Cancer and the Environment in Ontario:

Gap Analysis on the Reduction of Environmental Carcinogens

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By
The Cancer and the Environment Stakeholder Group

Executive Summary

Background

Cancer is a global issue, particularly problematic in the developed world. In Canada, it is estimated that there will be 159,900 new cancers diagnosed in 2007, of which 59,500 will be in Ontario.[1]

A great deal of research and preventive efforts have been focused on cancer, and as a result, many gains have been made in the prevention and early detection of the disease. In spite of these gains, in Ontario (according to the best available estimates), the number of newly diagnosed cases increases by 2.5% every year; it is projected that in the year 2020, there will be 91,000 new cancers diagnosed.[2] Cancer is costly to both the patient (personal discomfort, loss) and the Ontario healthcare system, and in the case of preventable cancers, these costs are not necessary. It is important to examine the preventable causes of cancer and to look for ways to stop cancer from developing.

While the exact contribution of the environment to cancer risk is not known, it is an important topic for consideration. There is public concern around the issue, and a number of cancers are potentially associated with exposure to environmental carcinogens. The Canadian Cancer Society (CCS) and Cancer Care Ontario (CCO) have established a comprehensive cancer prevention strategy for the province, known as Cancer 2020, in which action on environmental exposures was included among a set of targets to be achieved, by the year 2020.[i]

This document is a product of the Cancer and the Environment Stakeholder Group, which was supported by CCO and the CCS, which has the objective of developing and supporting the implementation of an environmental cancer prevention strategy for Ontario. Elements of the strategy include research, surveillance, policy initiatives, collaborative partnerships, knowledge exchange and skill building, media campaigns and educational and community based programs. Among its guiding principles, this group embraces the precautionary principle in its efforts to reduce the burden of illness from environmental carcinogens. The precautionary principle holds that if there is a threat of harm, risk should be avoided though reduced exposure, or elimination of the exposure, even when full cause and effect information is not available. This approach is complementary to Environment Canada's Environmental Protection Hierarchy.

[i] Targets for environmental carcinogens, established in the Cancer 2020 Report are: the development of a surveillance system to estimate and monitor levels of exposure to specific substances, the identification of specific substances for action, and reduced exposure to the substances identified, based on practices used in comparable jurisdictions.

Purpose and approach

This paper examines overall regulatory strategies that are used to reduce the use and release of toxic substances within Ontario, and those in the United States and the European Union, with the understanding that its purpose is to explore how *environmental carcinogens* are controlled within these regulatory strategies.

Toxics use reduction is an approach used in some jurisdictions that is complementary to the existing system in Ontario. Toxics use reduction is an overall tactic that focuses on using less toxic substances, and ensures that carcinogenic substances are not replaced with other substances of concern (due to other health or environmental characteristics). The Environment and Cancer Stakeholder Group identified toxics use reduction as being a framework that would complement the existing system in Ontario, where toxic substances are currently controlled within general strategies, without an overall focus on carcinogenic substances.

In order to develop and support an environmental cancer prevention strategy, it was decided that the Stakeholder Group first needed to understand the current management of environmental carcinogens in the province, and to identify where improvements could be made. The **purpose** of this document is to describe the existing practices for managing environmental carcinogens in Ontario, to examine them in light of recognized international practices, and to identify directions for future policy development that will improve them. An additional purpose of this document is to develop a comprehensive list of environmental carcinogens for the province of Ontario. This document has been developed for non-government organizations (NGOs), government and other agencies focused on reducing environmental carcinogens in Ontario.

International regulatory strategies

Regulatory approaches that can be used for environmental carcinogen use reduction include:

- Reporting requirements: includes reporting on health or environmental data, resource use, emissions, and developing pollution prevention plans
- Restrictions or limits: caps, controls or bans; restricted manufacture, use or emissions
- Increased manufacturer responsibility: e.g., liability, taxation, burden of proof (of safety)
- Product registration or pre-manufacturing data submission
- Substitution: includes product reformulation or process changes wherein hazardous materials are substituted with those that are less hazardous

- Comparative assessment: determining which product or process has the least adverse impact among a set of similar products or processes. This may incorporate an economic assessment.
- Public education and awareness: includes 'eco-labeling' (labeling products that are free of hazardous chemicals) and ingredient labeling requirements.
- Surveillance and tracking the use and release of environmental carcinogens, monitoring the chemical load in individuals.
- Process Changes: more efficiently controlling use of and exposure to carcinogens.
- Right-to-know laws: laws enabling access to information that is held by governments or industry.

After an examination of a number of selected international practices, it was determined that, generally speaking, the United States and the European Union place greatest emphasis on:

1. Public education and awareness,
2. Substitution of toxic chemicals with those that are less toxic, either through product reformulation or comparative assessment,
3. Placing greater responsibility on those who produce or use the toxic product, by requiring them to prove that they are necessary, and
4. Pollution prevention planning, requiring the replacement of toxic chemicals, or changes that lower the need for their use.

In some instances, carcinogens are specifically identified as being chemicals of priority, and steps are taken to control them. It was also found in the United States that when some form of technical assistance was provided to companies, they were more able to achieve toxics use reduction.

While the European and American programs surveyed do differ in many ways, what they share is an approach that emphasizes preventing pollution and population exposure to carcinogens.

Practices and Possibilities for Ontario

In its work, the Stakeholder Group defined an *environmental carcinogen* as being a carcinogen “found in the environment to which the public can be expected to be exposed as the result of human activity.”[3] The Stakeholder Group, using this definition, expert input, and lists from the International Agency for Research on Cancer and the U.S. National Toxicology Program then developed a target carcinogen list for Ontario. The Stakeholder Group then examined how environmental carcinogens are controlled in Ontario.

In Ontario, a number of methods are being used to reduce (or virtually eliminate) environmental carcinogen use, release and human exposure. The environmental

carcinogens that are controlled within the province are done so on a substance-by-substance basis, as part of general regulatory strategies designed to control groups of toxic substances. In these regulatory strategies, carcinogens are not identified as such, nor are they marked for special treatment. Voluntary pollution prevention programs are commonly used in these strategies.[4] In short, an environmental carcinogen use reduction strategy does not exist for Ontario.

With respect to who is responsible for controlling environmental carcinogens, to a greater or lesser extent, all three levels of government (federal, provincial and municipal) have jurisdiction over toxic substances in Ontario. There is overlap between where and how a particular carcinogen is controlled, and the jurisdictions of those responsible.

In some individual instances, the current Ontario framework has realized significant improvements: *Canadian Environmental Protection Act* regulations (which apply to Ontario) have reduced ambient levels of the carcinogen benzene by almost 47% since 1998, and rural ambient benzene concentrations have been reduced by over 32%.[5] Further, some Canadian companies have eliminated or reduced the levels of carcinogens that they release, largely as the result of government regulations, or through the development of pollution prevention plans. Individual examples of Ontario companies instituting pollution prevention programs include Scarborough-based Novopharm, which modified its processes and led to the substitution of a solvent-based pill process using methylene chloride with an aqueous based process, and the company Interface, which changed its manufacturing process in Belleville so that it did not use dyes produced from heavy metals.[6] It is also true that Canada is the first country to have categorized all of the substances (23,000) on its Domestic Substances List, in order to determine priorities for health and the environment that take the potential for exposure into account.

However, according to PollutionWatch, which is a collaborative project of the group Environmental Defence and the Canadian Environmental Law Association, Ontario ranks highest among the provinces in environmental carcinogen release, and when Environmental Defence recently conducted lab testing on the blood of four Canadian politicians, it was found that their blood contained many toxic chemicals, including 54 carcinogens.[7,8]

The partial controls that currently exist show that while results can be achieved, there is no strategy in place that can deliver these gains across the board.

Comparisons between practices

There are a number of differences between the international practices surveyed and current practices in Ontario:

- Public education and eco-labeling are used more commonly in the European Union and in some States than they are in Ontario.
- The right-to-know provisions and surveillance efforts that are used in Ontario could benefit from further expansion.
- Compared to the practices used in the European Union and in some States, environmental carcinogens are less controlled in Ontario.
- Environmental carcinogens are controlled differently elsewhere; Ontario might benefit from adopting some of the measures being used in other jurisdictions.
- Pollution prevention plans are voluntary in Ontario, whereas they are often mandatory in other jurisdictions.
- In the European Union, comparative assessment and substitution are used much more frequently than in Ontario.
- Compared to the jurisdictions examined, economic and practical incentives are not commonly used in Ontario.
- The province of Ontario could benefit from an independent body, dedicated to environmental carcinogen use reduction and surveillance, such as that found in Massachusetts.
- Compared to other countries, Canada is an international leader in the categorization of chemical substances.
- The needs of the unborn, children and pregnant women are not identified as a priority in standards setting in international or Ontario programs.

The approaches to future policy development described below outline how the governments that control environmental carcinogens in Ontario may adopt practices used in the European Union and in some States to reduce carcinogen use and release.

Next Steps

The analysis undertaken in this document demonstrates that at present, a carcinogen use reduction strategy does not exist for the province of Ontario, and that the current system may be improved by adopting toxic use reduction as an overarching framework, incorporating relevant elements from programs that some States and European countries currently use.

At this point, there is a need for further action, including a full analysis of the approaches to future policy development that are suggested below. Non-government organizations, environmental groups, and the government could take these tasks on. This analysis should include an assessment of the overall impact of the changes suggested, including the evidence of health benefits and cost and benefits of implementation.

The guiding principles outlined here are to be considered in the application of the directions for future policy development outlined below.

Guiding Principles

Identifiable groups that are vulnerable to environmental carcinogens include, but are not limited to, pregnant women and the unborn, seniors, children and Aboriginals. Standards of safety are needed to account for the greater vulnerability of some groups to environmental carcinogens.

The precautionary principle, which states that action to reduce risk should not wait for scientific certainty, should be adopted in relation to environmental carcinogens.

Carcinogen use reduction planning should take into account the cumulative effects of multiple pollutants, and aggregate carcinogen exposure.

Wherever possible, the creation of pollutants or waste should be avoided or minimized.[9]

Directions for future policy development

Primary Directions

1.1 That a comprehensive, integrated, provincial regulatory strategy be developed for environmental toxics use reduction. This strategy will involve government and key stakeholders, and focus on goals and caps for carcinogen use reduction.

1.2 That an arm's length Ontario Carcinogen Use Reduction Institute (OCURI) be established and fully funded, mandated by law, to reduce carcinogen use by: researching substitutes, assisting industry in switching to chemicals of lower toxicity (through training, knowledge transfer and direct assistance), collecting and reporting annually on the use of carcinogens, and following up with industry.

Surveillance

2.1 That an environmental carcinogen surveillance strategy (including environmentally-related cancer cases and deaths, residential and occupational history, biomonitoring, and tracking environmental carcinogen trends) be developed that easily links into federal information gathering databases.

2.2 That an environmental carcinogen surveillance strategy annually report on regional and provincial trends on environmental carcinogens (those with a known presence in Ontario, and classified by the International Agency for Research on Cancer as being a known or probable carcinogen, or classified as being a known or reasonable human carcinogen according to the U.S. National Toxicology Program) in the air, water and soil.

Policies and Programs

3.1 That users, manufacturers and importers of new or existing substances be required to demonstrate, to the responsible Minister, that it does not pose significant environmental or health risks, before it is permitted for import, manufacture or use.

3.2 That comparative assessments and chemical substitution be adopted as the means of achieving carcinogen use reduction in Ontario, and that tax incentives, professional assistance and the scientific assessment of less toxic alternatives be provided to chemical users and manufacturers in the province.

3.3 That an accelerated assessment and approval process be developed for chemicals known to be of low risk, so that they may quickly move through the processes of obtaining permission for import, manufacture or use, and through comparative assessment.

3.4 That the list of substances in the federal National Pollutant Release Inventory be amended to include environmental carcinogens (substances with a known presence in Canada, and classified by the International Agency for Research on Cancer as being a known or probable carcinogen, or classified as being a known or reasonable human carcinogen according to the U.S. National Toxicology Program), and that this list be assessed annually and revised when necessary.

3.5 That the label on all consumer products sold in Ontario (including pesticides) clearly indicate the presence of carcinogens (those with a known presence in Ontario, and classified by the International Agency for Research on Cancer as being a known or probable carcinogen, or classified as being a known or reasonable human carcinogen according to the U.S. National Toxicology Program) with an easily recognized symbol.

3.6 That public health standards include carcinogen use reduction, including community-based programs, policies and education.

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SECTION I—Introduction

Background

Although many gains have been made in the prevention, early detection and treatment of cancer, across the globe, incidence of the disease is on the rise. In Canada, it is estimated that there will be 159,900 new cancers diagnosed in 2007, of which 59,500 will be in Ontario.[10] Further, it is expected that 26,900 Ontarians will die from the disease.[11] In Ontario, every year (according to the best available estimates), the number of newly diagnosed cancers increases by 2.5%; it is projected that in the year 2020, there will be 91,000 new cancers diagnosed.[12]

Cancer is costly to both the patient (personal discomfort, loss) and the Ontario healthcare system, and in the case of preventable cancers, these costs are not necessary. It is important to examine the preventable causes of cancer, and to look for ways to stop cancer from developing.

Many studies have been dedicated to discovering the causes of cancer with the hope of preventing it, and much has been published in this regard. It is now known that about half of all cancer deaths can be attributed to tobacco use, poor diet and physical inactivity, and that occupational factors, infections, family history, and alcohol use are other important sources of risk.[13] It is also known that the projected increase in the number of new cancers is largely due to population aging and growth.

Despite research into the causes of cancer, a significant percentage (16 to 18%) of cancers cannot be explained by known risk factors, and although there is a link between increasing cancer rates and aging, cancer incidence is rising in young adults, and over half (56%) of new cancer cases occur among those under 70 years of age.[14,15] It is known from migrant studies of some cancers that individuals who move from a country with a low cancer risk to one with a higher risk acquire the higher risk, and that twin cohort studies have not found that inherited factors contribute greatly to the risk of most cancers.[16,17] This information has led many individuals to question what role the environment and environmental carcinogens play in causing cancer.

The percentage of cancers related to environmental exposure is not well documented, however there is public concern around the issue, a number of cancers are potentially affected by exposure to environmental carcinogens (e.g., those of the bladder, breast, pancreas, prostate, kidney, ovary and lung),[18] and some childhood cancer sites (including those of the thyroid and brain, and childhood leukemia) have been linked to environmental exposures.[19] It appears

that precautionary action would be a prudent approach to environmental carcinogens.

A recognition of the relevance of environmental carcinogens is reflected in the provincial cancer action plan of 2003, *Targeting Cancer: An Action Plan for Cancer Prevention and Detection (Cancer 2020 Report),* led by Cancer Care Ontario (CCO) and the Canadian Cancer Society (CCS), which sets targets for the province to be achieved by the year 2020,[ii] wherein it is recommended that surveillance and action be taken on environmental exposures, despite the uncertainty surrounding the issue.[20]

The argument for action on environmental carcinogens in the Cancer 2020 Report was based on principles that include:

- The **precautionary principle**, which states that when an activity raises the threat of harm (in this case cancer), risk should be avoided through the reduction and/or elimination of the exposure, even if full cause and effect evidence is not yet available.
- **Pollution prevention**, which posits that damage to environment and human health is easier and less expensive to prevent than it is to manage.
- The **weight of evidence approach**, which combines the results of many types of studies investigating harm, concluding that there is a need for action on a particular issue.
- The community's right to know about environmental risk, and their right to participate in decisions that affect their health.[21]

While cancer prevention programs must be evidence based and result in health benefits, action can be recommended based on the principles noted.

In 2005, CCO and CCS released a report entitled *Environmental Exposures and Cancer,* in which it concluded that evidence supports an association between the development of cancer and exposures from air pollution, arsenic, asbestos, water disinfection by-products, and radon in the environment. Further, a recent review undertaken for the Canadian Strategy for Cancer Control on best practices for preventing environmental cancers identified various measures that could be strengthened for cancer prevention. Among these measures is the minimization of exposure to carcinogens at all times, with an aim to eliminate them where possible.[22]

Cancer is comprised of many individual diseases, and is the result of a complex interaction of multiple exposures. Cancer prevention efforts should include focus on reducing exposure to all avoidable sources of risk, which include

[ii] Targets for environmental carcinogens, established in the Cancer 2020 Report are: the development of a surveillance system to estimate and monitor levels of exposure to specific substances, the identification of specific substances for action, and reduced exposure to the substances identified, based on practices used in comparable jurisdictions.

environmental carcinogens.[23] A general approach to reduce exposure to many environmental carcinogens, such as those that reduce overall vehicle emissions would also lower the risk of other health problems that are caused by environmental pollutants, such as cardiovascular and respiratory problems, and increased hospital admissions, which are associated with high levels of air pollution. Efforts to control carcinogen release and exposure will also help reduce exposure to substances that are of concern due to reproductive, neurological, and endocrine disruption effects.

Although carcinogens are not its focus, Environment Canada does recognize the importance of prevention, placing pollution prevention at the top of the Environmental Protection Hierarchy. Here pollution prevention reduces the risk to human health and the environment by eliminating the causes of pollution, rather than treating its symptoms. This focus encourages the types of changes likely to lead to lower production costs, increased efficiency and a more efficient protection of the environment.[24]

The Cancer and the Environment Stakeholder Group

As a result of the action plan described in the *Cancer 2020 report*, the **Cancer and the Environment Stakeholder Group** was created by CCO with support from the CCS with the objective of developing and supporting the implementation of an environmental cancer prevention strategy in Ontario. This group is guided by the precautionary principle and principles of prevention in its efforts to reduce the burden of illness from environmental carcinogens.

