Acknowledgments

Pollution Probe gratefully acknowledges the funding support provided to this project by the following sponsors:

THE ONTARIO TRILLIUM FOUNDATION
LAIDLAW FOUNDATION

George Cedric Metcalf Charitable Foundation
M. A. Motz Foundation
The Alice and Murray Maitland Foundation
The Canadian Standards Association

Pollution Probe also thanks the following in-kind supporters:

Canadian Institute of Child Health
Canadian Association of Physicians for the Environment
Ontario College of Family Physicians
Ontario Public Health Association

This report was prepared by Jill McDowell, Co-ordinator, Child Health Programme, Pollution Probe.

We recognize and appreciate the work of: Ian Morton and Ken Ogilvie in preparation of this report; Randee Holmes for editing; Natasha Teoli for research; and Krista Friesen for technical and design assistance. We are also pleased to acknowledge the following contributors to specific sections of the report: Joe Castrilli on *Legal Review and Analysis* and Edward Hanna on *Cost/Benefit Analysis Framework*.

A special thank you to the project advisory committee members who dedicated their time and gave invaluable insight and strategic counsel to Pollution Probe:

Gary Gibson and Peer Frederiksen — The Durham District School Board
Shirley Thompson and Tim Robins — Toronto Catholic District School Board
Brian Eggleton — Halton District School Board
Dr. Monir Taha — City of Toronto, Public Health
Gerry Granek — ECE Group Limited (advisor to)
Helen Webb — Parents of Peel
Maggie Joshi — Parents Environmental Network
Laurissa Werhun — Ontario Secondary School Teachers' Federation
Wanda Bailey — Elementary Teachers' Federation of Ontario
Linda Ivey — Canadian Union of Public Employees
Bruce M. Small — Sustainable Solutions
Allan Fogwill — Union Gas Limited
Bob De Grasse — Enbridge Consumers Gas
Paul Cryne — Rose Technology Group

Pollution Probe extends its gratitude to the following organizations and individuals who reviewed and commented on this report (or parts of the report):

Ontario Ministry of Health and Long-Term Care
Ontario Ministry of the Environment
Ontario Ministry of Education
Ontario Ministry of Labour
Integrated Services for Children (Ontario government)
Office of the Minister Responsible for Children (Ontario government)
City of Toronto — Public Health Department
Ontario Public Health Association (Environmental Health Workgroup)
Canadian Standards Association
Sandra Schwartz, Canadian Institute of Child Health
Dr. Alan Abelsohn, Ontario College of Family Physicians
Gary Gibson, The Durham District School Board
Shirley Thompson and Tim Robins, Toronto Catholic District School Board
Arnie Wohlgemut and Doug Morris, Waterloo Region District School Board
Margaret Brevik and Graeme Gilday, York Region District School Board
Jill Witherspoon, Toronto District School Board
John Guevin, U.S. Environmental Protection Agency — Indoor Environments Division
Gerald Muise, Nova Scotia Government
Sandra Moser and Karen Robinson, Citizens for A Safe Learning Environment, Nova Scotia
Nita Chaudhuri, South Riverdale Community Health Centre
Bob De Grasse, Enbridge Consumers Gas
Helen Webb, Parents of Peel
Maggie Joshi, Parents Environmental Network

Table of Contents

Appendices

1.0 Executive Summary

In January, 1999, Pollution Probe launched a project to address the state of the indoor environment in Ontario schools. This project was an outcome of a 1998 conference that Pollution Probe and the Canadian Institute of Child Health held on children's health and air contaminants. Experts at this forum claimed that children are more sensitive to the harmful effects of environmental pollutants than adults and that indoor contaminants are among the top risks to the respiratory health of children (see proceedings from conference — The Air Children Breathe: The Effects on Their Health). A priority action item of the conference was to address the state of indoor environments in the places where children spend their time (i.e., schools, recreational facilities and day cares).

In response, Pollution Probe initiated *Healthy Schools — Healthy Children*, a two-phase project that aims to assess the range of indoor environmental issues facing Ontario schools, and to develop a cost-effective, proactive indoor environment management plan to help school boards identify, prevent and remediate indoor environmental problems. The purpose of Phase One is to provide the baseline information and analysis needed for Phase Two, enabling Pollution Probe and key stakeholders to develop solutions for improving the quality of school indoor environments in Ontario. This report reflects the findings from Phase One of Pollution Probe's research and addresses the following:

- the state of the indoor environment in Ontario schools;
- current legal authority and responsibility for issues related to indoor environmental quality and children's health in schools;
- jurisdictional leadership (including case studies of indoor environmental programmes in schools);
- the economic implications of improving indoor environments in schools;
- a proposed framework for a voluntary indoor environment management plan; and,
- recommendations for action.

1.1 Issue Summary

Poor indoor air quality has been cited by many experts internationally as a serious health and environmental issue. The Science Advisory Board of the U.S. Environmental Protection Agency (EPA) claims that indoor air pollution is one of the top five environmental hazards to human health. As well, the EPA states that levels of pollutants indoors can be two to five times higher than levels of pollutants outdoors and, in some instances, can be up to 100 times higher.[1] The World Health Organization and the North Atlantic Treaty Organization (NATO) also recognize poor indoor air quality as a serious human health threat.[2] These claims are significant given that humans spend about 90% of their time indoors.[3]

Although children may typically spend more time out-of-doors than do adults, the majority of their time is spent in the indoor environment. Elements of an indoor environment that can affect health and comfort include: the presence of chemicals from cleaning, building and renovation products, pesticides, perfumes and furnishings; the presence of tobacco smoke, mould, dust and animal dander; practices associated with building, renovation, maintenance and cleaning; and the amount of air flow in a building. Some health effects linked to poor indoor air quality include: eye, nose, and throat irritation, dryness of mucous membranes and skin, nosebleeds, skin rash, mental fatigue, headache, cough, hoarseness, wheezing, nausea, and dizziness.[4] Indoor air pollution is particularly problematic for those who have asthma, allergies or other respiratory problems.[5]

Because children are more vulnerable than adults to the effects of indoor pollutants, special care must be taken to optimize the environmental quality of the places where they spend their time.

While more attention needs to be paid to the quality of indoor environments in all building categories, schools deserve special attention for several reasons. Schools serve one of the most important functions in our communities – they provide generations of children with the academic and social skills that will profoundly affect the way in which they lead our society into the future. The physical condition of a child's learning space will affect that child's health and capacity for academic development. Schools are publicly funded facilities where children are expected to go for their education. Since they have little choice but to attend school, it is incumbent upon us to ensure that schools are safe and conducive to healthy physical, emotional and intellectual development. Moreover, schools present unique challenges for managing indoor environmental problems: occupancy rates are high and children are in close proximity to one another; schools have unique pollutant sources including vocational education areas and art and science classes; schools have pest and germ problems that can, in some cases, result in strong chemical use; lack of funds for building renewal and deferred maintenance have resulted in school building systems being left to deteriorate; and facility budgets are tight and often the first to be cut during difficult fiscal periods.

Although the condition of a school facility may affect both the health and academic performance of a child, there has been little federal or provincial leadership to address indoor environmental quality in schools. Pollution Probe conducted a legal analysis to determine the potential constitutional, common law and legislative avenues for addressing indoor environmental issues in schools. Although there are no statutes that explicitly address indoor air pollution in schools, there is a range of laws and a variety of ministries, departments and agencies that have some authority for addressing different aspects of the problem. The participation of many players in this area, with no clear assignment of overall responsibility, complicates the task of improving school indoor environments. The fragmentation of authority prevents Ontario policy-makers from addressing indoor environmental issues in schools in a coherent, systematic, and unified manner. Other jurisdictions, however, have had greater success in this regard and have shown significant leadership on issues related to indoor air quality in schools. In Canada, the provinces of Nova Scotia, New Brunswick and British Columbia have enacted policies and/or programmes that aim to improve the quality of school indoor environments. In the U.S., the EPA and the states of Texas, Washington, Maryland and Vermont have developed initiatives that specifically address indoor environmental quality in schools.

While the provincial government has been slow to act on indoor environmental issues pertaining to schools, some Ontario school boards have made significant efforts to better manage their indoor environmental problems. For example, the Waterloo Region District School Board has developed an internationally recognized "ECO classroom" initiative, which is a programme designed to accommodate children with indoor environmental sensitivities. However, the mechanisms by which school boards address indoor environmental problems vary significantly from one board to the next. Some school boards address problems on a case-by-case basis in response to specific complaints. Others employ proactive strategies to prevent problems from occurring. What seems to be lacking is a consistent, proactive, province-wide strategy at the school board level to improve indoor environmental quality in schools. The degree to which school boards address indoor environmental problems in schools depends on how aware they are of the issues, their priorities, and the availability of resources. School boards claim that resource constraints, in particular, have been a significant barrier to school facility

improvements. The new provincial funding formula for education has created financial hardship for some school boards, limiting their ability to invest in improvements to the indoor environment. The provincial government, however, claims that its funding provisions are adequate. Since 1998, the province has made $477 million available in grants to school boards for renewal projects. In December 1999, the Minister of Education allocated $50 million to school boards that experienced financial hardship managing mould problems.[6]

Although school board officials cite cost as one of their biggest concerns with respect to making indoor environmental improvements in schools, the potential economic benefits of preventing or addressing indoor environmental problems are rarely taken into consideration. There are times when the financial benefits of investing in good equipment or practicing preventative maintenance have been considered with respect to long-term operating costs. However, the financial benefits to society of improved health of school occupants from better indoor air quality have not been given the attention they deserve. Making responsible, informed decisions that affect indoor air quality in schools requires consideration by governments and school boards of both the costs (i.e., investments required to improve indoor air quality) and the benefits. The benefits include: improved learning and retention of knowledge by students; improved physical and mental health of students, teachers and support staff; reduced costs (both direct and indirect) of treating air quality-induced illnesses; and, reduced costs resulting from absenteeism and reduced productivity. The use of cost/benefit analysis for determining optimum outdoor air quality has gained considerable acceptance over the past 10 years. The use of cost/benefit analysis now needs to be broadened to include the examination of indoor air quality.

1.2 Recommended Actions

The long-term goal of Pollution Probe's *Healthy Schools — Healthy Children* project is to facilitate the development of strategies that will help optimize indoor environmental quality in schools. Pollution Probe believes that there is enough knowledge about children's vulnerability to pollutants and the related health implications of exposure to indoor contaminants to take action on a precautionary basis sooner, rather than later. While debate continues on the degree to which indoor pollutants affect children's health, childhood asthma and allergies are rising, schools and portable classrooms across the country are in need of rehabilitation due to mould problems, and tension between parents and school boards is growing.

Pollution Probe believes that a voluntary indoor environment management plan that provides school boards with cost-effective strategies for preventing, remediating and resolving indoor environmental problems in schools should be developed by interested stakeholders as soon as possible. Models for consideration could include: activities already underway at some school boards; an electronic interactive Web-based plan; the U.S. EPA's *Indoor Air Quality Tools for Schools Action Kit*; an environmental management system, such as ISO 14001; or any number of existing programmes that best suit the needs of school boards. Public recognition of actions taken by school boards should be an essential component of any programme; i.e., participating school boards should be acknowledged through media events, on a Web site and/or with awards. In the end, a voluntary strategy should aim to: optimize the quality of school indoor environments; build on existing leadership in this area; raise awareness of indoor environmental issues among school occupants; and, improve public relations between school boards and parents.

A voluntary plan can be an effective tool for indoor environmental improvements because it incorporates flexibility and can achieve quick results. Pollution Probe believes, however, that a comprehensive strategy to protect children's environmental health in Ontario will also require significant long-term investments by governments and interested stakeholders into research, policy and outreach activities related to indoor environments and children's health. To help move this agenda forward, Pollution Probe proposes the following recommendations that represent an ideal course of action for optimizing school indoor environmental quality and enhancing children's environmental health.

- To advance a consistent, cohesive platform on indoor environmental quality in Ontario schools, the Government of Ontario should recognize the importance of healthy indoor environments and assign one of the ministries of education, labour, health or environment with the authority and resources to take leadership. This has happened in Nova Scotia whereby the government provided the Department of Education with the expertise and resources to begin addressing school indoor environment issues more effectively.

- While one ministry should assume leadership for these issues, all of the ministries that currently have partial jurisdiction should work together more effectively to develop a comprehensive strategy to improve school indoor environments. Using Nova Scotia as a model, an inter-ministerial committee on indoor environments, with representatives from the ministries of health, education, labour and environment, should be formed as soon as possible.

- To better protect children from exposure to indoor contaminants in schools, a provincial policy/regulatory framework should be developed that acknowledges children's unique vulnerability to indoor contaminants and provides children with protection from these hazards in schools. Moreover, governments should endorse, support and promote the concept of developing a voluntary indoor environment management plan for Ontario schools and school boards.

- To better understand the scope of indoor environmental challenges that Ontario school boards face, inventories of existing problems should be conducted and more systematic indoor air quality testing in schools should occur.

- To better understand the extent to which school children are at risk from exposure to indoor air pollution, co-ordinated, systematic, epidemiological and clinical health studies of the impacts of poor indoor air quality on children should be conducted.

- To better understand the net economic benefits to society of optimizing indoor environmental quality in schools, a comprehensive cost/benefit analysis should be undertaken.

- To encourage improvements to the indoor environment in schools, the provincial funding formula should be modified such that school boards have access to sufficient resources when modifications to schools are required to improve indoor environmental quality. Alternatively, a special projects fund earmarked specifically for indoor environmental improvements should be established and made available to school boards.

- To provide the public with opportunities for effective participation in decision-making processes related to school indoor environments, there needs to be better outreach and education on the range of indoor environmental issues that could affect children's health.

2.0 Background and Introduction

In May 1997 in Ottawa, Pollution Probe participated in a national conference on children's health and environmental contaminants. Hosted by the Canadian Institute of Child Health (CICH), the conference addressed many of the environmental challenges facing our children. The relationship between children's health and wellness and environmental contaminants is an issue of increasing interest in the health and environmental communities. The Ottawa conference was the first in Canada to explore this relationship in a meaningful and informative manner. Through this venue and other research efforts, the CICH has advanced the dialogue on some fundamental issues regarding the way we address children's environmental health in Canada.

Building on the work by the CICH, in January 1998 Pollution Probe launched its own programme on children's health and environmental contaminants. As a kick-off to the programme, Pollution Probe and the CICH hosted an Ontario educational forum on the impacts of air pollution on children's health. Health professionals, policy-makers, educators, day care providers, and community workers came together to define the environmental risks facing children and to develop solutions to the problems. The forum highlighted several issues:

- children are more susceptible to harm from environmental contaminants than are adults;
- indoor environmental contaminants have significant impacts on children's health;
- we need to pay greater attention to the indoor environments in which children spend their time; i.e., schools, recreational facilities and day cares;
- Canada is falling behind other jurisdictions, particularly the United States, in its policy and research efforts to protect children from environmental pollutants; and,
- in Ontario, there are no guidelines, policies or programmes that specifically protect children from potential indoor environmental hazards in schools.

Since children are more susceptible than adults to the impacts of environmental contaminants, an unhealthy indoor environment can cause students to experience short- and long-term health problems.

