.5	0.9
Provincial government	432	5.3	27.3	39.4	27.3	0.7
Private industry	432	4.9	17.8	33.1	43.1	1.2

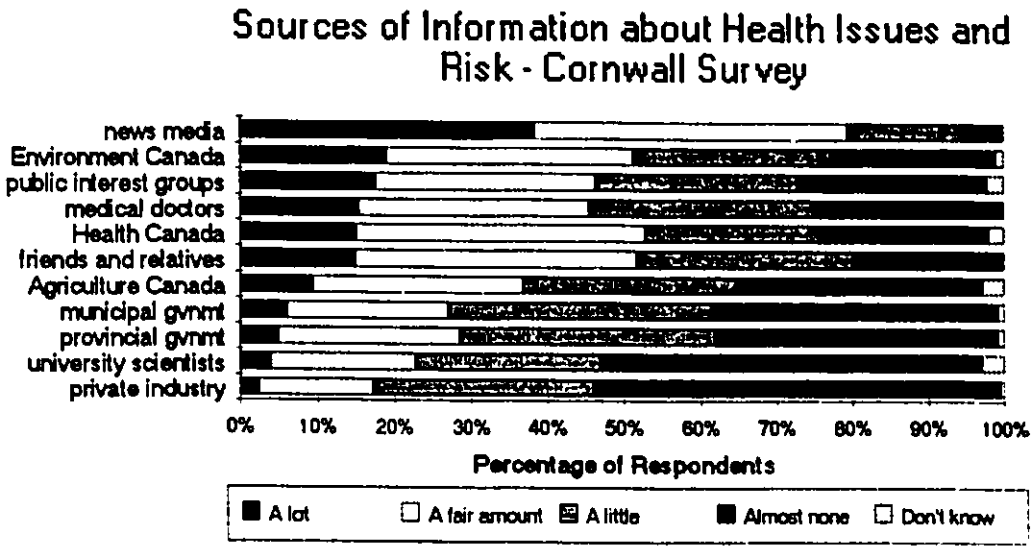


Figure 8. Sources of Information about Health Issues and Risk from the Cornwall Survey.

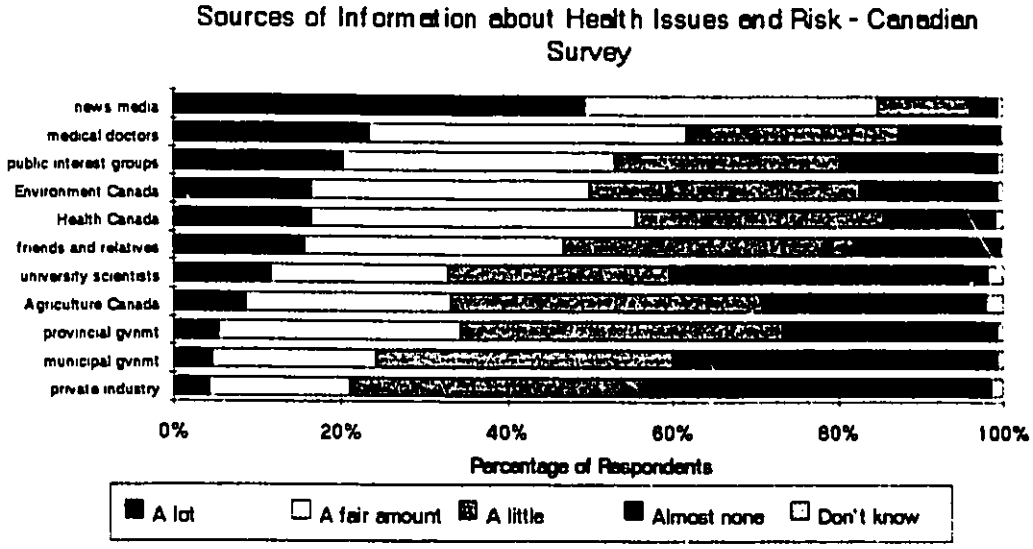


Figure 9. Sources of Information about Health Issues and Risk from the Canadian Survey.

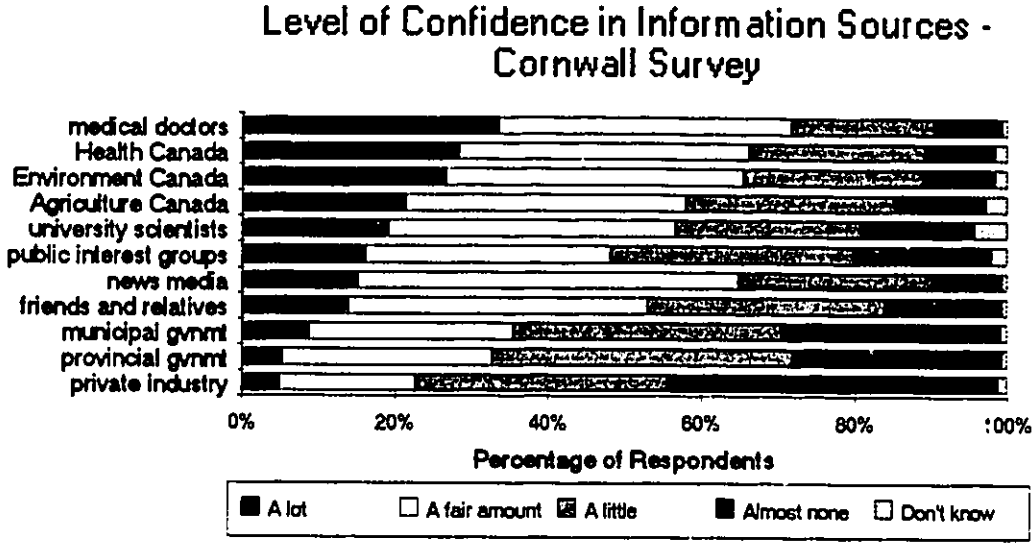


Figure 10. Level of Confidence in Information Sources from the Cornwall Survey.

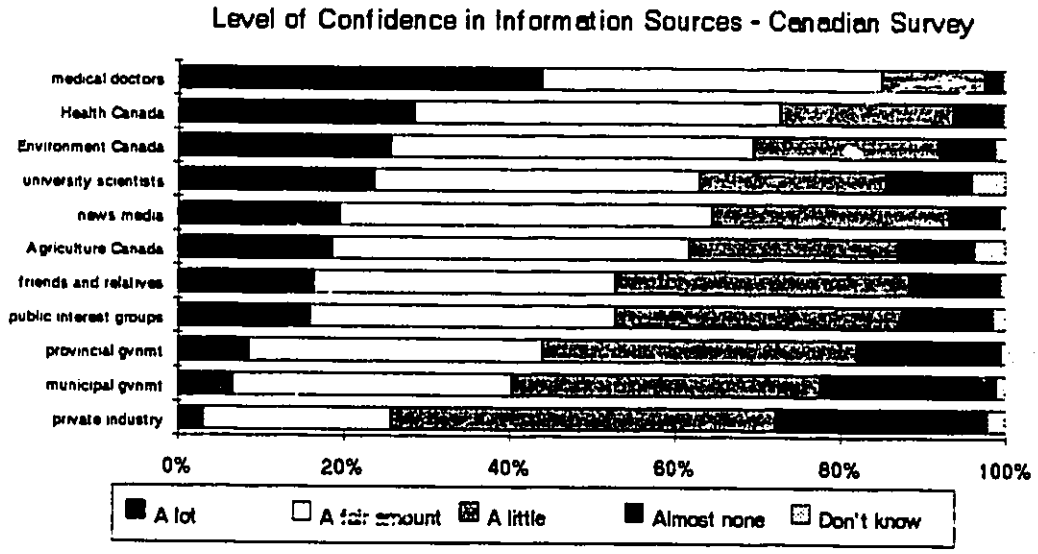


Figure 11. Level of Confidence in Information Sources from the Canadian Survey

4.3.5 Attitudes and Opinions

Attitudes and opinions regarding various environmental and health issues were sought in Part Five of the Questionnaire. This part was divided in three categories of questions:

1. Attitudes and opinions about local and global environment
2. Attitudes and opinions about health risks from chemicals
3. Attitudes and opinions about miscellaneous issues.

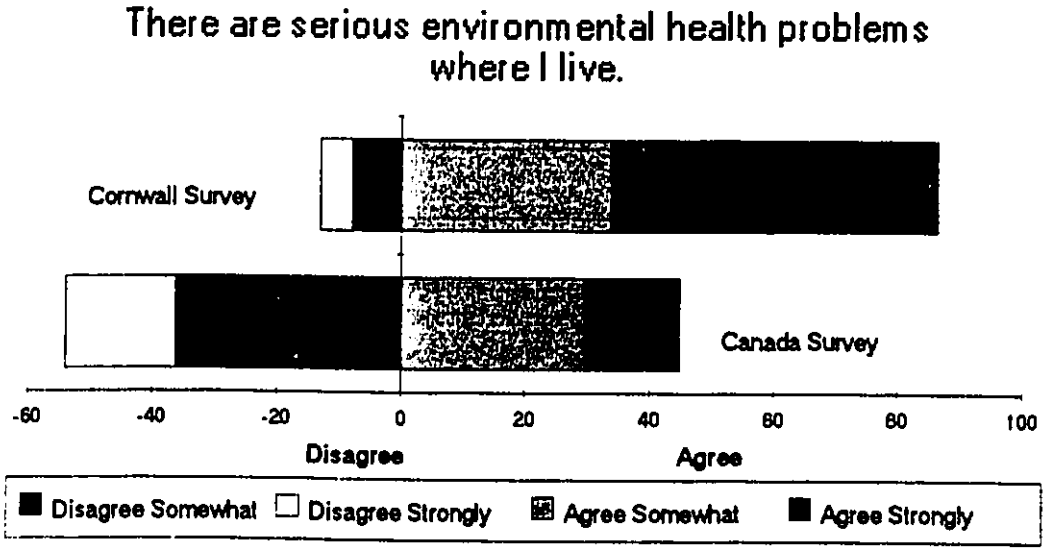
4.3.5.1 Attitudes and Opinions about Local and Global Environmental Health Risks

When given the statement "There are serious environmental health problems where I live.", over 85% of respondents agreed somewhat or strongly, as shown in Figure 12. This proportion was significantly different from the 45% obtained in the Health-Risk Perception in Canada survey and indicates the greater concern about environmental health problems in Cornwall.

Approximately 32% of Cornwall respondents disagreed strongly with the statement "I believe my community is becoming a healthier place in which to live.", as illustrated in Figure 13, while only about 22% of respondents from the Canadian survey disagreed strongly with this statement. The proportions of agree/disagree for both surveys seem similar. However, the difference is statistically significant, which means that people in Cornwall are less likely to believe that their community is improving than in Canada in general.

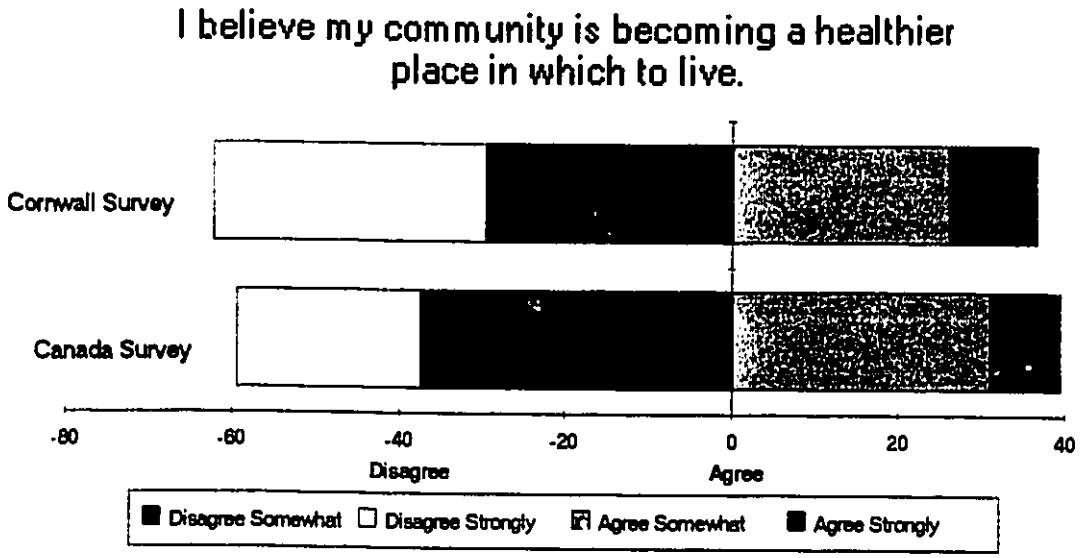
Figure 14 displays the responses to the statement "The land, air, and water around us are, in general, more contaminated now than ever before." The difference in proportions between the Cornwall survey and the Canadian survey is again significant, suggesting that people in Cornwall disagree more with this statement than the Canadian population.