Members of the group include health, professional and environmental organizations, charities, and labour groups. Representatives from the Ministry of Health and Long-Term Care and the Ministry of the Environment were a resource to the group who provided information on programs in their respective ministries. A complete listing of the group terms of reference and its membership can be found in Appendix B.

Objectives, Purpose and Approach

In order to develop and support an environmental cancer prevention strategy, the Stakeholder Group first needed to understand the current management of environmental carcinogens in the province, and to identify the areas where improvements could be made. The **purpose** of this document is to describe the existing practices for managing environmental carcinogens in Ontario, to examine them in light of recognized international practices, and to identify directions for future policy development that will improve them. An additional purpose of this document is to develop a comprehensive list of environmental carcinogens for the province of Ontario. This document has been developed for non-government organizations (NGOs), government and other agencies focused on reducing environmental carcinogens in Ontario.

Next steps would involve a full analysis of the directions for future policy development that are suggested, including an assessment of the overall impact of the changes suggested, including evidence of health benefits, and cost and benefits of implementation.

The **objectives** of this project are to:

- Identify the components of programs that reduce the release of toxic substances, environmental carcinogens in particular.
- Describe the current regulatory and policy approaches to environmental carcinogens in Ontario.
- Review the current Ontario practices and evaluate their effectiveness in reducing the use and release of toxic substances, carcinogens in particular.
- Identify gaps and determine ways that could further reduce the use and release of carcinogens in Ontario.
- Develop a set of directions for future policy development.

Scope

This paper examines overall regulatory strategies that are used to reduce the use and release of toxic substances within Ontario, and those in the United States and the European Union, with the understanding that its purpose is to explore how *environmental carcinogens* are controlled within these regulatory strategies.

Toxics use reduction is an approach used in some jurisdictions that is complementary to the existing system in Ontario. Toxics use reduction is an overall tactic that focuses on using less toxic substances, and ensures that carcinogenic substances are not replaced with other substances of concern (due to other health or environmental characteristics). The Environment and Cancer Stakeholder Group identified toxics use reduction as being a framework that would complement the existing system in Ontario, where toxic substances are currently controlled within general strategies, without an overall focus on carcinogenic substances.

The stakeholders have defined an environmental carcinogen as being a carcinogen “found in the environment to which the public can be expected to be exposed as the result of human activity.”[25] While occupational exposures are not a focus of this document, it is true that if a substance is an occupational carcinogen, from a precautionary stance, it is also an environmental carcinogen, and that if the substance is removed from the workplace, it is removed from the environment.

While the control of individual carcinogens is not the focus of this paper, the stakeholders developed a target **carcinogen list** (Appendix A), that is the result

of a complex, iterative process. It was decided out of this process that a substance would be retained on the list if it has a known presence in Ontario, is a known or probable carcinogen according to the International Agency for Research on Cancer (IARC), or has been identified as known or reasonably anticipated to be a human carcinogen by the U.S. National Toxicology Program (NTP). Biological agents or those used solely as pharmaceuticals were not included. Assessments made by IARC and the NTP were used as the basis of the Stakeholder list because these organizations are credible. Further, CCO is not in the position to develop and maintain such a list, and an official carcinogen list does not exist for Ontario or Canada.

The stakeholder-defined list does not include:

1. Substances where the scientific evidence is sufficient, but it has not yet been evaluated by IARC or NTP,
2. Substances that disrupt the endocrine system, but for which carcinogenicity has not yet been established,
3. Pharmaceuticals that enter the environment during manufacture or disposal, and
4. Particulate matter. While there is an association between exposure to particles in ambient air and cancer, it is though that their nitrogen and sulphur components (which play a significant part in the health impact of smog) are not carcinogenic, but act as a vehicle of carcinogen transmission.

Structure of the Report

In the sections that follow, examples of progress in environmental carcinogen control in Ontario are cited, followed by a summary of practices that reduced (or are anticipated to reduce) the use and release of environmental carcinogens in North America and Europe. After this section is a description of selected federal, provincial and municipal legislation and other initiatives that deal with carcinogens found in the Ontario environment. While the international practices are presented as complete strategies, the Ontario context is organized by mode of delivery (air, water and land, and personal care products), as this is how the legislation is organized in the province.

The Ontario context is then compared to the selected international practices, and areas of strength and weakness are described, along with the gaps observed. The document concludes with directions for future policy development to strengthen the existing practices in Ontario, so that they can more effectively reduce the use of, and exposure to environmental carcinogens.

The Stakeholder group felt that it is important to pay specific attention to the greater vulnerability of children and the unborn to carcinogens. As a result,

children and the unborn (including pregnant women) were considered in the review of environmental carcinogen control strategies.

Limitations

In the short time line for this paper it was not possible to ensure that every practice in Canada and the world was surveyed, yet this report did examine commonly cited practices in the European Union and the United States, and a number of Canadian practices.

A great deal of work is being done to control environmental carcinogens by labour and by environmental advocates in regard to occupational carcinogens, however, this work is out of the scope of this paper, as are strategies that deal with sunlight and environmental tobacco smoke.

The documents selected for inclusion were determined in consultation with Peggy Sloan of Cancer Care Ontario and Ronald Macfarlane of Toronto Public Health, the Cancer and the Environment Stakeholder Group, government experts, and as the result of literature searches.

Also used to inform this document were the presentations of keynote speakers and comments from attendees at the Environmental Carcinogen Use Reduction Symposium of February 6, 2007, [26] hosted by the Canadian Cancer Society, the Canadian Strategy for Cancer Control, and Cancer Care Ontario (see Appendix C).

The precautionary principle is a tool for making decisions in the absence of certainty. In this document the principle is applied to assess Ontario's need for a strategy to further reduce exposure to environmental carcinogens. In order to do this, we made use of only those substances that are accepted as known human carcinogens, according to reputable international and national organizations.

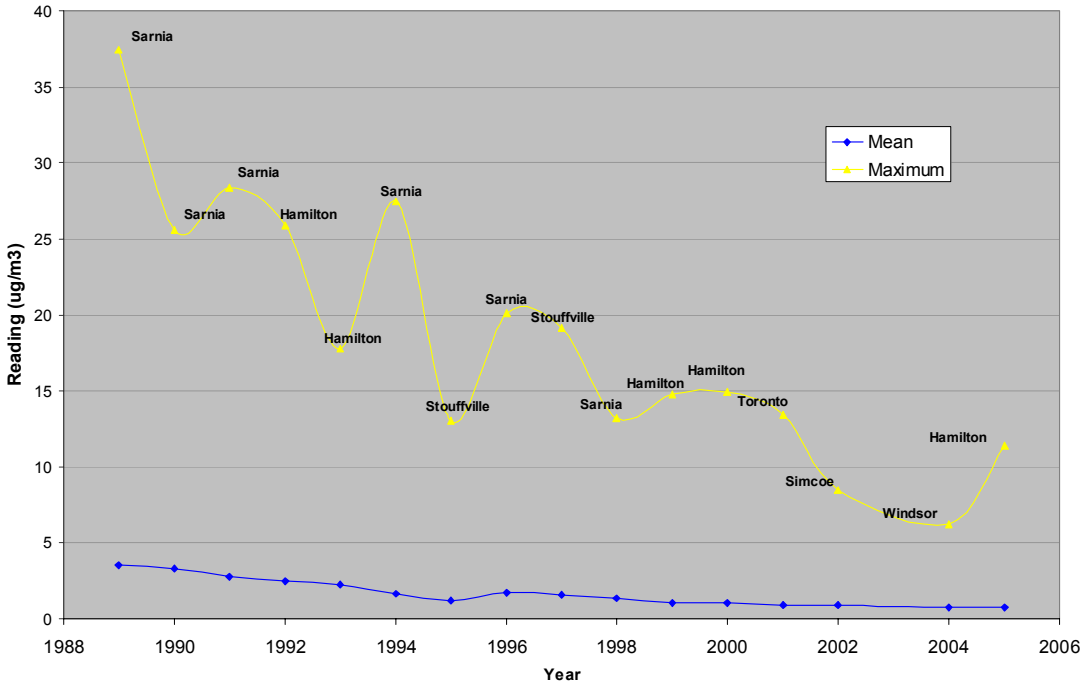
Section II: Ontario—Examples of Carcinogen Use Reduction

Before examining the control of environmental carcinogens in the United States and the European Union, it is important to note that:

- This discussion is meant to illustrate some techniques that may lead to improvements if they were to be applied to the Ontario context, and
- There are instances where the controls that already apply in Ontario have reduced the use or release of environmental carcinogens.

In fact, regulations under the federal *Canadian Environmental Protection Act 1999* (CEPA), which apply to Ontario, have led to a reduction in levels of ambient benzene concentrations by almost 47% since 1998, and rural ambient benzene concentrations have been reduced by over 32%.[27] Figure 1, using National Air Pollution Surveillance Network data provides an illustration of the positive results Ontario has experienced in reducing exposure to benzene. Benzene still remains a concern and a risk factor; these approaches have not virtually eliminated its presence.

Figure 1: Benzene in Ontario, 1989-2005



Source: National Air Pollution Surveillance Network

Regulations for the pulp and paper sector under the *Fisheries Act*, together with similar regulations that are found under CEPA, which apply to Ontario, have been effective. These regulations have set discharge limits and monitoring requirements for furans, dioxin requirements from pulp mill effluents, and forced mills to monitor their effluents.[28] Because of this, most Canadian mills purchased control equipment, and converted from chlorine to chlorine dioxide processes, leading to a 99% drop in dioxin and furan discharges (in 1997) from 1989 levels.[29]

Trichloroethylene and tetrachloroethylene were assessed as toxic under CEPA, and solvent degreasing regulations were published in the Canada Gazette in 2003.[30] These regulations implemented a three year freeze in the consumption of the two chemicals, followed by a 65% reduction in their use (although this regulation applies only to companies using over 1,000 kg of solvent a year).[31] Regulations have led some companies to use substitution rather than continued monitoring and reporting. Environment Canada does list alternatives to solvent degreasers. Tetrachloroethylene regulations have been established for dry cleaners, and this has led to a reduction in its use, due to switching to better machinery.[32]

With respect to specific company examples, some Ontario companies have eliminated or reduced the levels of carcinogens that they release, largely as the result of government regulations, or through the development of pollution prevention plans. Notable examples of Ontario companies instituting pollution prevention programs include:

1) Scarborough-based Novopharm (http://www.novopharm.com/home_main_e.asp). This company modified its manufacturing process in order to substitute a solvent-based pill coating process that made use of methylene chloride with an aqueous-based process.

2) Interface (http://www.interfaceinc.com/). This carpet and fabric company changed its manufacturing process in Belleville so that it did not use dyes made from heavy metals.

3) Husky Injection Molding Systems (http://www.husky.ca/) which diverted 95% of its waste in 2000, realized a $348,000 savings in disposal costs, and generated $804,000 in revenue through the innovative reuse of materials.[33]

Although these examples may not illustrate a trend, it can be said that there are some aspects of the current framework that are efficient. Despite some areas of efficiency, the province of Ontario could benefit from adopting elements of carcinogen use reduction programs that are being used in other countries.

SECTION III—International Regulatory Strategies

Toxics Use Reduction and the Control of Environmental Carcinogens

Examples of regulatory practices that reduce (or are expected to reduce) population exposure to toxic chemicals and environmental carcinogens are described in this section, in order to provide a basis for comparison, and to provide a platform from which improvements can be suggested.

Recognized regulatory approaches that can be applied to environmental carcinogen use reduction include:

- Reporting requirements: reporting on health or environmental data, resource use, emissions, developing pollution prevention plans, etc.
- Restrictions or limits: caps, controls or bans, restricted manufacture, use or emissions.
- Increased manufacturer responsibility: liability, taxation, burden of proof (of safety), etc.
- Product registration or pre-manufacturing data submission.
- Substitution: includes product reformulation or process changes wherein hazardous materials are substituted with those that are less hazardous.
- Comparative assessment: determining which product or process has the least adverse impact among a set of similar products or processes. This may incorporate an economic assessment.
- Public education and awareness: includes 'eco-labeling' (labeling products that are free of hazardous chemicals) and ingredient labeling requirements.
- Surveillance and tracking the use and release of environmental carcinogens, monitoring the chemical load in individuals.
- Process Changes: more efficiently controlling use of and exposure to carcinogens.
- Right-to-know laws: laws enabling access to information that is held by governments or industry.

The following section will describe recognized approaches in greater detail as they relate to practices in the European Union and the United States. Table 1 presents these main approaches, along with the programs to which they apply.

Table 1: Selected American and European Regulatory Strategies for Carcinogen Use Reduction and their Associated Programs

Regulatory Programs	Reporting Requirements	Restrictions or Limits	Increased Manufacturer Responsibility	Product Registration	Substitution, reformulation	Comparative Assessment	Public education and Awareness	Surveillance and Tracking	Process Changes	Right-to-know laws
Denmark Chemical legislation		X	X	X	X		X			
Sweden-Comparative assessment/substitution	X		X	X	X	X				X
European Union-REACH		X	X	X	X		X			X
European Nations-Eco-Labeling schemes						X	X			
European Union-CAREX, ASA								X		
European Union-Cosmetics Directive		X			X		X			X
United States-Toxics Release Inventory (TRI)	X			X			X			X
United States-Fair Packaging and Labeling Act							X			X
California-Safe Drinking Water and Toxic Enforcement Act, Safe Cosmetics Act			X				X			X
California-Bio-monitoring program								X		
California-Chemical Detection Bill			X							
New Jersey-Pollution Prevention Act, Worker Right-to-Know Act	X	X	X	X	X				X	
Massachusetts-Toxics Use Reduction Act, "CleanerSolutions"	X		X	X	X		X		X	X

The European Union

European measures that address carcinogens are largely related to public education, often in the form of eco-labeling (which identifies products that are considered less harmful than other, similar products) and the elimination or substitution of toxic substances with those that are less toxic. The European Union has also introduced a number of laws, including those that place responsibility on industry for the disposal of potentially hazardous materials, along with those that restrict companies from using specific toxic chemicals in electrical and electronic products.[34]

Danish Chemical Legislation

Denmark is among the international leaders in chemical regulations. In this country, emphasis is on reducing chemical use, particularly in the areas of agricultural pesticides and biocides. Danish efforts focus on: reducing the consumption of problematic chemicals, controlling the use of chemicals, increasing the responsibility of manufacturers (by making them financially responsible for clean-up), assuring public access to information, and encouraging the European Union to regulate chemicals more stringently.[35] Under the Danish system, less toxic alternatives are sought, risk assessments and regulations are completed, and products are registered.

In Denmark, a number of dangerous chemicals have been banned, prohibitions have been leveled against phthalates in certain toys, and the use of arsenic in preserved wood has been banned. As a result, the consumption of some important carcinogens has been reduced. Notably, the consumption of heavy metals (including the carcinogen cadmium) has been reduced by 50%.[36] Taxing the use of toxic substances of greatest concern has encouraged manufacturers to substitute them with less hazardous choices. Denmark also makes use of initiatives that foster the development of cleaner products, information campaigns and eco-labeling, and has worked to reduce the use of agricultural pesticides through reductions in the frequency of treatments, and in the protection of sensitive areas.[37]

Because environmental pollution does cross borders, and in the past the European Union did not have a cohesive regulatory system, Danish efforts were limited by continental legislative shortcomings. As a result, Denmark placed pressure on the European Union to tighten chemical regulations.

Swedish System of Comparative Assessment/Substitution

Sweden, which has strict chemical laws, is regarded as being the European leader in chemical regulation.[38] The Swedish Environmental Code includes the principles of precaution, product choice, and "polluter pays." In the product choice principle, there is an obligation to choose less harmful substances, wherever possible. Industrial and commercial operators must make use of the best available methods, their operations must be located where they will have the least environmental or human health impact, and those who damage the environment must clean it up.[39] The Swedish Parliament has set a goal to, within one generation, free the environment from man-made or extracted compounds and metals that threaten human health or biological diversity, and they prioritize chemicals for risk reduction based on this goal. In Sweden, manufacturers and importers of chemicals must provide sufficient information about the substances they wish to use or sell, along with risk, safety, and labeling information.[40]

Phasing out substances through product choice or substitution is advised for use when the substance has unacceptable environmental and health risks. A seven-stage model is recommended to users by which they may select substances that prevent or avoid risk. Carcinogens (Category 1 and 2) are among those selected for phase-out, with cadmium and lead considered to be particularly hazardous materials.[41]

Sweden has used the principle of substitution in its pesticide regulations. Starting in 1990, pesticides must be re-registered every five years, and are subject to comparative assessment. The level of risk between products of similar use are compared and ranked, with cut-off criteria applied, which include carcinogenic and reproductive effects. While high risk products are phased out and low risk items are approved, moderate risk items are subject to comparative risk assessment, and phased out if lower risk alternatives exist. Substitution may occur during a review, in new product examination, and when a new product is set to displace an existing product.[42] Alternative products must present a much lower risk to health or the environment, be effective against the target organism, must not impose any significant economic or practical disadvantage to the user, and must be available and applicable for the intended use.[43]

This method provides continuous improvement, and negates the need to manage the risk posed by obviously hazardous, potentially carcinogenic materials. This method encourages the development of less toxic substances, and prevents one dangerous substance from being replaced with another.[44] This method can be extrapolated to other areas where carcinogenic substances are used, allowing the replacement of dangerous carcinogens with products that do not damage human health or the environment.