In response, Pollution Probe embarked on a project to address the state of the indoor environment in Ontario schools. In light of findings that indoor air can be significantly more polluted than outdoor air, the fact that children spend about five to six hours a day inside of schools engaged in important learning activities is significant. Since children are more susceptible than adults to the impacts of environmental contaminants, an unhealthy indoor environment can cause students to experience short- and long-term health problems.[7] In contrast, a healthy indoor school environment can contribute to the productivity of students, teachers and staff, improve comfort levels, and reduce sickness and absenteeism.[8] While it is difficult for persons other than parents or guardians to protect children in their home environments, the public places where children spend their time should be safe and healthy.

Healthy Schools — Healthy Children is a two-phase project that aims to assess the range of indoor environmental issues facing Ontario schools, and to develop a cost-effective, proactive indoor environment management plan to help

schools identify, prevent and remediate indoor environmental problems. The purpose of Phase One is to provide the baseline information and analysis needed for Phase Two, enabling Pollution Probe and key stakeholders to develop solutions for improving the quality of school indoor environments in Ontario. This report reflects the findings from Phase One of Pollution Probe's research and addresses the following:

- the state of the indoor environment in Ontario schools;
- current legal authority and responsibility for issues related to indoor environmental quality and children's health;
- existing jurisdictional leadership (including case studies of indoor environmental programmes in schools);
- the economic implications of improving the indoor environments in schools;
- a proposed framework for a voluntary indoor environment management plan; and
- recommendations for action.

Pollution Probe's *Healthy Schools — Healthy Children* project advisory committee (see Appendix 1 for a list of committee members) provided the direction for many of the ideas reflected in this report. Other information was gathered through Internet and library research and interviews.

Since children are expected to attend school, it is important that these public facilities be maintained at the highest possible standards. Pollution Probe believes that it is incumbent upon caregivers, parents, teachers, school board officials, health-care providers and policy-makers to ensure that the school environment for children is optimal for learning and is conducive to healthy physical, academic and emotional development.

3.0 The Need for Action

There is a significant need for action to improve indoor environmental quality in Ontario schools. Three fundamental reasons for moving forward with a plan to address indoor environmental issues in Ontario schools are: 1) children are more vulnerable to the harmful effects of environmental pollutants than are adults; 2) indoor contaminants can have negative health impacts on children; and, 3) schools are important places where children spend their time, and they present particular challenges for managing indoor environment problems.

3.1 Children's Susceptibility to Environmental Contaminants

Children are not simply small versions of adults. This has profound implications for how they are affected by contaminants in the environment. Developmental, physiological, and behavioural differences make children, in many instances, more vulnerable than adults to pollutants.

From the foetal stage through to the end of adolescence, children are in a dynamic state of growth with cells multiplying and organ systems developing. At birth, their nervous, respiratory, reproductive and immune systems are not yet fully developed.[9] If a contaminant enters the tissues or organs of a child during a critical stage of development, it can interfere with healthy maturation. Disruption of healthy brain development is of particular concern because the brain undergoes dramatic growth and development, not only during gestation, but for many years afterwards. The creation of synapses (linkages) between brain neurons is vital; synapses make up the neuronal networks that are the basis of further development and patterns of adaptation and behaviour. Timing is critical for some aspects of brain development; disruption during a critical period of development or to certain cell systems may result in permanent damage. Some environmental agents are capable of interfering with both the timing and organization of brain development.[10]

Children are physiologically different than adults, and this often increases their exposure to environmental contaminants. Because their protective barriers are still developing, children absorb substances (including pollutants) at a much higher rate than adults through their skin, gastrointestinal tract and respiratory system. As well, because their livers and other metabolic systems are immature, infants and children are less able than adults to detoxify and excrete toxins.[11] As a result, if they are exposed to contaminants, the impact can be quite significant. The high rate at which children breathe air and consume water and food per kilogram of body weight also puts them at risk. For example, an infant's daily water intake per kilogram of body weight is almost three times that of an adult.[12] Proportionate to body weight, the average one-year old can eat up to seven times more grapes, bananas, pears, carrots and broccoli than an adult.[13] Hence, developing children may receive higher doses of pollutants from air, water and food sources than adults.

Children's behavioural characteristics can also serve to increase their exposure to environmental contaminants, often placing them in close proximity to sources of environmental pollutants. As compared to adults, children are physically closer to the ground — a place where many biological and chemical pollutants tend to settle. Infants and young children spend a lot of their time crawling and playing on floors, carpets, and grass, and can therefore suffer prolonged exposure to the contaminants that permeate these areas. Young children pass through an intense oral phase, ingesting relatively large quantities of "non-edible" products that may contain harmful substances. Similar to adults, children spend a good deal of their time engaged in indoor activities. As a result, they are subjected to a

range of indoor contaminants, including tobacco smoke, volatile organic compounds, dust mites, mould, and pesticides.

Because children are more vulnerable than adults to the effects of environmental pollutants, we must take special care to minimize their exposure in all circumstances. In particular, we need to pay more attention to indoor environments and their potential health implications for children.

> The EPA states that levels of pollutants indoors can be two to five times higher than levels of pollutants outdoors and, in some instances, can be up to 100 times higher.

3.2 Indoor Contaminants and Children's Health

Poor indoor air quality has been cited as a serious health and environmental issue by many experts internationally. The Science Advisory Board of the U.S. EPA claims that indoor air pollution is one of the top five environmental hazards to human health. As well, the EPA states that levels of pollutants indoors can be two to five times higher than levels of pollutants outdoors and, in some instances, can be up to 100 times higher.[14] The World Health Organization recognizes poor indoor air quality as a serious human health threat.[15] A study done by the North Atlantic Treaty Organization (NATO) deemed indoor air quality a priority non-military issue facing NATO nations.[16]

Many factors affect the quality of an indoor environment, including the products used in the building, the practices for maintaining the facility, the rate of airflow, and the age and/or condition of the structure. Specific elements of an indoor environment that can affect the health and comfort of the occupants include: the presence of tobacco smoke, mould, dust and animal dander; the presence of chemicals from cleaning and renovation products, pesticides, perfumes and furnishings; the use of chemicals in photocopiers and laminators; the presence of polluted outdoor air; and the practices of renovation, maintenance and cleaning. Carpets and fabric upholstery can have a significant impact on indoor environmental quality as they act as sinks for bacteria, viruses, pollens, mould, organic chemicals and dust.[17] For example, the amount of dust found in a square metre of old carpet can be up to 400 times that found on smooth surface flooring.[18]

The human health effects from poor indoor environmental quality are often similar to the symptoms of sick building syndrome (SBS). Health effects linked to SBS include eye, nose, and throat irritation, dryness of mucous membranes and skin, nosebleeds, skin rash, mental fatigue, headache, cough, hoarseness, wheezing, nausea, and dizziness[19] (refer to Appendix 2 for more on indoor contaminants and health effects). Dr. Malcolm Sears of McMaster University claims that indoor contaminants are the most important sources of risk to the respiratory health of our children.[20] In a Canadian study undertaken in 30 communities, it was found that in homes with indoor mould problems, the increase in asthma was 45%, bronchitis — 32%, chest illness — 52%, wheeze — 58% and cough — 89%.[21] According to a recent study by Statistics Canada, the rate of asthma among children under the age of 15 has quadrupled in the past 20 years.[22] According to a 1996-97 Population Health Survey conducted by the same agency, approximately 11% of Ontario

> Dr. Malcolm Sears of McMaster University claims that indoor contaminants are the most important sources of risk to the respiratory health of our children.

children under the age of 19 have asthma. Asthma is the leading chronic childhood disease and the primary cause of school absenteeism.[23]

While respiratory illness is the primary health effect associated with poor indoor air quality, there are additional health effects that have been linked to indoor contaminants. The presence of environmental (second-hand) tobacco smoke can cause children to develop ear infections, as well as asthma and other breathing problems.[24] A study done in Cleveland, Ohio revealed an association between infant deaths due to lung haemorrhage and the presence of *Stachybotrys chartarum* mould in the homes of these infants.[25] Dr. Doris Rapp, U.S. Paediatrician, Allergist, and Environmental Medical Specialist, has documented numerous cases of children with chemical and environmental sensitivities who suffer severe and debilitating health effects after exposure to mould, dust, perfumes and cleaning products.[26] Due to varying sensitivity among individuals, indoor pollutants can cause significant health impacts for some children and mild impacts for others.

> The time that children spend in schools is extremely important given that they are there to acquire academic and social skills that will, ultimately, affect their future and the future of our society.

Determining with certainty the impacts of indoor pollutants on all types of children (i.e., sensitive and nonsensitive) is a task that could take years of research, especially given the multiplicity of pollutants that exist in the indoor environment and the potential synergistic impacts that we know little about. Waiting until there is documented, scientific cause and effect evidence before we act could compromise the health of a generation of children. While the debate continues on the degree to which indoor pollutants affect children's health, childhood asthma and allergies are rising, schools and portable classrooms across the country are in need of rehabilitation due to mould problems, and tension between parents and school boards is growing. We know enough about children's vulnerability to pollutants and the serious impacts of indoor contaminants to take action on a precautionary basis sooner, rather than later.

3.3 Schools as a Priority Place for Action

Although children may typically spend more time out-of-doors than do adults, the majority of their time is also spent in the indoor environment.[27] Children attending school spend about five to six hours of every weekday in these facilities; young children who attend day care in a school spend even more than that amount of time there. The time that children spend in schools is extremely important given that they are there to acquire academic and social skills that will, ultimately, affect their future and the future of our society. Since schools are publicly funded facilities where children are expected to go for their education, society has the responsibility to provide these children with the best possible environment in which to learn.

Schools present particular challenges for managing indoor environmental problems. Approximately four times as many students and teachers occupy a given classroom space as do employees occupy an office space.[28] Yet many schools have a lower ventilation capacity than a typical office building. Given the rate at which infections can spread through a school population, highly volatile commercial cleaners are often used to keep germs under control. Schools have other unique pollutant sources, including cafeterias, art and science classes, vocational education areas, pools, rest rooms and locker rooms.[29] Historically, education in the classroom has been given priority over maintenance of the educational facility. Hence,

maintenance budgets are tight and often the first to be cut during difficult fiscal periods.[30]

> Of Ontario school administrators surveyed for ***Canadian Schoolhouse in the Red***, 88% believe that the learning environment is a "key factor" of or "absolutely critical" to student achievement.

According to the first national study of school facilities, done in 1993 — *Canadian Schoolhouse in the Red*, Canadian schools have specific problems related to building deterioration, upgrades, deferred maintenance and indoor air quality.[31] Moreover, one in six schools across Canada is considered an inadequate place for learning.[32] In 1993 in Ontario, 73% of schools had outlived their life expectancy, which is typically 40 years. Forty-three per cent were deemed in excellent shape, 37% were in fair condition and 20% were in poor condition.[33] The report states that substandard conditions of many of the facilities are due to deferred maintenance and building deterioration. With competing demands and limited resources, school boards are often faced with reducing maintenance budgets. In 1993, Ontario had a deferred maintenance burden of $396 million. When maintenance is deferred, building systems deteriorate more quickly and indoor air quality problems increase.[34]

Of Ontario school administrators surveyed for *Canadian Schoolhouse in the Red*, 88% believe that the learning environment is a "key factor" of or "absolutely critical" to student achievement. A 1991 study conducted at Georgetown University in Washington confirms these assumptions.[35] Fifty-two school facilities in Washington were assessed by engineers and architects and classified into three categories: excellent, fair or poor condition. Factoring out the variables that could affect learning, student achievement scores were then evaluated in all of the schools. The researcher found that the students attending schools in poor condition were 5.5 percentage points behind students attending schools in fair condition, and 11 percentage points behind those attending schools in excellent condition. This research prompted the U.S. government to pass the State Infrastructure Banks for Schools Act of 1997 that enacts funding provisions for school building and repair.[36]

Schools clearly should be a priority place for improving indoor environmental quality. If the purpose of schools is to educate children, then the facilities that house children for this important activity should be in optimal condition.

4.0 Legal Review and Analysis

Although the condition of a school facility may affect both the health and academic performance of a child, there is little federal or provincial leadership to address indoor environmental quality in schools. This section of the report draws upon the text that is relevant to schools of an analysis prepared for Pollution Probe by Joe Castrilli, Barrister and Solicitor, entitled *Legal Aspects of Indoor Air Quality in Canada*. (Please refer to this report for references and a more detailed legal analysis of indoor air quality issues in general.)

> With respect to legislation, there are few statutes that explicitly address control of indoor air pollution, and none that explicitly protect children from the potential harm associated with indoor contaminants in schools.

In the review below, Pollution Probe uses Mr. Castrilli's analysis to examine the potential constitutional, common law and legislative avenues for addressing indoor environmental quality in schools. Under the Constitution, the federal spending power could be applied to indoor air quality in schools. The Charter of Rights provides the potential basis for initiating litigation to protect the rights of chemically sensitive groups from discrimination. Under common law, students and school boards can impose liability on an array of defendants responsible for creating indoor air pollution problems. With respect to legislation, there are few statutes that explicitly address control of indoor air pollution, and none that explicitly protect children from the potential harm associated with indoor contaminants in schools. Moreover, even where legislation addresses problems of indoor air quality, the standards that have been developed cover few chemical substances of concern.

4.1 Constitutional Aspects

The Canadian Constitution divides the legal authority for environmental issues between the federal and provincial governments. In previous cases dealing with constitutional aspects of environmental legislation, the focus has been on the "natural" (i.e., outdoor), rather than the "built" (i.e., indoor) environment. Indoor environmental issues in schools should be considered under both the division of powers and the Charter of Rights under the Constitution.

With respect to division of power, the Canadian Constitution grants spending power to the federal government that could impact the way in which provinces fund education. Under this power, Parliament may spend or lend funds to any government, institution, or individual for any purpose, and may attach to any grant or loan any condition it chooses, including conditions it cannot directly legislate. Therefore, the federal government has the authority to place conditions related to indoor air quality on funds transferred to the province. In terms of provincial powers, the Constitution gives the Ontario government the authority to regulate indoor air quality if it chooses to do so.

The Charter of Rights and Freedoms provides the public with certain fundamental liberties that governments cannot interfere with, unless governments can demonstrate that such interference is justified in a free and democratic society. It states, "Every individual is equal before and under the law and has the right to the equal protection and equal benefit of the law without discrimination based on . . . sex, age or . . . physical disability." It is possible that federal or provincial laws, programmes, or activities that

protect the "average" Canadian within the context of the indoor environment, but fail to protect women, children, the elderly, or those suffering from special chemical sensitivities might run afoul of the Charter's equality rights provision.

4.2 Common Law Implications

The common law (law made by a judge) may provide compensation for people who have been harmed as a result of exposure to indoor air pollutants. Specifically, children who have been harmed as a result of poor indoor air quality in schools could sue under common law principles**.** Those that may be liable could include owners, architects, contractors and engineers, among others. It may, however, be legally difficult to prove that any harm suffered by the child was caused by the actions or practices of particular individuals.

Although there have been few reported judgements in Canadian courts to date regarding liability for indoor air pollution, tort theories of liability may be used to address these cases where they arise. Tort theories of liability that are most applicable to damage suffered by children in schools are negligence and products liability.