Figure 15 shows a significant difference between the surveys' responses to the statement "The greenhouse effect is a serious problem which could lead to harmful changes in the environment and in people's health." Cornwall respondents do not place as much of an importance on the greenhouse effect as does the Canadian population in general.



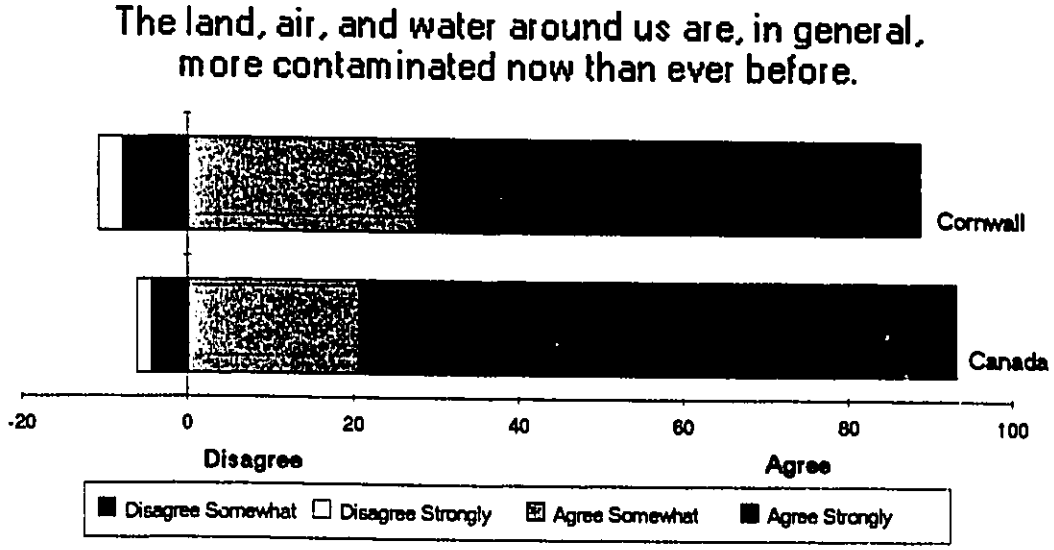
$\chi^2 = 329.10$, df = 3, p = 0.000001 $\chi^2_{trend} = 280.077$, p = 0.00000

Figure 12. Responses to the statement "There are serious environmental health problems where I live.



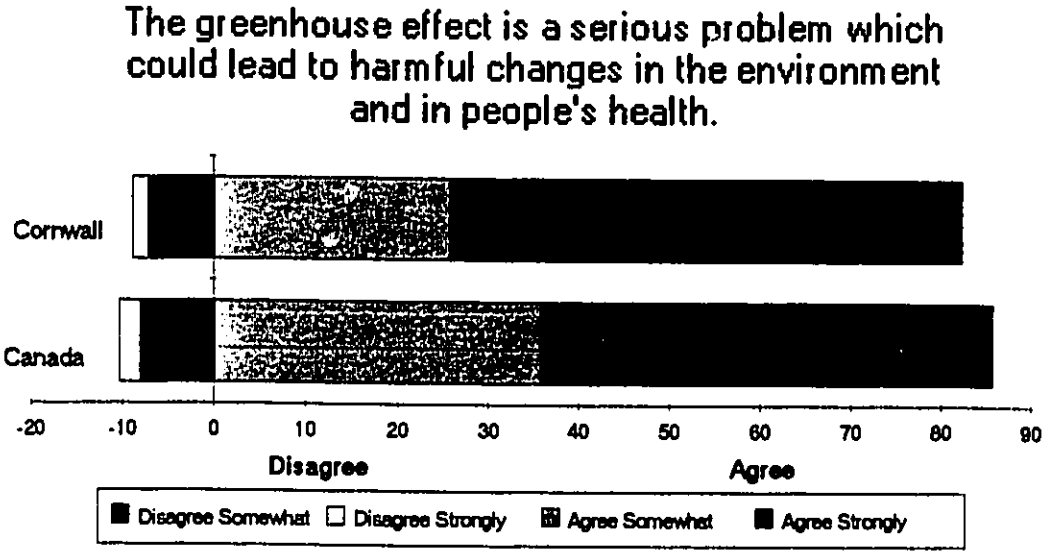
$\chi^2 = 26.20$, df = 3, p = 0.000009 $\chi^2_{trend} = 5.047$, p = 0.02466

Figure 13. Responses to the statement "I believe my community is becoming a healthier place in which to live."



$\chi^2 = 23.80$, df = 3, p = 0.000027 $\chi^2_{trend} = 21.611$, p = 0.00000

Figure 14. Responses to the statement "The land, air, and water around us are, in general, more contaminated now than ever before."



$\chi^2 = 13.33$, df = 3, p = 0.003967 $\chi^2_{trend} = 7.415$, p = 0.00647

Figure 15. Responses to the statement "The greenhouse effect is a serious problem which could lead to harmful changes in the environment and in people's health."

4.3.5.2 Attitudes and Opinions about Health Risks from Chemicals

The responses to the statement "Use of chemicals has improved our health more than it has harmed it." displayed in Figure 16 significantly demonstrate that Cornwall respondents believe this is untrue. About 70% disagree with this statement as opposed to about 55% in the Canadian survey.

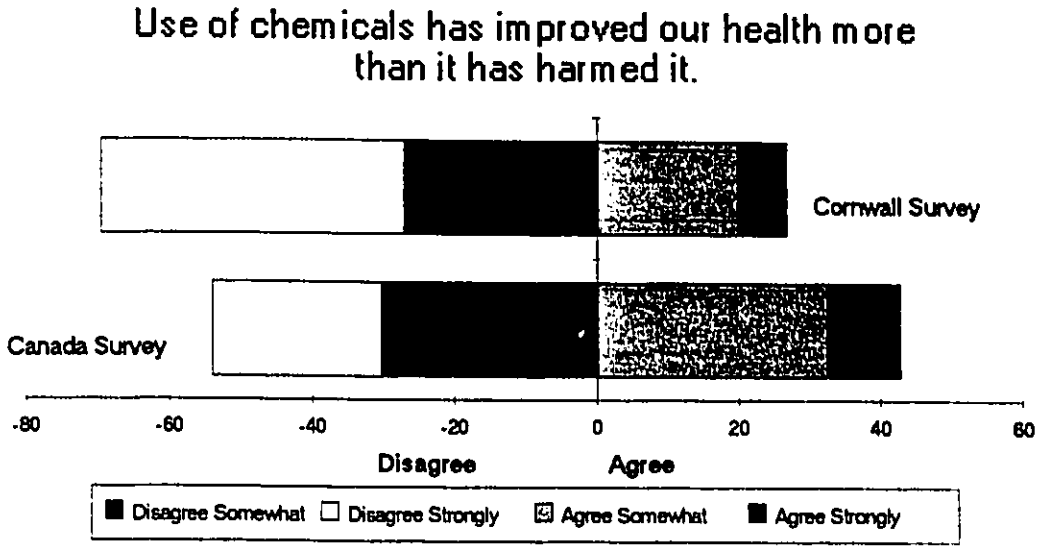
The opinions of the Cornwall respondents of the previous statement are supported in Figure 17 which shows the responses to the statement "Most chemicals cause cancer." Almost 60% of Cornwall respondents agreed with this statement, while less than 50% of respondents from the Canadian survey agreed. This difference is statistically significant.

Respondents in the Cornwall survey are equally concerned about chemicals as the respondents in the Canadian survey. Figure 18 indicates that there is no statistically significant difference between their responses to the statement "I don't worry much about chemicals because there are too many other things in my life that I have to deal with.".

Figure 19 displays the results obtained from the statement "I try hard to avoid contact with chemicals and chemical products in my daily life." Cornwall respondents are less likely to avoid chemicals than Canadian respondents. Statistics show significantly less Cornwall respondents agree and significantly more disagree with this statement.

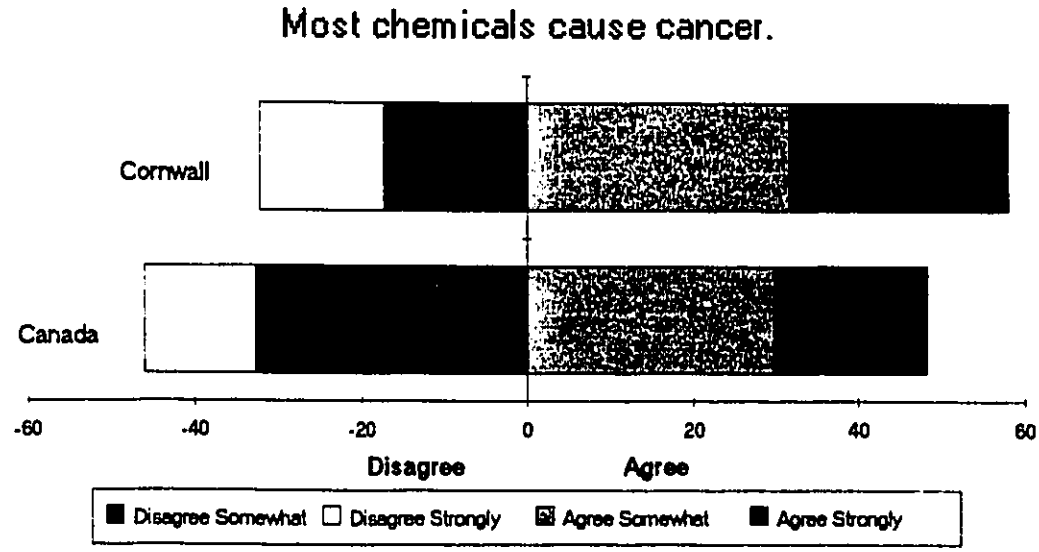
4.3.5.3 Attitudes and Opinions about Miscellaneous Questions

It would seem that the Cornwall respondents do not believe that "People can offset health risks from pollution by improving their individual lifestyle, such as exercising and eating properly". Figure 20 reveals that a statistically significant lower percentage of Cornwall respondents agree and a greater percentage disagree with this statement than the Canadian respondents.



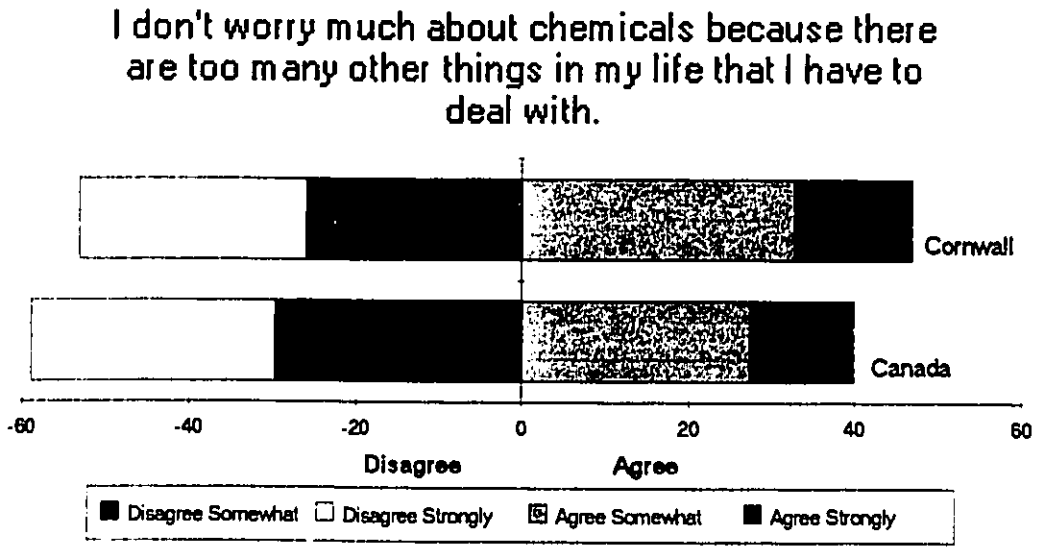
$\chi^2 = 65.32$, df = 3, p = 0.000000 $\chi^2_{trend} = 53.255$, p = 0.00000

Figure 16. Responses to the statement "Use of chemicals has improved our health more than it has harmed it."