Chemical emissions are also registered in Sweden, to give the public access to information, and to fulfill international commitments.[45]

The environmental quality objectives of Sweden have been met with approval from the public, regulators and industry, largely because of reasons particular to Sweden; their chemical industry is small, there are strong environmental interests in the country, and the public is concerned with the environment.[46] The system has been in effect for well over a decade, and many pesticide substances and products have been removed due to comparative assessment.[47]

Sweden advocated similar chemical legislation for the European Union for many years. In 2006 their goal was realized; new, far reaching legislation was agreed to by the European Parliament.

REACH

Up until now, the legislative framework around chemical substances in the European Union was a patchwork of directives and regulations where, as is the case in other nations, 'existing' chemicals (the approximately 100,000 substances on the market between 1971 and 1981) were never tested, and 'new' chemicals (introduced after 1981, amounting to over 3800 substances) were tested before market placement.[48] The system: a) discouraged research and the invention of new substances, with companies naturally favouring the use of older, untested chemicals and b) placed the onus on public authorities to complete comprehensive substance risk assessments.[49]

In 2006, the European Parliament's environmental committee agreed to REACH (Registration, Evaluation, and Authorization of Chemicals), which is revolutionary legislation that uses the precautionary principle in relation to industrial chemicals. REACH shifted the burden of proof regarding chemical safety from regulators to businesses, and requires that they prove the safety of up to 30,000 commonly used substances.[50]

The two greatest aims of the strategy are to protect human health and the environment, and to enhance the competitiveness of the European Union chemicals industry.

Some important elements of the plan are that:

- The European Chemicals Agency (ECHA) is responsible for managing the administrative, technical and scientific aspects of the system at the community level.
- Chemical makers must register the properties of their substances, including information on their use and safe management.
- Correct information on the hazard and risk associated with a substance and its management must be made available throughout the supply chain.
- Testing proposals and compliance are checked by the ECHA, which also ensures the coordination of substance evaluations by the authorities.

- There are restrictions regulating the manufacture, availability or use of substances of concern, subjecting them to conditions or prohibition.
- There is a classification and labeling inventory of dangerous substances.
- Access to information rules apply, with publicly available information, and a system of requests for information that protects confidential business information.[51]

The chemicals industry and the United States strongly challenged REACH, which led to changes to the legislation that weaken it. Included among the changes are: 1) many lower volume chemicals are exempted from full testing, 2) companies can argue that the risks of a hazardous chemical are controlled for, or that there are no suitable alternatives to the chemical, and that the benefit outweighs the risk,[52] and 3) the 'right-to-know' clause, requiring the labeling of hazardous chemicals has been dropped.

REACH supersedes the legislation that exists in the individual European nations. As a result of the successful challenges to REACH, in some cases, Swedish and Danish efforts have been weakened.

Because the legislation is new, it will be some time before an evaluation of it is available. It is safe to assume that, if it is not further weakened, its results will be important.

There have been many impact studies evaluating the cost-benefit ratio of adopting REACH.[53] The results of studies not funded by industry groups suggest that the effects of implementing REACH on the GDP will be limited, that there will be significant health cost savings, and that there will be business benefits that include improvements in innovation, competitiveness and worker safety.[54]

Eco-Labeling schemes

Product labeling is frequently used in European nations. In 1989 the Nordic Council of Ministers introduced "the swan" as its common, official environmental label. The swan logo is used by these countries as a way to designate an item as being a product with preferred environmental properties (compared to other products in its class). Under the scheme, a wide range of products that fulfill certain environmental criteria can apply the label.[55] The swan is a well known, cost efficient (as it does not require education campaigns) means of conveying environmental information to the consumers of these countries.

The European Union itself has also developed an eco-label scheme, similarly designed to stimulate the supply and demand of products that have a reduced environmental impact. Under the scheme, only those manufacturers, retailers or service providers who meet certain criteria (for a product group) and have applied for the eco-label may market their products as such.[56] This voluntary

program relies on comparative assessment, wherein only those products with the lowest environmental impact in a range of products are awarded the label.

The decision as to which products are awarded the label is determined by scientific and technical guidelines, and with the participation of other independent and neutral bodies, designated to implement the scheme.[57] Most participants in the European scheme use the logo in their marketing campaigns, and the scheme has made a positive impact on the market; over half of the eco-labeling companies have experienced an increased market share or more new customers.[58]

European Union Cosmetics Directive

Cosmetics and other personal products can be an important source of toxic substances, and their ubiquitous nature makes them a particular concern. The European Union Cosmetics Directive of 1976, most recently amended in 2003, requires that the ingredients of personal care items be listed on product labels, and that the manufacturers or EU distributors of such products prove their safety.

Importantly, the 2003 amendment required that chemicals linked to cancer and birth defects be completely removed from personal care products by 2004. This legislation forced major companies to reformulate many of their products for the European market. While these products have yet to be made available globally, their existence presents an opportunity for global improvements as a result of this legislation.[59]

The United States

While European countries tend to focus on substitution laws and labeling as a way to reduce the use of toxic chemicals and carcinogens, the United States emphasis has been put on “right-to-know” laws and toxics use reduction initiatives.

The main federal right-to-know legislation in the United States is the Toxics Release Inventory (TRI), established under the *Emergency Planning and Community Right-To-Know Act 1986* (EPCRA), and expanded under the *Pollution Prevention Act 1990*. The TRI is a publicly available database containing information on 581 individually listed chemicals and 30 chemical groups. TRI information includes quantities of chemicals released on-site, transferred off-site, waste treated on-site, and data on waste management and source reduction activities. While some companies have avoided reporting requirements by selling off some parts of their companies so their emissions appear lower, and not all substances are on the Inventory,[60] the TRI is important. By providing publicly available information on these chemicals, environmental groups, communities, governments and ordinary citizens can identify local

facilities, quantify chemical disposal and other release patterns, and make informed decisions. The TRI website offers users an on-line tutorial, and tools that enable users to access data.

The *Fair Packaging and Labeling Act* of the United States is another example of right-to-know measures, which requires that the ingredients (including chemicals) of personal products and consumer goods be listed on them.[61]

A number of American States have laws beyond federal laws in promoting reduction in the use of toxic chemicals, examples of which are discussed in the following sections.

California

Of particular relevance to this document is *California's Safe Drinking Water and Toxic Enforcement Act* (Proposition 65), which requires that drinking water and products available in the State that contain carcinogens have explicit warning labels. Some have commented that this Act has led to labels being applied too frequently, which points to the need to ensure that information provided to the public under such provisions is not redundant.[62] Despite this criticism, these warnings have led many manufacturers to reformulate their products to avoid the application of warning labels.[63]

The State also passed an environmental contaminant biomonitoring program, designed to measure the chemical load in residents across the State for public health and regulatory purposes. This program will allow experts to identify trends, and determine the effectiveness of prevention methods and regulations.[64]

The governor of California has also signed a Chemical Detection Bill, which went into effect on January 1, 2007. This Bill shifts the cost of testing for chemicals in air, soil, water and humans to those that produce the chemicals, requiring that companies develop and provide these methods to State agencies. In this manner, State agencies will not waste precious resources and time on developing test methods.[65]

The *California Safe Cosmetics Act 2007* requires that companies producing cosmetics inform the State of product ingredients known to cause cancer or reproductive effects. This Act gives the Department of Health Services the authority to evaluate if normal product use could result in toxic effects, and to require that manufacturers provide health effects data.[66]

New Jersey

The New Jersey *Worker and Community Right-to-Know Act 1983* is an example of a State initiative that has extended the federal right-to-know requirements.

This Act ensures that employers list the names and amounts of hazardous chemicals stored and used at their site. The *New Jersey Pollution Prevention Act 1991* aims to identify and minimize the use and generation of hazardous substances, so that they are not released.[67]

In this State, facilities must prepare plans demonstrating opportunities for pollution prevention, followed up by submitted summaries and yearly progress reports. Further, they must complete surveys of the names and amounts of hazardous chemicals that are stored and used at their site. The pollution prevention categories used in New Jersey are: input substitution, product reformulation, efficiency improvement, in-process recycling, and housekeeping improvements. The Pollution Prevention Act helped many New Jersey companies make changes which led to significant toxics use reduction, and to considerable cost savings.[68]

Massachusetts Toxics Use Reduction Act

The *Massachusetts Toxics Use Reduction Act 1989* is designed to protect and promote the competitive advantage of Massachusetts businesses. There is evidence that this Act has been very successful in advancing toxics use reduction and management.[69] Within nine years of being enacted, this Act reduced the amount of toxic waste generated in the State by 50%, and carcinogen use, byproduct and release were significantly reduced, with participating firms experiencing cost savings.[70]

The Act itself is a planning tool for the development of efficient operations that produce less waste. Under the Act, those firms using over 10,000 pounds of any of 1200 toxic chemicals must pay an annual fee, and develop a plan (certified by a Toxics Use Reduction Planner and updated every two years) that describes how and why these chemicals are used, how they plan to reduce or eliminate these chemicals, and provide an evaluation of their other options.[71] Further, these companies must annually report the quantity of toxic chemicals used, the amounts they generate as waste, and how much they ship in or out as product. These data are available on the internet, displayed by year, by chemical and by facility. While companies are not required to implement their plans, the mandatory requirement that they prepare such documentation, and fees paid on high volume chemical users have led to a significant reduction in the use of the targeted chemicals in this State. Preparing the plan often results in companies making process changes that lead to savings; less money spent on environmental permitting, and improved company operation and maintenance. By not requiring that companies implement their plans, companies are able to consider ambitious goals, and to implement what is feasible.[72]

The implementation of the Act is supported through research and the provision of technical advice. There are a number of on-line technical support services that

exist. For example, the Toxics Use Reduction Institute provides an online database, CleanerSolutions, an interactive website designed to help manufacturers switch to safer surface cleaning solvents.[73] This free tool helps manufacturers find safer cleaning alternatives that perform as well as hazardous chemicals. Manufacturers can find safer cleaning products, along with performance test results and safety information, based on five environmental and health indicators (global warming potential, ozone depletion potential, volatile organic content, flammability/reactivity and acute toxicity).[74]

The Toxics Use Reduction Institute, established under the Act, is maintained as a university centre with 14 full-time employees, and has an annual budget of $1.2 million. The Institute provides research, training, technical support and public awareness, and runs a number of programs, such as 1) technical and policy research, 2) Toxics Use Reduction Planner training, and 3) maintains a Surface Solutions laboratory (a lab that works to help industry find safer cleaning processes, through the development and promotion of less hazardous alternatives).[75] This Institute has a legislated mandate to study alternatives to priority chemicals, and suggest alternatives to formaldehyde, hexavalent chromium, and perchloroethylene.[76]

Surveillance

In a discussion of the prevention of population exposure to environmental carcinogens, it is important to address the issue of surveillance. The surveillance of environmental carcinogens involves the collection of data for the purposes of planning interventions that might reduce the amount, or consequences of exposure. Surveillance of cancer cases is technically a way to identify environmental carcinogens and their role in cancer however, due to the long latency between an exposure and cancer, and the multi-causal nature of the disease, this is not the best surveillance method for environmental carcinogens.[77]

In the European Union, the International Information System on Occupational Exposure to Carcinogens (CAREX) is used to estimate the burden of occupational cancer. This information system has been modified for use in Canadian provinces to estimate the numbers of workers who are exposed to common workplace carcinogens.[78] In Finland, the ASA registry is used to document workers exposures to carcinogens, which are classified and listed in the Registry.

Internationally, human biomonitoring is commonly used to assess environmental exposure. Biomonitoring assesses chemical exposure based on findings from human tissues or fluids, plants and animals.[79] These studies demonstrate the possible items that can be tracked and reported, and can identify emerging problems. Over time, this research can be used to identify chemical exposure trends.[80]

Another example of surveillance is the California Air Resources Board, which monitors air quality through real-time measurements of ambient level pollutants, at locations across the State. Site data are used to determine the nature and severity of pollution, to identify trends, to develop air models and emission inventories, and to designate areas as having reached attainment or non-attainment (of the standard). A non-attainment designation brings with it costs and plan development.[81]

Section Summary: Selected European and American practices

As the preceding discussion has shown, efforts are being made in Europe and the United States in toxics use reduction, and as an extension, carcinogen use reduction. A number of practices are being undertaken in these countries that provide useful elements which may be adopted to strengthen the Ontario framework for reducing the use and release of carcinogens, and the production of wastes containing them. These practices are summarized in Table 1.

Generally speaking, as Table 1 shows, recognized international programs place great emphasis on:

- Public education and awareness,
- Substitution of toxic chemicals with those that are less toxic, either through product reformulation or comparative assessment,
- Placing greater responsibility on those who produce or use the toxic product, by requiring them to prove that they are necessary, and
- Pollution prevention planning, requiring the replacement of toxic chemicals, or changes that lower the need for their use.

In some instances, these strategies specifically identify carcinogens as chemicals of priority, with steps taken to control them. It was also found in the United States that when some form of technical assistance is provided to companies as part of a mandatory program requiring reporting and planning, they are more likely to achieve toxics use reduction.

Section IV—The Control of Environmental Carcinogens in Ontario

In Ontario, while there are a number of strategies around individual environmental carcinogens such as tobacco smoke and sunlight, and occupational strategies have dealt with a number of others (such as benzene and asbestos), 'carcinogen' control legislation does not exist for the province Ontario. In existence are general regulatory strategies that apply to environmental substances, which include carcinogens.

This section reviews a number of regulatory strategies used by the provincial government to reduce or eliminate the threat posed by dangerous environmental substances, and, where applicable in Ontario, a number of those used by federal and municipal governments. The purpose of this section is to describe how environmental *carcinogens* are controlled within these strategies.

This section will first discuss the overarching federal legislation, the *Canadian Environmental Protection Act 1999*, and will then go on to describe some of the ways that carcinogens are controlled in the soil, water, and air, along with the control of pesticides, and carcinogens in personal products in the province of Ontario.

As this chapter will demonstrate, in Ontario, responsibility for the environment is shared between the federal and provincial governments. For the most part, environmental carcinogens are controlled in Ontario through limits and reporting requirements.

General Federal Controls

Canadian Environmental Protection Act 1999 (CEPA)

Although it is federal legislation, no discussion of the control of environmental carcinogens in Ontario would be complete without a discussion of the **Canadian Environmental Protection Act, or CEPA**. CEPA is the legislative tool the federal government uses for managing toxic chemicals in Canada. CEPA gives the government the power to control environmental carcinogens.

The aim of CEPA is to protect human health and the Canadian environment from new and existing substances of concern.[82] CEPA is jointly administered by Health Canada and Environment Canada, and work under CEPA is guided by the following principles:

- Sustainable development: development should not compromise future generations.

- Pollution prevention: the creation of pollutants or waste should be avoided or minimized.
- Ecosystem approach: reflects an understanding that living organisms and their non-living environment are interrelated.
- Precautionary principle: if inaction might lead to serious, irreversible damage, the enactment of preventive, cost-effective measures should not be postponed.
- Virtual elimination: substances that are declared 'toxic' under CEPA are those that are persistent, are bioaccumulative (collect in living organisms), and result from human activity are given special attention, in order to ensure that the release of the substance to the environment is not detectable by current technology.
- Polluter pays principle: producers and users of harmful substances have a responsibility for the costs associated with safe use and disposal of these substances and wastes.
- Intergovernmental cooperation: the recognition that all governments can benefit from cooperative problem solving.
- Science-based decision making: using the weight of evidence approach and the precautionary principle.[83]

Under CEPA, a substance can be designated as 'toxic' if it is found to enter the environment in quantities that:

- Have or may have harmful long-term or immediate effects, either on the environment or its biological diversity,
- Present, or might present, a danger to the environment upon which life depends, or
- Present, or might present, a danger to human life or health.[84]

Under the Act, if a substance is found to be 'toxic', it may be proposed for addition to the List of Toxic Substances (Schedule 1 of CEPA 1999). A Schedule 1 designation gives the government the authority to adopt ways to manage the substance, in order to reduce or eliminate the risk it poses.[85]

Tools used to manage toxic substances are developed through the Toxics Management Process, wherein a Risk Management Strategy document is prepared by Environment Canada, in consultation with Health Canada, outlining an approach to managing the risks to the environment and human health posed by a particular substance. If several substances from one sector require management, a sector specific strategy is developed. In developing the strategy, high risk sectors are identified through a risk assessment, followed by the identification of risk management objectives.[86]

Once the objectives are set, risk management tools and instruments are selected, including those available both inside and outside CEPA, including the regulations of other governments, and voluntary approaches.[87] Instruments

authorized under CEPA include economic instruments (including financial incentives, environmental taxes), joint federal/provincial/territorial initiatives, provincial/territorial Acts, and other federal Acts (such as the Fisheries Act, Hazardous Products Act, Pest Control Products Act).[88]

CEPA Management tools are those that manage the toxic substance, while a CEPA instrument includes regulations, and is authorized under CEPA. CEPA authorized instruments must actually establish preventive or control actions that reduce or eliminate the risk.[89] These instruments include:

- Regulations, which restrict activities related to the substance, or limit concentrations used, released, or present in a product.
- Environmental objectives, which recommend goals or purposes for pollution prevention or environmental control.
- Environmental guidelines, including recommendations that support particular uses of the environment.
- Environmental release guidelines, which are limits on concentrations or quantities for release of a substance into the environment.
- Codes of practice recommend practices, procedures, and release limits for developmental and operation phases, and any monitoring activities.
- Pollution prevention plans, which the Minister can require preparation and implementation of, showing how to prevent or minimize the creation, use or release of pollutants or waste.
- Environmental emergency plans involving the preparation and use of an environmental emergency plan.
- Data and research agreements involving the creation, operation or maintenance of environmental quality monitoring stations.
- Administrative agreements which are usually work-sharing agreements between the federal and other governments regarding CEPA administration. Canada-Wide Standards are signed under this authority. [90]

Canada-Wide Standards (CWSs) are developed by federal, provincial and territorial ministers of the environment to coordinate action towards reaching common environmental standards. CWSs represent commitments by the Ministers to address key issues of environmental protection and risk issues associated with environmental health.[91] A CWS can target certain substances from sectors in a specific timeframe, or could be a broad control management strategy. Once set, each provincial government is responsible for implementing the CWS, and provincial governments are expected to address the problem correctly, doing what makes sense within their jurisdiction.[92]

A CWS establishes preventive or control actions, which are developed within CEPA timelines, can be combined with other instruments as part of a risk management strategy. If the federal government is best suited to action on a certain sector or source, the federal government can develop a regulation,

guideline or another preventive or control instrument under CEPA to fulfill the CWS agreement.