4.2.1 Negligence

Negligence is conduct that breaches a standard of care owed to a person who is harmed by the conduct. To prove an action in negligence, the plaintiff must show that**:** 1) s/he is within a class of people the defendant was obligated to care for; 2) the defendant's behaviour fell below the standard they should be expected to maintain; and 3) the plaintiff suffered damage that was foreseeable by the defendant.

Since principals and school boards owe a "duty of care" to the students, failing to address indoor environmental problems could constitute negligence.

4.2.2 Product Liability

When manufacturers, processors, sellers, or others produce products that injure people or property, they may be liable in negligence. The negligence theory of product liability is similar, in principle, to ordinary negligence law. Manufacturers and others have a duty to use reasonable care in producing products. For example, if it were shown that failure to take reasonable care in constructing a school resulted in defects that posed a substantial danger to the health and safety of school occupants, school boards could be liable. As well, since school boards are consumers of building materials, they could sue suppliers if their products were found to be defective. Although manufacturers are required to provide consumers with warnings associated with the product's danger, this obligation does not exonerate them from the duty to manufacture safe products in the first place.

When manufacturers, processors, sellers, or others produce products that injure people or property, they may be liable in negligence.

Overall, product liability provides a potential legal basis for imposing liability on an array of defendants responsible for creating indoor air pollution problems. However, for this defense to be successful, complex problems of scientific and medical proof still must be overcome.

4.2.3 Obstacles and Opportunities in Indoor Air Pollution Litigation

Using private litigation for resolving indoor environmental problems in schools presents significant obstacles for plaintiffs. One of the greatest challenges for a person suing is to prove that the action or product of the person being sued caused the problem. The prohibitive expense and complexity of civil litigation is

another challenge for plaintiffs. Because indoor environmental problems are often complex, the plaintiff may need technical, medical, and scientific expert witnesses in order to prove their case. Given that indoor environmental problems can arise from several factors, plaintiffs may be required to sue more than one party. Moreover, in civil litigation in Ontario, unsuccessful plaintiffs not only have to pay the costs of their own lawyers and experts but also a portion of the costs incurred by successful defendants. This can have a chilling effect on the ability and willingness of "victims" to take on such litigation.

The range of federal and Ontario legislation potentially applicable to indoor air quality is enormous. Due to the diversity of issues that may touch on indoor air quality, a variety of ministries, departments and agencies at all levels of government may have some authority for addressing different aspects of the problem.

Reliance on private litigation, to solve what seem to be pervasive challenges facing a significant portion of the nation's building stock, is not necessarily prudent or effective. Private litigation is primarily reactive in nature and available only to people who have the time, energy and funds to pursue such an undertaking. As an effective strategy for addressing indoor environmental problems, litigation needs to be combined with legislation that is preventive, is systematic, and seeks to achieve long-term planning goals.

On the other hand, civil litigation may be the only way to achieve a remedy where government agencies have failed to act, and to heighten the profile of indoor air quality with the public, the legislature, and the media. Several provinces, including Ontario, now authorize class actions or proceedings, whereby several people who have a common interest or injury may jointly sue a defendant (or defendants) for damages in a single case. This measure permits plaintiffs to offset the often prohibitive costs of lawyers and expert witnesses associated with civil litigation by combining resources for a case.

Overall, civil litigation may be used as a tool for redressing injuries sustained from indoor air pollution, filling gaps in the legislative regime, and providing a stimulus for the development of more comprehensive legislative schemes.

4.3 Legislation

The range of federal and Ontario legislation potentially applicable to indoor air quality is enormous. It includes laws pertaining to toxic substances, energy conservation, health promotion and protection, human rights, housing, building codes, product safety, radiation protection, occupational health and safety, workers' compensation, pesticides and tobacco control. Due to the diversity of issues that may touch on indoor air quality, a variety of ministries, departments and agencies at all levels of government may have some authority for addressing different aspects of the problem. This diversity of authority is understandable, given the number of areas involved. However, diversity also has the potential to create fragmentation of authority and result in ineffectiveness. This can occur if various levels of government and different ministries with a wide variety of, as well as potentially conflicting mandates, do not co-ordinate their efforts to address indoor air pollution in a coherent, systematic, and unified manner.

This section reviews the most important pieces of federal and Ontario legislation that are relevant, or potentially relevant, to the control of indoor air pollution in schools. Identification of a statute in this section does not necessarily mean that the statute is actually applicable to the indoor air quality problem; the application may be more potential or theoretical than actual.

4.3.1 Education Act

The Education Act, administered by the Ontario Ministry of Education, is the primary provincial law dealing with the establishment and maintenance of schools in Ontario. As noted above, the provinces have exclusive jurisdiction to develop laws governing education. Provincial education legislation reflects concern for the health, safety, and welfare of students, but is silent on the issue of indoor air quality. Provincial statutes usually impose responsibilities on school boards and their employees to supervise pupils, ensure cleanliness, provide ventilation, inspect equipment, and undertake related obligations. These legal responsibilities are in addition to those existing in common law, primarily associated with the law of negligence.

> The Education Act imposes duties on school principals to "give assiduous attention to the health and comfort of the pupils, to the cleanliness, temperature, and ventilation of the school . . . and to the condition of school buildings".

The act authorizes the Minister to make regulations regarding establishing schools, accommodation and equipment of buildings, and duties to supervisory officers. The Minister also allocates funding to school boards based on pupil accommodation allocation formulas established under the regulations. As well, the act imposes specific duties on school boards including (1) keeping the school buildings and premises in proper repair and in proper sanitary condition, providing suitable furniture and equipment and keeping it in good repair, and protecting the property of the board, and (2) insuring the buildings and equipment of the school board as well as employees. School boards also have authority to: erect, add to, or alter buildings for their purposes on land owned by the boards; erect school buildings on land leased by the boards where the terms of the lease, the school site, and the school building plans are approved by the Minister; and, add to, alter, or improve school buildings on leased lands with the approval of the Minister.

The act also imposes duties on school principals to "give assiduous attention to the health and comfort of the pupils, to the cleanliness, temperature, and ventilation of the school . . . and to the condition of school buildings" and to "report promptly to the board and to the medical officer of health when the principal has reason to suspect the existence of any communicable disease in the school, and of the unsanitary condition of any part of the school building." The regulations impart additional obligations on school principals, including organizing and managing the school, and inspecting the school premises at least weekly and reporting to the school board (1) any repairs to the school that are required and (2) any lack of attention on the part of the building maintenance staff of the school.

Overall, the act provides a potential basis for action on, but no specific guidance with respect to, indoor air quality issues by the Minister, school boards, and principals. Imposed primarily on school boards and principals, the statutory duties raise the possibility of potential liability for indoor air quality issues. For example, failure of a school board or principal to deal with indoor environmental problems could result in a breach of statutory obligations, which could constitute negligence under common law.

4.3.2 Health Protection and Promotion Act

Health legislation at the federal and provincial level is potentially applicable to the problem of indoor air pollution because of the general focus of such legislation on protection of the public from health risks and hazards. This includes the federal Department of Health Act, the Ontario Ministry of Health Act and the Ontario Health Protection and Promotion Act. Indeed, some government health

departments have developed voluntary, or non-regulatory, indoor air quality programmes. However, in practice, federal and provincial health laws are no more specific than most environmental laws in addressing indoor air quality.

> To ensure community health protection, the Health Protection and Promotion Act requires medical officers of health to conduct inspections to prevent, eliminate, and decrease the effects of health hazards in their jurisdiction.

The statute most relevant to a discussion of Ontario schools is the Health Protection and Promotion Act. Administered by the Ontario Ministry of Health and Long-Term Care, the purpose of this act is to (1) provide for the organization and delivery of public health programmes and services, (2) prevent the spread of disease, and (3) promote and protect the health of the people of Ontario. The act authorizes the creation of local boards of health to meet these objectives. The act defines "health hazard" as a condition of a premises, a substance, thing, plant, or animal other than human, or a solid, liquid, gas, or combination of any of these, that "has or is likely to have an adverse effect on the health of any person." Under the statute, the Minister is authorized to publish guidelines for mandatory health programmes and services with which every board of health must comply. However, the act makes it clear that the guidelines are not regulations and that, in the event of a conflict between the two, the regulations prevail.

To ensure community health protection, the act also requires medical officers of health to conduct inspections to prevent, eliminate, and decrease the effects of health hazards in their jurisdiction. They must respond to complaints of health hazards related to occupational or environmental health in their health unit. The medical officer of health, alone or in conjunction with other ministries that have primary authority for the problem, must investigate the complaint to determine whether a health hazard exists, and report the results of the investigation to the complainant. Medical officers of health also must keep themselves informed on issues related to occupational and environmental health. As well, the medical officer of health and public health branch staff provide research support and technical expertise. The ministries of environment, health and labour are required to provide information requested by medical health officers.

Where a medical officer of health believes that a health hazard exists in his or her health unit, s/he may issue an order to a person to address the health hazard. The order may require the vacating, closing, cleaning, and placarding of the premises, removing or destroying the source of the health hazard, and prohibiting or regulating the manufacturing, processing, preparation, storage, handling, display, transportation, sale, or distribution of anything that is the source of the health hazard. When mould was found in many of the portable classrooms in the region of Halton, for example, the medical officer of health ordered invasive inspection of all portable classrooms.

The Minister also is authorized to exercise the powers granted to boards of health and medical officers of health under the act, when the Minister is of the opinion that a situation exists anywhere in Ontario that constitutes a risk to the health of any person. Actions available to the Minister include investigating, preventing, eliminating, or decreasing the risk.

The act is clearly broad and general enough to permit the ministry, local boards, and medical officers of health to address issues relating to indoor air quality in Ontario. However, the act, regulations, and guidelines are not specific to the issue, and provide no special guidance on controlling indoor air pollution in schools.

4.3.3 Occupational Health and Safety

At federal and provincial levels in Canada, occupational health and safety legislation is designed to address workplace conditions, including aspects of indoor air quality. With respect to schools, it applies only to the workers in that environment, and not to the children who occupy the same premises. The origin of this type of legislation was the industrial or manufacturing workplace where there was a focus on certain hazardous air pollutants and their impact on the healthy male adult worker. While modern occupational health and safety legislation broadly defines the workplace environment, the focus of the regulations, with some exceptions, still tends to be related to the industrial setting. The continuing focus on air pollutants in industrial workplaces may not be helpful to workers and others in non-industrial workplaces, such as office buildings, schools, and nursing homes.

The provincial Occupational Health and Safety Act (OHSA), administered by the Ontario Ministry of Labour, imposes responsibilities on employers to protect and inform workers, and establish committees to deal with workplace health and safety issues. It also provides the Ministry of Labour with the authority to conduct inspections and control toxic substances that may endanger the health of workers. With respect to indoor air quality, the ministry uses, as best practices guidelines, the current standards set by the American Society of Heating, Refrigerating and Air-conditioning Engineers (ASHRAE) and the recommendations of the Inter-Ministerial Committee on Indoor Air Quality.

The OHSA also authorizes the province to make regulations to protect worker health and safety and to list any biological, chemical, or physical agents or combination thereof as designated substances. Regulations made under this authority have dealt with such materials as lead and asbestos. Because only one substance is considered at a time, only twelve designated substance regulations have been developed to date. The need to control other workplace toxic substances led the province to create a generic regulation for controlling exposure to approximately 600 biological and chemical agents listed in the regulation. In addition, as part of the national programme on hazardous materials disclosure and protection of confidential business information, Ontario has developed a regulation on workplace hazardous materials information.

At federal and provincial levels in Canada, occupational health and safety legislation is designed to address workplace conditions, including aspects of indoor air quality. With respect to schools, it applies only to the workers in that environment, and not to the children who occupy the same premises.

4.3.4 Building Codes

Building codes have the potential to affect indoor air quality in the context of building ventilation and use of building materials. At the federal level, the national building code is a guideline that has no legal effect unless it is specifically referred to in another federal statute. On the other hand, provincial building codes tend to be developed as regulations under provincial building code legislation. They have broad legal effect and may be enforced by provincial and municipal governments. Building codes are still evolving in terms of whether and, if so, how they specifically address indoor air pollution issues.

The Building Code Act, 1992, administered by the Ontario Ministry of Municipal Affairs and Housing, provides province-wide standards for construction, demolition, and maintenance of buildings (including schools). The act makes municipal councils responsible for enforcement of the act in their municipality, and requires that

they appoint chief building officials and inspectors for this purpose. The act and the building code established under it supersede all municipal by-laws regarding the construction or demolition of buildings in Ontario.

There are two aspects of the building code that have potential application to indoor air quality problems. These include standards for heating, ventilating, and air-conditioning (HVAC) systems, and for building materials. Under the code, HVAC systems must be designed, constructed and installed to conform to "good engineering practice" as set out in a number of handbooks published by ASHRAE. This includes requirements that HVAC systems be designed to minimize the growth of microorganisms. Additionally, the rate at which outdoor air is supplied to rooms and spaces in buildings by ventilation systems must meet certain ASHRAE standards. Air contaminants released within buildings must be removed at their points of origin and must not be permitted to accumulate in concentrations greater than the limits established by the American Conference of Governmental Hygienists. The code also specifies that materials used in air duct systems must be constructed of certain materials including "asbestos, cement or similar noncombustible material."

There are two aspects of the building code that have potential application to indoor air quality problems. These include standards for heating, ventilating, and air-conditioning (HVAC) systems, and for building materials.

The act establishes a building materials evaluation commission whose powers and duties include (1) researching and examining materials, techniques, and building design for construction, (2) authorizing the use of any innovative material, system, or building design, and (3) making recommendations to the Minister respecting changes to the act or building code. While the code standards for building materials are silent on indoor air quality issues, they do permit the use of innovative alternatives to those materials specified in the code. In general, however, the code is not overly specific about control of indoor air pollution.

4.3.5 Environmental Legislation

Environmental legislation at the federal and provincial levels of government in Canada tends, on the whole, to focus on outdoor air quality. This includes the federal Department of Environment Act, Canadian Environmental Protection Act, and Canadian Environmental Assessment Act, and the provincial Ontario Environmental Protection Act, Environmental Assessment Act, and Environmental Bill of Rights. While improving ambient (or outdoor) air quality can provide an indirect benefit to indoor air quality by reducing the concentrations of pollutants introduced by outdoor air, federal and provincial environmental legislation is generally not directly focused on, or designed to address, the specific problems posed by indoor air pollution. The Ontario Environmental Assessment Act, however, is the exception and does have some application to indoor air quality.

Ontario's Environmental Assessment Act (OEAA) has the potential to apply to indoor air quality issues associated with the establishment of new projects, or the expansion of existing projects, that are subject to the act. The definition of environment is broader than that found under federal environmental legislation or under the Ontario Environmental Protection Act. Under the OEAA, environment means (1) air, land, or water, (2) plant and animal life, including human life, (3) the social, economic and cultural conditions that influence the life of humans or a community, (4) any building, structure, machine, or other device or thing made by humans, (5) any solid, liquid, gas, odour, heat, or radiation resulting directly or indirectly from human activities, or (6) any combination thereof. Moreover, the act further defines air to include

"enclosed air." As a result of these broader and more explicit definitions that include reference to the environment encompassing buildings, enclosed air, and humans, it is arguable that indoor air quality considerations may be taken into account in connection with new or expanded projects that are made subject to the OEAA. This could apply to new school construction or significant additions to schools.