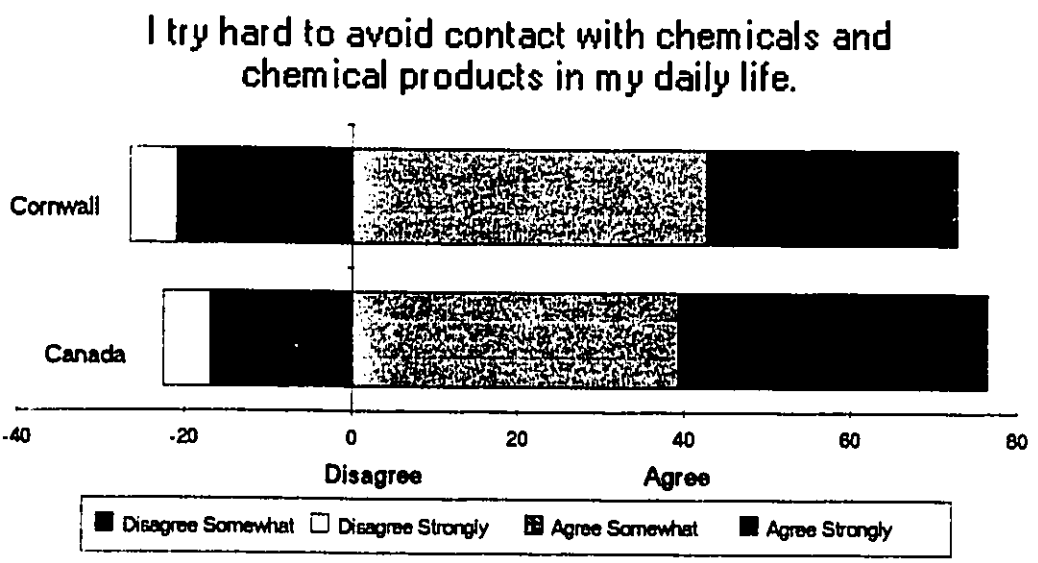
$\chi^2 = 39.54$, df = 3, p = 0.000000 $\chi^2_{trend} = 12.699$, p = 0.00037

Figure 17. Responses to the statement "Most chemicals cause cancer."



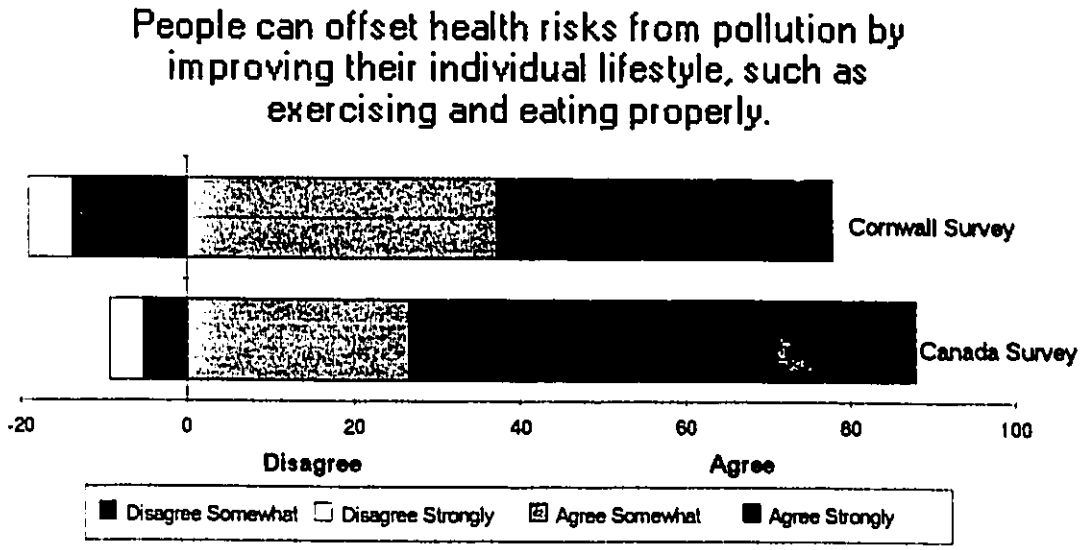
$\chi^2 = 6.20$, df = 3, p = 0.102176 $\chi^2_{trend} = 3.247$, p = 0.07154

Figure 18. Responses to the statement "I don't worry much about chemicals because there are too many other things in my life that I have to deal with."



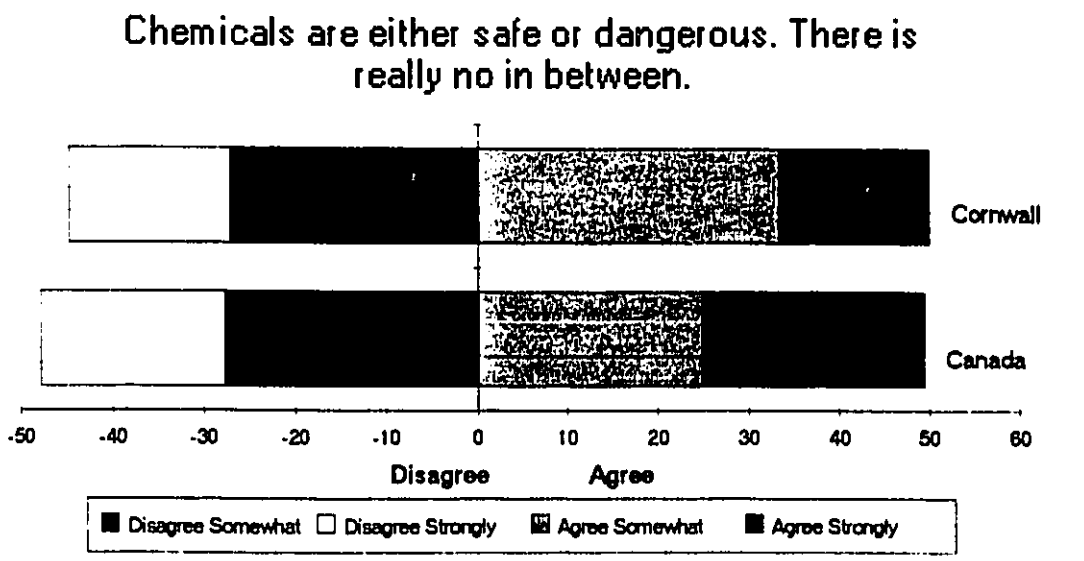
$\chi^2 = 8.41$, df = 3, p = 0.038187 $\chi^2_{trend} = 5.277$, p = 0.02160

Figure 19. Responses to the statement "I try hard to avoid contact with chemicals and chemical products in my daily life."



$\chi^2 = 74.34$, df = 3, p = 0.000000 $\chi^2_{trend} = 51.660$, p = 0.00000

Figure 20. Responses to the statement "People can offset health risks from pollution by improving their individual lifestyle, such as exercising and eating properly."



$\chi^2 = 20.25$, df = 3, p = 0.000151 $\chi^2_{trend} = 0.487$, p = 0.48536

Figure 21. Responses to the statement "Chemicals are either safe or dangerous. There is really no in between."

Figure 21 shows the proportions of Cornwall and Canadian respondents that agree and disagree with the statement "Chemicals are either safe or dangerous. There is really no in between." A slightly higher percentage of Cornwall respondents agree, and a lower percentage than the Canadian respondents disagree with this statement. This difference in proportions is statistically significant.

Less Cornwall respondents agree and more disagree that "Experts are able to make accurate estimates of the health risks from chemicals in the environment." than Canadian respondents, as Figure 22 indicates. Cornwall respondents have less confidence in experts than Canadians in general.

Cornwall respondents also feel they have little control over risks to their health. A significantly higher proportion of them agree with the statement "I feel that I have very little control over risks to my health." Figure 23 displays these results.

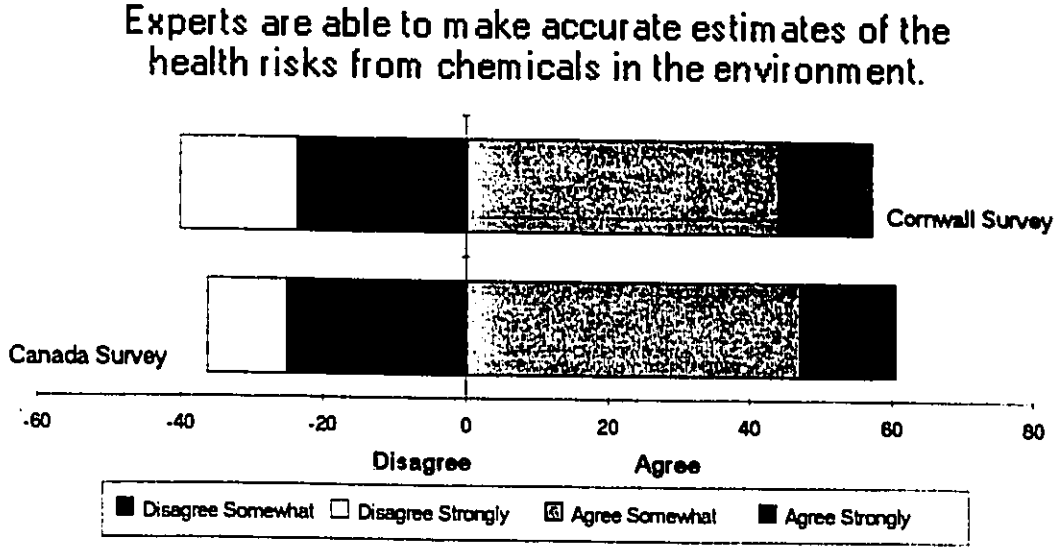
Table 15 presents a summary of the comparisons made between the results of the Cornwall survey and the results of the Canadian survey.

4.3.6 Personal, Behavioural and Demographic Data

Personal, behavioural and demographic data were collected in Part Six of the interview. The demographic data are presented in Chapter 7 (see Tables 2 and 3).

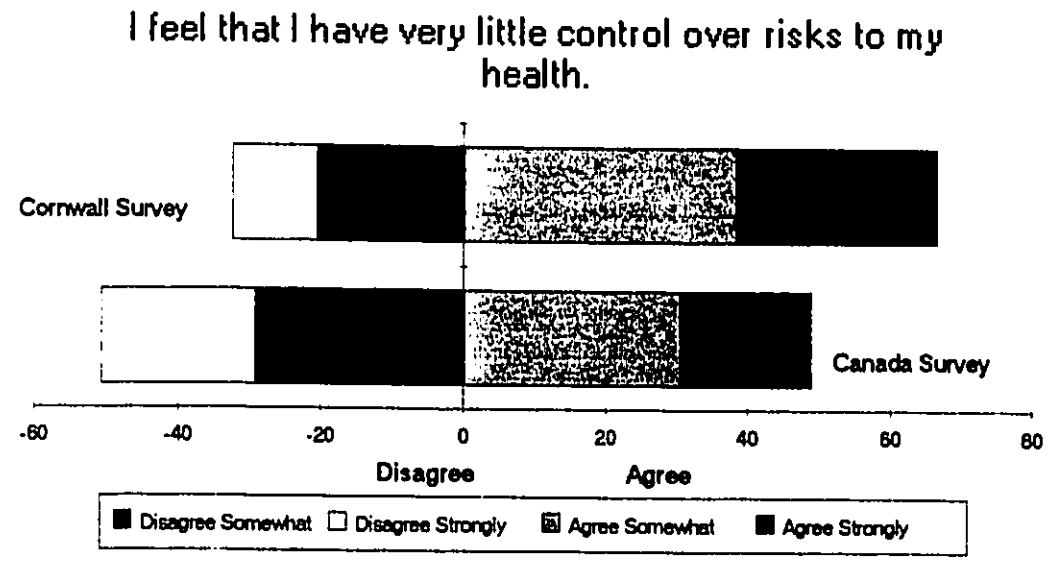
4.3.6.1 Participation in Risky Activities

The first behaviour of interest was the participation in risky activities. This type of question is useful to identify risk takers and to see what activities the respondents perceive as risky. Only 15.4% of respondents said that they participate in activities that others consider risky. The activities mentioned fit into three categories: sports/adventure, activities/behaviour, and occupation. The breakdown of these categories is listed in Table 16.