The ways these substances are managed varies; sometimes management is achieved through a CWS, other times it is through substance specific regulations, and on occasion a substance is banned. Toxicity determinations depend on whether the substance enters the environment in a concentration, quantity or under conditions that have a harmful effect on the environment or its biological diversity, poses a danger to the environment upon which life depends, or poses a danger to human life or health in Canada.[93]

Through risk management, Environment Canada can identify sectors posing the greatest threat to the environment, guided by the science of a risk assessment. A risk management objective is then identified for the factors, based on the best available processes, products or techniques, or in some cases, environmental quality objectives.[94] The strategies employed vary; they may be substance specific, or sector-specific.

Examples of carcinogen controls under CEPA are few: they include the federal prohibitions on N-nitrosodimethylamine and dichlorodiphenyltrichloroethane (DDT), and the partial or conditional prohibitions on benzidine and hexachlorobenzene.[95] Canada-Wide Standards have been set for benzene, dioxins and furans, and petroleum hydrocarbons in soil.[96]

Health Canada considers carcinogenicity to be one of the most serious impacts of a chemical on human health. Under CEPA, the potency of a carcinogen and the potential for exposure are considered in order to determine the priority for risk management. Carcinogens that are considered to be 'non-threshold' carcinogens have their risk managed by reducing exposure to the greatest extent possible by using best available technology.[97]

As stated above, companies can be required by the government to develop and implement a Pollution Prevention Plan. It is not required that these plans are submitted or made public, and companies only must declare that they have developed and are implementing their plan.[98]

Environment Canada and Health Canada recently completed a review of over 23,000 substances already in commercial use (on the Domestic Substances List) and categorized them according to important characteristics (persistence, bioaccumulation, toxicity and potential for human exposure) that determine their perceived level of risk and need for further assessment. The analysis of risk will help the government determine if control is needed, and what type of control is best.[99] The health hazards considered did include known or suspected carcinogenicity, and evaluations were based on studies in mammals after short medium, and long-term exposure, along with clinical and epidemiological investigations into human populations.[100] Out of the review, it was determined

that approximately 4300 substances require future attention, 500 of which are of high priority for action. The next step for substances requiring further attention involves a screening assessment, research (if necessary), and control measures, if necessary. It may also be determined that some substances pose no significant risk.[101]

At this time, the government has challenged industry to provide more information on a number of potentially harmful chemicals. Substances in groups of 15-30 are being published every three months, along with a chemical profile, which stakeholders and industry can comment on and provide information regarding, over a six month period. Following this, government scientists will review the information, and the government will decide on action.[102]

In the future assessment, a greater focus on carcinogens might be used, with known carcinogens screened first. [103]

National Pollutant Release Inventory (NPRI)

There is an information gathering provision in CEPA, requiring that there be a national inventory of the release of certain pollutants. The National Pollutant Release Inventory (NPRI) is the only official, publicly accessible, chemical release inventory available in Canada, providing legislated, company-specific information about the release and transfer of a limited number of pollutants (under 400), including known and probable carcinogens.[104] The PollutionWatch website does provide the same information, in a more user friendly format.

Over 60 carcinogens on the Cancer and the Environment Stakeholder list are currently reported in the NPRI (see Appendix A). For most of the inventory substances, companies report if they are manufactured, processed or used in very large quantities (10 tonnes or more), with employees working 20,000 hours or more at the facility. Lower thresholds were recently established for a number of substances, including cadmium, arsenic and lead, which must be reported at quantities of 50 kilograms or more, and the incidental manufacture, release, disposal or transfer of polycyclic aromatic hydrocarbons, which are also reported at the 50 kilogram threshold.[105]

The NPRI tracks information on these pollutants when they are released, disposed of, and recycled by facilities in Canada. Many industrial, municipal and commercial companies meet the criteria for reporting to the NPRI, yet many other users and small companies are not required to report. Facilities must explain changes to their yearly releases, and the changes they anticipate in their pollution prevention activities.

NPRI information is publicly available through a searchable website, which also contains information on the facility, such as its number of employees, location and nature of business. This information is also available in an annual public report, and on a website that is maintained by the Canadian Environmental Law

Association and Environmental Defence, known as PollutionWatch (see http://www.pollutionwatch.org/).

Environment Canada notes that publishing this information in the NPRI can lead to some voluntary reductions in substance release and transfer, and that this information helps the government track reductions or increases in the release of these pollutants, and make decisions regarding action.[106] As a result of this information, it is thought that communities can identify some of the carcinogens that are being released in their vicinity.

Using NPRI data, the group PollutionWatch estimated that the air releases of chemicals designated as toxic under CEPA and carcinogens dropped by 4% and 22%, respectively in the period from 1995-2002.[107] However in 2004, this same group indicated that most pollutants are released into the air, and that most of the pollutants released into the air are considered toxic under CEPA.[108]

Pesticide Controls

Pesticides control, destroy, attract, reduce or repel pests.[109] Humans can be exposed to pesticides through inhalation, ingestion or absorption. Included among these substances are insecticides, herbicides, and fungicides.[110] Because pesticide residues can be found in the air, soil, water, fresh food and on household surfaces, it is important to control those that are carcinogenic. The Ontario College of Family Physicians, the Registered Nurses' Association of Ontario, the Ontario Public Health Association and the Canadian Cancer Society support precautionary restrictions on the non-essential use of pesticides, and one of Canada's largest food distributors, Loblaws, has phased out chemical pesticides, and offers its customers lower-risk alternatives for pest control.[111]

The protection of the Canadian public and the environment from unacceptable risks posed by pesticides has traditionally been through harmonized regulatory systems at the federal and the provincial levels. In recent years, well over 100 municipalities have adopted bylaws that place further restrictions on the use of pesticides within their boundaries.

The Pest Control Products Act

Before a pesticide can be used in Canada, it undergoes scientific review and risk assessment by the Pest Management Regulatory Agency (PMRA) of Health Canada, which controls pesticides through the *Pest Control Products Act.* Health Canada promotes the reduced use of pesticides, supporting approaches that combine biological, physical, cultural and chemical tools to manage pests and publishes educational material for the safe use of these substances in and around the home. The PMRA registers new pesticides for a specific use, and

reevaluates older pesticides to ensure that they meet current safety standards.[112] Among the steps of a scientific risk review is an examination of the likelihood that a pesticide may cause an adverse health effect, such as cancer.

A chemical's potential to cause cancer is determined based on information from experiments conducted by industry on at least two species, combined with evidence from genotoxicity (toxic to DNA) studies, taking into consideration the number and type of lesions that appear. If this information is submitted, by industry, to the PMRA, it is then combined with what is known about the substance mechanism, in order to decide how much risk the chemical poses to humans.[113] Further assessment uses complex statistics to translate the results of animal testing to human populations. For humans, it is 'acceptable' if there is a lifetime human cancer risk of one in a million when exposure occurs through pesticide residue on food, or through unintentional exposure. A higher risk has been tolerated in some instances of occupational exposure.[114] When it is expected that children will be exposed to a pesticide, risk assessments do take into account their unique biological characteristics and exposure patterns (e.g., through crawling).[115] Extra protection is also provided for pregnant women. As part of its review, PMRA consults other regulatory agencies, such as the United States Environmental Protection Act, and the European Union, in order to compare their findings and conclusions.[116]

The Pest Control Products Act supports pesticide risk reduction by ensuring that only products making a useful contribution to pest management are registered, with lower risk products receiving expedited registration.[117] Recent revisions to the Act increase requirements for transparency and enhance public participation. A public registry that provides access to non-confidential information on products and the regulatory process has been created. There is also a reading room, where confidential test data can be viewed.[118]

Further, approved pest products are re-evaluated every fifteen years, and if necessary products can be removed, and registrants and applicants are required to report incidents and adverse effects (human or environmental). Higher penalties can be imposed under the recent changes, up to $1 million for serious offenses.[119] Under the revised Act, the PMRA holds that Canadian growers will be better able to access new, safer pesticides that increase their competitiveness in the global market.[120]

Product assessments ensure that a pesticide is only registered if it manages pests, does not pose an unacceptable risk, and serves a useful purpose to health, the economy or the environment.[121] From the information obtained in the scientific review, the agency sets dose standards, determines the best application mode, decides what protective measures are needed, and sets maximum residue limits.[122]

Health Canada promotes the reduced use of pesticides, supporting approaches that combine biological, physical, cultural and chemical tools to manage pests and publishes educational material for their safe use in and around the home.[123] Pesticides are federally regulated, with control resting on the federal parliament's criminal law power, and the provinces can also restrict or prohibit their use by enacting legislative authority to create regulations, and municipalities can enact bylaws around their use.[124] For example, in 1987 the Ontario Ministry of Agriculture, Food and Rural Affairs launched the Food Systems 2002 program, which aimed to reduce pesticide use on agricultural crops in Ontario by 2002. A pesticide use survey in 2003 found that from the benchmark year of 1983, pesticide use dropped on agricultural crops by 52%.[125]

Ontario Pesticides Act

For a pesticide to be sold or used within Ontario, it must be federally registered, and undergo provincial review by a committee of experts, who will recommend that it be classified into one of six schedules. The schedule determines who can sell or use it and restricts the use of more toxic products to persons who are trained to handle and use them. For example, homeowners do not have access to the more toxic pesticides that licensed exterminators and certified growers can use for commercial and agricultural pest control. Characteristics of the pesticide (e.g., toxicity and persistence) are factors that determine what schedule products are placed into.[126] Provincial decisions can take into consideration general welfare and public concerns.[127]

Pesticides are managed within Ontario under the *Ontario Pesticides Act* and Regulation 914. Under these regulations, the Ministry of the Environment regulates the sale, use, transportation, storage and disposal of pesticides, monitors compliance, issues applicator, vendor and operator licenses, and enforces the regulation.[128] Further, the Ministry requires that commercial applicators be trained and certified, as well, growers must be certified to purchase and use more toxic pesticides and vendors selling more toxic pesticides must employ certified staff to sell those products. The Ministry also has requirements for public notification of pesticide use in landscapes. Public notification requirements serve to inform the public of pesticide use, provides information on which pesticides are used and when the application took place, and allows the public to make a personal choice about whether to avoid areas where pesticides were applied. For a complete list of pesticides available for sale and use in Ontario, see: www.opac.gov.on.ca.

At this time, the province is working with the federal government and other provinces to develop a national pesticide classification system. The Ministry has worked with the federal PMRA, provincial agencies and stakeholders to implement a Healthy Lawns Strategy to reduce reliance on lawn pesticides. The Healthy Lawns strategy promotes the use of integrated pest management

approaches to maintain healthy lawns so that they are less susceptible to damage by pests.

The PMRA is responsible for assessing the safety of pesticides and approving them for sale and use in Canada, and the Ontario Ministry of the Environment then classifies pesticides into schedules to direct products to users (i.e. to those with appropriate training and /or licensing or to homeowners). Although they are subject to reevaluation, known carcinogens are contained in a few of the pesticides approved for use in Ontario.

Air Controls

Clean and safe air is essential to human health. Air pollution occurs when there are substances in the air that can harm the health of living beings (including humans and plants), property and the environment. Many chemicals, some of which are carcinogenic, pollute the air. Inhaling indoor or outdoor pollutants is generally the way one is exposed to carcinogens in the air. [129]

The federal government manages some sources that emit or discharge carcinogens in the air through CEPA (discussed above). The federal government controls vehicle emissions, limiting the release of air pollutants deemed toxic under the Act, and trans-boundary pollution. [130] The federal government can also set national ambient air quality objectives and guidelines that govern industrial emissions. The National Plan for Action on Clean Air (2003) focuses on transportation, the industrial sector, monitoring and reporting.[131] Air quality information is released to the public through the NPRI and the National Air Pollution Surveillance (NAPS) Network, which is said to enable Canadians to take actions that will protect their health.[132] Under CEPA, the NPRI inventories specific chemicals released in the air, including many known and suspected environmental carcinogens.

In order to help Canadians make decisions about their health, Environment Canada's Air Quality Services maintains a website where the air quality of various regions of the country can be viewed, along with the region's recent history, the causes of poor air quality (such as fine particulate matter), and the potential health effects of these pollutants.[133]

Generally, the provinces control pollution from commercial activities and industry in their jurisdictions. In Ontario, the Ministry of the Environment (MOE) sets contaminant-specific air quality standards and guidelines to manage air pollution from industrial and commercial sources. Ontario's air standards are based on the best scientific information available and are now being set at levels that safeguard the natural environment and protect sensitive populations such as children and the elderly. Ontario Regulation 419/05: Air Pollution – Local Air Quality is the primary regulatory tool used for the assessment and implementation of air standards to protect local air quality in communities. Other

general provisions of the *Environmental Protection Act* (EPA) are also made use of, including the prevention of adverse effects. The Ministry has a list of over 300 air quality standards and guidelines. Standards and guidelines are used to assess air quality and possible health and/or environmental effects.

The MOE administers the protection of local air quality through a series of legal requirements, as well as policy/guidance documents.[134] In general, there is a hierarchy of requirements, which work from top to bottom in this order: Legislation (laws approved by legislature; EPA), Regulations (laws approved by cabinet), Legal instruments (e.g., certificates of approval), MOE guidelines, MOE guidance, and other technical documents.[135]

Air Regulations

In 2005, the Ontario government updated its air regulations. The two new air regulations are 194/05 (Industry Emissions – Nitrogen Oxides and Sulphur Dioxide) and 419/05 (Air Pollution – Local Air Quality). While Regulation 194/05 addresses important smog-causing pollutants, this regulation will not be discussed in this document: as stated earlier, fine particulate matter is an important vehicle of carcinogen transmission, however nitrogen oxide and sulphur dioxide are not thought to be carcinogens themselves.[136] Provincial laws require facilities to comply with air and water discharge limits. The Ministry publishes known cases of non-compliance in annual Environmental Compliance Reports. Information on testing for toxic substances in drinking water is also available.

Regulation 419/05 updated or set provincial standards for 40 harmful air pollutants, including carcinogens and toxic substances. This regulation phases in some requirements, such as the use of air dispersion models from the U.S. Environmental Protection Agency, thought to offer good assessments of air pollution's impact.[137] Risk assessments of an additional 18 substances have been published as information drafts, and work on another 40 substances is in process. As the result of a comparison of standards published by other regulatory agencies, the Ministry has proposed that another 75 of its air standards be reaffirmed at their present values.

The items contained in this new regulation that correspond with the stakeholder group list of environmental carcinogens can be found in Appendix A. Incorporating the standards within the regulation has made them more enforceable and easier to use in assessing and managing the potential impact of an industry on its neighbours and surrounding community.[138] To give industry time to make the necessary changes in order to comply with the regulation, more stringent standards are being phased in over a five year period, with these standards applying to all facilities by February 1, 2010.[139] The Ministry anticipates that new standards and improvements in the ability to enforce these

standards will lead to lower industrial emissions, and/or improved protection of local air communities.[140] Examples of new standards can be seen in Table 2.