> As a result of broad and more explicit definitions that include reference to the environment encompassing buildings, enclosed air, and humans, it is arguable that indoor air quality considerations may be taken into account in connection with new or expanded projects that are made subject to the Ontario Environmental Assessment Act.

The OEAA requires proponents of public, and designated private-sector undertakings to prepare an environmental assessment that outlines the purpose of, and rationale for, the undertaking. The environmental assessment also may consider possible alternatives to the undertaking, advantages and disadvantages to the environment, and mitigating measures. For major projects, approvals under the statute may be preceded by quasi-judicial hearings before the Environmental Assessment Board, established under the act. The act and guidance documents require a proponent to go through an environmental planning process that contains five key features: (1) consultation with affected parties; (2) consideration of reasonable alternatives; (3) consideration of all aspects of the environment; (4) systematic evaluation of net environmental effects; and (5) provision of clear and complete documentation.

4.3.6 Human Rights Legislation

Human rights legislation at the federal and provincial levels in Canada aims to prohibit discrimination against people with handicaps or disabilities, and requires employers and others to reasonably accommodate such individuals. Key to determining the effectiveness of human rights legislation in addressing indoor air quality in schools is whether a student suffering from chemical sensitivities could be considered disabled, and what actions would constitute reasonable accommodation of this person.
The Ontario Human Rights Code, administered by the Ontario Ministry of Citizenship, Culture, and Recreation, contains a number of statements regarding the need for freedom from discrimination. These include (1) recognition of the inherent dignity and equal rights of individuals in accordance with the Universal Declaration of Human Rights proclaimed by the United Nations, (2) declaration that it is public policy in Ontario to recognize the dignity and worth of every person and to provide for equal rights and opportunities without discrimination that is contrary to law, and (3) confirmation that it is desirable to "extend the protection of . . . human rights in Ontario."

> Key to determining the effectiveness of human rights legislation in addressing indoor air quality in schools is whether a student suffering from chemical sensitivities could be considered disabled.

The code states that every "handicapped" person has the right to equal treatment without discrimination with respect to: services, goods, and facilities; accommodation; contracts; and, employment. "Handicap" is defined as "any degree of physical disability . . . caused by illness" or a "disability for which benefits were

claimed or received under an insurance plan established under the Workplace Safety and Insurance Act, 1997." People with handicaps must be reasonably accommodated, unless this cannot be achieved without undue hardship on employers or others responsible for providing the accommodation, taking into account cost factors, outside opportunities for funding, and health and safety requirements.

Although there are no reported cases of discrimination under the code related to chemical sensitivities from indoor air pollution, there is some recent case law that makes it conceivable that a person with such sensitivities could be considered disabled. In one case, a Board of Inquiry found that alcoholism amounted to a "degree of physical disability . . . caused by illness", even though nothing in the code specifically included alcoholism within the definition of handicap. If Boards of Inquiry are prepared to find that alcoholism constitutes a handicap, then it is conceivable that, in future cases, disability due to chemical sensitivity could also be included in the definition.

5.0 Indoor Environmental Issues Facing Ontario Schools

The quality of indoor environments in Ontario schools is determined by a range of factors at school boards, including financial resources, priorities and general awareness of indoor environmental issues. This section describes the indoor environmental challenges faced by school boards, the mechanisms they employ to address these challenges and public perception of indoor environmental quality in schools. To begin, some basic school statistics are presented to provide an overview of Ontario's school system.

5.1 Factual Overview

Ontario Schools

Publicly funded Ontario schools (based on 1997-98 data)

- Total enrolment: 2,095,630
- Number of schools: 4,751
- Number of teachers: 117,007

Privately funded Ontario schools (based on 1997-98 data)

- Total enrolment: 92,070
- Number of schools: 618
- Number of teachers: not available

Estimated number of non-teaching staff in publicly funded schools (i.e.., support staff, custodians, administrators, etc.): 38,000

Sources: Ontario Ministry of Education Web site (www.edu.gov.on.ca/eng/elcome.html) and Linda Ivey, Ontario School Board Co-ordinating Committee, CUPE.

Day Care in Ontario Schools

- There are approximately 3,000 licensed day cares in Ontario with about 150,000 children in attendance.
- Approximately one-half of all day cares are located in schools.
- Day care programmes with school-aged children can be operated in portable classrooms.
- Children in day care are covered by the Day Nurseries Act, which addresses conditions of the physical plant. The only requirement related to air quality is that children must go outside twice a day.

Source: Kerry McCuaig, Executive Director; Ontario Coalition for Better Child Care

Ontario Portable Classrooms

- There are approximately 10,000 portables in Ontario (the exact number is unknown; the Ontario Ministry of Education does not have records of every portable purchased in the province).
- Most portable growth was in the mid-1980s for the purpose of accommodating spikes in school population.
- The life expectancy for a wood-frame portable is 15 years, depending on the maintenance regime and stability of location.
- There are approximately 4,000 portables in Ontario that are 15 years or older.

Source: Business Services Branch; Ontario Ministry of Education

5.2 Indoor Environmental Challenges

Anecdotal evidence, media reports and the conclusions reached in *Canadian School House in the Red* suggest that Ontario school boards are dealing with a host of challenges related to the condition of school facilities and indoor air quality. The new provincial funding formula exacerbates the challenges as it lacks the necessary provisions for indoor air quality improvements.

One of the key indoor environmental issues that school boards encounter is inadequate ventilation of schools. The Durham District School Board claims that exhaust-only ventilation systems are one of the primary causes of indoor air quality problems in their schools.[37] This type of system exhausts air to the outside through fans, generally located in ceilings of classroom clothes closets.[38] Inside air should be replaced by outside air entering through windows and cracks in the structure. However, in colder temperatures, windows are not opened; as well, energy conservation efforts have sealed cracks and blocked off pathways for outside air. Approximately 70% of Ontario schools were built before the 1970s with exhaust-only ventilation systems.[39] Another cause of ventilation problems is poorly designed renovation schemes. In many schools, rooms have been subdivided to accommodate more students, programmes and day cares. Often the occupants of the new room are cut off from the ventilation provided to the larger room.[40] Ventilation provided to rooms that house computers and photocopiers is frequently inadequate. Older schools were not built to accommodate newer technologies. As a result, students and staff who study and work in these areas are more likely to report health problems associated with poor ventilation.[41]

Other indoor environmental factors that require the attention of school board officials include chemicals and biological agents. The former Metro Toronto School Board dealt with complaints related to specific contaminants, such as ozone and formaldehyde, and microorganisms, such as dust mites.[42] Health effects that are commonly reported (often to school board and union officials) include headaches, low energy, sore throat, respiratory problems and general flu-type symptoms.[43] Recently, school board health and safety officers have been receiving numerous complaints related to indoor air quality in portable classrooms.[44] Recent mould problems in Halton and Peel region portables have heightened concern among parents and school portable occupants. Portable classrooms were never designed for permanent use. Poor design and construction practices have made portables prone to water seepage, which leads to mould growth.[45] As well, if they are not aired out regularly, they become stuffy, carbon dioxide levels rise and occupants become tired and less productive.[46] Mould has also been a problem in permanent school structures. Recently, two Ontario schools temporarily closed for rehabilitation due to mould problems.[47] Mould tends to collect in carpets as well, along with other biological agents such as dust mites, pollen and bacteria.[48] In fact, the Durham District School board found over the years that mould amplifiers are more prevalent in carpets than in portables.[49]

Through Bill 160, the Education Quality Improvement Act, the Ministry of Education now assumes control over school funding. The new funding formula has no specific provisions for indoor environmental improvements and offers no flexibility for dealing with special concerns. For many boards, the new funding formula has meant fewer resources for everything, including facilities management.

Radon, a naturally occurring radioactive gas, is another substance of concern in schools. The Canadian Institute for Radiation Safety has found high levels of radon in four Ontario schools during the past six years.[50] Two schools in the former Metro Toronto School Board had readings at or above the U.S. Action Level of 20 mWL (milli Working Levels). As well, two schools in the Northumberland Board of Education had readings at 25 mWL and 48 mWL. Radon is a carcinogenic substance. Increases in exposure to radon equal increased health risks. Whereas the U.S., the U.K. and Sweden have done extensive testing, very little radon testing has been done in Canada. In the province of Ontario, only the former Metro Toronto School Board has conducted comprehensive radon testing. More testing is needed to ascertain the extent to which radon presents a risk to children's environmental health in Ontario schools.

While there exists some evidence to suggest that Ontario schools have indoor environmental problems, more research is needed to ascertain the range and extent of the problems and the potential health impacts on school occupants. With the exception of that published in *Canadian School House in the Red* in 1993, there have not been any formal studies conducted on the state of school facilities in Ontario. Moreover, there have never existed any systematic inventories of all indoor environmental problems that exist in Ontario schools. There are gaps also in our knowledge of the degree to which school indoor contaminants are exacerbating the health problems of children with asthma, allergies, immune system deficiencies and other sensitivities. This information needs to be gathered to better understand the scope of the issues and encourage a co-ordinated response to the problems.

To assist school boards in responding to indoor environmental challenges in a responsible, effective manner, more resources are needed. In 1997, the provincial government made significant reforms to Ontario's education sector through Bill 160 — the Education Quality Improvement Act. One of the major changes made by Bill 160 was a new funding formula for schools. Prior to Bill 160, local school boards were responsible for funding their own facilities. They had the power to raise funds locally, through property taxes, and could apply to provincial grant programmes for special projects. With Bill 160, the Ministry of Education now assumes control over school funding. Through several grant programmes, the Ministry provides school boards with funds based on the number of students and the square footage of the facility. The new funding formula has no specific provisions for indoor environmental improvements and offers little flexibility for dealing with special concerns. The government would argue that the new funding formula provides adequate financial resources for facilities issues; in 1999-2000, it will allocate $1.7 billion to school boards for operation, maintenance and renewal of schools — an amount that government officials believe is sufficient.[51] However, many boards claim that the new funding formula has meant fewer resources for everything, including facilities management. For example, the Toronto District School Board will have $300 million less in their funding pot due to Bill 160; as well, the majority of the cuts to this board are in non-classroom categories such as school operations, maintenance and renewal.[52] The provincial funding formula needs to be modified to allow school boards access to sufficient financial resources where modifications to schools are required to improve indoor environmental quality. Alternatively, a special projects fund needs to be established for indoor environmental improvements in schools.

5.3 Current Response Mechanisms for Indoor Environmental Problems

Currently, there is no overarching programme, strategy or policy on a province-wide basis to proactively address the quality of school indoor environments. Many Ontario school boards have

acquired extensive experience in dealing with indoor air quality problems and have implemented effective approaches to addressing the issues. However, many also deal with indoor air quality complaints on a case-by-case basis, reacting to and resolving problems as they arise.

While there is much flexibility in the way that indoor environmental issues are resolved in schools, the general chain of command is as follows:

- the complaint is made to the principal;
- the principal resolves the problem or directs complaint to the school board's Health and Safety Officer (HSO);
- depending on the nature of the problem, the HSO may consult with school board officials responsible for plant operations;
- when a complaint comes from a student or parent, the Public Health department may become involved; this could involve an independent inspection and, in turn, orders being issued by the medical officer of health;
- if necessary, the HSO conducts a site inspection and orders air quality testing; the Ontario Ministry of Labour may also conduct an inspection if a complaint is made by staff; and
- recommendations are made to the principal.

Some school boards employ proactive measures to address indoor environmental problems. Some examples include: the Durham District School Board has developed a passive air supply system to improve ventilation; the former Metro Toronto School Board developed a Product Assessment Matrix for purchasing low emission products; the Waterloo Region District School Board uses indoor air quality as a criteria for purchasing products; the Toronto Catholic District School Board surveys school occupants for environmental health symptoms; the Halton District School Board issues regular bulletins on indoor air quality to teachers and occupants; and, the Lakehead District School Board has developed an indoor air quality guide (see Appendix 3 for some examples of healthy schools initiatives; see Section 6.0 for more Durham and Waterloo initiatives).

While some school boards are clearly taking steps to improve indoor environmental quality, there is great inconsistency from one school board to the next in the way in which indoor environmental problems in schools are handled. The degree to which schools and school boards address indoor environmental challenges depends on how aware they are of the issues, their priorities, and the availability of resources. In 1998, a Master's student at the University of Calgary surveyed 293 school systems across Canada on issues related to indoor air quality in schools and found the following:

- a general lack of familiarity with indoor air quality issues;
- insufficient commitment from school administration and Departments of Education to provide leadership and the necessary resources (funding, skills, equipment, and technology) to address indoor air quality effectively;
- lack of communication between the school system and the public, and between school administration and staff;
- inadequate provisions for training staff about the causes of poor indoor air quality and the ways their actions might have an impact on air quality;
- limited indoor air quality-related documentation required for evaluation purposes;

- lack of a system to measure indoor air quality so that assurance can be provided to stakeholders about the quality of air in school buildings; and,

- a tendency to rely on the reactive approach which often leads to having to deal with emergency situations.[53]

In Ontario, although school boards have responsibility for providing children with a healthy learning environment, they are consumed with financial difficulties related to the new funding formula and with more immediate concerns, such as school board amalgamation. Indoor air quality is low on the priority list when compared with budget cuts and amalgamation restructuring. Hence, the development of a proactive strategy for dealing with indoor environmental issues in Ontario schools is not receiving the attention that is needed. An indoor environment management plan would aim to make this issue more visible by building on the current leadership of some school boards and providing cost-effective, proactive strategies for improving the indoor environment. Moreover, with growing public concern about the environmental safety of schools, a proactive plan to address indoor environmental quality would help to build trust between school boards and parents.

5.4 Public Perceptions and Concerns

This section draws on the conclusions of a media analysis that Pollution Probe conducted on indoor environmental issues in Ontario schools (refer to Appendix 4 for full media report). The purpose of the media analysis was to better understand what information the public receives on indoor environmental problems and how the media documents public reaction to these issues. The analysis was based on 118 media clippings gathered from daily newspapers in Ontario during the period 1996–1999.

As the Regional Chair of Halton stated, "It doesn't matter if a problem is perceived or whether it exists; what matters is that parents have the peace of mind that when they send their children to school, they are as safe as they can be."[54] Since the recent emergence of mould-related problems in portable classrooms, particularly in the Halton and Peel districts, parental anxiety about the safety of schools is on the rise. The number of cases of mould-related illness and portable classroom closures is growing; a sense of public fear and urgency is being expressed in the media. Many factors, including the media, have influenced the way the public perceives this issue. Public perception is important, as it will influence the way in which governments and school boards deal with the problems.

Although there are several factors that affect the quality of indoor environments in Ontario schools, mould is the issue about which parents are currently most concerned. This is due, in part, to the attention it has received in the media. The controversy and uncertainty of the way that mould impacts children's health has helped fuel the "newsworthiness" of the story. Initially, when the issue of mould in portables arose, the lack of a definitive conclusion on the health effects of exposure resulted in differing reactions to the issue by the Public Health Units in Ontario. As well, the issue involves conflict between parents and school boards; heated debate among experts on health risk; sick children; and inaction by the government. All of these factors create the kind of story that attracts media attention.

As the Regional Chair of Halton stated, "It doesn't matter if a problem is perceived or whether it exists; what matters is that parents have the peace of mind that when they send their children to school, they are as safe as they can be."