$\chi^2 = 8.58$, df = 3, p = 0.035445 $\chi^2_{trend} = 3.718$, p = 0.05382

Figure 22. Responses to the statement "Experts are able to make accurate estimates of the health risks from chemicals in the environment."



$\chi^2 = 48.04$, df = 3, p = 0.000000 $\chi^2_{trend} = 45.637$, p = 0.00000

Figure 23. Responses to the statement "I feel that I have very little control over risks to my health."

Table 15. Summary table of comparisons between Cornwall Survey and Canadian Survey.

Health risk perception regarding various environmental factors:

No statistically significant difference ($p>0.05$) found between the two surveys for the percentage of respondents stating that they perceive these environmental factors to be a high health risk to the Canadian public in general:

- depletion of the ozone layer
- outdoor air quality
- tap water

A statistically significant ($p<0.05$) lower percentage of Cornwall respondents stated that they perceive these environmental factors to be a high health risk to the Canadian public compared to the the Canadian Survey:

- chemical pollution in the environment
- PCB or dioxin
- pesticides in food
- bottled water

Sources of information regarding health issues and level of confidence in these sources:

A lot of information (descending %)		A lot of confidence (descending %)	
Cornwall Survey	Canadian Survey	Cornwall Survey	Canadian Survey
news media	news media	medical doctors	medical doctors
Environment Canada	medical doctors	Health Canada	Health Canada
public interest groups	public interest groups	Environment Canada	Environment Canada
medical doctors	Environment Canada	Agriculture Canada	university scientists
Health Canada	Health Canada	university scientists	news media
friends and relatives	friends and relatives	public interest groups	Agriculture Canada
Agriculture Canada	university scientists	news media	friends and relatives
municipal government	Agriculture Canada	friends and relatives	public interest groups
provincial government	provincial government	municipal government	provincial government
university scientists	municipal government	provincial government	municipal government
private industry	private industry	private industry	private industry

Table 15 (cont'd) Summary table of comparisons between Cornwall Survey and Canadian Survey.

Attitudes and Opinions about Local and Global Environmental Health Risks

A significantly higher percentage of Cornwall respondents than Canadian respondents agree that there are serious environmental health problems where they live.

A significantly lower percentage of Cornwall respondents than Canadian respondents

- believe that their community is becoming a healthier place in which to live.
- agree that the land, air and water around them are, in general, more contaminated now than ever before
- agree that the greenhouse effect is a serious problem which could lead to harmful changes in the environment and in people's health

Attitudes and Opinions about Health Risks from Chemicals

A significantly lower percentage of Cornwall respondents than Canadian respondents agree that:

- the use of chemicals has improved our health more than it has harmed it.
- they try hard to avoid contact with chemicals and chemical products in their daily life.

A significantly higher percentage of Cornwall respondents than Canadian respondents agree that most chemicals cause cancer.

No significant difference was found between the percentage of Cornwall and Canadian respondents that agree or diagree that they don't worry much about chemicals because there are too many other things in their life that they have to deal with.

Attitudes and Opinions about Miscellaneous Questions

A significantly lower percentage of Cornwall respondents than Canadian respondents agree that people can offset health risks from pollution by improving their individual lifestyle, such as exercising and eating properly.

No significant difference was found between the percentage of Cornwall and Canadian respondents that agree or diagree that:

- chemicals are either safe or dangerous and that there is really no in between.
- experts are able to make accurate estimates of the health risks from chemicals in the environment.

A significantly higher percentage of Cornwall respondents than Canadian respondents feel that they have very little control over risks to their health.

Table 16. Participation in Risky Activities

Participation in Risky Activities:	Yes: 15.4%	No: 84.6%	
Risky Activities Mentioned		Frequency	Total
Sports/Adventure			31
	Skiing	5	
	Hockey	3	
	White Water Rafting	3	
	Bungy Jumping	3	
	Motorcycle	3	
	Car Racing	3	
	"Sports"	2	
	Sky Diving	2	
	Camping	1	
	Cycling	1	
	Sea-Doo	1	
	Rock Climbing	1	
	Football	1	
	Scuba Diving	1	
	Four Wheeling	1	
Activities/Behaviour			30
	Smoking	10	
	Driving/Speeding	5	
	Work	3	
	Donating Blood	1	
	Overeating	1	
	Use of Household Chemicals	1	
	Drink a lot of Pepsi	1	
	Building a Maze for War Games	1	
	Smuggling Alcohol	1	
	Stock Market	1	
	Drugs	1	
	Sex	1	
	Smashing Cars	1	
	Church	1	
	Do Everything	1	
Occupation			10
	Armed Forces	3	
	Nursing	1	
	Work at the Mill	1	
	Extermination	1	
	Police Officer	1	
	Construction	1	
	Truck Driving	1	
	Airplane Pilot	1	

4.3.6.2 Sport Fish Consumption

Sport fish consumption habits are of great interest to the public health field as this behaviour results in exposure to the contaminants found in the St. Lawrence River. Guidelines are established in the Guide to Eating Ontario Sport Fish to advise the public on safe eating practices based on contaminant levels in fish in specific bodies of water.

Table 17 displays the results obtained from the sport fish consumption questions. Of all respondents, 33.6% stated that they eat fish caught in the St. Lawrence River. Most of them (77.4%) do so less than 10 times per year. The most common fish eaten is Perch, mentioned in 80.3% of responses. This fish is served in many restaurants in the Cornwall area and is often referred to as Lancaster Perch. Other species of fish are eaten less often, as shown in Table 17. Respondents were also asked if there are any kinds of fish they refuse to eat, which ones, and why. A total of 69.9% of respondents refuse to eat certain kinds of fish. The other 30.1% will eat any fish. Most respondents (54.5%) refuse to eat all kinds other than perch. Northern Pike, American Eel and Carp were the three kinds most often not eaten, representing 12.2%, 9.8% and 8.9% of responses respectively. The complete list can be found in Table 17. In 54.9% of the cases, certain species are not eaten because of their taste. Only 14.7% refuse to eat certain species because of concern regarding pollution or contamination, although 1.8% responded that they avoid some species because they are unsafe. Another 6.9% avoid scavengers, and 5.9% do not eat the "big" fish. Other reasons such as "too many bones", "don't know them" and "can't catch them" were mentioned.

Table 17. Sport Fish Consumption

Sport Fish Consumption (N=437)	Yes: 33.6%	No: 66.4%
Frequency of Sport Fish (N=146)		
Less than 10 times per year		77.4%
1 to 3 times per month		15.8%
1 to 3 times per week		6.8%
More than 3 times per week		0%
Kinds of Sport Fish Consumed (N=178)		
Yellow Perch		80.3%
Walleye		6.7%
Smallmouth Bass		3.9%
Rock Bass		3.4%
Northern Pike		2.2%
Channel Catfish		1.1%
American Eel		0.6%
Others		1.7%
Refuse to eat specific kind (N=146)	Yes : 69.9%	No: 30.1%
Kinds Refused (N=123)		
All Others		54.5%
Northern Pike		12.2%
American Eel		9.8%
Carp		8.9%
Pumpkinseed		5.7%
Rock Bass		3.3%
Channel Catfish		2.4%
Smallmouth Bass		1.6%
Brown Bullhead		0.8%
Black Crappie		0.8%
Reasons for Not Eating Specific Kinds (N=102)		
Mainly Taste		54.9%
Pollution/Contamination		14.7%
Unsafe		11.8%
Scavengers		6.9%
Too Big/Not the Big Ones		5.9%
Too Many Bones		2.9%
Don't Know Them		2.0%
Can't Catch Them!		1.0%

Table 18 provides information collected from the 66.4% who do not eat sport fish from the St. Lawrence River. Over forty six percent (46.3%) stated that the reason for not consuming sport fish from the St. Lawrence River is concern about pollution. Some (18.1%) perceive fish from the St. Lawrence River to be unsafe or unhealthy. Contamination and chemicals are a concern for 4.9% of non-eaters and mercury was specifically mentioned by 5.2% of respondents. The full list of reasons is available in Table 18. The Guide to Eating Ontario Sport Fish was familiar to only 23.6% of the sample interviewed (see Table 19). Of these respondents, only 42.2% have consulted it at one point.

4.3.6.3 Swimming in the St. Lawrence River

Perceptions concerning the health risks of swimming in the St. Lawrence River were also of interest. Table 20 reveals that only 24.0% of respondents swim in the St. Lawrence River. The 76% of respondents who don't were asked why. The most popular response was pollution, given by 38.0% of the sample. 24.8% either choose not to swim or cannot swim. Another 13.5% think the water is too dirty and of poor quality, while 10.7% feel it is unhealthy or unsafe. One respondent gave "weeds" as the reason for not swimming in the St. Lawrence River.

4.3.6.4 Medical Conditions

Another interest of the Ecosystem Recovery on the St. Lawrence project was to get people's perceptions on medical conditions and what they think might be the cause of them. The respondents were first asked if they have a medical condition, what this condition is, and what they think might be the cause of this condition. The same questions were asked regarding other persons in the household. In order of frequency, the top five responses were asthma (16.3%), arthritis (11.1%), allergies (9.2%), heart conditions (9.2%), and diabetes (7.8%). The complete list of responses can be found in Table 21.

Table 18. Sport Fish Non-Consumption

Reasons for Not Consuming Sport Fish (N=287)	
Concerned about Pollution	46.3%
Unsafe/Unhealthy	18.1%
Don't like fish/Don't eat fish	18.5%
Contamination/Chemicals	4.9%
Mercury	5.2%
Allergy	0.7%
No need to/Buy it	2.8%
Just moved to Cornwall	0.3%
Too Expensive	0.3%
Unavailable/Can't Catch Any	2.8%

Table 19. Awareness of Guide to Eating Ontario Sport Fish.

Familiar with Guide to Eating Ontario Sport Fish (N=432)	Yes: 23.6% No: 76.4%
Of those familiar with Guide, Used it (N=102)	Yes: 42.2% No: 57.8%

Table 20. Swimming in the St Lawrence River

Swim in the St Lawrence River (N=437)	Yes: 24.0% No: 76.0%
Reasons for Not Swimming in the St Lawrence River	
Pollution	38.0%
Don't Swim/Can't Swim	24.8%
Too Dirty	13.5%
Unhealthy/Unsafe	10.7%
Go Elsewhere/Pools	5.2%
Have a Pool	4.3%
No Time	2.1%
No Access/Not Available	0.6%
Too Cold	0.3%
Weeds!	0.3%

Table 21. Reported Medical Conditions

Medical Condition	Frequency	Percent
Asthma	25	16.3%
Arthritis	17	11.1%
Allergies	14	9.2%
Heart Conditions	14	9.2%
Diabetes	12	7.8%
Hypertension	10	6.5%
Back Problems	9	5.9%
Bronchitis	5	3.3%
Ulcer	4	2.6
Cancer	3	2.0
Thyroid Problems	3	2.0%
Angina	3	2.0%
Stroke	2	1.3%
Nervous Disorder	2	1.3%
Hay Fever	2	1.3%
Bladder Operation	2	1.3%
Migraine Headaches	2	1.3%
Bilateral Patella Femoral Syndrome	2	1.3%
Liver Problems	1	0.7%
Muscular Dystrophy	1	0.7%
Hypercholesterolemia	1	0.7%
Psoriasis	1	0.7%
Diverticulosis	1	0.7%
Handicapped Feet	1	0.7%
Anxiety Attacks	1	0.7%
Memory Loss	1	0.7%
Tumor	1	0.7%
Osteoporosis	1	0.7%
Temporal Mandibular Joint Problem	1	0.7%
Foot Spurs	1	0.7%
Lung Problems	1	0.7%
Epilepsy	1	0.7%
Cold	1	0.7%
Bad Legs	1	0.7%
Gout	1	0.7%
Blood Clot In Leg	1	0.7%
Partial Paralysis	1	0.7%
Teeth Infection	1	0.7%
Hip Replacement	1	0.7%
Sarcadosis	1	0.7%
Total	153	100.0%

Table 22. Perceived Causes of Medical Conditions

Perceived Causes of Asthma	Frequency
Pollution	7
Don't know	7
Heredity	6
City of Cornwall	2
Perinatal	1
Perceived Causes of Arthritis	
Old Age/Overuse	5
Don't Know	5
Heredity	3
Injuries/Strain	2
Perceived Causes of Diabetes	
Heredity	7
Don't Know	2
Old Age	1
Overweight	1
Shock	1
Perceived Causes of Allergies	
Environment	4
Cornwall	3
Don't Know	3
Pollution	2
Adverse Event of Medication	1
Perceived Causes of Heart Conditions	
Heredity	4
Stress	2
Don't Know	2
Smoking	1
Poor Diet	1
Overworked	1
Perceived Causes of Hypertension	
Stress	3
Heredity	2
Overweight	2
Don't Know	1
Adverse Event of Medication	1
Poor Diet	1
Perceived Causes of Back Problems	
Injury	5
Old Age	2
Heredity	1
Perceived Causes of Bronchitis	
Don't Know	2
Pollution	1
Smoking	1
Congenital	1

Table 22 shows the perceived causes of several medical conditions. Of the 25 responses of asthma, 7 were perceived to be associated with pollution, 6 with heredity, 2 with Cornwall, and 1 with perinatal events. Seven others did not know what caused their asthma. Arthritis was linked to old age and overuse in 5 situations, to heredity in 3, to injuries or strain in 2, and to an unknown cause in 5. Four cases of allergies were attributed to the environment, 3 to Cornwall, 2 to pollution, and 1 to an adverse event of medication. Three others were linked to unknown causes. Four respondents associated heart conditions with heredity, 2 with stress, 1 with smoking, 1 with poor diet, and 1 with overwork. Two respondents did not know what the cause might be. Diabetes was attributed to heredity by 7 respondents, to old age by 1, to obesity by 1 and to shock by 1. Two respondents said the cause was unknown.