Table 2: Air Carcinogens* with New and Updated Standards, Incorporated into Regulation 419/05

Substance	Example of industrial emitter	New POI Standard ½ Hour Average (ug/m3)
Acetaldehyde	Chemical production, leather tanning	500
Acrylonitrile	Plastics and synthetics, rubber products	1.8
Carbon tetrachloride	Industrial gas production, chemical lab fume hoods	7.2
Chloroform	Pulp and paper industry	3
Di (2-ethylhexyl) phthalate (DEHP)	Auto paints and varnishes, plastics & synthetics, rubber products, pulp & paper	100
Dichlorobenzene, 1-4	Sewage sludge & municipal waste incineration	285
Ethylene dichloride	Vinyl chloride, manufacturing, petrochemical manufacturing, degreasers	6
Methylene chloride (Dichloromethane)	Foam & expanded plastics, pharmaceutical manufacturing	660
Propylene oxide	Chemical and chemical products manufacturing	4.5
Tetrachloroethylene (PERC)	Metal degreasing operations, dry cleaning	1,080
Toluene diiscocyanate	Polyutherane foam manufacturing	0.6
Trichloroethylene (TCE)	Metal degreasing operations, adhesive coatings	36
Vinyl chloride	Plastics and synthetics, rubber products	3

*Carcinogens as defined on the cancer and the environment stakeholder list
POI: point of impingement concentrations. This refers to the closest point where air contamination emitted by a source will impinge on a building or beyond the property line

The first step in showing compliance with the new regulation is to develop an Emission Summary and Dispersion Modeling Report, including a summary of the air emissions from the property. Emissions can then be assessed, using either air dispersion models, or monitoring methods. Point Of Impingement (POI) concentrations are often assessed using mathematical air dispersion models that consider emission rates and weather conditions, along with site-specific factors in calculating a concentration that is compared to the air quality standard or guideline. The new dispersion models are a more advanced tool than are the existing models, and are also used to assess compliance with the standards and guidelines. The phase-in of new models is by sector; in choosing the sectors, the Ministry considered the level of risk associated with the substances emitted by those industries. By 2010 the first industry group must demonstrate compliance using new models, followed by the second in 2013, and the rest by 2020.[141]

Within the regulation is a process to deal with compliance barriers by using site-specific considerations of technical limitations for industry, the cost, and potential risks to the local community, and public notification. Site-specific alternative

standards will be set, based on a consideration of timing, technical limitations and/or economic barriers. [142] Facilities must demonstrate that they are doing their best to reduce concentrations, and report to the Ministry on how they plan to improve their emissions over time. Site-specific alternative standards will be periodically reviewed, in order to ensure continuous improvement towards achieving the standard.[143]

Approval cannot be given if emissions result in a concentration of a contaminant that exceeds a predetermined upper risk level (the upper risk threshold) at places including schools, homes and hospitals. For carcinogens, the upper risk threshold is based on the risk of 1 person in 10,000 who may develop some form of cancer (100x the standard). If these thresholds are exceeded, the MOE must be notified immediately.

Soil and Water Controls

Under CEPA, the NPRI inventories specific chemicals released in the water, including many known and suspected environmental carcinogens. The *Fisheries Act* prohibits the deposit of deleterious items in water frequented by fish, unless specifically permitted. Also under CEPA, the NPRI inventories specific chemicals released in the soil, including many known and suspected environmental carcinogens

Ontario Drinking Water Standards

Ontario enacted the *Safe Drinking Water Act* in 2002, converting drinking water standards into legally binding standards, which are captured in the Ontario Drinking Water Quality Standards Regulation. The Drinking Water Systems Regulation requires that drinking water be tested for many substances, which include many known and probable carcinogens. Furthermore, this information is made available to the public, and published in an annual report.

In general, Ontario adopts the federal drinking water quality guidelines, and, in some cases has set more conservative limits. For example, Ontario has proposed a lower standard for trihalomethanes (some of which are carcinogens) than the federal guidelines (80ug/L, in contrast to the Federal guideline of 100ug/L).[144] The carcinogens that Ontario water which are located on the stakeholder group list can be viewed in Appendix A. As this list demonstrates, arsenic, radionuclides, cadmium and benzene are among the carcinogens monitored.

The *Safe Drinking Water Act (2002)* and Drinking Water Quality Systems Regulation mandate that the results of water tests for specific substances be available to the public, and the suppliers of water, primarily municipalities, must

prepare annual reports, including test results. The municipalities are responsible for the operation of the drinking water systems.

Municipal/Industrial Strategy for abatement (MISA)

Ontario signed an Agreement Respecting the Great Lakes Basin Ecosystem in the years 1987, 1994 and 2002, committing the province to managing persistent toxic substances. MISA is the way Ontario addresses persistent toxic substances in direct industrial discharges that enter Ontario's waterways. MISA focuses on specific sectors: petroleum, metal mining, industrial minerals, metal casting, organic and inorganic chemical manufacturing, iron and steel, and electricity generation. MISA sets regulations for monitoring and reporting, and sets limits on what a facility can discharge.

- Every MISA chemical has two limits, which are daily (not to be exceeded in a day) and a monthly average,
- Monthly compliance monitoring,
- Effluents that are not toxic to fish and water fleas,
- Plants must prepare publicly available annual reports,
- Quarterly reports are submitted to the ministry, and
- Non-compliance is reported to the ministry.[145]

This strategy provides protocols for sampling and analysis of industrial/municipal wastewater, and for conducting a storm water control study. The carcinogens in this regulation that correspond with those on the stakeholder list can be viewed in Appendix A.

Ontario Brownfields Regulation and the Nutrient Management Act

The Ministry of the Environment (MOE) uses regulations, environmental approvals and standards, targeted monitoring and enforcement, reduction programs, safe tracking and disposal of hazardous waste, and a host of programs to clean up and reclaim land.[146]

Provincially, soil and groundwater standards are covered under Regulation 153/04. Property owners must meet site standards before they can change the use of their land to a more sensitive use, and what standards are used depend on the intended use.

Before a property can undergo an alteration of the use of the land to a more sensitive use, owners must file a Record of Site Condition (RSC) with the Environmental Site Registry. In completing an RSC, the property is assessed for soil, sediment and groundwater standards that are appropriate for the proposed use.[147] Land users are given protocols for the analysis of soil, sediment and groundwater.

Brownfield sites are lands that are undeveloped or previously developed (such as gas stations) that could be contaminated. The redevelopment of a brownfield can lower the level of contamination in soil or groundwater.[148] Brownfield redevelopment often reclaims land that already has transit infrastructure and surrounding population. The redevelopment of such land has environmental and health benefits, such as the need to cut down fewer trees, the availability of public transit, and the option of walking to destinations. Property owners and developers must follow requirements under the Ontario *Environmental Protection Act* before the land can be developed. [149]

The Ministry of Environment reviews and approves risk assessments, acknowledges RSCs, and sets out changes in property use for which a RSC must be filed before a building permit can be issued. Web links and learning opportunities are made available to interested individuals.

Current brownfields legislation provides property owners with general protection from environmental cleanup orders for historic contamination after they have appropriately filed a RSC, acknowledged by the MOE. Ontario's new Record of Site Condition Regulation (O. Reg. 153/04) details requirements related to risk assessment and obtaining a RSC. The regulation replaces the Guideline for Use at Contaminated Sites in Ontario.[150]

The government provides property tax incentives for brownfields redevelopment. Reclaiming land saves greenfields (i.e. undeveloped, likely clean land), and cleans up contaminated sites. Municipalities across the province are invited to submit proposals for affordable housing projects on brownfield sites. Under the EPA there is limited liability protection for municipalities, secure creditors, receivers and others active at former commercial or industrial land sites. Changes have been made to property tax law that offsets site remediation costs.

Also with respect to land, the *Nutrient Management Act 2002* does have a testing requirement, wherein soil is tested for regulated metals, some of which are carcinogens, before bio-solids are applied on lands.

Relevant Municipal Efforts

As the earlier discussion on pesticides has demonstrated, it is possible for known carcinogens to be contained in the pesticides currently used in Ontario. The *Municipal Act* allows municipal governments to adopt measures to control environmental carcinogens through a general health clause allowing municipalities to pass by-laws that regulate the health, safety, mortality and welfare of the people who live there. A good example of this power is in relation to pesticides. Well over 100 municipalities have instituted, or are considering instituting restrictions on the use of pesticides on private and public lands. It is

easier to achieve such changes at the municipal level, where politicians are more accessible to the public.

On June 28, 2001, the Supreme Court of Canada upheld a bylaw passed on pesticides by the Town of Hudson, Quebec, confirming the authority of municipalities to restrict pesticide use, setting a precedent for future restrictions on their non-essential use. In 2002, the City of Cobalt was the first municipality in Ontario to pass a bylaw banning the non-essential use of pesticides on all properties. Many other municipalities followed suit; for example, the Town of Caledon enacted similar restrictions in 2003, as did the City of Toronto in 2004 (with fines imposed as of 2005).

Some municipalities, such as The City of Toronto have enacted a Sewer Use By-law that limits the discharge of substances, including some carcinogens, into sewers, and requires pollution prevention planning on a number of priority pollutants.[151] Some municipalities have green procurement policies. For example, the City of Toronto encourages the avoidance of products that contain carcinogenic ingredients, and has consulted the federal Environmental Choice program in identifying non-toxic cleaning products for use.[152]

Municipalities can also encourage the redevelopment of brownfields through their own planning documents, including official plans, community improvement and planning applications. Under community improvement programs, municipalities can require a copy of a filed RSC before funding is provided. Further, municipalities can ask for a RSC in subdivision, zoning and consent applications.

Through a Community Improvement Plan (CIP) municipalities can encourage the redevelopment of brownfields by offering financial incentives to owners, assignees or tenants within a designated improvement area. Incentives offered by municipalities to redevelop such land can include grants or loans to help with feasibility studies, municipal fees and other eligible costs.[153]

Municipalities have control and influence of a number of sources of air pollution, and can take action to improve their air quality. Among the actions municipalities can take are smog management plans, land use planning, increased investment in public transit, education campaigns and greening operations.[154] Proximity to carcinogen emitters is an important risk for residents; land use planning allows municipalities to consider residential home proximity to industrial sites.

Other Carcinogen Controls

Consumer products

In 2006, a new Cosmetic Regulation became law, requiring mandatory ingredient labeling, in both official languages, on all cosmetic products sold in Canada. These labels must appear by November 16, 2007. Manufacturers and suppliers

must ensure their products are safe and comply with Canadian regulations. The ingredient names to be used must be those used by the International Nomenclature of Cosmetic Ingredients labeling system, which will make it easier to a consumer to identify an ingredient, as the same name will be used across all products that contain it.[155]

Ensuring that products are labeled properly will help medical professionals treat and report adverse events more efficiently, and help consumers to use the product appropriately, although the labels contain ingredients unfamiliar to the public.

Ecolabeling

Canada's Environmental Choice Program (ECP) is a voluntary eco-labeling scheme, designed to identify products and services that are less harmful to the environment. ECP certification indicates that a product or service: uses recycled materials, can be reused, reduces hazardous byproducts, or improves energy efficiency.[156] Over 3,000 products and services have been certified by the program. TerraChoice Environmental Services Inc., a private sector company, currently manages the program. While consumers were the initial target audience for ECP, currently, the targets of the program have shifted upstream (industry groups, school boards and private institutions, for example).[157] Products receiving approval in the program must not be formulated with proven or probable carcinogens, as appear on IARC's list of carcinogens.

Surveillance

In Canada, little surveillance is undertaken that specifically targets environmental carcinogens. The NPRI (discussed above) is technically a surveillance tool; it does provide gross emission estimates, however these data are limited.

The National Air Pollution Surveillance Network (NAPS) provides an air quality surveillance function. Established as a joint program of the federal and provincial governments, NAPS gathers air quality data that are used to evaluate air pollution control strategies, and track urban air quality trends and emerging air quality issues. Data regarding sulphur dioxide (SO_2), carbon monoxide (CO), nitrogen dioxide (NO_2), ozone (O_3), metals and volatile organic compounds (VOCs) (which contain some carcinogens), and total suspended particulates (TSP) are measured across the country at various stations, and reports are published annually. The Ontario Ministry of the Environment also publishes an annual air quality report using data from its own monitoring network, and Environment Canada's stations. In addition to the regular program, Environment Canada and the Ontario Ministry of the Environment will occasionally undertake special monitoring activities.[158]

Statistics Canada is undertaking a national survey (from 2007 to 2009) of a sample representative of all Canadians over six years of age. This study will include biomonitoring as a way to measure human levels of environmental chemicals. Blood and urine samples will be analyzed for a number of target substances, including metals, PCBs, phthalates and perfluorinated compounds.[159]

In Ontario, Regulation 127/01-Airborne Contaminant Discharge Monitoring and Reporting requires that facilities based in Ontario report to the government, and make this information public (beginning in 2005), through NPRI reporting. Ontario also has a Drinking Water Information Management System, which collects and stores drinking water quality data in order to: support standards development, audit water samples, define contaminant level and trends, assess emerging contaminants, and track the efficiency of water treatment processes.[160]

The best surveillance program in Canada, although related to occupational exposures, is the National Dose Registry, which monitors workers' exposure to ionizing radiation, a known carcinogen. Further, in Alberta, the Community Exposure and Health Assessments Program and the Northern Contaminants Program both provide information on environmental carcinogens that can be used for preventive programming.[161]

Section Summary

All three levels of government have some jurisdiction over toxic substances, within which many carcinogens are included, even though they are not specified as such. As Appendix A demonstrates, there overlap between where and how particular carcinogens are controlled, and the jurisdictions of those who are responsible for their control. Similar to the international measures discussed, the special needs of children and pregnant women are not specifically mentioned to any great extent in the existing Ontario framework.

While this section simply presented the Ontario situation, the following section discusses the control of environmental carcinogens in Ontario in light of the methods employed internationally.

Section V—Gap Analysis: How does Ontario Compare to International Practices?

From the preceding discussion and an examination of the items contained in Appendix A, it is readily evident that to a greater or lesser extent, all three levels of government have jurisdiction over toxic substances, including carcinogens, and that toxic substances are controlled on a substance-by-substance basis.

What follows is a discussion of how the framework for controlling carcinogens in Ontario compares with, and may benefit from an incorporation of some of the elements from the programs described in some States and the European Union

Public education and eco-labeling are used more commonly in the European Union and in some States than they are in Ontario

Providing the public with information about the presence of carcinogens serves to identify substances that may potentially cause cancer. Examples include information in the form of educational materials and disclosing the results of testing for carcinogens, labeling products as being carcinogenic (or not carcinogenic) and labeling products with their ingredients.

Although cosmetics sold in Canada must now contain ingredient listings, carcinogens and toxic substances are not specifically addressed in the regulation, and ingredients are not easily understood by the public. It would be beneficial if products sold in Ontario specifically identified any substances in these products that are suspected of causing cancer. While Health Canada does publish a 'hotlist' of substances that are banned or restricted in Canadian cosmetics, not all substances used in cosmetics have been reviewed by Health Canada, and there is a need for a list of permitted ingredients for Canadian cosmetics.[162] While it is true that some cosmetics are labeled with avoidable hazards and cautions if they contain particular ingredients, carcinogens and toxic substances are not yet specifically addressed in the regulation. Cosmetics sold in other countries (where carcinogens are not permitted in cosmetics) may potentially differ from those sold in Canada, even for the same brand or product. In some of the strategies used in other jurisdictions, products are labeled as being cancer free, carcinogens are not allowed in the product at all, or the known carcinogens are labeled. The province of Ontario may benefit from adopting elements of these strategies.

While Canada's Environmental Choice Program can be used to identify carcinogen-free products, at this time program marketing focuses on upstream users, i.e., it is not directed at consumers; it is used by businesses and governments to find environmental products when they have made a decision to go 'green'.[163]

This program may consider increasing advertising efforts in order to target the general public, by offering tax incentives to companies to reformulate their products, and by incorporating comparative assessments and phase outs of the less 'green' brands, as is done in Europe, which could lead to market-based incentives to produce safer products.

The right-to-know provisions and surveillance efforts that are used in Ontario could benefit from further expansion

Similar to the practice in the United States, in Canada there are established right-to-know measures. For example, Ontario's Regulation 127/01- Airborne Contaminant Discharge Monitoring and Reporting Regulation requires public reporting by Ontario-based facilities that emit specified quantities of certain substances, and new amendments harmonize it with the federal NPRI in order to eliminate duplicate reporting. The NPRI is a good example of attempts on the part of federal authorities to inform the public about the release of certain chemicals.

However, there are some areas where the NPRI could be improved.[164] According to the group PollutionWatch, under the current NPRI: pesticides are not included, limited releases are unreported, recycling and energy recovery are not included, not all substance users report (e.g., small companies, research facilities, schools, agriculture, mining—processing of mined materials is included are exempt), and information is not included on the amount of carcinogens that can be released under permits, agreements or regulations.[165] The high reporting thresholds for the NPRI generally exclude smaller facilities. In Toronto, 97 percent of facilities are not required to report their emissions due to their small size. In response to the situation, Toronto Public Health developed a framework wherein institutional, commercial and industrial operators in the city report the use and emission of 25 priority chemicals, including carcinogens such as vinyl chloride, nickel, and lead. [166]

As Appendix A demonstrates, carcinogens such as asbestos, vinyl chloride, benzene and trichloroethelene are reported according to the Part 1A rules of the NPRI, which means that they are reported if the company employs the equivalent of 10 full-time employees, and the company manufactures, processes or uses the substance in quantities of 10 tonnes or more. Other carcinogens, such as arsenic and cadmium are reported at lower thresholds (50 kilograms or more), if employees work many hours. While threshold reporting can lead to less use of these products, this method does not encourage the use of products that are necessarily safer, and it has been commented that while releases have decreased, transfers have increased.

In comparison with the American TRI, the NPRI contains fewer chemicals (under 400 substances, compared to the almost 600 individual chemicals, and 30 chemical categories found in the TRI) and the TRI reports on pesticides.

The TRI led to a drop in the use of chemicals (reported) in the United States, and has become a tool used by the public, providing information on potential health hazards. It is difficult to assess the effectiveness of NPRI reporting, as the rules have, changed over time, and reporting has limitations (discussed above). The group PollutionWatch, using NPRI data, demonstrates on their website that six of the top ten facilities releasing carcinogens into the environment in 2005 were located in Ontario (see http://www.pollutionwatch.org, carcinogens released in Canada, on and off site).

Annual reports on CEPA are available on the general CEPA website. However, the currently available report is for the period of 2003-2004. Reporting on these data has improved recently; 2005 data were released less than six months after the reporting deadline.