It is interesting to look at the difference in the way that the media handled the asbestos issue during the same period. Although asbestos is deemed a carcinogenic substance by the medical community, and is still considered a problem in Hamilton, Burlington and Oakville schools, fewer articles were written on the subject, the reporting tone was much more even and the health factor was less of a feature. Even though the evidence for health risks to children from asbestos is clearly documented, the stories were considered less newsworthy. Since the issue of asbestos has been around for more than a decade, there is no debate or controversy in the medical community on the health risks, there are protocols in place to deal with the substance, and the government is involved in monitoring its use and disposal. The story has lost its sensational appeal. In fact, the transparency and openness of process that have developed around the issue of asbestos have helped to foster trust between the community and the school boards. The Hamilton-Wentworth school board has invested a lot of time into their "model" asbestos abatement programme, which has helped to shift media attention away from school boards in regard to asbestos. Hence, current public distress and outrage about asbestos are considerably less than they are for mould.

The way in which this issue has been reported by the media, along with the lack of co-ordinated response to the problems, has left parents feeling vulnerable and confused. The provincial government will not take responsibility for the problem because the science is not clear. Each school board is dealing with the situation in a different manner. Some school boards are conducting invasive testing of portables, while others are doing visual inspections. Some school boards are decommissioning portables, while others are doing renovations. This sends mixed messages to parents, and reduces their confidence in the decision makers who are responsible for keeping their children safe. The Ontario Ministry of Health and Long-Term Care made efforts to examine the controversy surrounding mould by initiating an Expert Panel on Fungal Contamination Indoors. This panel developed a framework for action which, if followed, will result in a more uniform response by medical officers of health to future mould issues.

The public perceives mould as a significant health threat to children. They will continue to see mould as a problem until there is a co-ordinated, proactive response to the issue. The mould issue has also opened the door for more discussion and debate on the variety of indoor contaminants that exist in a child's learning environment. As the public becomes more informed, proponents will continue to advocate for healthier indoor environments with determination. As problems escalate, the media will continue to report the stories that reflect and fuel parent anger. This happened in Nova Scotia and led, in part, to provincial action on indoor environmental issues in schools (see Section 6.1.2 for more on Nova Scotia). Parents can greatly influence the actions of decision makers in government and school boards. Whether it is crisis management later, or proactive programmes now, governments and school boards will be called upon to address the public's fears about the safety of school facilities.

6.0 Jurisdictional Leadership

Historically, the Ontario government has taken little responsibility for indoor environmental issues in schools. Recently, the Ministry of Education has stated that it will be facilitating workshops in the near future to assist school boards in mould management; as well, it is planning to work with the Ministry of Health to develop indoor air quality guidelines for schools.[55] Other jurisdictions have shown more leadership in this area, and their efforts provide a good framework for Ontario-based action. For example, New Brunswick has developed low-emission product purchasing criteria for schools, issues educational newsletters to parents and requires regular duct cleaning in schools.[56] The Workers' Compensation Board of British Columbia has recently enacted indoor air quality parameters within the Occupational Health and Safety Regulation that affect the school environment.[57] The Nova Scotia government is drafting indoor air quality regulations and has dedicated staff to help school boards address their problems (see Section 6.1.2 for a full discussion on Nova Scotia). In the U.S., the EPA and the states of Texas, Washington, Maryland and Vermont have developed guidelines, programmes and legislation to improve indoor environmental quality in schools.[58]

In 1995, the U.S. EPA developed a national voluntary programme to address indoor air quality in schools. Entitled ***Indoor Air Quality Tools for Schools Action Kit,*** this programme has been touted as one of the best programmes in North America to address indoor air quality problems in schools.

As mentioned previously in Section 5.3, several Ontario school boards are also showing leadership in this area. School boards in eastern Canada are particularly active. The Saint John School Board Districts Six and Eight have implemented scent-free, pesticide-free policies, as well as initiatives addressing ventilation problems.[59] The Annapolis Valley Regional School Board in Nova Scotia has a comprehensive preventative maintenance programme and protocols for assessing cleaning products.[60] The Halifax District School Board has just completed a draft scent-free policy for its schools.[61]

The level of awareness and action in some jurisdictions is markedly higher than in others. Understanding the reasons behind this will help to inform a strategy for the Ontario government and school boards to take action. It is useful to understand what motivates some jurisdictions to take action on indoor environmental issues in schools, what factors influence their decisions, what issues present barriers to progress, and how their actions achieve results. The following sections consider these questions, and others, in relation to efforts by two governments and two school boards. These case studies provide insight into the factors that encourage jurisdictions to become proactive.

6.1 Government Leadership

6.1.1 U.S. Environmental Protection Agency

In 1995, the U.S EPA developed a national voluntary programme to address indoor air quality in schools. Entitled *Indoor Air Quality Tools for Schools Action Kit (IAQ Tools for Schools)*, this programme has been touted as one of the best programmes in North America to address indoor air quality problems in schools.[62] As well, the Consumer Research Council, in co-operation with the EPA, has drafted model legislation on indoor air quality in schools. The

Consumer Research Council will now be encouraging state and local governments to adopt this legislation.

IAQ Tools for Schools aims to help school occupants identify, prevent and remediate indoor air quality problems through step-by-step instructions, checklists, an indoor air quality problem-solving wheel and a video.[63] While the EPA would like to deliver this programme in all 110,000 schools in the country, the EPA Congressional mandate is to have 16,500 schools implement *IAQ Tools for Schools* by 2005. To date, the EPA has invested $485,000 for programme development and $1.5 million for implementation.[64]

The programme is based on the following principles:

- The expense and effort required to prevent most indoor air quality problems is much less than the expense and effort required to resolve problems after they develop.

- Educating school staff and students about the factors that create them can prevent many indoor air quality problems. When indoor air quality problems do arise, they can often be resolved using skills available in-house.

- If outside assistance is needed to solve an indoor air quality problem, the best results will be achieved if school officials are informed customers.[65]

The programme requires a dedicated indoor air quality co-ordinator in each school to act as leader for the indoor air quality team. The indoor air quality team consists of teachers, students, parents, administrative staff, facility operators, custodians, health officers, school boards, contract service providers, and local news media. The programme kit provides each team member with background information and easy-to-follow activities that will help them prevent and resolve indoor air quality problems (see Appendix 3 for sample action list). The kit also provides step-by-step instructions on how to develop a management plan, including procedures for assessment and identification, repairs and upgrades, monitoring, indoor air quality policies, education and reporting. As well, the proposed management plan structure is flexible so that schools can tailor it to their own needs.

The EPA has shown great leadership on indoor air quality in schools and has committed a significant amount of time and resources to developing and implementing *IAQ Tools for Schools*. The EPA began taking action on this issue due to the findings of a national school facilities study conducted by the U.S. General Accounting Office (GAO) in February 1995.[66] Due to factors such as deferred maintenance and ventilation problems, the study claimed that about half of America's schools experienced poor indoor environmental quality. The public was also instrumental in encouraging government action; the volume of indoor air quality complaints from parents and school occupants prompted the government to conduct the study, which led to the development of their programme. The desire to improve public relations was a significant motivator for the EPA's actions on this issue.[67] By taking steps to address the problems, the U.S. government demonstrated to the public that it was doing its best to protect children from the potential health risks associated with poor indoor air quality.

The EPA used health and economic messages to promote the programme and relied heavily on external partners for implementation. It focused on the fact that asthma-related deaths among children aged 5 to 24 had doubled between 1980 and 1993, and that indoor contaminants were primary culprits in causing and/or exacerbating asthmatic symptoms. Since most American schools experience budgetary constraints, it was important for the EPA to include low- or no-cost solutions in its programme. In addition, the EPA marketed the programme on the idea that participating schools could prevent expensive

investigation and remediation, lower heating and cooling costs, and reduce the potential for liability.

The EPA partnered with several organizations and other government agencies to assist in outreach and implementation. It held ongoing train-the-trainer sessions with the American Lung Association, National Education Association, American Association of School Administrators and the National PTA. As well, it secured an Interagency Agreement with the U.S. Department of Agriculture for community educators to assist in promoting the programme. Three training modules have been produced for the participating schools and for partner organizations — one full-day presentation, one half-day presentation, and one 45-minute presentation.

The biggest weaknesses with *IAQ Tools for Schools* are related to monitoring and follow-up. The programme lacks a mechanism by which the EPA can assess the extent to which the schools are utilizing the tools. Moreover, the EPA does not know how beneficial it has been for schools, or whether indoor air quality has improved. In January 1999, the EPA commissioned the Consumer Federation of America Foundation to conduct focus groups with teachers, administrators and facility managers to better understand the incentives for and barriers to participation. Some of the key findings from the study included the following:[68]

- Lack of awareness of indoor air quality was a significant barrier to implementation. Conflicting awareness was also seen as a problem; i.e., educators/administrators had limited knowledge of indoor air quality issues but believed they caused health problems; facility managers had more knowledge of the issues but were less likely to believe that poor indoor air quality was a health risk.

- Due to competing priorities and lack of resources, more solid evidence is needed of the link between indoor air quality and student achievement, attendance, and health before indoor air quality will be moved up the priority list.

- More sectors need to be included to encourage implementation (i.e., PTAs, health and safety committees, maintenance engineers, and school administrators). In addition, parents need to be utilized as the driving force for the programme.

- Mandating indoor air quality in schools may be more effective than encouraging voluntary initiatives due to competing priorities.

To assess the programme's effectiveness, in September 2000 the EPA will conduct a survey of 16,500 schools that are participating in the programme. This will help to further identify areas for improvement and to determine future strategies for promotion and implementation.

6.1.2 Nova Scotia

Nova Scotia is one of the most active jurisdictions in Canada on issues related to indoor environmental quality in schools. It is investing resources into this area, encouraging voluntary strategies, and drafting indoor air quality regulations for public buildings such as schools and libraries.

Below is a list of the government's past and current efforts in this area:[69]

- Recently hired an Environmental Health and Safety Co-ordinator who works with school boards to address issues related to indoor air quality in schools;

- Developed an indoor air quality complaint response protocol for school boards;

- Purchased equipment for each school board ("Indoor Air Quality Detective") that measures particulates as small as .02 microns in size;

- Currently piloting the EPA's *IAQ Tools for Schools* programme in two schools and considering it for province-wide implementation;

- Using the Indoor Air Quality Detective to establish a baseline of particulate levels in all schools;

- Building new schools in the province according to "healthy school" guidelines, which include specifications for ventilation, filtration of air and ecological product purchasing;

- Requiring new schools to undergo an environmental preoccupancy review to determine the environmental safety of the school;

- Building ECO (environmentally controlled opportunity) classrooms in some school districts as part of a new school construction project;

- Advising consultants and designers on indoor air quality considerations for new school construction; and,

- Drafting indoor air quality regulations for non-industrial workplaces that address the following: ventilation standards, design and documentation, HVAC maintenance and operation, building maintenance and upgrades, exposure control for airborne hazardous substances, communication, complaint procedure and investigations, and education.

The Nova Scotia government began addressing the quality of indoor environments in schools as a result of school closings associated with contaminants in the school environment.[70] Mould was the primary problem, due to structural deterioration of the facilities and associated dampness. While school closings prompted the government to become more proactive, other factors were also influential.[71] The media were critical in holding the government's attention on the issues. The policy-makers could not ignore the number of news reports on problems associated with indoor air quality in schools. As well, external stakeholders played a key role in encouraging government action. Particularly influential were the local non-profit organization — Citizens for a Safe Learning Environment (CASLE), elected school board members and the teachers' federations. The fact that these groups were well informed and had the ability to speak technically (as opposed to emotionally) helped incite the government to action.[72]

> Nova Scotia is one of the most active jurisdictions in Canada on issues related to indoor environmental quality in schools. It is investing resources into this area, encouraging voluntary strategies, and drafting indoor air quality regulations for public buildings such as schools and libraries.

Initially, the government sought scientific, medical evidence of the causal relationships between indoor contaminants and children's health. When they found that the evidence was unclear, however, this did not prevent them from moving forward with their programmes. Other factors became important in determining their actions, such as teacher and student complaints, and occupant discomfort in the classroom.[73] As well, the way in which the Environmental Health Co-ordinator at the Department of Education interprets the Occupational Health and Safety Act has a bearing on the government's response to this issue. The act provides adults with protection from hazards in the workplace. The Environmental Health Co-ordinator considers poor indoor air quality as a hazard under the act and addresses it in the same manner as he does any other workplace hazard. When poor indoor air quality is acknowledged as a potential hazard, actions are taken that benefit the health of staff and students.

Once Nova Scotia's draft Indoor Air Quality regulation becomes law, school occupants will have more protection from indoor environmental hazards than they currently have under the Occupational Health and Safety Act.[74] While this regulation is a good effort towards improving indoor air quality in non-industrial buildings, it does not take into consideration the vulnerability of children or those with environmental sensitivities.[75] As with the Occupational Health and Safety Act, this regulation is largely concerned with workplace conditions for healthy adult employees. Nonetheless, when passed, it will mark a move forward on improving indoor environments in Nova Scotia.

Taking steps to address indoor environmental quality in schools has had public relations and economic benefits for the government and the school boards.[76] Having programmes and protocols in place to address indoor air quality complaints has helped to reduce occupant anxiety and promote good relations among stakeholders in the school community. In some cases, teachers, students and staff are more patient with government and school board officials than they were previously, knowing that these officials are committed to the issues and doing the best that they can. While the health benefits are difficult to measure, the government attests to the economic benefits associated with their efforts. During the school closings several years ago, the government experienced significant financial losses. Therefore, preventing school closings is one of the key economic benefits. As well, the government's actions have achieved reductions in the costs associated with remedial work and equipment replacement. It once cost them $97,000 to clean up a spill from a leaking oil tank in a school.[77] A more rigorous preventative maintenance plan would have likely prevented this crisis.

The Nova Scotia government has taken significant steps to remediate and prevent indoor environmental problems in schools. With effective encouragement from external partners, it now acknowledges poor indoor air quality as a health hazard to children and is committing resources to finding solutions. Preventing indoor air quality crises motivates the government to continue its efforts.

6.2 School Board Leadership

6.2.1 Waterloo Region District School Board

One of the most well known indoor air quality initiatives of the Waterloo Region District School Board is the environmentally controlled opportunity (ECO) classroom for children with environmental sensitivities. The ECO classroom is designed and maintained to minimize student exposure to indoor contaminants.[78] For example, some of the elements of an ECO classroom are: concrete floors, low emission paint, sealed ceiling tiles to minimize dust, white boards with water-based markers, windows that open, cork boards with low emission adhesives, an independent air management system that includes filtration and air exchange, and solid wood or steel furniture. The cost of building an ECO classroom into an existing school is approximately $40,000 – $50,000. However, when incorporating an ECO classroom into a newly built facility, the cost is estimated to be between $10,000 and $20,000.[79] The Waterloo Board has implemented four ECO school programmes at the elementary level and two at the secondary level. ECO classrooms are being built in new schools when enrolment is high and a need is identified in the community. Although no formal studies have been conducted, ECO classroom children appear to do better (based on health, behaviour and academic performance) in these classrooms than they had previously in regular classrooms.