4.4 Multivariate Analysis

To predict what respondents were most likely to agree with the statement "There are serious environmental health problems where I live.", a stepwise logistic regression was computed using the BMDP statistical package. The following variables were thought to be of importance: sex, age category, level of education, participation in risky activity, sportfish consumption, language, time living in Cornwall, awareness of Guide to Eating Ontario Sportfish, ever smoked, smoke now, rating of personal health, medical condition, and swimming in the St. Lawrence River. As shown in Table 23, the variables "level of education" and "sportfish consumption" entered the model. At step 1, the level of education significantly improved the prediction with an improvement χ^2 of 20.25 and a p-value of 0.000. At step 2, sportfish consumption also improved the prediction significantly, with an improvement χ^2 of 5.804 and a p-value of 0.016. The other variables did not improve the prediction since they were not entered into the model.

When the regression coefficients and standard errors of this analysis are observed, as done in Table 24, the interpretation can be taken further. The coefficient/standard error can be roughly read as a t statistic, and the exponential value of the coefficient can be interpreted as an approximate odds ratio[51,52]. The 95% confidence intervals of the exponential value of the coefficient has also been calculated.

Table 23. Summary of the stepwise logistic regression results using the variables sex, age category, level of education, participation in risky activity, sportfish consumption, language, time living in Cornwall, awareness of Guide to Eating Ontario Sportfish, ever smoked, smoke now, rating of personal health, medical condition, and swimming in the St. Lawrence River to predict agreement with the statement "There are serious environmental health problems where I live."

Step Number	Variables entered	df	Log Likelihood	Improvement χ^2	p value
0			-162.759		
1	level of education	4	-152.634	20.250	0.000
2	sportfish consumption	1	-149.732	5.804	0.016

Table 24. Summary of regression coefficients for the results of the stepwise logistic regression presented in Table 23.

Variable	Categories	Coefficient	Standard Error	Coeff/SE	Exp(Coeff)	95% Confidence Interval of Exp(Coeff)
level of education	high school vs elementary	0.9767	0.376	2.60	2.66	1.27-5.56
	community college vs elementary	1.520	0.459	3.31	4.57	1.85-11.3
	university vs elementary	3.139	1.06	2.96	23.1	2.87-185
	graduate school vs elementary	1.596	1.10	1.45	4.93	0.565-43.0
sportfish consumption	no vs yes	0.7346	0.303	2.43	2.08	1.15-3.78
constant		0.3610	0.362	0.997	1.43	0.704-2.92

The results in Table 24 indicate that the higher the level of education, the more likely the respondent will agree with the statement that there are serious environmental health problems in Cornwall. Respondents with a high school education were 2.66 times more likely to agree with the statement than respondents with an elementary school education. Respondents with a community college education and university educated respondents are respectively 4.57 times and 23.1 times more likely to agree with the statement than respondents with an elementary school education.

The confidence intervals are above 1.00, indicating that these odds ratios are statistically significant. The odds ratio drops to 4.93 for the respondents with a graduate school level of education, but the number of respondents in this category was only 11. The large confidence interval indicates the instability of this value. Sportfish non-consumers are 2.08 times more likely to agree with the statement than sportfish consumers. The confidence interval shows that this odds ratio is also statistically significant.

Another stepwise logistic regression was computed using the following variables: sex, age category, level of education, participation in risky activity, sportfish consumption, language, and time living in Cornwall, to try to improve the predictive model. The results are shown in Tables 25 and 26. When these variables were used, three were entered into the model: level of education, sportfish consumption, and time living in Cornwall. The improvement χ^2 values were statistically significant for level of education and sportfish consumption, and were not very different than in the previous stepwise logistic regression (see Table 25). The "time living in Cornwall" variable managed to enter the model, but did not significantly improve the prediction, as indicated by the improvement χ^2 of 2.546 with a p-value of 0.111. Table 26 shows similar odds ratios for the level of education and the sportfish consumption. The odds ratio of 0.988 for the time living in Cornwall suggests that the longer the respondents have been living in Cornwall, the less likely they are to agree with the statement that there are serious environmental health problems in Cornwall. However, this odds ratio is not statistically significant as it reaches the value of 1.00 in the confidence interval.

Table 25. Summary of the stepwise logistic regression results using the variables sex, age category, level of education, participation in risky activity, sportfish consumption, language, and time living in Cornwall to predict agreement with the statement "There are serious environmental health problems where I live."

Step Number	Variables entered	df	Log Likelihood	Improvement χ^2	p value
0			-167.509		
1	level of education	4	-156.108	22.801	0.000
2	sportfish consumption	1	-153.670	4.876	0.027
3	time living in Cornwall	1	-152.397	2.546	0.111

Table 26. Summary of regression coefficients for the results of the stepwise logistic regression presented in Table 25.

Variable	Categories	Coefficient	Standard Error	Coeff/SE	Exp(Coeff)	95% Confidence Interval of Exp(Coeff)
level of education	high school vs elementary	0.8299	0.387	2.14	2.29	1.07-4.91
	community college vs elementary	1.342	0.479	2.80	3.82	1.49-9.81
	university vs elementary	2.949	1.08	2.74	19.1	2.30-158
	graduate school vs elementary	1.245	1.13	1.10	3.47	0.375-32.2
sportfish consumption	no vs yes	0.5727	0.306	1.87	1.77	0.972-3.24
time living in Cornwall	per year	-0.01242	0.777E-02	-1.60	0.988	0.973-1.00
constant		0.9637	0.540	1.79	2.62	0.907-7.57

To narrow down the model even more, only the variables "level of education", "sportfish consumption", and "time living in Cornwall" were used for a third stepwise logistic regression. As displayed in Table 27, both "level of education" and "sportfish consumption" significantly improved the prediction, while "time living in Cornwall" did not. Once again, the odds ratios and confidence intervals were similar (see Table 28).

A fourth stepwise logistic regression was computed using different variables: sex, age category, sportfish consumption, and swimming in the St. Lawrence River to predict agreement to the statement "There are serious environmental health problems where I live." Interestingly, only the variable "age category" entered the model, with a statistically significant improvement χ^2 of 18.487 with a p-value of 0.002 (see Table 29). The odds ratios in Table 30 suggest that the older the respondents are, the less likely they are to agree with the statement. However, this seems significant only for the comparison between the 65+ category and the 18-24 category, as all other confidence intervals overlap 1.00. However, the trend is evident.

Table 27. Summary of the stepwise logistic regression results using the variables level of education, sportfish consumption, and time living in Cornwall to predict agreement with the statement "There are serious environmental health problems where I live."

Step Number	Variables entered	df	Log Likelihood	Improvement χ^2	p value
0			-168.367		
1	level of education	4	-157.067	22.599	0.000
2	sportfish consumption	1	-154.661	4.813	0.028
3	time living in Cornwall	1	-153.227	2.868	0.090

Table 28. Summary of regression coefficients for the results of the stepwise logistic regression presented in Table 27.

Variable	Categories	Coefficient	Standard Error	Coeff/SE	Exp(Coeff)	95% Confidence Interval of Exp(Coeff)
level of education	high school vs elementary	0.8029	0.384	2.09	2.23	1.05-4.75
	community college vs elementary	1.306	0.476	2.74	3.69	1.45-9.41
	university vs elementary	2.916	1.07	2.71	18.5	2.23-153
	graduate school vs elementary	1.192	1.13	1.05	3.29	0.356-30.4
sportfish consumption	no vs yes	0.5663	0.305	1.86	1.76	0.968-3.21
time living in Cornwall	per year	-0.01310	0.00773	-1.69	0.987	0.972-1.00
constant		1.030	0.532	1.94	2.80	0.985-7.97

Table 29. Summary of the stepwise logistic regression results using the variables sex, age category, sportfish consumption, and swimming in the St. Lawrence River to predict agreement with the statement "There are serious environmental health problems where I live."

Step Number	Variables entered	df	Log Likelihood	Improvement χ^2	p value
0			-168.650		
1	age category	5	-159.407	18.487	0.002

Table 30. Summary of regression coefficients for the results of the stepwise logistic regression presented in Table 29.

Variable	Categories	Coefficient	Standard Error	Coeff/SE	Exp(Coeff)	95% Confidence Interval of Exp(Coeff)
age category	25-29 vs 18-24	-0.08456	0.737	-0.115	0.919	0.216-3.91
	30-44 vs 18-24	-0.2014	0.521	-0.386	0.818	0.293-2.28
	45-54 vs 18-24	-0.5664	0.554	-1.02	0.568	0.191-1.69
	55-64 vs 18-24	-0.9483	0.561	-1.69	0.387	0.129-1.17
	65+ vs 18-24	-1.689	0.510	-3.31	0.185	0.0678-0.503
constant		2.512	0.424	5.92	12.3	5.35-28.4

5. Chapter 5 - Discussion

The survey aimed at: evaluating Cornwall residents' risk perception of various environmental health issues; comparing their risk perception of certain environmental health issues to the Canadian population's perception, as given in the "Health-Risk Perception in Canada" report[43]; evaluating Cornwall residents' risk perception regarding various environmental health issues specifically associated with the Cornwall area and the St. Lawrence River; identifying the Cornwall residents' main sources of information on health issues and risk and comparing them to the Canadian population's sources of information; evaluating the level of confidence attributed to these sources of information by the Cornwall residents and comparing this level of confidence to the Canadian population's confidence in these sources; obtaining a general idea of Cornwall residents' attitudes and opinions to a variety of statements on environmental health issues; and finally collecting personal, behavioural and demographic data.

This information was collected through a cross-sectional random sample telephone survey. Although this type of survey only gives a "snap-shot" of the respondents perceptions and has limitations in regards to the interpretation of the data, it is useful to obtain a general idea of what the respondents think about environmental health issues. This survey design has the benefit of being relatively inexpensive and easy to do. In addition, the fact that the sample was randomly selected does give the data statistical validity.

To compare the Cornwall residents' perceptions to those of the Canadian public, the results obtained from the "Health-Risk Perception in Canada" survey[43] were used. Although the latter was conducted 2 years prior to the Cornwall survey, it was assumed that the perceptions of Canadians have not dramatically changed in that period of time so a comparison of the data was realistic. The fact remains that the Canadian survey of health-risk perception is the most comprehensive national survey of this type conducted to date. Therefore, it was considered the best available study to use for comparison purposes. It also removed the necessity of conducting the survey on a control group, which would have increased financial considerations.

To achieve the first objective of evaluating the perception that the residents of Cornwall have regarding various environmental health issues, word associations were used in Part One of the survey, and questions addressing the perception of health risk attributed to various environmental factors in Part Two of the survey.