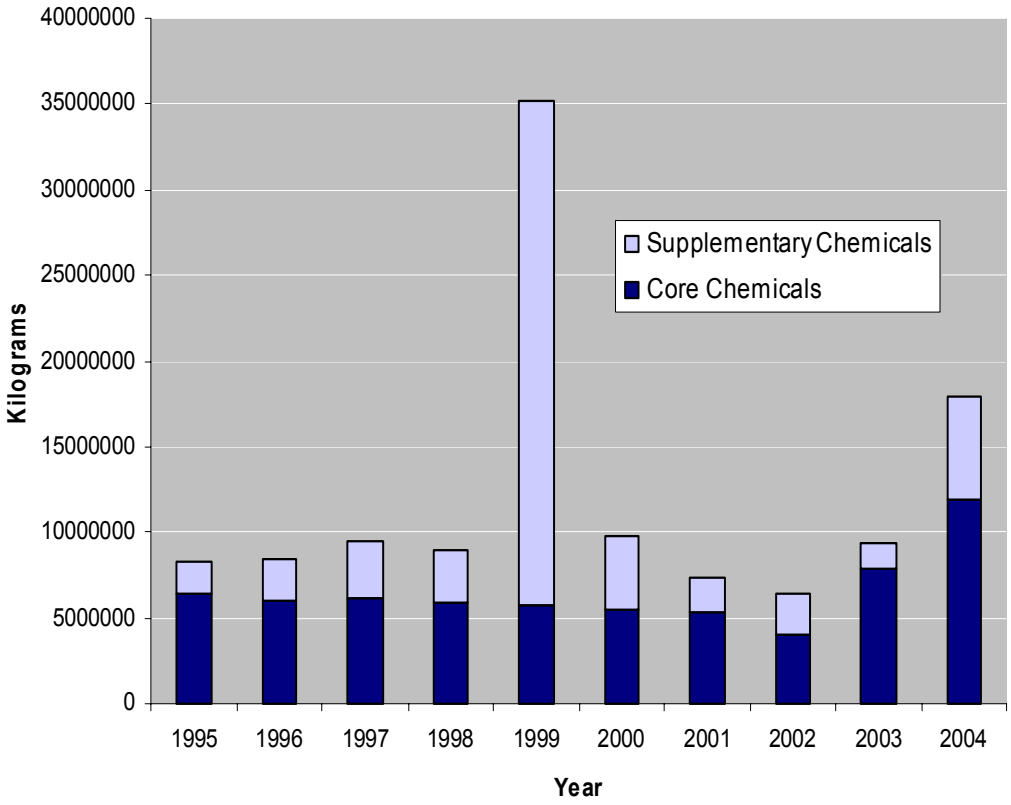
In summary, the NPRI could be improved by requiring reporting on additional carcinogens, including pesticides, and the adoption of lower thresholds for reporting carcinogens.

Canadian communities would benefit from greater access to information about carcinogens that are used or stored locally. Occupational Material Safety Data Sheets may be present at companies, are available on-line, and the community can ask their local Medical Officer of Health for them, but they are not made available or accessible to the wider community, i.e., individuals must actively seek them out. In the United States under their Emergency Planning and Community Right-to-Know Act such information is readily available. Canada's Environmental Emergency Regulations do allow for, but not require that hazardous chemical information be disclosed to firefighters or local communities.[167]

With respect to water, information is available to the public; municipalities do post annual reports of water quality on the internet. The people of Ontario might benefit if a more systematic approach were adopted in this regard, and an explanation of health effects. In the United States for example, the reporting of a value that exceeds standards under the *Safe Drinking Water Act* requires that the notification provide an explanation of the health effects.[168]

While surveillance is not a focus of this document, it can play an important role in assessing exposures to carcinogens, and can provide an indication of the effectiveness of intervention strategies. The NPRI could be used for surveillance, however, its reporting requirements only ensure data for crude measures. Figure 2 demonstrates how reporting requirements can vary, and the limitations of this reporting system.

Figure 2: Carcinogens Released On-and Off-Site, Ontario 1995-2004 (NPRI Reporting)



NB: The chemicals reported here are those deemed carcinogens by the NPRI.
According to PollutionWatch, Core Chemicals are **reported more consistently** than are Supplementary Chemicals, which accounts for the large increase in 1999. It is also likely that since these data are reported by industry, 1999 data reflect overestimates.

The National Air Pollutants Surveillance Network does encompass some carcinogens, therefore it provides more useful information for assessing trends and progress. While the air is probably the most important route of exposure for many environmental carcinogens, a full picture of environmental carcinogen exposure would need to include other media. Personal monitoring studies have shown that ambient measurements are often an underestimate of actual exposure.

Epidemiologic studies measure past exposures, while biomonitoring can be used to assess current exposure. Biomonitoring is now being undertaken by Statistics Canada, and presents a good way to assess exposure to some environmental carcinogens. If repeated over time, Ontario would benefit from the increased surveillance of environmental carcinogens. When the group Environmental Defence recently conducted lab testing on the blood of four Canadian politicians, it was found that their blood contained many toxic chemicals, including 54 carcinogens.[169,170]

In Canada, all three levels of government play a role in addressing toxic substances, including carcinogens. As stated earlier, carcinogens are not specifically targeted as a class of substances; they are generally addressed within larger frameworks of control, such as those for pesticides, air pollution or toxic substances.

Compared to practices in the European Union and in some States, environmental carcinogens are less controlled in Ontario

While there are important municipal, provincial and federal efforts that protect the environment, Canada and Ontario could benefit by adopting some of the strategies used by the European Union and in some States in pollution and environmental carcinogen control.

According to the group PollutionWatch (using NPRI data), in 2005, Ontario released over 33 million kg of carcinogenic pollutants. (see http://www.pollutionwatch.org, carcinogens released in Ontario, on and off site, 2005). A NAPS paper on benzene found that mean concentrations of the substance are highest at an Ontario site, Sault Ste. Marie, Marie-Bonney Street Mill Facility (10.3 ug/m3). This study found that results varied over time, with most sites recording decreased concentrations between 1990 and 1997, however, at some sites no improvement was observed (between 1990 and 1996), with some sites with the highest mean concentration showing little or no improvement. Review of data from 1987-1997 showed that levels of PAHs in Hamilton showed considerable variation across the years and their median concentration was the same in 1996 as it was in 1989. Toronto did show a significant decline in PAH levels from 1994 to 1996. This paper concluded that action to accelerate reductions in environmental exposure was needed. [171]

These data suggest that more could be done to reduce the use and release of carcinogens in Ontario.

Environmental carcinogens are controlled differently elsewhere; Ontario might benefit from adopting some measures from other jurisdictions

CEPA provides the necessary authority to address and even eliminate the use of dangerous substances, such as carcinogens, yet the process for this has been described as slow. In Canada, there are few bans or restrictions on carcinogens in the workplace, environment or products. The regulations that do exist favour pollution control over the elimination or substitution of dangerous substances. Canada differs from Europe in that carcinogens are not systematically treated as chemicals of high concern, and ways to eliminate them are not articulated, [172] and they are not banned from personal products. CEPA does not specifically target carcinogens.

It is hopeful to note that recently, proposed amendments to Bill C-30 (Canada's Clean Air and Climate Change Act) that include substitution as a principle to be incorporated was agreed to by all four political parties.

The governments of Canada and Ontario provide limited resources for the regulation of substances, and for proving the safety of chemicals. In the European Union, however, burden is placed on industry to prove that chemicals are safe, before their continued use is allowed.

Pollution prevention plans are voluntary in Ontario, whereas they are often mandatory in other jurisdictions

While there are efforts being undertaken in Ontario that have yielded progress (as described earlier), and efforts which include risk based inspections (in sectors of concern), compliance assistance pilot projects, and the small business compliance improvement strategy have been undertaken, the federal and Ontario governments tend to focus on voluntary goals and targets with regard to toxics use reduction, and the enforcement and regulatory tools are often unclear.

It was suggested at a recent House of Commons Standing Committee on Environment and Sustainable Development that without a regulatory framework requiring all companies to meet carcinogen use reduction targets, future improvements will be limited, and that in the United States, their approach is legally binding, with standards, emissions monitoring and pollution attainment designations.[173] Perhaps Ontario might examine and adopt the segments of this approach that are relevant.

The statistics on carcinogen release outlined earlier indicate that voluntary measures are not working very well in Ontario. Under CEPA, the federal

government uses Pollution Prevention Plans as its way of limiting specific toxic substances, rather than requiring companies to make comprehensive plans and reductions (as is the case in Massachusetts).[174] Further, it is impossible to evaluate the effectiveness of such Plans, as they are not publicly available.

Further, there are questions regarding what needs to be done about the 4300 substances on the Domestic Substances List that require further examination. The group PollutionWatch has suggested that for CEPA to reach its greatest potential to control environmental carcinogens, a stronger and more modern legal framework is needed.[175] PollutionWatch goes on to suggest that under CEPA, deadlines are needed, with stronger provisions that are less discretionary, with multiple stages in the process in order to review the worst chemicals and eliminate them where necessary. [176]

In the United States, laws such as the Massachusetts *Toxic Reduction Act* have aimed to reduce the amount of toxic waste generated in the State by a specified time. Massachusetts also has a regulatory scheme similar to Ontario wherein limits are set. In this State it was found that if a careful balance is maintained between mandatory and voluntary instruments, innovative solutions can result.[177] By requiring that companies who use over 10,000 pounds of specific chemicals develop a plan examining how and why the chemicals are used and to evaluate their options (without requiring implementation, but requiring that there be reporting planning and payment of a levy on toxic substances used), the actual preparation of the plans has led to many substitutions and process changes. Since the Act was passed, a 50% reduction was seen in the generation of hazardous waste, a 40% reduction in the use of toxic chemicals and a 30% reduction in emissions. The Act also demonstrates an economic benefit, i.e. savings of over $14 million, and other benefits such as lower environmental permitting, improved operation and maintenance, and product reformulation with non-toxic materials.[178] Direct assistance was provided to these companies at a level that exceeds the amount provided to Ontario companies.

In the European Union, comparative assessment and substitution are used much more frequently than in Ontario.

It is clear from this discussion that the strategies around toxic substances used in Ontario concentrate on approaches that manage the risk that they pose. This approach stands in contrast to the strategies examined that achieve toxics use reduction through comparative assessment and/or substitution with safer alternatives. The principle of substitution operates under the premise that hazardous chemicals should be substituted with chemicals of lower toxicity.

The greatest benefit of a strategy that embraces a toxics use reduction framework which incorporates comparative assessment and substitution as its methods is that it would ensure that one toxic substance (e.g., carcinogen) is not replaced with another toxic substance (e.g., endocrine disruptor). Without a

specific policy to use alternatives that are not toxic, the replacement can be just as hazardous, or it may involve only a reduction in the amount of the chemical used or released, as opposed to complete substitution.[179]

Canada could benefit from the use of substitution laws. A recent review by the Canadian Strategy for Cancer Control found that in Canada, the only federal substitution legislation refers to the occupational setting, under the Canada Labour Code. This legislation requires that where a less hazardous substance is available, it should be used, and this applies only to federal employees and those in other federal undertakings such as post offices and railways. The authors of this paper did not list any substitution laws for Ontario.[180]

In Europe, there are initiatives that identify carcinogens for elimination or substitution with less hazardous substances. Many Swedish companies have phased out potentially harmful substances, including many carcinogens, with Germany and Norway seeking similar substitution. Further, in the EU, carcinogens are not allowed in personal care products.

A good illustration of the situation in Ontario is in relation to a common chemical used for dry cleaning. Tetrachloroethylene is a Group 2A carcinogen according to IARC, and is reported under the NPRI at the 10 tonne threshold (Health Canada does not consider it to be a carcinogen). While a decreased use of this substance is a CEPA success story, it is still being used, and can affect workers health.[181] Efforts to control this substance have led to a reduction, not to an elimination or substitution of the use of this carcinogen.

Compared to the jurisdictions examined, economic and practical incentives are not commonly used in Ontario

Economic incentives are rarely used in efforts to control environmental contaminants in Ontario. As has been found in Massachusetts, the environment can be improved by reducing toxic chemicals use, with focus on facility planning and chemical management.[182] This gap between Ontario and international practices presents an effective, unexplored opportunity for the province.

Actions to close the gaps between international practices and Ontario would reduce the level of risk posed by environmental carcinogens and present important economic and social implications. It has been demonstrated in Massachusetts that toxics use reduction, if applied appropriately, can lead to significant cost savings to industry, [183] and if efforts to match EU regulations were matched here, there is the possibility that Ontario's economic picture would be improved, as it could facilitate increased trade with the European Union and other nations with strict chemical controls.

Ontario would benefit from an independent body, dedicated to environmental carcinogen use reduction and surveillance, such as that found in Massachusetts.

The Massachusetts Toxics Use Reduction Institute (TURI) has likely played a role in reducing the use and production of hazardous materials. TURI is dedicated to providing research, training, support and public awareness regarding toxic chemicals. While organizations such as the Canadian Centre for Pollution Prevention do provide information and support for reduction in the use of toxic chemicals, there is no program equivalent to the TURI; carcinogens and toxic chemicals are managed within the programs of the various Ministries.

When jurisdictional control of substances overlaps, there is a risk that control will not be optimal. A clear opportunity for this to happen is in the case of pesticide controls, where all three levels of government have jurisdictional responsibility, and in the establishment of Canada Wide Standards, where provincial governments must implement the standard in their own jurisdictions, and are expected to do what makes sense for their own province.

As has been observed in this document, the combination of research and technical assistance, offered by a government-funded, independent body, similar to that offered in Massachusetts, would help the province to adopt the use of safer chemicals, and carcinogen use reduction.

It is difficult to assess the number of environmental cancers, due to a lack of data on exposure and surveillance of cases. An Ontario Carcinogen Reduction Institute, if established, could also coordinate surveillance of these areas.

Compared to other countries, Canada is an international leader in the categorization of substances

Canada is the first country to have categorized all of the substances (23,000) on its Domestic Substances List, in order to determine priorities for health and the environment, taking the potential for exposure into account. While the categorization process has been met with the criticism from groups such as PollutionWatch, who claim that it made use of dated and incomplete information,[184] the work itself is a step forward, it considers human health, and sets triggers for more work.

At this time, Canada and other jurisdictions are developing ways to deal with the legacy of existing substances, and tools are being designed that will fill in data gaps, and establish priorities. Further, the government believes that out of this, improvements will be made to product labeling, and it will deal with imports which use prohibited chemicals.[185] In the next step of the categorization process being undertaken by Canada, comparative analysis of the cancer risk posed by prioritized substances could be made better use of, as a means of identifying

carcinogenic products as being unacceptable, and require that they be replaced by products that are less destructive to the environment, and are of lower concern. This would help lower the exposure of Canadians to carcinogenic substances, and encourage the development of lower risk substances.

In comparison with international practices, Ontario does not make use of the effective practice of Comparative Assessment, as is being undertaken by Sweden, described in Section II.

The needs of the unborn, children and pregnant women are not identified as a priority in standards setting in either international or Ontario programs

Environmental carcinogens can affect children and fetuses differently than adults, because they may be exposed in different ways, have longer to develop problems, and because they may be more vulnerable to carcinogens.

Although childhood cancer is relatively rare, cancer is still the leading cause of disease-related death among Canadians aged 1-14. Relative to their size, compared to adults, children eat and drink more, and breathe more air, exposing them to relatively higher amounts of carcinogens, and the activities of children (crawling, putting their hands in their mouths, etc.) can result in their facing greater exposure than adults.[186] A recent report found that for all cancers diagnosed in Ontario children aged 0-14, the average annual age-standardized cancer rates increased from 147 per million in 1991 to 157 per million in 2001. This study also projected that the number of new cancers will increase, from an average of 320 per million in 1995 to 347 per million in 2015.[187]

Despite the recognition that children and the unborn are often more susceptible to toxic chemicals, among the documents examined for this paper, special consideration was mentioned only occasionally. This omission is a gap observed across the nations examined.

Section Summary

While the international programs surveyed earlier in this document differ in many ways, they do share an approach that emphasizes preventing pollution and population exposure to carcinogens. Ontario, in contrast, places its greatest emphasis on reducing the release of toxic substances on a substance-by-substance basis, and on the use of voluntary pollution prevention programs, which are not the most effective way to achieve environmental carcinogen reduction.[188]

In order to meet the goal of reduced environmental carcinogen exposure, a strategy could be developed at all three levels of government, with a stated purpose to reduce exposure to environmental carcinogens, and a provincial institute may be established in order to meet this goal.

For Ontario, switching its focus to substitution and comparative assessment would provide further protection for the citizens of the province, and provide a competitive edge to Ontario industry. As REACH becomes entrenched in Europe, Ontario companies will have the ability to demonstrate their competitive edge, where environmental regulations and standards are important to trading with these countries.[189]

Section VI—Next Steps

As this document has demonstrated, Ontario does not have an environmental carcinogen reduction strategy. There are a number of activities being undertaken by all three levels of government to manage the risk posed by toxic chemicals, yet these efforts are on a substance-by-substance basis, focused on reducing the amount released into the air, water and on land, and on removing them from consumer products.[190] Strategies, programs and legislation frequently overlap in scope and jurisdiction. As in other countries, except in a few instances, vulnerable groups such as children and pregnant women are not often explicitly given special consideration in the management of these substances, and surveillance of their release is inconsistent, which makes assessing their impact difficult. Typically, carcinogens are controlled and tested for among a group of toxic substances, and are controlled as part of general regulations that do not assign carcinogens with a specific label. There are no specific procedures for the control of carcinogens as a special class of substances.

Because responsibility for the environment is multi-jurisdictional, Ontario would benefit from collaboration with federal counterparts to ensure the development of a comprehensive strategy for the province. Current methods to protect the Ontario population from environmental carcinogens would benefit from the incorporation of a number of practices commonly employed in the European Union and in the United States.