Beyond the ECO classroom, the Waterloo Board is taking additional steps to address indoor environments in schools. Below are some

examples of the activities of the Plant Operations department that result in better indoor environmental quality:[80]

- Bases building practices, in part, on indoor air quality concerns, complaints and sensitivities;
- Strives to exceed standards set by law and by the manufacturer;
- Practices good maintenance of portables and school buildings;
- Builds new schools at high standards for indoor air quality (i.e., hard surface flooring, low emission paints and construction materials, windows that open, centralized air management systems with filtration);
- Provides ongoing education, awareness and training on indoor air quality for occupants and building operators;
- Actively searches for and tries alternative products that are considered less of a problem for environmentally sensitive children;
- Uses unscented commercial cleaners and hydrogen peroxide-based cleaning products when possible;
- Uses a chemical dispensing system for accurate measuring of cleaning solutions;
- Restricts the use of some chemicals and activities to times that will result in the least exposure to students;
- Supplies extra rinse after using chemicals to eliminate residue (in some cases);
- Will soon use non-treated mops;
- Continues to work with better filtered vacuums;
- Tests and experiments with water-based products;
- Provides good ventilation and air filtration (with hepa filters and activated charcoal compounds) during renovation;
- Monitors VOC levels during painting;
- Requires roofing contractors to use equipment with an after burner that will decrease odours and VOCs;
- Monitors construction and renovation sites to ensure that codes of practices are followed;
- Puts pressure on suppliers to develop products that don't adversely affect children with environmental sensitivities;
- Conducts regular in-house testing of CO_2 to determine ventilation rates;
- Takes into account indoor air quality in energy efficiency initiatives;
- Considers new innovations seriously and always looks for new designs and ways to improve their facilities; and,
- Upgrades lighting (board wide) from fluorescent to better quality and energy efficient choices.

One of the most well known indoor air quality school board initiatives is the Waterloo Region District School Board's environmentally controlled opportunity (ECO) classroom for children with environmental sensitivities.

While the Waterloo Region District School Board is one of the most proactive school boards in Ontario on indoor environmental quality, it has

no explicit policies or directives in this area. Consideration for students' environmental health seems to be ingrained into the culture at the board and the way in which it does business. The ECO classroom programme and the outlook that led to its development have driven the current attitude at the board.[81]

In the 1980s, a number of children in the Waterloo Region were unable to attend school due to health-related problems. When away from the school environment, the children performed better and, as a result, many stayed at home for their schooling.[82] In their search for answers to these children's problems, the school board held several forums with doctors and experts from across North America on the topic of body chemistry and behaviour. The presentations helped the board and the community to understand that certain environmental factors could modify body chemistry in some individuals, which could affect an individual's health and their ability to think, feel, behave and perceive their environment.[83] Along with the awareness created by the lectures, other factors helped to advance the development of the ECO classroom. These included: a deep commitment by the board to respond to the needs of school children; open-mindedness on the part of the board to explore the connection between environment and learning; dedication and awareness of the school administrators and special education staff; and persistence of the parents.[84] Today, these factors continue to shape the attitude of the board and the school community at large.

The attitude towards learning and indoor environmental quality is particularly evident within the Plant Operations department at the Waterloo Board. The activities listed above demonstrate how plant personnel consider the impacts of their practices. Indoor environmental quality, however, is only one of many elements that drive their codes of practice.[85] Cost, durability and the law also determine how plant personnel do business. They are constantly balancing these factors with student exposure to contaminants. For example, some teachers and parents want the board to clean entire schools (not just the ECO classrooms) with vinegar and water or hydrogen peroxide-based cleaners only. While vinegar can be effective, a job that takes five minutes with a commercial cleaner takes half an hour with vinegar — a significant resource consideration. Hydrogen peroxide cleaners do not meet the legal definition of a germicide, which plant personnel believe is necessary for high germ areas such as bathrooms. Instead, they consider other measures that will reduce student exposure, such as scheduling maintenance work at times when school occupants are not present, using a chemical dispensing system for accurate measuring of cleaning solutions, providing an extra rinse to eliminate residue, and using non-scented commercial cleaners. By actively working to find solutions, they gain the confidence of the school occupants, making it easier to do their job and improve indoor environmental quality.

The Plant Operations personnel consider what they are doing as "baby steps" in the right direction. They claim that good indoor air quality is often an offshoot of their commitment to long-term planning and life-cycle costing. Investing in good quality equipment and doing regular maintenance helps them save money and improve indoor environmental quality. They claim that better technology and products would make it easier for them to continue their efforts. Support and encouragement from the board environmental officer and ECO classroom co-ordinator helps to keep their momentum going. It takes time to change 30 years of ingrained practices and to train 500 custodians on environmental health issues. The awareness created by the ECO programme, along with political support from the top, keeps them moving in the right direction.

6.2.2 Durham District School Board

The Durham District School Board has taken several steps to prevent and address some of the problems it encounters related to the indoor environment. In particular, it has been, and

continues to be, proactive in finding solutions to address mould. Below is a list of the board's past and current efforts in this area.[86]

- Have conducted routine airborne fungal sampling of classrooms and portables since 1991;
- Recently formalized an indoor environmental quality procedure, including a process by which complaints are handled promptly, responsibilities are clearly assigned and lines of communication are maintained;
- Produced a ventilation guide for portables;
- Reviewed products in art supplies and banned those considered toxic (e.g., ceramic glazes that contain lead), and provided educational workshops to art teachers;
- Developed a passive air supply system to improve ventilation in older schools (see Appendix 3);
- Currently developing a guide to recognize and manage indoor microbiological agents, including the following preventative measures:
  - limit carpeting in new schools and additions
  - remove carpets and replace with vinyl tile in old schools
  - inspect portables annually
  - caulk portables biannually
  - replace old style exhaust fans in portables with better ventilation systems;
- Providing training courses for chief custodians on mould identification;
- Purchasing new portables (as needed) with design features that include wider roof overhangs and individual ventilation systems; and,
- Communicating all activities and expectations to school occupants.

Two factors that have been key in advancing the Durham Board's efforts to improve indoor environmental quality are awareness and internal partnerships.[87] Much of what the board does is precipitated by recognition that poor indoor air quality can affect the health, productivity and comfort of the students and staff. Health and safety officers need to understand the issues of environmental health in order to consider complaints within the context of indoor environmental factors; teachers need to know the impact of indoor contaminants on health to be able to accurately assess a student's symptoms; facilities people must understand how their practices affect occupant health before they can consider alternative practices; and senior administrators need to understand the issues in order to support the efforts of their staff. While education and awareness have been important, internal partnerships have also been critical for improving indoor environmental quality. The Health and Safety department works closely with Facilities Services to find solutions to the problems. Facilities Services and Health and Safety have support from the top in order to put their ideas into practice. Support from the teachers' federation and the Joint Health and Safety Committee also help to move the initiatives forward.

The Durham District School Board has long-standing mould protocols which have helped them assuage the fears of staff and parents sparked by the recent media reports on mould. Much of what the board does is precipitated by recognition that poor indoor air quality can affect the health, productivity and comfort of the students and staff.

The barriers that the board faces to implementing initiatives are largely related to time and resource constraints. Fostering awareness of environmental health and developing partnerships takes patience and time. The board begins with small projects (which lead to bigger undertakings), builds internal alliances, understands fiscal restraints and is flexible.[88] These strategies are evident in the development of the board's passive air supply system. Occupants of some schools were experiencing a significant number of health symptoms related to poor indoor air quality. When investigated by the Health and Safety department, it was found that these schools had high CO_2 levels and were under negative pressure (not enough air was coming in to replace the outgoing air). The challenge for the staff was to improve the ventilation in these older schools, while also considering the fiscal constraints of the board. Implementing a full mechanical ventilation system would have cost anywhere from $100,000 to $500,000 for each school, which was financially prohibitive. Facilities Services worked with Health and Safety to resolve the problem. The flexibility and innovation of the plant supervisor resulted in the development of the passive air supply system — an alternative that cost only $5,000 per unit. Complaints were greatly reduced and occupant confidence in the board increased.

While the board has not actively measured the impact of its actions, school occupants and board staff have noted several benefits.[89] Teachers are noticing marked improvements in student health and attendance in classrooms where carpets have been removed. By taking steps to address indoor environmental quality, officials in the Health and Safety department and in Facilities Services are gaining credibility in the school community. Credibility enables them to manage indoor environmental concerns with simple, quick and effective solutions in a non-confrontational manner. For example, long-standing mould protocols have helped them assuage the fears of staff and parents sparked by the recent media reports on mould. In the end, all of the efforts have led to greater awareness of the issues and increased confidence in the board's ability to prevent and address problems.

7.0 Cost/Benefit Analysis Framework

School board officials cite cost as one of their biggest concerns with respect to making indoor environmental improvements in schools. However, rarely taken into consideration are the potential cost benefits of preventing or addressing indoor environmental problems. There are times when the financial benefits of investing in good equipment or practicing preventative maintenance are considered with respect to long-term operating costs. However, the financial benefits to society of improved health of school occupants from better indoor air quality are not being given the attention they deserve. The long-term impacts on health and learning due to indoor air pollution in schools, and the potential associated health care costs, are poorly understood at the present time. To gain a better understanding of the societal costs and benefits of improving indoor environments in schools, a comprehensive cost/benefit analysis is needed.

The use of cost/benefit analysis for determining optimum outdoor air quality has gained considerable acceptance over the last 10 years. A cost/benefit analysis done in 1997 for the Canadian Council of Ministers of the Environment showed that a 50% reduction in SO_2 emissions in eastern Canada and the U.S. could save between $500 million and $5 billion annually in avoided health costs in Canada.[90] The acceptance of cost/benefit analysis now needs to be broadened to include examination of indoor air quality problems.

This section describes the basic concepts of applying a cost/benefit analysis framework to the issue of indoor air quality in schools, the information gaps and deficiencies that would impact its application, and strategies for overcoming any limitations. The information presented below is summarized and excerpted from an analysis prepared by Edward Hanna for Pollution Probe entitled *Cost/Benefit Analysis Framework: Economic Issues Associated with Indoor Air Quality in Schools*. For a complete, detailed analysis, please refer to Hanna's report.

7.1 Applying a Cost/Benefit Analysis Framework

Making responsible, informed decisions that affect indoor air quality in schools requires consideration by governments and school boards of both the costs (i.e., investments required to improve indoor air quality) and benefits (i.e., improved health and learning abilities of school occupants) of a particular design, construction, operation, or maintenance option for a school. Ideally, indoor air quality in schools should be maintained at a level that yields the optimum net benefits to society. These benefits include:

- improved learning and retention of knowledge by students;
- improved physical and mental health of students, teachers and support staff;
- reduced costs (both direct and indirect) of treating air quality-induced illnesses; and,
- reduced costs resulting from absenteeism and reduced productivity.

In concept, determining the optimum indoor air quality for schools is relatively straightforward. Estimate total benefits (of two or more options); subtract costs; make an allowance for risk, uncertainty and fair distribution of benefits and costs; and, choose the best solution (see Appendix 5 for an illustration of the cost/benefit framework). While the concept may be relatively straightforward, putting it into practice is quite a different thing. As is often the case with many environmental problems, preventive, mitigative and/or rehabilitative costs are relatively well defined, readily available, accurate and precise. Quantification of benefits, on the other hand, is a frequent and often substantial "weak link" in the

evaluation and resolution of environmental problems. This is certainly the case when trying to assess the net benefits of improved indoor air quality in schools.

> Making responsible, informed decisions that affect indoor air quality in schools requires consideration by governments and school boards of both the costs (i.e., investments required to improve indoor air quality) and benefits (i.e., improved health and learning abilities of school occupants).

The costs of improving indoor air quality in schools can be estimated with reasonable accuracy and include:

- changes in chemicals and maintenance/ cleaning practices;
- changes in building design;
- changes in HVAC systems; and,
- changes in equipment and furnishings.

Such analyses are typically supported by an extensive information and knowledge base relating to standard engineering cost components and data. In many discussions of environmental problems, the emphasis is on these types of well-defined costs while benefits become almost secondary due to their somewhat nebulous, unquantifiable and undervalued nature. Benefits of improving indoor environmental quality are, in fact, cost savings due to reduced health impacts. Estimating benefits requires comparing the indoor air quality-induced health effects costs of one option vs. another (i.e., comparing the costs of health effects associated with the use of low emission cleaning products vs. highly volatile cleaning products). The net savings is the potential benefit society would realize by implementing one option over another. To accurately estimate benefits, it is necessary to be able to forecast the indoor air quality of a particular option and the concomitant health effects on school occupants. These are two essential aspects of the benefits assessment framework for which significant information gaps need to be addressed.

7.2 Information Gaps and Deficiencies

Predicting the indoor air quality that will result from choosing a particular option is complex. This is due to: 1) the number of pollutants of potential concern, some of which have high concentrations in indoor environments; 2) variety and number of emission sources; 3) variable emission rates and patterns over time; 4) complex pollutant circulation patterns within a building; and 5) variations in the rate of pollutant removal. In addition to these complexities, another major consideration is the lack of long-term monitoring data for virtually all indoor environments. This lack of data is partly due to the absence of clearly delegated administrative responsibility within the government for managing indoor air quality. In contrast to outdoor air quality, no provincial-level monitoring network is in place for indoor air quality. Tools for forecasting indoor air quality are not available for the current range of building types and the majority of pollutants of concern. Building designers have, in some cases, used crude relationships, like air exchange rates and the presence/absence of known sources of indoor air pollutants, as a basis for making gross forecasts of “good” or “bad” indoor air quality. Rectifying this deficiency is critical to optimally improve indoor air quality in schools. The informed evaluation of options demands that each option be analyzed in terms its associated expected indoor air quality. Such forecasts are not undertaken at the present time.

Predicting the health effects that will result from exposure to indoor air pollutants is another major

component of the benefits assessment that presents complexities. Two basic research methodologies are commonly used to make such predictions — epidemiological methods and clinically controlled tests and studies. With respect to indoor air pollution exposure, epidemiological literature relating to health effects is virtually nonexistent. Where such literature does exist, it generally involves office buildings and impacts of broad air quality parameters, such as air exchange rates, on worker productivity. Nothing comparable exists for schools and the health effects of indoor air pollution on students, teachers and staff. Only by relying on large samples of individuals can sufficient statistical power be obtained to detect subtle health effects resulting from poor indoor air quality and the relative contribution of individual environmental factors to these effects.

Clinical studies offer some insight into predicting the potential health responses to indoor air pollution exposure, but they also have their drawbacks. Typically, clinical studies examine the impact of one pollutant on a small sample of individuals and track short-term physiological responses to the exposure. Clinical studies generally have difficulty dealing with multiple risk factors and, in this particular case, dealing with exposure to complex mixtures and concentrations of pollutants. Nonetheless, for the clinical studies that do exist, the benefit assessment framework provides a comprehensive and technically sound context within which to apply the results of these studies. However, even where such results are rigorously and prudently applied, there can remain considerable doubt as to their validity at a population level (as opposed to individual patient level) without corroborating population-level evidence.