The word associations in Part One of the questionnaire captured the concepts behind the respondents' perceptions to the words "chemicals", "risk" and "pollution". The results of the associations to the word "chemicals" in the "Health-Risk Perception in Canada" survey[43] revealed that terms related to danger and pollution made up approximately 35% of responses. The main concept to surface, however, were terms related to chemicals and chemical products, which made up 39.6% of responses (e.g. medicines, drugs, cleaning agents, fertilizers, pesticides, and gasoline). Interestingly, out of 1466 responses, only 10 had a positive connotation (e.g. useful or beneficial). The Cornwall survey shows similar results. The most frequent association to the word "chemicals" was "pollution", representing 19.1% of responses. Domtar (12%), chemical companies and manufacturing plants (6%), negative terms such as bad, scary, destroying, disgusting (6.9%), cleaning agents (6.5%), dangerous (6.1%), chemical products (5.6%), poisonous (4.4%), chemistry and related apparatus (4.2%), medicines and drugs (2.9%), pesticides (2.9%) and toxic (2.2%) consisted of an additional 59.7% of responses. Health issues also surfaced, as 2% of respondents associated chemicals with the term "unhealthy". Only one respondent responded positively, associating the term "useful" to the word "chemicals". Terms such as air, environment, water, river, and earth also appeared.

In the Health-Risk Perception in Canada report[43], the word "risk" was mostly associated with terms such as accidents (22.4%), danger (22.2%), illness (8.4%), simple associations/definitions (e.g. risky, hazard) (7.6%) and economic/financial (7.3%). Once again, positive associations were rare, representing 3.2% of responses and relating to adventure, challenge, and sports.

The Word Associations results of the Cornwall survey are very similar. The term "danger" was associated with the word "risk" in 21.7% of responses, while illness/health risk, simple associations/definitions, and accidents represented 16.1%, 6.1% and 5.4% respectively. In the Canadian survey, terms such as environment and pollution were given in 3.7% of cases, and were given in 4.6% of cases in the Cornwall survey. Only 2 positive associations were made (or 0.5%) in the Cornwall survey, with terms such as "minimal" and "safe". Other associations worth mentioning were terms such as Domtar (3.1%), air (2.3%), water (1.0%), river (0.8%), Cornwall (0.5%), and fish (0.5%). The fact that these responses were stated indicates that these concerns are present in this community.

Although not part of the Canadian questionnaire, the Cornwall respondents were asked for their associations to the word "pollution". Terms such as Domtar, air, other chemical companies and manufacturing plants, dirt/dirty, water, infections, disease/unhealthy, negative terms and Cornwall represented 18.7%, 14.3%, 6.9%, 4.8%, 4.4%, 4.4%, 4.4%, and 4.2% of responses respectively. River/lake (3.7%), St. Lawrence River (3.0%), environment (2.3%), asthma/lungs (1.8%) and fish (0.2%) also made it on the list. The data from these word associations are of a qualitative nature and prove themselves useful in revealing important aspects of the way people perceive risks. One could argue that this exercise might influence the answers to the following questions. It is important to realize that these word associations could have been likewise influenced by questions preceding them, had they been posed later in the interview. For comparability purposes, it was thought best to include this exercise at the beginning of the interview as was done in the national survey. The results from the word associations suggest that the Cornwall respondents experience fear and concern about chemicals. They attribute chemicals as being the cause of pollution emerging from Domtar and other chemical companies and manufacturing plants. They find chemicals dangerous, poisonous and toxic. Risk is usually thought of as related to danger, health and accidents. This reveals their predisposition to think about their health when asked about their risk perceptions. Finally, pollution is associated to Domtar and other industrial activities, air, water and health.

Part Two of the questionnaire addresses the perception of health risk attributed to various environmental factors. Perception of health risk to the respondent and his or her family was asked, followed by perceived risk to the Canadian public in general. Seven environmental factors were taken directly from the "Health-Risk Perception in Canada" questionnaire: depletion of the ozone layer, outdoor air quality, chemical pollution in the environment, PCB or dioxin, pesticides in food, tap water, and bottled water. An eighth one, river water, was added due to its relevance to the Cornwall population.

It was thought unnecessary to compare the perceived risk of these factors against perceived risks from other non-environmental factors such as cigarette smoking, stress, AIDS, etc. It has been documented that over 90% of Canadians find environmental issues important and 83% feel that environmental problems have already affected their health[7]. An effort was also made to obtain the maximum amount of information regarding environmental health issues in the shortest amount of time possible in order to encourage participation in the survey. More than sixty two percent (62.4%) of Cornwall respondents considered river water to be a high health risk to themselves and their family. Over fifty four (54.1%) consider depletion of the ozone layer to be a high health risk to themselves and their family. Outdoor air quality came in third with 45.8% of respondents. This coincides with a survey conducted in 1992 by Environment Canada' Communication Division which revealed that the three most important concerns of the respondents were the pollution of water, the depletion of the ozone layer and air pollution[7].

Chemical pollution in the environment, PCB or dioxin, and pesticides in food were perceived as a high health risk to themselves and their family by 44.2%, 33%, and 24.1% of respondents respectively. Perceived risks from drinking water revealed that 17.3% of respondents consider tap water a high health risk to themselves and their family compared to 3% for bottled water. The respondents were then asked to rate the same environmental factors for their perceived health risks to the Canadian public.

The percentage of respondents who perceived a high health risk to the Canadian public as a whole from the environmental factors were as follows: depletion of the ozone layer (53.9%), river water (35.8%), chemical pollution in the environment (29.7%), PCB or dioxin (24.4%), pesticides in food (21%), outdoor air quality (17.6%), tap water (12.1%) and bottled water (2.1%). Statistical analyses revealed that there was a significantly higher percentage of respondents who perceived a high health risk to themselves and their family compared to the percentage of respondents who perceived a high health risk to the Canadian public in general from the following environmental factors: river water, outdoor air quality, chemical pollution in the environment, PCB or dioxin, tap water. These results indicate that the Cornwall respondents believe that their health is more at risk from these factors that the health of the average Canadian. This is true despite the fact that in general they perceive health risks to be lower than the Canadian respondents in the national survey.

When Cornwall and Canadian respondents were asked to state their perceived health risk to the Canadian public in general from various environmental factors, a consistently lower percentage of Cornwall respondents stated that they perceived these factors to be a high health risk to the Canadian public compared to the respondents in the national survey. This difference was statistically significant for chemical pollution, PCB or dioxin, pesticides in food, and bottled water. The national survey did not ask its respondents about their perceived risks to themselves and their family from these factors, so the comparison cannot be made between the two surveys.

The Cornwall respondents were asked about their perception of health risks to themselves and their family from environmental factors specifically associated with the Cornwall area and the St. Lawrence River. In order of importance, the following percentages of respondents perceived these environmental factors to be a high health risk to themselves and their family: water from the St. Lawrence River (68.8%), mercury in fish or water (67.4%), PCB in fish (57.1%), outdoor air quality in Cornwall (29.4%).

If we compare some of these results to the results obtained for comparable factors in Part Two, it is found that the percentage of respondents attributing a high health risk to these factors significantly increases. For instance, 62.4% of respondents stated that they perceive river water as a high health risk to themselves and their family in Part Two of the survey, while 68.8% of respondents perceived the St. Lawrence River to be a high health risk to themselves and their family in Part Three. A significant increase also resulted when stating "PCB in fish" as opposed to "PCB or dioxin", "outdoor air quality in Cornwall" as opposed to "outdoor air quality", and "tap water in Cornwall" as opposed to "tap water". These significant increases could be explained by a "build up" effect of asking the same question over and over again. Perhaps mentioning Cornwall specifically makes questions more personal and gives an accurate idea of the true concerns of the respondents. The true reason cannot be determined by this survey. The questions would have to be asked to two separate groups to compare the percentage of respondents who attribute a high health risk to the factors mentioned in Part Two to the percentage of respondents who attribute a high health risk to the factors in Part Three. Nevertheless, it is interesting and perhaps quite revealing to obtain significant differences between the two parts.

The survey also aimed to identify the sources of information on health issues and risks, and to compare these sources to those identified in the national survey. Based on the percentages of respondents who said they get a lot of information from these sources, the news media was the most common source mentioned, followed by Environment Canada, Public interest groups, medical doctors, Health Canada, friends and relatives, Agriculture Canada, municipal government, provincial government, university scientists, and finally private industries.

When these results are compared to those of the national survey, it is clear that the Cornwall residents do not rely on medical doctors for information regarding health issues and risks as much as Canadians in general. Medical doctors ranked fourth in the Cornwall survey, and second in the Canada survey. However, Environment Canada appears to be more important to Cornwall respondents. In both surveys, public interest groups ranked as the third most important source, while Health Canada, and friends and relatives, ranked fifth and sixth respectively. University scientists ranked seventh in the Canadian survey but only eleventh in the Cornwall survey. Agriculture Canada, municipal government and provincial government were close in standing as sources of information. In both surveys, private industry ranked last as a source of information regarding health issues and risks.

Beyond obtaining the information, believing this information is also important. When asked about the level of confidence respondents attribute to these information sources, medical doctors ranked the highest in both surveys, followed by Health Canada and Environment Canada. In the Cornwall survey, these three sources were followed by Agriculture Canada, university scientists, public interest groups, news media, friends and relatives, municipal government and provincial government. The national survey indicated a slightly different order, ranking university scientists as fourth, news media as fifth, Agriculture Canada as sixth, friends and relatives as seventh, public interest groups as eighth, provincial government as ninth, and municipal government as tenth. News media dropped to seventh place in the Cornwall survey and fifth place in the Canadian survey. Private industry ranked last in both surveys. From these results, it is clear that the Cornwall respondents get most of their information regarding health issues and risk from the news media, but do not give this source much credibility. The information they trust the most is obtained from medical doctors, Health Canada, and Environment Canada. These types of questions are subject to the respondents' interpretation of what is meant by the phrases "a lot of information", "a fair amount of information", etc. and "a lot of confidence", "a fair amount of confidence", etc. However, if taken qualitatively instead of quantitatively, these findings are important to consider when planning risk communication strategies.

The best way to reach the general population in Cornwall would be to have interviews with medical doctors, Health Canada representatives and Environment Canada representatives either on television, on the radio, or in the newspaper. This would reach the most amount of people and would receive the greatest confidence. Another option might be to hold public meetings with representatives from the medical community, Health Canada and Environment Canada to answer questions and clarify issues regarding health risks related to the environment.

In order to obtain a general idea of their attitudes and opinions regarding various environmental and health issues, the respondents were asked whether they "disagree strongly", "disagree somewhat", "agree somewhat" or "agree strongly" to a variety of statements. The respondents were asked a series of questions regarding local and global environmental health risks. A significantly higher proportion of Cornwall respondents agree somewhat or strongly that there are serious environmental health problems where they live compared to the national survey. Furthermore, significantly more Cornwall respondents disagreed somewhat or strongly that they believe their community is becoming a healthier place in which to live than in the Canadian survey. A significantly greater proportion of Cornwall respondents disagreed that the land, air, and water around them are more contaminated now than ever before. Significantly less Cornwall respondents agreed that the greenhouse effect is a serious problem which could lead to harmful changes in the environment and in people's health.

It is apparent, from the much higher proportion of Cornwall respondents that agreed with the statement that there are serious environmental health problems where they live than in the national survey, that environmental health problems are a great concern in this community. In fact, local environmental issues related to health are a preoccupation based on their disagreement with the statement that Cornwall is becoming a healthier place in which to live.

They are less worried about global issues than the respondents in the national survey based on responses to the greenhouse effect statement and the land, air and water statement. We can conclude from these statements that Cornwall respondents are more concerned about local environment and its effect on their health, than with global environmental factors affecting their health. This conclusion is only based on these four statements, but results from the previous parts of the survey seem to support this interpretation.

As for health risks from chemicals, a significantly greater proportion of Cornwall respondents disagree that the use of chemicals has improved their health more than it has harmed it, compared to the Canadian respondents. Significantly more Cornwall respondents agree that most chemicals cause cancer than in the national survey. However, there is no significant difference between the proportion of Cornwall and Canadian respondents that agree or disagree with the statement: "I don't worry much about chemicals because there are too many other things in my life that I have to deal with". Nevertheless, significantly less Cornwall respondents than Canadian respondents agree that they try hard to avoid contact with chemicals and chemical products in their daily life.

It seems that Cornwall respondents' overall concern about chemicals is greater than that of Canadians as far as effects to their health are concerned. However, they are less likely to take preventative action to avoid being exposed to chemicals. This conclusion is supported by responses to the miscellaneous statements. Significantly less Cornwall respondents than Canadian respondents agree that people can offset health risks from pollution by improving their individual lifestyle such as exercising and eating properly. This conclusion is strengthened by the fact that significantly more Cornwall respondents agree that they feel that they have very little control over risks to their health compared to Canadian respondents.