The analysis undertaken in this document demonstrates that at present, a carcinogen use reduction strategy does not exist for the province of Ontario, and that the current system may be improved by adopting toxic use reduction as an overarching framework, incorporating relevant elements from programs that some States and European countries currently use.

The directions for future policy development outlined below incorporate lessons learned from the practices of the countries examined. More specifically, they identify how Ontario can move forward in the reduction of environmental carcinogens, and the guiding principles provide an important filter to consider.

At this point, there is a need for further action, including a full analysis of the directions for future policy development that are suggested below. Non-government organizations, environmental groups, and the government could take these tasks on. This analysis should include an assessment of the overall impact of the changes suggested, including the evidence of health benefits and cost and benefits of implementation.

The guiding principles outlined here are to be considered in the application of the directions for future policy development.

Guiding Principles

Identifiable groups that are vulnerable to environmental carcinogens include, but are not limited to, pregnant women and the unborn, seniors, children and Aboriginals. Standards of safety are needed to account for the greater vulnerability of some groups to environmental carcinogens.

The precautionary principle, which states that action to reduce risk should not wait for scientific certainty, should be adopted in relation to environmental carcinogens.

Carcinogen use reduction planning should take into account the cumulative effects of multiple pollutants, and aggregate carcinogen exposure.

Wherever possible, the creation of pollutants or waste should be avoided or minimized.[191]

Directions for future policy development

Primary Directions

1.1 That a comprehensive, integrated, provincial regulatory strategy be developed for environmental toxics use reduction. This strategy will involve government and key stakeholders, and focus on goals and caps for carcinogen use reduction.

1.2 That an arm's length Ontario Carcinogen Use Reduction Institute (OCURI) be established and fully funded, mandated by law, to reduce carcinogen use by: researching substitutes, assisting industry in switching to chemicals of lower toxicity (through training, knowledge transfer and direct assistance), collecting and reporting annually on the use of carcinogens, and following up with industry.

Surveillance

2.1 That an environmental carcinogen surveillance strategy (including environmentally-related cancer cases and deaths, residential and occupational history, biomonitoring, and tracking environmental carcinogen trends) be developed that easily links into federal information gathering databases.

2.2 That an environmental carcinogen surveillance strategy annually report on regional and provincial trends on environmental carcinogens (those with a known presence in Ontario, and classified by the International Agency for Research on Cancer as being a known or probable carcinogen, or classified as being a known or reasonable human carcinogen according to the U.S. National Toxicology Program) in the air, water and soil.

Policies and Programs

3.1 That users, manufacturers and importers of new or existing substances be required to demonstrate, to the responsible Minister, that it does not pose significant environmental or health risks, before it is permitted for import, manufacture or use.

3.2 That comparative assessments and chemical substitution be adopted as the means of achieving carcinogen use reduction in Ontario, and that tax incentives, professional assistance and the scientific assessment of less toxic alternatives be provided to chemical users and manufacturers in the province.

3.3 That an accelerated assessment and approval process be developed for chemicals known to be of low risk, so that they may quickly move through the processes of obtaining permission for import, manufacture or use, and through comparative assessment.

3.4 That the list of substances in the federal National Pollutant Release Inventory be amended to include environmental carcinogens (substances with a known presence in Canada, and classified by the International Agency for Research on Cancer as being a known or probable carcinogen, or classified as being a known or reasonable human carcinogen according to the U.S. National Toxicology Program), and that this list be assessed annually and revised when necessary.

3.5 That the label on all consumer products sold in Ontario (including pesticides) clearly indicate the presence of carcinogens (those with a known presence in Ontario, and classified by the International Agency for Research on Cancer as being a known or probable carcinogen, or classified as being a known or reasonable human carcinogen according to the U.S. National Toxicology Program) with an easily recognized symbol.

3.6 That public health standards include carcinogen use reduction, including community-based programs, policies and education.

Appendix A: Stakeholder-Defined Carcinogen List as it compares to some selected strategies

Comparison of Lists	Chemical Abstracts Service Registry Number	IARC Carcinogen Group	National Toxicology Program (U.S.)	In Ontario Reg. 419/05 POI[2]	Soil, Ground Water and Sediment Standards- EPA , March 28, 2007 (Full Depth Generic Site, Potable Ground Water Condition)	Under NPRI reporting, 2006¥	Known pesticide ingredient, subject to reassessment	Safe Drinking Water Act, 2002	MISA
1,1-Dimethylhydrazine (UDMH)	57-14-7	Group 2B	Reason						
1,2,3-Trichloropropane	96-18-4	Group 2A	Reason						
1,2-Dibromo-3-chloropropane (DBCP)	96-12-8	Group 2B	Reason						
1,2-Dichloroethane (Ethylene dichloride)	107-06-2	Group 2B	Reason	S	X	Part 1A, 5		X	X
1,2-Dimethylhydrazine	540-73-8	Group 2A							
1,3-Butadiene	106-99-0	Group 2A	Known			Part 1A, 5			
1,3-Dichloropropene	542-75-6	Group 2B	Reason		X		X		
1,3-Propane sultone	1120-71-4		Reason						
1,4-Dichlorobenzene (PDCB)	106-46-7	Group 2B	Reason	S	X	Part 1A, 5		X	X
1,4-Dioxane	123-91-1	Group 2B	Reason	P	X	Part 1A			
1,6-Dinitropyrene	42397-64-8	Group 2B	Reason						
1,8-Dinitropyrene	42397-65-9	Group 2B	Reason						
1-Amino-2,4-dibromoanthraquinone	81-49-2		Reason						
1-Amino-2-methylanthraquinone	82-28-0	Group 3	Reason						
1-Nitropyrene	5522-43-0	Group 2B	Reason						
2,2-Bis(bromomethyl)-1,3-propanediol	3296-90-0	Group 2B	Reason						

Comparison of Lists	Chemical Abstracts Service Registry Number	IARC Carcinogen Group	National Toxicology Program (U.S.)	In Ontario Reg. 419/05 POI[Ω]	Soil, Ground Water and Sediment Standards- EPA , March 28, 2007 (Full Depth Generic Site, Potable Ground Water Condition)	Under NPRI reporting, 2006¥	Known pesticide ingredient, subject to reassessment	Safe Drinking Water Act, 2002	MISA
2,3,7,8-Tetrachlorodibenzo-*para*-dioxin	1746-01-6	Group 1	Known		X	Part 3			X
2,3-Dibromo-1-propanol	96-13-9	Group 2B	Reason						
2,4,6-Trichlorophenol	88-06-2		Reason		X			X	X
2,4-Diaminoanisole sulfate	39156-41-7		Reason						
2,4-Diaminotoluene	95-80-7	Group 2B	Reason			Part 1A			
2-Acetylaminofluorene	53-96-3		Reason						
2-Amino-1-methyl-6-phenylimidazol[4,5-b]pyridine (PhIP)	105650-23-5	Group 2B	Reason						
2-Amino-3,4-dimethylimidazo[4,5-f]quinoline (MeIQ)	77094-11-2	Group 2B	Reason						
2-Amino-3-methylimidazo[4,5-*f*]quinoline (IQ)	76180-96-6	Group 2A	Reason						
2-Aminoanthraquinone	117-79-3	Group 3	Reason						
2-Methylaziridine (Propyleneimine)	75-55-8	Group 2B	Reason						
2-Naphthylamine	91-59-8	Group 1	Known						
2-Nitropropane	79-46-9	Group 2B	Reason			Part 1A			
3,3'-Dichlorobenzidine (and dihydrochloride)	612-83-9 91-94-1	Group 2B	Reason	P	X	Part 1A			
3,3'-Dimethoxybenzidine (*o*-Dianisidine) and dyes	119-90-4	Group 2B	Reason						

Comparison of Lists	Chemical Abstracts Service Registry Number	IARC Carcinogen Group	National Toxicology Program (U.S.)	In Ontario Reg. 419/05 POI[Ω]	Soil, Ground Water and Sediment Standards- EPA , March 28, 2007 (Full Depth Generic Site, Potable Ground Water Condition)	Under NPRI reporting, 2006¥	Known pesticide ingredient, subject to reassessment	Safe Drinking Water Act, 2002	MISA
3,3'-Dimethylbenzidine (*o*-Tolidine) (and dihydrochloride)	119-93-7 612-82-8	Group 2B	Reason						
3-Chloro-2-methylpropene	563-47-3	Group 3	Reason			Part 1A			
4-(*N*-Nitrosomethylamino)-1-(3-pyridyl)1-butanone (NNK)	64091-91-4	Group 2B	Reason						
4,4'-Diaminodiphenyl ether (4,4'-Oxydianiline)	101-80-4	Group 2B	Reason						
4,4'-Methylene bis(2-chloroaniline)	101-14-4	Group 2A	Reason	P		Part 1A			
4,4'-Methylene bis(N,*N*-dimethyl)benzenamine	101-61-1	Group 3	Reason						
4,4'-Methylenedianiline (and dihydrochloride)	101-77-9 13552-44-8	Group 2B	Reason	P		Part 1A			
4,4'-Thiodianiline	139-65-1	Group 2B	Reason						
4-Aminobiphenyl	92-67-1	Group 1	Known						
4-Chloro-*o*-phenylenediamine	95-83-0	Group 2B	Reason						
4-Chloro-*o*-toluidine (and hydrochloride)	3165-93-3 95-69-2	Group 2A	Reason						
4-Dimethylaminoazobenzene	60-11-7	Group 2B	Reason						
4-Vinyl-1-cyclohexene diepoxide (Vinyl cyclohexenedioxide)	106-87-6	Group 2B	Reason						
5-Methoxypsoralen	484-20-8	Group 2A							
5-Methylchrysene	3697-24-3	Group 2B	Reason						

Comparison of Lists	Chemical Abstracts Service Registry Number	IARC Carcinogen Group	National Toxicology Program (U.S.)	In Ontario Reg. 419/05 POI[Ω]	Soil, Ground Water and Sediment Standards- EPA , March 28, 2007 (Full Depth Generic Site, Potable Ground Water Condition)	Under NPRI reporting, 2006¥	Known pesticide ingredient, subject to reassessment	Safe Drinking Water Act, 2002	MISA
6-Nitrochrysene	7496-02-8	Group 2B	Reason						
7H-Dibenzo[c,g]carbazole	194-59-2	Group 2B	Reason			Part 2			
Acetaldehyde	75-07-0	Group 2B	Reason	S		Part 1A			
Acrylamide	79-06-1	Group 2A	Reason	S		Part 1A			
Acrylonitrile	107-13-1	Group 2B	Reason	S		Part 1A			X
Aflatoxins	1402-68-2	Group 1	Known						
Alcoholic beverages	---	Group 1	Known						
Aluminum production	---	Group 1		P sterate P disterate P tristerate P oxide		Part 1A (fume or dust)			X (Alumi num)
Amitrole	61-82-5	Group 3	Reason				X		
Aristolochic acids (naturally occurring mixtures of)	---	Group 2A							
Arsenic (inorganic arsenic compounds)	1001, 7440-38-2	Group 1	Known	P		Part 1B (arsenic and its compounds)	X		X
Arsenic in drinking-water	---	Group 1			X			X	
Art glass (manufacture of)	---	Group 2A	Reason						
Asbestos	1332-21-4	Group 1	Known	P		Part 1A (friable form)			
Auramine, manufacture	492-80-8	Group 1							
Benz(α)anthracene	56-55-3	Group 2A	Reason		X	Part 2			X
Benzene	71-43-2	Group 1	Known	P	X	Part 1A, 5		X	X
Benzidine-based dyes	---	Group 2A	Known						
Benzo(*b*)fluoranthene	205-99-2	Group 2B	Reason		X	Part 2			X
Benzo(*j*)fluoranthene	205-82-3	Group 2B	Reason			Part 2			

Comparison of Lists	Chemical Abstracts Service Registry Number	IARC Carcinogen Group	National Toxicology Program (U.S.)	In Ontario Reg. 419/05 POI[Ω]	Soil, Ground Water and Sediment Standards- EPA , March 28, 2007 (Full Depth Generic Site, Potable Ground Water Condition)	Under NPRI reporting, 2006¥	Known pesticide ingredient, subject to reassessment	Safe Drinking Water Act, 2002	MISA
Benzo(*k*)fluoranthene	207-08-9	Group 2B	Reason		X	Part 2			X
Benzo(α)pyrene	50-32-8	Group 2A	Reason	P	X	Part 2		X	X
Beryllium and compounds	7440-41-7	Group 1	Known	S	X			X	X
Bis(chloromethyl)ether and chloromethyl methyl ether	107-30-2 542-88-1	Group 1	Known						
Boot and shoe manufacture and repair	---	Group 1							
Bromodichloromethane	75-27-4	Group 2B	Reason		X				X
Butylated hydroxyanisole (BHA)	25013-16-5	Group 2B	Reason						
C.I. Basic Red 9 monohydrochloride	569-61-9	Group 2B	Reason						
Cadmium and cadmium compounds	1004 7440-43-9	Group 1	Known	S	X	Part 1B		X	X
Captafol	2425-06-1	Group 2A							
Carbon tetrachloride	56-23-5	Group 2B	Reason	S	X	Part 1A		X	X
Chlordecone (Kepone)	143-50-0	Group 2B	Reason						
Chlorendic acid	115-28-6	Group 2B	Reason			Part 1A			
Chlorinated paraffin waxes	108171-26-2	Group 2B	Reason						
Chloroform	67-66-3	Group 2B	Reason	S	X	Part 1A			X
Chloroprene	126-99-8	Group 2B	Reason						

Comparison of Lists	Chemical Abstracts Service Registry Number	IARC Carcinogen Group	National Toxicology Program (U.S.)	In Ontario Reg. 419/05 POI[Ω]	Soil, Ground Water and Sediment Standards- EPA , March 28, 2007 (Full Depth Generic Site, Potable Ground Water Condition)	Under NPRI reporting, 2006¥	Known pesticide ingredient, subject to reassessment	Safe Drinking Water Act, 2002	MISA
Chromium compounds	1012 7440-47-3	Group 1	Known	P	X	Part 1A		X	X
Coal gasification	---	Group 1							
Coal-tar pitches	65996-93-2	Group 1	Known						
Coal-tars	8007-45-2	Group 1	Known	P					
Cobalt metal with tungsten carbide	---	Group 2A							X
Coke production	---	Group 1	Known						
Creosotes	8001-58-9	Group 2A				Other groups and mixtures			
DDT (Dichlorodiphenyl-trichloroethane)	50-29-3	Group 2B	Reason		X			X	
di(2-ethylhexyl)phthalate	117-81-7	Group 3	Reason	S		Part 1A			X
Diazoaminobenzene	136-35-6		Reason						
Dibenz[a,h]acridine	226-36-8	Group 2B	Reason						
Dibenz[*a,h*]anthracene	53-70-3	Group 2A	Reason		X	Part 2			X
Dibenz[a,j]acridine	224-42-0	Group 2B	Reason			Part 2			
Dibenzo[a,e]pyrene	192-65-4	Group 2B	Reason						
Dibenzo[a,h]pyrene	189-64-0	Group 2B	Reason						
Dibenzo[a,i]pyrene	189-55-9	Group 2B	Reason			Part 2			
Dibenzo[a,l]pyrene	191-30-0	Group 2B	Reason						
Dichloromethane (methylene chloride)	75-09-2	Group 2B	Reason	S/P	X	Part 1A		X	X

Comparison of Lists	Chemical Abstracts Service Registry Number	IARC Carcinogen Group	National Toxicology Program (U.S.)	In Ontario Reg. 419/05 POI[Ω]	Soil, Ground Water and Sediment Standards- EPA , March 28, 2007 (Full Depth Generic Site, Potable Ground Water Condition)	Under NPRI reporting, 2006¥	Known pesticide ingredient, subject to reassessment	Safe Drinking Water Act, 2002	MISA
Diesel engine exhaust	---	Group 2A	Reason						
Diethyl sulfate	64-67-5	Group 2A	Reason			Part 1A			
Diglycidyl resorcinol ether (DGRE)	101-90-6	Group 2B	Reason						
Dimethyl sulfate	77-78-1	Group 2A	Reason			Part 1A			
Dimethylcarbamoyl chloride	79-44-7	Group 2A	Reason						
Disperse Blue 1	2475-45-8	Group 2B	Reason						
Epichlorohydrin	106-89-8	Group 2A	Reason			Part 1A			
Ethyl-4,4'-dichlorobenzilate	510-15-6	Group 3	Reason						
Ethylene oxide	75-21-8	Group 1	Known	P		Part 1A	X		
Ethylene thiourea	96-45-7	Group 3	Reason			Part 1A			
Formaldehyde	50-00-0	Group 1	Reason	S		Part 1A, 5	X		
Furan	110-00-9	Group 2B	Reason		X			X	
Furniture and cabinet making	---	Group 1							
Gallium arsenide	1303-00-0	Group 1							
Glycidol	556-52-5	Group 2A	Reason						
Hairdresser or barber (occupational exposures as a)	---	Group 2A							
Hematite mining with exposure to radon	---	Group 1							
Hexachlorobenzene	118-74-1	Group 2B	Reason		X	Part 3			X
Hexachloroethane	67-72-1	Group 2B	Reason		X	Part 1A			X
Hexamethylphosphoramide (HEMA)	680-31-9	Group 2B	Reason						
Hydrazine (and salts)	302-01-2	Group 2B	Reason			Part 1A			