7.3 Mitigating Strategies

In order to implement an ideal cost/benefit analysis, the information gaps need to be addressed with respect to forecasting indoor air quality and estimating health responses. Routine monitoring of indoor air quality in schools needs to be initiated throughout each school system (or at minimum, a representative group of schools) so that reasonable characterization of indoor air pollutants, their concentrations and variations diurnally, weekly and seasonally can be reasonably determined. As well, quantitative emission factors for key pollutants of concern need to be developed so that reasonable forecasts of indoor air quality can be derived based on the design, construction, operation and maintenance features of school buildings. With respect to health responses, systematic epidemiological and clinical health studies of the impacts of indoor air contaminants on school occupants should be initiated. As part of these studies, primary pollutants of concern and combinations of pollutants need to be identified.

Addressing the information gaps associated with doing a comprehensive cost/benefit analysis is a challenging and important undertaking that will require a considerable amount of time and resources. Given the importance of cost/benefit analysis in responsible decision making, consideration should be given to immediately conducting a cost/benefit analysis based on the best available data and the knowledge of health experts, architects, engineers and school board plant managers. The existing provincial stock of school buildings could be categorized based on the key design, construction and maintenance factors known, or suspected, to strongly affect indoor air quality. For each building category, forecasts of the health and economic benefits of improved indoor air quality could be prepared. Forecasts of health responses could be made using existing clinical studies. Although the accuracy of these forecasts will be limited, they will, nonetheless, be better than what can be expected in the absence of such a systematic approach.

The optimum (i.e., most beneficial) level of indoor air quality in schools is the target toward which every school board, as well as the provincial government, should be striving. A

cost/benefit analysis of improving indoor air quality in schools could help achieve that target by providing information that would help governments and school boards make informed decisions. Cost/benefit analysis should be viewed as an effective decision support tool; responsible decision-making still requires that judgment, ethics and insights come into play.

8.0 Proposed Framework for an Indoor Environment Management Plan

8.1 Rationale

The long-term goal of Pollution Probe's *Healthy Schools — Healthy Children* project is to develop strategies to help schools and school boards identify, prevent and remediate indoor environmental problems. This section outlines a proposed framework for a plan that aims to help optimize the quality of school indoor environments. During the next phase of Pollution Probe's *Healthy Schools — Healthy Children* project, school boards and other stakeholders will be consulted more extensively to build upon the ideas presented here.

Moving forward with a proactive, voluntary indoor environment management plan for Ontario schools is important at this time for several reasons:

- Evidence suggests that indoor pollutants are the most important source of risk to the respiratory health of children. They can have serious health effects on children with pre-existing health problems, such as asthma, allergies and environmental sensitivities.

- Children spend approximately 90% of their time indoors and about five to six hours of every weekday inside of a school. The time that children spend in schools is important given that they are there to acquire the academic and social skills that will, ultimately, affect their future and the future of our society.

- Schools present particular challenges for managing indoor environmental quality, including unique pollutant sources and high occupancy rates. While many school boards have developed expertise for dealing with indoor environmental problems, there is great inconsistency from one school board to the next in the way in which problems are handled. Some school boards have taken a proactive approach to preventing problems and others respond to problems as they occur on a case-by-case basis.

- Proactive plans to address indoor pollutants in schools are underway in other jurisdictions and at some Ontario school boards. Hence, this is a good time to build and expand upon the success of other initiatives.

- School board action on this issue through a voluntary management plan will have the greatest chance of achieving immediate indoor environmental improvements in schools. While provincial action is also necessary, a voluntary initiative will likely deliver results more quickly than a government policy or programme. The current will, knowledge and interest exist at the school board level. Proactive school board initiatives will inform and help stimulate government policy and programme development.

- Momentum on this issue is building among stakeholders, due, in part, to the recent discovery of mould in many Ontario school portables. There is a strong group of committed partners, including public health officials, school boards, unions, physicians, and parents who are ready to take this plan forward.

Improving indoor environmental quality in schools could potentially benefit the entire community. As the chart below outlines, the benefits are multifaceted and include health, awareness, economic, political and community outcomes.

8.2 Considerations

During a six-month period, Pollution Probe interviewed experts in the field of children's environmental health and indoor air quality. These experts provided insight into the key issues and made suggestions on potential components of an indoor environment management plan (see Appendix 6 for key informant interview summary). Pollution Probe also held informal discussions with several school board officials, parents, and health professionals on this topic. These discussions have confirmed the interest in and need for developing a plan to improve indoor environmental quality in schools. Some key considerations that arose out of the discussions included the following:

- School boards have restricted budgets; the plan must include low cost solutions.
- Each school board has different issues and needs; the plan must be simple and provide flexibility.
- Schools need to work with what they have; the plan should focus on pollution prevention and on better management of the facility; e.g., carpet use and low emission options, cleaning products and practices, and dust control.
- Everyone must be involved, including senior school board officials, school staff, teachers, parents, students, and administrators. The support of and participation by plant personnel, health and safety officers, and principals, however, will be key to the success of the programme.
- A hard copy manual or report will likely sit on a shelf; the plan should utilize the latest in electronic communication technology, be universally acceptable at minimal cost, and be kept up-to-date with the latest techniques and solutions.
- The plan must generate immediate benefits; parents are concerned about the health of their children in schools.

Based on these considerations, an effective plan would be one that is voluntary, action-oriented, cost-effective, flexible, and able to complement a school's regular operational activities. As well, it would take advantage of Web-based technology, including mechanisms for reporting and monitoring. It would also be designed to complement other work in this area, such as the Ontario government's Environmental Management System (ISO 14001) Sector Guide for Schools.

The plan should be designed for use by everyone involved in the school community. Teachers, parents, students, principals, school board officials, and custodians should all be able to benefit from the plan. Health and safety officers and plant personnel will likely be the main users and implementers of the plan. People involved in building operations and occupant care are in the best position to influence the quality of a school's indoor environment. Plant personnel have the knowledge and expertise on ventilation systems, maintenance activities and products, and renovations — three important factors that influence the quality of the indoor environment. They are the people charged with the responsibility for building care and who have access to resources for their activities. Health and safety officials have the mandate to ensure a safe and healthy working environment for school occupants. The plan should provide them with useful information on environmental health that can be applied to their day-to-day activities. The plan will give users the opportunity to link with each other and with those outside of the school community.

An indoor environment management plan will provide users with a menu of opportunities for indoor environmental improvements from which they can design a strategy to address the unique issues facing their school or school board.

8.3 Plan Framework

Given the growing interest in electronic communication, the plan could be housed in interactive, Web-based database technology. This format provides the following advantages:

- allows participants to access current information as new developments occur in the indoor environment field;
- provides a mechanism for school boards to share information and trade experiences and best practices;
- enables participants to harness information from multiple sources;
- ensures openness by providing the public with access to school activities; and,
- enables world-wide participation and feedback from others, enhancing the scope of solutions that may be available.

A Web-based plan would consist of two components:

- an object-oriented database repository of information; and,
- a user interface for interactive communication.

An object-oriented database to the Web would provide a repository for diverse forms of useful information for the user. This could include: instruction sheets, case studies, names and addresses of useful contacts, written conference extracts, Web addresses of relevant sites, photographs of indoor environmental problems and solutions, audio and video extracts from conferences or instructional tapes, descriptions of problems by users, helpful experience from people who have encountered and solved indoor environmental problems, listings of resources such as books, manuals, videos, and audio tapes, and conceivably many more forms of

information. Building a solution that allows transfer of text, audio, video, photographs, graphics, animation, presentation slides and other diverse forms of "data" will provide a richer resource than a static text-based Web presence.

A user interface could consist of dynamic Web pages that respond to a user's needs, interests and specific queries. The dynamic pages would allow a "window" into the database and allow the user to extract those specific items that are relevant to him or her. Unlike most databases, this one would be highly interactive. Issues related to the indoor environment are dynamic; people dealing with it need to interact on a regular basis with others facing the same problems. The best solutions will come from the users who have begun to tackle specific indoor environmental problems in their own schools. Ideally, their information will be readily available to others through the same database. The user interface will also provide instructions and easy routes for others to log their information into the database. Having schools provide information and activity updates to the database will be important for monitoring and evaluating the success of the programme. Some of the topics to be considered for the database could include:

Operation and Maintenance of Heating Ventilation and Air Conditioning (HVAC) Systems
Building Maintenance
Custodial Care
Materials and Product Selection
Construction, Renovation and Repair
New School Design, Construction and Accommodation
Energy Management
Detecting and Remediating Mould
Temperature and Humidity
Air Pressure Control and Air Filtration
Detecting and Monitoring Indoor Environmental Problems
Building Assessment and Management Systems for Indoor Air Quality
Indoor Air Quality Complaint Protocols
Legal Requirements for Indoor Air Quality
Classroom and Art Supplies
Radon, Lead, Asbestos
Pest Control
Furnishings and Flooring
Lighting
Office Supplies and Equipment
Fragrance Chemicals
Indoor Contaminants and Children's Health
Environmental Sensitivities
Indoor Air Quality Testing
Exposure Assessments
Communication and Education

For each subject area, the plan will provide access to information, actions, and strategies to address specific concerns. Links to public or private sector programmes that could support the implementation of an action will also be listed. As well, visual presentations successfully used by school boards to facilitate discussion and decision-making on this topic will also be available to users. In essence, the plan will provide the participant with a menu of opportunities for indoor environmental improvements from which they can design a strategy to address the unique issues facing their school or board.

8.4 Participation and Recognition

School boards participating in the programme could strive to achieve a series of principles or goals. Examples might include the following:

- Prevent indoor environmental problems.
- Remediate existing indoor environmental problems.
- Resolve indoor environmental problems as they occur.
- Share experiences of problems and solutions with others.

A Web-based indoor environment management plan would help participating schools and school boards achieve these goals. As well, once a school board committed to the programme, key personnel (such as facilities staff) would be offered a seminar on the reasons and strategies for improving indoor environmental quality. Information would be provided so that board staff could then repeat the seminar internally. This would help to promote the plan and encourage participation.

Gaining participation in any voluntary initiative requires extensive outreach and marketing. This presents particular challenges, given that school boards are consumed with amalgamation challenges, budget cuts and new programmes, such as teacher testing. The plan must be well-crafted and uniquely branded in order to interest school boards. Piquing interest in the programme would involve outreach through media articles, press events and presentations to school board officials, school administrators, joint health and safety committees, board trustees and parents. Having some school boards endorse the plan early on would be crucial for creating momentum and increasing participation across the province.

School boards that sign on to the plan would be acknowledged for their efforts with some form of award. They would also be commended regularly through media events and on the Web site. Pollution Probe would be able to assess the level of participation at each school and acknowledge the sites that are showing leadership. In the end, schools would be rewarded for their achievements, which would enhance their public image and encourage future participation.

9.0 Conclusions and Recommendations

Pollution Probe believes that a comprehensive strategy to protect children's environmental health in Ontario will require significant long-term investments by governments and interested stakeholders into research, policy and outreach activities related to indoor environments and children's health. To help move this agenda forward, Pollution Probe has, below, summarized key conclusions of this report and proposed recommendations which represent an ideal course of action for optimizing school indoor environmental quality and enhancing children's environmental health.

1. There is no clearly assigned government responsibility for the quality of indoor environments in schools. A wide variety of government ministries, departments, and agencies have partial responsibility for some aspect of the indoor environment, but none have a clear mandate to preserve and enhance indoor environmental quality in schools. The diversity of participants in this area creates fragmentation of authority and reduces effectiveness with respect to improving school indoor environments.

Recommended Action:

- **Assign lead responsibility for the quality of school indoor environments to a provincial ministry.** In order to advance effective programmes and strategies to improve indoor environmental quality in schools, a single ministry must be responsible and accountable for this issue. The government of Ontario should recognize the importance of healthy indoor environments and assign one of the ministries of education, labour, health or environment with the authority and resources to take leadership. This has happened in Nova Scotia whereby the government provided the Department of Education with the expertise and resources to begin addressing school indoor environment issues more effectively.

Lead Agency: Government of Ontario.

- **Develop a more co-ordinated provincial approach to addressing indoor environmental issues and children's environmental health in schools.** While one ministry should assume leadership for these issues, all of the ministries that currently have partial jurisdiction should work together more effectively to develop a comprehensive strategy to improve school indoor environments. Using Nova Scotia as a model, an inter-ministerial committee on indoor environments, with representatives from the ministries of health, education, labour and environment, should be formed as soon as possible.

Lead Agencies: Ontario ministries of health, education, labour and environment.

2a. Poor indoor environmental quality in Ontario schools has negative health and learning implications for children. Health experts claim that children are more vulnerable to the harmful effects of environmental contaminants than are adults, and that indoor contaminants are among the most important sources of risk to the respiratory health of children. According to a study done by a Georgetown University researcher, students attending schools that were in poor condition were 5.5 percentage points behind students attending schools that were in fair condition and 11 percentage points behind those attending schools that were in excellent condition. In a 1993 survey of Ontario school

facilities, it was found that most school administrators believe that the learning environment is "absolutely critical" to student achievement.

2b. The current legislative framework does not specifically identify children's unique vulnerabilities to indoor contaminants and guarantee for children a healthy learning environment. A healthy learning environment is one that provides children with optimal opportunity for healthy physical, social, emotional and intellectual development. Components of that environment include proper nutrition, emotional support, academic instruction and a healthy space in which to learn. There is currently no legislation that specifically requires that children be protected from the potential harm associated with poor indoor environmental quality in schools. On the other hand, adults who work in schools are protected from indoor hazards, to some degree, through the Occupational Health and Safety Act.

Recommended Action:

- **The Ontario Minister of Health should develop a provincial policy and regulatory framework that ensures that children have a healthy learning environment.** The minister responsible for health should ensure that children in schools have the best possible indoor environment for healthy development. A provincial policy/regulatory framework should be developed that acknowledges children's unique vulnerability to indoor contaminants and protects children from these hazards in schools.

Lead Agency: Ontario Ministry of Health and Long-Term Care.

---

3. The full extent of indoor environmental problems in Ontario schools and their impact on the children who attend school need to be better understood. With the exception of the information published in *Canadian School House in the Red* in 1993, no formal studies have been conducted on the state of school facilities in Ontario. As well, the potential for significant health problems, including long-term effects on learning and skill development, due to indoor air pollution in schools is poorly understood**.** According to a 1996–97 Population Health Survey conducted by Statistics Canada, approximately 11% of Ontario children under the age of 19 have asthma; based on these statistics, there could be up to 245,022 asthmatic children attending Ontario schools who are highly sensitive to the conditions of indoor environments.

Recommended Action:

- **Conduct routine indoor air quality monitoring and prepare an inventory of existing indoor environmental problems in Ontario schools.** To get a better understanding of the scope of indoor environmental challenges Ontario school boards are facing, a record of their day-to-day problems and a more systematic protocol for measuring indoor air quality is necessary. The conclusions reached in the 1993 school facilities survey, along with significant anecdotal evidence of indoor air quality challenges in schools, point to the need for further investigation. A more comprehensive picture of the state of the indoor environment in Ontario schools will assist decision makers in designing long-term strategies for improving indoor environmental quality in schools.

Lead Agency: Ontario Ministry of Labour in collaboration with Ontario school boards.

- **Initiate co-ordinated, systematic epidemiological and clinical health studies of the impacts of poor indoor air quality on children.** More research is needed to clarify and determine the health and learning outcomes for children exposed to indoor pollutants. As part of these studies, primary pollutants of concern and combinations of pollutants need to be identified and assessed. The federal government should assume a lead role in addressing health effects research needs. The results of such research should be generically applicable and beneficial to all provinces.