There was no statistically significant difference between the proportions of Cornwall and Canadian respondents that agreed or disagreed with the following two statements: "Chemicals are either safe or dangerous. There is no in between.", and "Experts are able to make accurate estimates of the health risks from chemicals in the environment."

It should be noted that the Canadian survey contained more statements than the Cornwall survey. Only the statements related to environmental health issues were used in the Cornwall survey. This might have had an impact on the differences in proportions of respondents that agreed or disagreed with the statements. Nevertheless, results indicate that Cornwall respondents seem more concerned about local environmental factors affecting their health, and feel they have little control over these risks, appear to be consistent throughout the survey.

Questions on a number of behaviours of interest were added to the questionnaire. A question on participation in risky activities was included to identify risk takers. The respondents were first asked whether they voluntarily participate in any activity that others consider risky. If so, they were asked to name the activity. Only 15.4% of respondents stated that they participate in a risky activity. The activities mentioned were divided into three categories: sports and adventure, specific behaviours, and occupation.

Sport fish consumption is specifically of interest as it involves direct exposure to contaminants found in the St. Lawrence River. A total of 33.6% of respondents said that they do eat fish caught in the St. Lawrence River. The most common fish consumed is Yellow Perch. Most respondents that do consume sport fish eat Yellow Perch and no other kind, mainly for taste preferences, although 36.5% of sportfish eaters refuse to eat specific kinds due to concerns about pollution, contamination, and safety. It should be noted that many local restaurants serve Lancaster Perch, which is taken from the St. Lawrence River. Some respondents may not be aware of this and may not know that they are actually consuming fish from the St. Lawrence River. The majority of fish non-consumers, or 64.4%, abstain due to concerns about pollution and effects to their health.

Data on awareness of the "Guide to Eating Ontario Sport Fish" confirms that less than one quarter of the respondents had heard of the Guide. Of these, less than half had ever used it. It would seem that sport fish consumers of Cornwall are unfamiliar with this Guide, which indicates that they are unfamiliar with sport fish consumption recommendations. However, sport fish non-consumers are more aware of eating restrictions, or are simply more concerned about pollution and contamination of the fish as clearly indicated in their reasons for not consuming sport fish. One might therefore infer that sport fish consumers are simply unaware of the health risks and the Guide's recommendations, or do not believe that there is a risk.

Another behaviour of interest was swimming in the St. Lawrence River. Less than one quarter of the respondents swim in the St. Lawrence River. The others respondents do not swim in the St. Lawrence River because of their concern regarding the quality of the water and its effects on health.

The medical conditions reported by respondents reveal what they perceive to be a medical condition. These data were collected for qualitative purposes. There was no intention to measure prevalence of any of these conditions. The responses varied from very specific medical terms (e.g. Bilateral Patella Femoral Syndrome), to very broad, general terms (e.g. Bad legs). For perceived causes of the most common medical conditions reported, some were associated with environmental factors. Asthma was thought to be linked to pollution and the City of Cornwall. Allergies were attributed to the environment, to Cornwall, and to pollution. Bronchitis was linked to pollution by one respondent.

The results from the stepwise logistic regression have indicated that the level of education, sportfish consumption, time living in Cornwall, and age category might be important factors to consider when addressing the residents of Cornwall regarding health issues related to the environment. The less educated, older sportfish consumers who have been living in Cornwall for many years are less likely to associate health effects from environmental pollution. This should be considered when communicating environmental health risks to such groups.

6. Chapter 6 - Recommendations

The following recommendations are made based on the results obtained in this survey:

1. That the residents of Cornwall be provided with a report comprised of all available information regarding environmental health issues in this area so that they may be aware of the state of knowledge regarding these issues.

2. That communication of health risks associated to environmental factors be done by Health Canada and Environment Canada as Cornwall residents place a lot of confidence in these sources. This would ensure that adequate information be communicated to prevent creating new concerns. This could be done through the media, to reach the most residents. It is not feasible to give that responsibility to medical doctors as environmental health is not currently included in their training, and as the range of communication would be limited to their patients.

3. That epidemiological studies be done to measure the incidence of certain conditions associated with exposure to contaminants in the environment. This would provide specific information on Cornwall, and the actual health risks related to environmental contamination in the area[b].

4. That focus groups be consulted and person-to-person interviews be conducted to clarify the Cornwall residents' concerns and improve communication between policy-makers and the public.

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[b]A study of this type, "The Great Lakes Anglers Exposure Study" was done in 1992-93 by the Great Lakes Health Effects Program of Health Canada on anglers in Cornwall and Mississauga. The report is now available.

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APPENDIX A - QUESTIONNAIRE

Questionnaire 1.ID:_____

Good morning/afternoon/evening. My name is _____. I'm calling on behalf of the University of Ottawa. We are doing a research project in your area and are conducting a survey among men and women concerning health issues related to the environment. This is to assist in developing health policies and programs for the residents of Cornwall. We would appreciate about 15 minutes of your time. We are not selling anything. We are simply interested in your attitudes and opinions.

Participation in this survey is completely voluntary. You are free to refrain from answering any question and can withdraw from the study at any time for any reason. The information will be kept strictly confidential. Your participation would be very helpful to us and most appreciated. Would you like to participate?

YES⟶PROCEED NO⟶TERMINATE CALL

Your telephone number has been selected randomly and we would like the opinions of one of the members of your household. To make sure I'm interviewing the right person in this household, I would like to ask you a few introductory questions:

2. Including everyone, how many people live in this household:__

3. Of these, how many are 18 years of age or older:__

Would you please tell me the first name or first initial of all people 18 years of age and older living in this household?

	Name	Respondent (SELECT FROM TABLES)
(1)	_____	___
(2)	_____	___
(3)	_____	___
(4)	_____	___
(5)	_____	___
(6)	_____	___
(7)	_____	___

ASK TO SPEAK TO SELECTED RESPONDENT
ASK RESPONDENT IF INTERVIEW SHOULD BE DONE IN FRENCH OR ENGLISH.

4. (Reason why unable to continue interview:___)

1-refusal by selected respondent
2-unable to reach selected respondent after 3 trials
3-other (specify:_____)

5. Time interview started:_____

REPEAT INTRODUCTION IF RESPONDENT IS DIFFERENT THAN THE PERSON WHO ANSWERED.

Part One - Word Associations

6. The first question involves word association. Think of the word "chemicals" for a moment. When you hear the word "chemicals", what is the first word or image that comes to mind?

_____

7. Now think of the word "risk" for a moment. When you hear the word "risk", what is the first word or image that comes to mind?

_____

8. Now think of the word "pollution". When you hear the word pollution, what is the first word or image that comes to mind?

_____

Part Two - Risk Perception

a. I'm going to read you a list of items relating to health. For each item, I'm going to ask for your opinion, first about the health risk to you and your family, and then about the health risk to the Canadian public as a whole.

b. In thinking about yourself and your family, would you say there is almost no health risk, slight, moderate, or high health risk from...

c. Using the same scale, how would you rate the health risk to the Canadian public as a whole from...

	Almost no health risk	Slight health risk	Moderate health risk	High health risk	Don't know (DO NOT READ)
Chemical pollution in the environment					
9. you and your family....	☐1	☐2	☐3	☐4	☐8
10. Canadian public.....	☐1	☐2	☐3	☐4	☐8
Pesticides in food					
11. you and your family....	☐1	☐2	☐3	☐4	☐8
12. Canadian public.....	☐1	☐2	☐3	☐4	☐8
Tap water					
13. you and your family....	☐1	☐2	☐3	☐4	☐8
14. Canadian public.....	☐1	☐2	☐3	☐4	☐8
Bottled water					
15. you and your family....	☐1	☐2	☐3	☐4	☐8
16. Canadian public.....	☐1	☐2	☐3	☐4	☐8
Outdoor air quality					
17. you and your family....	☐1	☐2	☐3	☐4	☐8
18. Canadian public.....	☐1	☐2	☐3	☐4	☐8
PCB or dioxin					
19. you and your family....	☐1	☐2	☐3	☐4	☐8
20. Canadian public.....	☐1	☐2	☐3	☐4	☐8
Depletion of the ozone layer					
21. you and your family....	☐1	☐2	☐3	☐4	☐8
22. Canadian public.....	☐1	☐2	☐3	☐4	☐8
River water					
23. you and your family....	☐1	☐2	☐3	☐4	☐8
24. Canadian public.....	☐1	☐2	☐3	☐4	☐8

Part Three - Section on Cornwall

d. For the next items, we would like your opinion on the health risks only for you and your family. For each item, please tell me whether you think there is almost no health risk, slight, moderate, or high health risk from:

	Almost no health risk	Slight health risk	Moderate health risk	High health risk	Don't know (**DO NOT READ**)
25. Water of the St Lawrence River.....	☐1	☐2	☐3	☐4	☐8
26. Outdoor air quality in the Cornwall area.....	☐1	☐2	☐3	☐4	☐8
27. Fish caught in the St Lawrence River.....	☐1	☐2	☐3	☐4	☐8
28. Mercury in the water or in the fish.....	☐1	☐2	☐3	☐4	☐8
29. PCB in fish.....	☐1	☐2	☐3	☐4	☐8
30. Tap water in the Cornwall area.....	☐1	☐2	☐3	☐4	☐8

Part Four - Sources of Information and Level of Confidence

e. People obtain their information on health issues and risks from a number of sources. I'm going to read you a short list of possible sources for health information. Would you please tell me, for each one, whether you get almost no information, a little, a fair amount or a lot of information from that source about health issues and risks?

	Almost no info	A little info	A fair amount of info	A lot of info	Don't know (**DO NOT READ**)
31. News media (TV, newspaper, radio).....	☐1	☐2	☐3	☐4	☐8
32. Private industry.....	☐1	☐2	☐3	☐4	☐8
33. Medical doctors.....	☐1	☐2	☐3	☐4	☐8
34. Municipal government...	☐1	☐2	☐3	☐4	☐8
35. Provincial government..	☐1	☐2	☐3	☐4	☐8
36. Health Canada.....	☐1	☐2	☐3	☐4	☐8
37. Environment Canada.....	☐1	☐2	☐3	☐4	☐8
38. Agriculture Canada.....	☐1	☐2	☐3	☐4	☐8
39. Public interest or environmental groups.....	☐1	☐2	☐3	☐4	☐8
40. University scientists..	☐1	☐2	☐3	☐4	☐8
41. Friends and relatives..	☐1	☐2	☐3	☐4	☐8

f. In considering this same list again, would you tell me how much confidence you have in each one as a source of information about health issues. Would you say you have almost no confidence, a little, a fair amount, or a lot of confidence in each of the following as an information source about health issues.

	Almost no conf	A little conf	A fair amount of conf	A lot of conf	Don't know (**DO NOT READ**)
42. News media (TV, newspaper, radio).....	☐1	☐2	☐3	☐4	☐8
43. Private industry.....	☐1	☐2	☐3	☐4	☐8
44. Medical doctors.....	☐1	☐2	☐3	☐4	☐8
45. Municipal government....	☐1	☐2	☐3	☐4	☐8
46. Provincial government...	☐1	☐2	☐3	☐4	☐8
47. Health Canada.....	☐1	☐2	☐3	☐4	☐8
48. Environment Canada.....	☐1	☐2	☐3	☐4	☐8
49. Agriculture Canada.....	☐1	☐2	☐3	☐4	☐8
50. Public interest or environmental groups.....	☐1	☐2	☐3	☐4	☐8
51. University scientists...	☐1	☐2	☐3	☐4	☐8
52. Friends and relatives...	☐1	☐2	☐3	☐4	☐8

Part Five - Attitudes and Opinions

g. Forming an opinion about health issues can be complex. People have very different opinions about the conditions and issues that apply to health risks. I am going to read you a series of statements and ask for your personal opinion about each one. Please tell me whether you disagree strongly, disagree somewhat, agree somewhat, or agree strongly with each of the following statements.