Lead Agency: Health Canada in collaboration with the Ontario Ministry of Health and Long-Term Care, universities and teaching public health units.

---

4. A comprehensive analysis of the costs and benefits of improving indoor environmental quality in schools in Ontario has not been undertaken. The use of cost/benefit analyses for determining optimal air quality conditions has gained considerable acceptance over the last 10 years with respect to outdoor air quality. This acceptance now needs to be broadened to include examination of indoor air quality problems. Large health costs to society may be accumulating due to the health impacts from poor indoor environmental quality in schools. The results of a cost/benefit analysis would lead to more informed decisions that will advance the public interest with respect to indoor environmental quality in schools.

Recommended Action:

- **Conduct a cost/benefit analysis of improving indoor environmental quality in Ontario schools.** A comprehensive analysis should be undertaken to determine: a) the capital, operating and maintenance costs of improving indoor environmental quality in schools with respect to building materials, furnishings, ventilation, and chemicals/consumables, and b) the benefits of improving indoor environmental quality in schools associated with potentially avoided health costs. In order to conduct an ideal cost/benefit analysis, the gaps and deficiencies in information, particularly with respect to indoor air quality conditions and concomitant health effects on school occupants, need to be addressed. In the meantime, however, consideration should be given to undertaking immediately a cost/benefit analysis based on the best available data and the knowledge of health experts, architects, engineers and school board plant managers.

Lead Agency: Health Canada in collaboration with Environment Canada and the Ontario Ministry of Health and Long-Term Care.

5a. Schools present unique challenges for managing indoor environmental problems. Seventy-three per cent of Ontario schools and almost half of Ontario's portable classrooms have outlived their normal life expectancy. Lack of funds for building renewal and deferred maintenance have resulted in school building systems being left to deteriorate. Poorly maintained facilities can lead to structural and ventilation problems that affect the quality of school indoor environments. Schools are densely populated with unique pollutant sources that cause indoor environmental challenges. Along with the more typical indoor contaminants, such as biological and chemical agents, schools also contain pollutants from cafeterias, arts and science supplies, furnace areas, rest rooms and locker areas.

5b. Restricted budgets limit Ontario school boards' abilities to identify, prevent and remediate indoor environmental problems in schools. With the new funding formula under Bill 160, school boards no longer have access to provincial grant programmes for special projects and have lost their power to raise funds locally through property taxes. The restrictive nature of the new funding regime will make it more difficult for some school boards to improve indoor environmental quality.

Recommended Action:

- **Provide school boards with support and resources for improving indoor environmental quality in schools.** The provincial funding formula needs to be modified such that school boards have access to sufficient financial resources when modifications to schools are required to improve indoor environmental quality. Alternatively, a special projects fund earmarked specifically for indoor environmental improvements needs to be established and made available to school boards. Resources to school boards are also needed for: technical support; monitoring and forecasting indoor air quality; training for key personnel and service providers; preventative maintenance; and, awareness and education programmes.

Lead Agency: Government of Ontario.

---

6. Healthy Schools initiatives are gaining momentum in North America and establishing the basis for leadership on indoor environmental issues. Creating healthy indoor school environments for children is beginning to take hold in some Ontario school boards and in other jurisdictions. The U.S. EPA and the province of Nova Scotia have shown significant leadership in this regard. Although indoor environmental problems in Ontario schools are generally dealt with on a case-by-case basis, some school boards are making advances in healthy school development. The Waterloo Region District School Board's ECO classroom programme, which has been studied internationally, has helped to inform a new building approach for new school construction in the region. These initiatives provide a good starting point for province-wide school board leadership on creating healthy schools.

Recommended Action:

- **Explore the use of a voluntary indoor environment management plan to help improve indoor environmental quality in schools.** A voluntary indoor environment management plan that provides school boards with cost-effective strategies for preventing, remediating and resolving indoor environmental problems in schools should be explored as soon as possible. Models for consideration should focus on pollution prevention and could include: activities underway at some boards; the U.S. EPA's *Indoor Air Quality Tools for Schools Action Kit*; environmental management systems, such as ISO14001; an electronic interactive Web-based plan; or any number of existing programmes that best suit the needs of school boards. Indoor environmental policies should also be examined as a potential tool for inciting action on indoor environmental issues in schools.

Lead Agency: Ontario school boards in collaboration with interested stakeholders.

- **Endorse, support and promote the concept of developing a voluntary indoor environment management plan for Ontario schools and school boards.** Governments should work with Ontario school boards and interested stakeholders to help develop and promote an effective indoor environment management plan to assist school boards to improve indoor environmental quality in schools.

Lead Agency: Ontario Ministry of Education in collaboration with the Ontario ministries of health, labour and environment; and local public health departments.

---

7. Parents are concerned about the safety of Ontario schools with respect to indoor environmental quality. Since the recent emergence of mould-related concerns in portables, particularly in the Halton and Peel districts, parent anxiety about the safety of schools has been on the rise. Reported cases of mould-related illness and portable classroom closures have drawn a lot of attention, and a sense of public fear and urgency is being expressed through the media.

Recommended Action:

- **Provide the public with the best available information on indoor contaminants and their impact on children's health.** It is important to provide the public with concise, credible information on the range of indoor environmental issues that could affect children's health. The recent conflict among experts on the health outcomes from mould in schools has caused confusion and fear in many communities. For effective participation in decision-making processes, the public needs to be well-informed on the full scope of the issue, including potential problems and possible solutions.

Lead Agency: Health Canada in collaboration with the Ontario Ministry of Health and Long-Term Care and other agencies working in this area: Canadian Institute of Child Health, Ontario Public Health Association, Pollution Probe and The Lung Association.

End Notes

1 U.S. Environmental Protection Agency. 1998. *Indoor air quality basics for schools*. http://www.epa.gov/iaq/schools/scholkit.html

2 Karen A. Beaulieu. 1998. *Management of indoor air quality in Canadian schools*. Master's thesis, University of Calgary, 26, 27.

3 U.S. Environmental Protection Agency. 1995. *Indoor air quality tools for schools: Co-ordinator's guide.* Washington. EPA, 3.

4 U.S. Department of Labour, Occupational Safety and Health Administration. 1994. *Federal Register April 5, 1994, 29 CFP Parts 1910, 1915, 1926, and 1928. Indoor Air Quality: Proposed Rule*. Washington, D.C.: U.S. Department of Labour, 16005–16006.

5 Pollution Probe. 1998. *The air children breathe: The effects on their health*. Toronto: Pollution Probe, Section 5.

6 Ontario Ministry of Education, Business Services Branch. Personal communication, 3 March 2000.

7 U. S. Environmental Protection Agency. *Indoor air quality tools,* 3.

8 Ibid.

9 Children's Environmental Health Network. (Undated). *Resource guide on children's environmental health*. Emeryville, CA: California Public Health Foundation.

10 G. Chance and E. Harmsen. 1998. Children are different: Environmental contaminants and children's health. *Canadian Journal of Public Health*. 8/9, Supp.1, May/June.

11 Children's Environmental Health Network.

12 Ibid.

13 Ibid.

14 U.S. Environmental Protection Agency. *Indoor air quality tools,* 3.

15 Beaulieu. *Management of indoor air,* 27.

16 Ibid., 26.

17 Maryland State Department of Education, Division of Business Services. 1993. *Technical bulletin — Carpet and indoor air quality in schools.* Baltimore, MD: Department of Education, 2-8.

18 John W. Roberts and Philip Dickey. 1995. Exposure of children to pollutants in house dust and indoor air. *Reviews of Environmental Contamination and Toxicology*. 143: 61.

19 U.S. Department of Labour, Occupational Safety and Health Administration. 1994. *Federal Register April 5, 1994, 29 CFP Parts 1910, 1915, 1926, and 1928. Indoor Air Quality: Proposed Rule*. Washington, D.C.: U.S. Department of Labour, 16005–16006.

20 Pollution Probe. *The air children breathe*, 40.

21 Ibid., 41.

22 Dennis Beuckert. 1999. *The Toronto Star*. 13 January, A20.

23 Canadian Institute of Child Health. 1998. *Fact sheet — Childhood asthma and air quality.* Ottawa: CICH.

24 Pollution Probe. *The air children breathe*, 46.

25 Ruth Etzel et al. 1998. Acute pulmonary haemorrhage in infants associated with exposure to Stachybotrys atra and other fungi. *Arch Pediatric Adolescent Medicine*. 152: 757.

26 Doris J. Rapp. Personal communication, 28 April 1999.

27 Pollution Probe. *The air children breathe*, 32.

28 U.S. Environmental Protection Agency. *Indoor air quality*, 4.

29 Washington State Department of Health. 1995. Why manage school IAQ? *School indoor air quality best management practices manual*. Olympia, WA: Washington State Department of Health, Section 2.

30 U.S. Environmental Protection Agency. *Indoor air quality*, 4.

31 Shirley J. Hansen. 1993. *Canadian schoolhouse in the red*. Ottawa: Canadian Automated Buildings Association, 10.

32 Ibid., 3.

33 Ibid., 20.

34 Ibid., 10.

35 Beaulieu. *Management of indoor air*, 104.

36 Ibid.

37 Gary Gibson (Health and Safety Officer, Durham District School Board and member of Health and Safety Subcommittee of the Ontario Association of School Board Officials). Personal communication, 17 February 1999.

38 Ibid.

39 Hansen. *Canadian schoolhouse*, 20.

40 Beatriz Milner (Day Care Supervisor, St. Stephens Community House Day Care, King Edward Public School). Personal communication, 23 February 1999.

41 Bill Butcher (Co-Chair, Joint Health and Safety Committee, Elementary Teachers' Federation, Durham Branch). Personal communication, 25 February 1999.

42 Jill Witherspoon (Energy Conservation Officer, Toronto District School Board). Personal communication, 27 January 1999.

43 Larry Sparks (Health and Safety Officer, Upper Canada District School Board). Personal communication, 26 February 1999; Butcher. Personal communication, 25 February 1999; Wanda Bailey (Health and Safety Officer, Elementary Teachers' Federation). Personal communication, 17 February 1999; Gibson. Personal communication, 3 January 1999.

44 Gibson. Personal communication, 3 January 1999.

45 Ontario Ministry of Health. July 1999. *Expert Panel on Fungal Contamination Indoors.* Toronto: Ontario Ministry of Health, Public Health Branch: Appendix, 2.

46 Pat Bruvelaitis (Health and Safety Specialist, London District Catholic School Board). Personal communication, 3 February 1999.

47 Harold Levy. 1998. *The Toronto Star*. 17 May, A1.

48 Norma L. Miller. 1995. *The healthy school handbook*. Washington, D.C.: National Education Association, 186.

49 Gibson. Personal communication, 5 May 1999.

50 Canadian Institute for Radiation Safety. 1990. *Radon in schools: Questions and answers*. Toronto: Canadian Institute for Radiation Safety.

51 Ontario Ministry of Education, Business Services Branch. Personal communication, 3 March 2000.

52 CBC Radio News Report quoting Gayle Nyberg (Chair of Toronto District School Board). 1 March 1999; and Gayle Nyberg (Chair of the Toronto District School Board). Personal communication, 10 January 2000.

53 Beaulieu. *Management of indoor air*, 37.

54 Bob Mitchell. 1998. *The Toronto Star*. 23 April, E5.

55 Ontario Ministry of Education, Business Services Branch. Personal communication, 3 March 2000.

56 Ron Breau (Director, Educational Facilities, New Brunswick Government). Personal communication, 17 June 1999.

57 Karen Bartlett (Ph.D. Candidate, University of British Columbia). Personal communication, 7 July 1999.

58 These initiatives include: U.S. Environmental Protection Agency. *Indoor air quality*; Texas Department of Health. 1998. *Voluntary indoor air quality guidelines for public schools*. Austin, TX: Texas Department of Health; Washington State Department of Health. *School indoor air*; Maryland State Department of Education. 1987. *Indoor air quality — Maryland public schools*. Baltimore, MD: Office of Administration and Finance; Vermont State legislation — *An Act Relating to Toxic Materials and Indoor Air Quality in Vermont Public Schools*. Passed March 2000. See www.leg.state.vt.us/docs/2000/bills/house/H-192.htm.

59 Patty Donavon (Parent, Quispamsis, New Brunswick). Personal communication, 1 September 1998.

60 Dr. James Gunn (Superintendent of Schools/CEO, Annapolis Valley Regional School Board, Nova Scotia). Personal communication, 30 April 1999.

61 Sandra Moser (Researcher, Citizens for a Safe Learning Environment, Nova Scotia). Personal communication, 12 July 1999.

62 John Guevin (Team Leader, Tools for Schools, Indoor Environment Division, U.S. EPA). Personal communication, 6 May 1999.

63 U.S. Environmental Protection Agency. *Indoor air quality tools*, 2.

64 Guevin. Personal communication, 6 May 1999.

65 U.S. Environmental Protection Agency. *Indoor air quality tools*, 1.

66 U.S. General Accounting Office. 1995. *School facilities: Condition of America's schools.* Washington, D.C.

67 Guevin. Personal communication, 6 May 1999.

68 Indoor Environment Review. 1999. Advanced workshop: EPA's 'Tools for Schools' — Implementation and case studies. *Indoor environment: The state of the industry. Presentations from the 7th annual indoor environment conference*. Bethesda, MD: IAQ Publications, 49.

69 Gerald Muise (Co-ordinator, Environmental Health and Safety, Department of Education and Culture, Facilities Planning and Operations, Nova Scotia Government). Personal communication, 29 April 1999.

70 Ibid.

71 Ibid.

72 Ibid.

73 Ibid.

74 Nova Scotia Department of Labour. 1997. *Draft indoor air quality regulation*. Halifax, NS: Nova Scotia Department of Labour.

75 Moser. Personal communication, 3 May 1999.

76 Muise. Personal communication, 29 April 1999; Gunn. Personal communication, 30 April 1999.

77 Muise. Personal communication, 29 April 1999.

78 Doug Morris (Special Education Consultant, Waterloo Region District School Board). Personal communication, 30 April 1999.

79 Ibid.

80 Arnie Wohlgemut (Supervisor, Structural Services, Plant Maintenance and Construction, Waterloo Region District School Board). Personal communication, 8 June 1999; Gerry Mills (Manger of Plant Operations, Waterloo Region District School Board). Personal communication, 8 June 1999; Craig Hynd (Environmental Officer, Plant Maintenance and Construction, Waterloo Region District School Board). Personal communication, 8 June 1999.

81 Wohlegemut. Personal communication, 8 June 1999; Mills. Personal communication, 8 June 1999.

82 Morris. Personal communication, 30 April 1999.

83 Waterloo County Board of Education. 1998. *Body chemistry (environmental sensitivities) and behaviour: Basic information package*. Waterloo, ON: Waterloo County Board of Education, 3.

84 Rapp. Personal communication, 28 April 1999.

85 Mills. Personal communication, 8 June 1999.

86 Gibson. Personal communication, 3 June 1999.

87 Ibid.

88 Ibid.

89 Ibid.

90 The Acidifying Emissions Task Group. 1997. *Towards a national acid rain strategy*. Ottawa: Environment Canada, 98.