	Disagree strongly	Disagree somewhat	Agree somewhat	Agree strongly	Don't know (DO NOT READ)
53. There are serious environmental health problems where I live....	☐1	☐2	☐3	☐4	☐8
54. Use of chemicals has improved our health more than it has harmed it.....	☐1	☐2	☐3	☐4	☐8
55. The land, air, and water around us are, in general, more contaminated now than ever before.....	☐1	☐2	☐3	☐4	☐8
56. I believe my community is becoming a healthier place in which to live.....	☐1	☐2	☐3	☐4	☐8
57. People can offset health risks from pollution by improving their individual lifestyle, such as exercising and eating properly.....	☐1	☐2	☐3	☐4	☐8
58. Most chemicals cause cancer.....	☐1	☐2	☐3	☐4	☐8

(CONTINUED ON NEXT PAGE)

	Disagree strongly	Disagree somewhat	Agree somewhat	Agree strongly	Don't know (DO NOT READ)
59. Chemicals are either safe or dangerous. There is really no in between.....	☐1	☐2	☐3	☐4	☐8
60. Experts are able to make accurate estimates of the health risks from chemicals in the environment.....	☐1	☐2	☐3	☐4	☐8
61. I don't worry much about chemicals because there are just too many other things in my life that I have to deal with.....	☐1	☐2	☐3	☐4	☐8
62. I try hard to avoid contact with chemicals and chemical products in my daily life.....	☐1	☐2	☐3	☐4	☐8
63. The greenhouse effect is a serious problem which could lead to harmful changes in the environment and in people's health.....	☐1	☐2	☐3	☐4	☐8
64. I feel that I have very little control over risks to my health.....	☐1	☐2	☐3	☐4	☐8

Part Six - Personal, Behavioural and Demographic Data

h. Now, in order to classify our data, we need some basic information about you. We will treat all information as confidential.

65. Are you.....male ☐1 or female ☐2

66. In which of the following age categories do you belong?

18 - 24	☐1
25 - 29	☐2
30 - 44	☐3
45 - 54	☐4
55 - 64	☐5
65 & over	☐6

67. In which education category do you belong?

Some or completed elementary school	☐1
Some or completed high school	☐2
Some or completed community college	☐3
Some or completed university	☐4
Some or completed graduate school	☐5

68. Has there ever been a period in your life when you smoked cigarettes regularly?

yes ☐1 no ☐2

69. Do you smoke cigarettes regularly now?

yes ☐1 no ☐2

70. Do you voluntarily participate in any activity that others consider risky?

yes ☐1 no ☐2

└——→ 71. What activity would that be?

_____

72. Do you exercise regularly?

yes ☐1 no ☐2

73. How would you rate your personal health?

Excellent	☐1
Good	☐2
Fair	☐3
Poor	☐4
Don't know	☐8

74. Do you presently have a medical condition?

yes ☐1 no ☐2

└→75. specify:_____

└→76. What do you think caused this condition?

_____

77. Does anyone else in your household presently have a medical condition?

yes ☐1 no ☐2 don't know ☐8

└→78. specify:_____

└→79. What do you think caused this condition?

_____

80. Do you eat fish that you or someone else caught in the St Lawrence River in the Cornwall area?

yes ☐1 ↓

no ☐2 → 81. Why not?

_____

GO TO QUESTION 87

82. How often?

less than 10 times per year ☐1
1 to 3 times per month ☐2
1 to 3 times per week ☐3
more than 3 times per week ☐4

83. What kind of fish caught in the St Lawrence River do you eat?

_____

(ACCEPT MORE THAN ONE ANSWER)

** For coding: 1Brown Bullhead 2Yellow Perch 3Northern Pike
4Black Crappie 5Walleye 6Smallmouth Bass
7Carp 8Rock Bass 9Pumpkinseed
10American Eel 11Channel Catfish 12Other

84. Are there any kinds of fish caught in the St Lawrence River you will not eat?

yes ☐1 no ☐2

85. Which ones?

_____

(ACCEPT MORE THAN ONE ANSWER FROM SAME LIST)

86. Why not?

_____

87. Do you ever swim in the St Lawrence River?

yes ☐1 no ☐2——→88.Why not?

_____

89. Have you ever heard of the "Guide to Eating Ontario Sport Fish"?

yes ☐1 no ☐2——→ GO TO QUESTION 91

└——→ 90. Have you ever used it?

yes ☐1 no ☐2

91. Are you currently employed?

yes ☐1 no ☐2——→ GO TO QUESTION 93

└——→ 92. What is your occupation?

_____

93. Do you consider yourself...?

English-speaking ☐1
French-speaking ☐2
Other ☐3——→94. Specify:_____

95. How long have you lived in the Cornwall area?

_____ years or _____ months

96. And finally, in which of the following classifications does your total household income fall before taxes? **Remember, this information will be treated as confidential.**

under $19999 ☐1
$20000-$29999 ☐2
$30000-$39999 ☐3
$40000-$49999 ☐4
$50000-$59999 ☐5
$60000-$74999 ☐6
$75000 and over ☐7
Refused ☐8

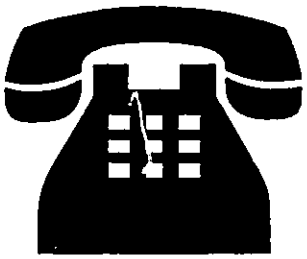
Thank you very much for your cooperation ☺.

Have a nice day/evening/weekend.

97. Time interview ended:_____

APPENDIX B - INTERVIEWER TRAINING MANUAL

SURVEY ON THE HEALTH RISK PERCEPTION ASSOCIATED WITH ENVIRONMENTAL HAZARDS IN CORNWALL



INTERVIEWERS' TRAINING MANUAL

INTERVIEWERS' TRAINING MANUAL

Log Book 

In the log book, you will find a list of telephone numbers to be used for the survey. Dial the number and record the date, time and outcome:

A - number not in service **(NNIS)**
- person who answered does not speak English or French **(NEF)**
- refusal by person who answered **(RA)**
- refusal by selected respondent **(RR)**

B - no answer **(NA)**
- busy signal **(BS)**
- answering machine **(AM)**
- selected respondent not in **(RNI)**

C - complete interview with selected respondent **(CI)**

D - other (please specify)

For situations in A, no further attempts will be made.

For situations in B, **3 trials** are required **at different times and on different days.** Please record the date and time of each attempt in the log book. When you get an answering machine, do not leave a message. This will save you time and us, money.

Situation C involves the interview.

Selecting the respondent ☑

Please put your initials on the "ID" line at the top of the questionnaire. Read the introduction to the person answering the telephone. If a child answers, ask for a parent or other adult.

Once the person on the phone has accepted to participate in the study and you know how many adults live in the household, consult the tables of random numbers to select the respondent (see booklet). Identify the selected respondent on the questionnaire by putting an X by the respondent's name. Cross off the number on the random table.

Example:

	Name	Respondent
(1)	Walter	X
(2)	Winnifred	
(3)	Sophia	

Interview Procedures ☎

Ask to speak to the selected respondent. If the selected respondent is not in, attempt to find out what time and day he or she will be in. Record this information in the log book. If the person does not know when the respondent will be back, make **2 more attempts on different days and at different times** and record this in the log book.

Once the selected respondent has been reached, the interview can begin.

Please enter the identification number from the log book on the ID line, beside your initials.

IMPORTANT: ☞

If the respondent is different than the person who answered the phone, please read the introduction again to inform the selected respondent on the nature of the study and to him or her to choose to participate or not..

Only the selected respondent may be interviewed. Do not make any substitutions.

If the interview was discontinued for some reason, please indicate why.
Please enter the time the interview started.

Part One - Word Associations

Do not read the titles of each part, this might influence their answers.

For this part, enter whatever the respondent says, whether it is a word, expression or short sentence. Do not give them examples of responses, encourage them to say whatever first comes to their mind.

Part Two - Risk Perception

Read the short introduction. Start reading from the item identified by the mark. Do not read the "Don't know" option. Fill this out only when the respondent says that he or she doesn't know. Repeat the scale often.

Part Three - Section on Cornwall

This one is straightforward. Start at the item identified by the mark.

Part Four - Sources of information and Level of Confidence

Same procedures.

Part Five - Attitudes and Opinions

Same procedures.

Part Six - Personal, Behavioural and Demographic Data

Record the sex and age of the respondent, based on the information obtained during the selection.

Remind them of the confidentiality of their answers.

Proceed with the remaining questions.

Thank them for their participation and their time.

If they have questions or concerns: ?

Lynne Belle-Isle	Survey Coordinator Department of Epidemiology Faculty of Medicine	(613)596-0041
Dr. S. Raman	Project Management Committee Department of Epidemiology Faculty of Medicine	(613)787-6436
Dr. Philippe Crabbé	Principal Investigator IREE	(613)564-7644

Progress Report

I will be contacting you at the end of each week to see how things are going and to collect the completed questionnaires. If you have any questions or concerns at any time, please do not hesitate to call me. If I am not in, leave a message and I will return your call as soon as I can. I will be checking my messages often during the study.

REC	NUMBER				
1	1	26	1	51	2
2	2	27	2	52	1
3	2	28	1	53	1
4	2	29	2	54	2
5	2	30	2	55	1
6	1	31	1	56	1
7	2	32	1	57	1
8	2	33	1	58	1
9	1	34	2	59	2
10	2	35	1	60	2
11	2	36	1	61	1
12	1	37	2	62	2
13	2	38	1	63	2
14	1	39	2	64	1
15	1	40	2	65	1
16	2	41	1	66	2
17	2	42	2	67	1
18	2	43	2	68	2
19	2	44	2	69	2
20	1	45	1	70	2
21	2	46	1	71	1
22	1	47	1	72	1
23	2	48	1	73	2
24	2	49	2	74	2
25	1	50	2	75	2

REC NUMBER

1	1	26	2	51	2
2	3	27	1	52	1
3	1	28	2	53	3
4	1	29	3	54	3
5	3	30	1	55	3
6	2	31	1	56	1
7	3	32	3	57	3
8	3	33	1	58	3
9	3	34	3	59	2
10	1	35	3	60	3
11	2	36	2	61	3
12	1	37	3	62	3
13	3	38	2	63	1
14	3	39	2	64	3
15	3	40	2	65	2
16	1	41	3	66	3
17	1	42	2	67	2
18	1	43	1	68	1
19	2	44	1	69	1
20	1	45	1	70	1
21	2	46	3	71	1
22	1	47	2	72	3
23	2	48	2	73	1
24	2	49	1	74	2
25	3	50	1	75	1

REC	NUMBER				
1	3	26	1	51	4
2	2	27	2	52	1
3	2	28	3	53	1
4	4	29	2	54	4
5	2	30	2	55	1
6	3	31	3	56	3
7	4	32	3	57	3
8	2	33	1	58	3
9	1	34	2	59	2
10	4	35	1	60	2
11	4	36	3	61	3
12	3	37	2	62	2
13	4	38	3	63	2
14	3	39	2	64	3
15	3	40	2	65	1
16	4	41	3	66	4
17	2	42	4	67	3
18	4	43	2	68	4
19	2	44	4	69	2
20	1	45	1	70	4
21	4	46	3	71	3
22	3	47	1	72	1
23	4	48	3	73	4
24	2	49	2	74	2
25	1	50	4	75	2

REC NUMBER

1	5	26	2	51	5
2	4	27	1	52	2
3	4	28	3	53	2
4	5	29	3	54	5
5	5	30	2	55	4
6	4	31	5	56	4
7	4	32	5	57	3
8	3	33	4	58	1
9	2	34	5	59	5
10	2	35	4	60	5
11	3	36	1	61	1
12	2	37	5	62	4
13	4	38	2	63	2
14	1	39	1	64	4
15	2	40	1	65	5
16	3	41	2	66	3
17	4	42	3	67	2
18	2	43	2	68	5
19	5	44	2	69	1
20	1	45	4	70	1
21	3	46	3	71	5
22	1	47	4	72	1
23	5	48	4	73	2
24	2	49	3	74	4
25	2	50	5	75	4

REC	NUMBER				
1	1	26	5	51	2
2	6	27	4	52	1
3	4	28	5	53	3
4	4	29	6	54	6
5	6	30	4	55	3
6	5	31	1	56	1
7	6	32	3	57	3
8	6	33	1	58	3
9	3	34	6	59	2
10	4	35	3	60	6
11	2	36	5	61	3
12	1	37	6	62	6
13	6	38	5	63	4
14	3	39	2	64	3
15	3	40	2	65	5
16	4	41	3	66	6
17	4	42	2	67	5
18	4	43	4	68	4
19	2	44	4	69	4
20	1	45	1	70	4
21	2	46	3	71	1
22	1	47	5	72	3
23	2	48	5	73	4
24	2	49	4	74	2
25	3	50	4	75	4