Comparison of Lists	Chemical Abstracts Service Registry Number	IARC Carcinogen Group	National Toxicology Program (U.S.)	In Ontario Reg. 419/05 POI[Ω]	Soil, Ground Water and Sediment Standards- EPA , March 28, 2007 (Full Depth Generic Site, Potable Ground Water Condition)	Under NPRI reporting, 2006¥	Known pesticide ingredient, subject to reassessment	Safe Drinking Water Act, 2002	MISA
Hydrazobenzene (1,2-Diphenylhydrazine)	122-66-7		Reason						
Indeno[1,2,3-*cd*]pyrene	193-39-5	Group 2B	Reason		X	Part 2			X
Indium phosphide	22398-80-7	Group 2A						X	
Involuntary smoking	---	Group 1	Known						
Iron and steel founding	---	Group 1						X	X
Isoprene	78-79-5	Group 2B	Reason			Part 1A			
Isopropanol manufacture (strong-acid process)	---	Group 1		S/P					
Lead compounds, inorganic	1026 7439-92-1	Group 2A	Reason	S	X	Part 1B		X	X
Lindane and other hexachlorocyclohexane isomers	58-89-9 608-73-1		Reason	P	X			X	
Magenta, manufacture	---	Group 1							
Methyleugenol	93-15-2		Reason						
Michler's ketone	90-94-8		Reason			Part 1A			
Mineral oils, untreated and mildly treated	---	Group 1	Known			Other groups and mixtures (white mineral oil)	X		
Mirex	2385-85-5	Group 2B	Reason						
Naphthalene	91-20-3	Group 2B	Reason	P	X	Part 1A	X		X
Nickel (Metallic)	7440-02-0	Group 2B	Reason	S	X	Part 1A			X

Comparison of Lists	Chemical Abstracts Service Registry Number	IARC Carcinogen Group	National Toxicology Program (U.S.)	In Ontario Reg. 419/05 POI[2]	Soil, Ground Water and Sediment Standards- EPA , March 28, 2007 (Full Depth Generic Site, Potable Ground Water Condition)	Under NPRI reporting, 2006¥	Known pesticide ingredient, subject to reassessment	Safe Drinking Water Act, 2002	MISA
Nickel compounds	1029	Group 1	Known						
Nitrilotriacetic acid, trisodium salt monohydrate	139-13-9 18662-53-8	Group 2B	Reason	S		Part 1A		X	
Nitrobenzene	98-95-3	Group 2B	Reason			Part 1A			
N-Nitrosodiethanolamine	1116-54-7	Group 2B	Reason						
N-Nitrosodiethylamine	55-18-5	Group 2A	Reason	P					
N-Nitrosodimethylamine	62-75-9	Group 2A	Reason	P				X	
N-Nitrosomethylvinylamine	4549-40-0	Group 2B	Reason						
N-Nitrosomorpholine	59-89-2	Group 2B	Reason						
N-Nitrosonornicotine	16543-55-8	Group 2B	Reason						
N-Nitrosopiperidine	100-75-4	Group 2B	Reason						
N-Nitrosopyrrolidine	930-55-2	Group 2B	Reason						
N-Nitrososarcosine	13256-22-9	Group 2B	Reason						
Non-arsenical insecticides (occupational exposures)	---	Group 2A							
o-Anisidine (and hydrochloride)	134-29-2 90-04-0	Group 2B	Reason						
Ochratoxin A	303-47-9	Group 2B	Reason						
o-Nitroanisole	91-23-6	Group 2B	Reason						
o-Toluidine (and hydrochloride)	636-21-5 95-53-4	Group 2A	Reason						
Painter (occupational exposure as a)	---	Group 1							
p-Cresidine	120-71-8	Group 2B	Reason						

Comparison of Lists	Chemical Abstracts Service Registry Number	IARC Carcinogen Group	National Toxicology Program (U.S.)	In Ontario Reg. 419/05 POI[α]	Soil, Ground Water and Sediment Standards- EPA , March 28, 2007 (Full Depth Generic Site, Potable Ground Water Condition)	Under NPRI reporting, 2006¥	Known pesticide ingredient, subject to reassessment	Safe Drinking Water Act, 2002	MISA
Petroleum refining (occupational exposures in)	---	Group 2A							
Phosphorus-32, as phosphate	---	Group 1						X	X
Plutionium-239 and its decay products as aerosols	---	Group 1							
Polybrominated biphenyls (PBBs)	59536-65-1	Group 2B	Reason						
Polychlorinated biphenyls (PCBs)	1336-36-3	Group 2A	Reason	P	X			X	X
Propylene oxide	75-56-9	Group 2B	Reason	S		Part 1A			
Radioiodines (including iodine-131)	---	Group 1							
Radionuclides, α/β-particle-emitting, internally deposited	---	Group 1							
Radium-224 and its decay products	---	Group 1						X	
Radium-226 and its decay products	---	Group 1						X	
Radium-228 and its decay products	---	Group 1						X	
Radon-222 and its decay products	---	Group 1	Known						
Refractory ceramic fibres	---	Group 2B	Reason						

Comparison of Lists	Chemical Abstracts Service Registry Number	IARC Carcinogen Group	National Toxicology Program (U.S.)	In Ontario Reg. 419/05 POI[Ω]	Soil, Ground Water and Sediment Standards- EPA , March 28, 2007 (Full Depth Generic Site, Potable Ground Water Condition)	Under NPRI reporting, 2006¥	Known pesticide ingredient, subject to reassessment	Safe Drinking Water Act, 2002	MISA
Rubber industry	---	Group 1							
Safrole	94-59-7	Group 2B	Reason			Part 1A			
Salted fish (Chinese-style)	---	Group 1							
Shale-oils	68308-34-9	Group 1							
Silica	14808-60-7	Group 1	Known	P					
Solar radiation	---	Group 1	Known						
Soots	---	Group 1	Known						
Strong-inorganic-acid mists containing sulfuric acid	7664-93-9	Group 1	Known	S		Part 1A			
Styrene-7,8-oxide	96-09-3	Group 2A	Reason		X	Part 1A			
Sunlamps and sunbeds (use of)	---	Group 2A	Known						
Talc containing asbestiform fibres	14807-96-6	Group 1		P					
Tetrachloroethylene (Perchloroethylene)	127-18-4	Group 2A	Reason	S/P	X	Part 1A		X	X
Tetrafluoroethylene	116-14-3	Group 2B	Reason						
Tetranitromethane	509-14-8	Group 2B	Reason						
Thioacetamide	62-55-5	Group 2B	Reason						
Thiourea	62-56-6	Group 3	Reason	P		Part 1A			
Thorium dioxide	1314-20-1		Known			Part 1A			
Tobacco products, smokeless	---	Group 1	Known						
Tobacco smoking	---	Group 1	Known						
Toluene diisocyanate	26471-62-5 584-84-9 91-08-7	Group 2B	Reason	S	X	Part 1A			

Comparison of Lists	Chemical Abstracts Service Registry Number	IARC Carcinogen Group	National Toxicology Program (U.S.)	In Ontario Reg. 419/05 POI[Ω]	Soil, Ground Water and Sediment Standards- EPA , March 28, 2007 (Full Depth Generic Site, Potable Ground Water Condition)	Under NPRI reporting, 2006¥	Known pesticide ingredient, subject to reassessment	Safe Drinking Water Act, 2002	MISA
Toxaphene (Polychlorinated camphenes)	8001-35-2	Group 2B	Reason						
Trichloroethylene	79-01-6	Group 2A	Reason	S	X	Part 1A		X	X
Tris(2,3-dibromopropyl) phosphate	126-72-7	Group 2A							
Ultraviolet radiation A	---	Group 2A	Reason						
Ultraviolet radiation B	---	Group 2A	Reason						
Ultraviolet radiation C	---	Group 2A	Reason						
Urethane (Ethyl carbamate)	51-79-6	Group 2B	Reason						
Vinyl bromide	593-60-2	Group 2A	Reason						
Vinyl chloride (chloroethylene)	75-01-4	Group 1	Known	S	X	Part 1A		X	X
Vinyl fluoride	75-02-5	Group 2A	Reason						
Wood dust	---	Group 1	Known						
X-and Gamma (γ)-Radiation	---	Group 1	Known						
α-Chlorinated toluenes (benzal chloride, benzyl chloride, benzotrichloride) (combined exposures)	100-44-7 98-07-7 98-87-3 98-88-4	Group 2A	Reason	P		Part 1A			
β-Propiolactone	57-57-8	Group 2B	Reason						

†† This list contains items that are on the Cancer and the Environment Stakeholder Group list, have a known presence in Ontario, are an IARC Carcinogen of group 1 or 2A or B, and are an NTP known or probable carcinogen. Items that appear more than once denote the pure substance and/or different compounds.

¥ Part 1A substances are reported if manufactured, processed or used quantities of 10 tonnes or more with employees working 20,000 hours or more. Part 1B substances are reported if manufactured, processed or used in quantities of 50 kilograms or more, with employees working 20,000

hours or more. Part 2 substances are reported if incidentally manufactured, released, disposed or transferred in quantities of 50 kilograms or more and employees worked 20,000 hours or more. Part 3 substances must be reported if the company engages in specific activities, including incineration, power generation and metal smelting. Part 5 substances have a mass threshold of 1 tonne of 10-tonne air release threshold for VOCs has been met.

Ω S=On a schedule for phase-in.
P=Has a Point Of Impingement guideline or Air Quality Criteria have been Set
For further information, see "Summary of O. REG. 419/05 Standards and Point of Impingement Guidelines &Ambient Air Quality Criteria (AAQCs)", Standards Development Branch, Ontario Ministry of the Environment, December 2005.

NB: The existence of a carcinogen in a regulation does not mean that it is regulated as being a carcinogen (it is regulated as being a toxic substance).

Appendix B: The Environment and Cancer Stakeholder Group Membership

Name	Organization
Abelsohn, Alan	Canadian Association of Physicians for the Environment, Department of Family and Community Medicine
Aubin, Louise	Ontario Public Health Association
Bray, Riina	Physician
DeCarlo, Nick	National CAW Representative for Health and Safety and Environment, Canadian Auto Workers
Edwards, Vern	Health and Safety Director, Ontario Federation of Labour
Filsinger, Brooke	Junior Research Associate, Research Unit, Cancer Care Ontario
Friesen, Krista	Senior Project Manager, Pollution Probe
Gilbertson, Michael	Retired International Joint Commission Scientist
Goldin Rosenberg, Dorothy	Ontario Institute for Studies in Education
Grier, Ruth	Provincial Council (PCSC)
Grinspun, Doris	Executive Director, Registered Nurses' Association of Ontario
Hay, Bruce	President, Ontario Parks Association
Keen, Deb	Director, Prevention Unit, Cancer Care Ontario
King, Andy	National Health, Safety and Environment Coordinator, United Steelworkers of America
Kreiger, Nancy	Director of Research, Division of Preventive Oncology, Cancer Care Ontario
Kyle, Robert	Commissioner and Medical Officer of Health, Durham Region Health Department
Marrett, Loraine	Director of Surveillance, Cancer Care Ontario
Macfarlane, Ronald	Toronto Public Health
Miller, Katrina	Toronto Environmental Alliance
Miller, Sarah	Co-ordinator and Water Policy Researcher Canadian Environmental Law Association
Nadalin, Vicki	Research Associate, Research Unit, Cancer Care Ontario
Nelson, Fiona	Chair, Toronto Cancer Prevention Coalition
Payne, Patti	Senior Manager, Prevention, Canadian Cancer Society, Ontario Division
Perley, Michael	Director, Ontario Campaign for Action on Tobacco
Sloan, Peggy	Manager, Research Unit, Cancer Care Ontario
Smith, Rick	Environmental Defence
Wellner, John	Environmental Issues, Ontario Medical Association
Whate, Rich	Toronto Public Health

Government experts who were not group members also provided information that informed various sections of this document:

Szakolcai, Akos	Coordinator, Air Standards Risk Management Ontario Ministry of the Environment
deJong, Minnie	Manager, Ontario Ministry of the Environment
Rachamin, Gloria	Toxicologist, Environmental Health Branch, Ontario Ministry of Health and Long-Term Care

The Environment and Cancer Stakeholder Group

TERMS OF REFERENCE

Vision	Establish, as a policy and legislative priority, the elimination of occupational and environmental carcinogens in Ontario (adapted from the Provincial Cancer Prevention and Screening Council priority)
Purpose	To decrease the burden from cancer due to environmental carcinogens
Objective	To develop and support the implementation of an environmental cancer prevention strategy in Ontario
Leadership	Start-up leadership for the Stakeholder Group will be provided by Cancer Care Ontario, as the interim chair, with secretariat support provided by staff within the Prevention Unit at Cancer Care Ontario. Long-term leadership and secretariat support for the Stakeholder Group has yet to be determined, but a number of options are being considered.
Membership	Stakeholder Group members will include representatives from key provincial and regional organizations and government as well as individuals with interests in environmental and occupational carcinogens.
Term	The Stakeholder Group, formed in October 2005, will meet until its objectives have been achieved. Individual members will sit on the Stakeholder Group for at least two years before seeking replacement or resignation, to ensure continuity.
Meetings	Meetings will be a combination of full group sessions to be scheduled bi-monthly (or as needed) with teleconference calls and e-mail discussions as required. Decisions will be reached by consensus.
Accountability	The Stakeholder Group will be accountable to its members. The Stakeholder Group will provide regular updates and communication to its working groups. Members will be responsible for working within their organizations to support and facilitate the attainment of the Stakeholder Group's objectives.

Appendix C—The Environmental Carcinogen Use Reduction Symposium

Held on February 6, 2007, in Toronto, Ontario

The Cancer and the Environment Stakeholder Group invited stakeholders in the environment to a one-day symposium, hosted by the Canadian Cancer Society, the Canadian Strategy for Cancer Control, and Cancer Care Ontario, in order to help inform its work.

Keynote speakers at this symposium were:

> Kristan Aronson, Member, Division of Cancer Care and Epidemiology at Queens University.
>
> Devra Lee Davis, Director of the University of Pittsburgh Cancer Institute's Center of Environmental Oncology.
>
> Ken Geiser, Co-Director, Lowell Center for Sustainable Production at the University of Massachusetts, Lowell.
>
> Larry Stoffman, Chair, National Committee on Environmental and Occupational Exposures, Canadian Strategy for Cancer Control.

At this symposium participants developed a common understanding about cancer and the environment and its current context within Ontario, based on current evidence, learned about the environmental carcinogen use reduction experiences and practices in the United States and the European Union, and provided input on a set of draft recommendations for the environmental carcinogen use reduction strategy described in this document.

Presentations at this symposium, and input on a set of draft recommendations for this paper informed this document.

Appendix D—Glossary and Acronyms

Biomonitoring	A scientific method whereby an individual's exposure to chemicals is assessed, based on findings from that person's tissues and fluids. These studies demonstrate the possible items that can be tracked and reported, and can identify emerging problems. Over time, this research can be used to identify chemical exposure trends
Brownfield sites	Lands that are undeveloped or previously developed (such as gas stations) that could be contaminated
Canada-Wide Standards	Standards developed by federal, provincial and territorial ministers of the environment to coordinate action towards reaching common environmental standards. CWSs represent commitments by the Ministers to address key issues of environmental protection and risk issues associated with environmental health.
Canadian Environmental Law Association	A non-profit, public interest organization established in 1970 to use existing laws to protect the environment and to advocate environmental law reforms.
CleanerSolutions	interactive website designed to help manufacturers switch to safer surface cleaning solvents, launched by the Massachusetts Toxics Use Reduction Institute
Environment and Cancer Stakeholder Group	A group, guided by the precautionary principle, established to develop and support the implementation of an environmental cancer prevention strategy in Ontario. Group members include the Ontario Medical Association, the Canadian Environmental Law Association, the Registered Nurses' Association of Ontario, the Canadian Cancer Society, stakeholder groups, the Ontario Federation of Labour, and physicians.
Environmental carcinogen	For the purposes of this report, it is a carcinogen found in the environment to which the public can be expected to be exposed as the result of human activity.
Environmental Defence	A group that works with individual Canadians, decision-makers and businesses to make the environment a top priority, focus on critical environmental and health issues of the day.
Greenfield Site	Undeveloped land, either currently agricultural or left to nature
National Pollutant Release Inventory	An official, publicly accessible chemical release inventory available in Canada, providing legislated, company-specific information about the release and transfer of a limited number of pollutants (under 400), including known and probable carcinogens.
Pest	An agency under Health Canada, which controls pesticides

Management Regulatory Agency	through the *Pest Control Products Act.*
Pollution prevention	A principle that states that damage to environment and human health is easier and less expensive to prevent than it is to manage.
PollutionWatch	A collaborative project of Environmental Defence and the Canadian Environmental Law Association, provides report and access to NPRI data.
Precautionary principle	A principle that states when an activity raises the threat of harm, risk should be avoided through the reduction and/or elimination of the exposure, even if full cause and effect evidence is not yet available.
Target carcinogen list	List defined by the stakeholder group for this report. A substance was retained if it has a known presence in Ontario, is a known or probable carcinogen according to the International Agency for Research on Cancer (IARC), or has been identified as known or reasonably anticipated to be a human carcinogen by the U.S. National Toxicology Program (NTP). Biological agents or those used solely as pharmaceuticals were not included. The final list of substances can be found in Appendix A. Does not include substances where the evidence is sufficient but not yet evaluated by IARC or NTP, substances that disrupt the endocrine system, but for which carcinogenicity has not yet been established, pharmaceuticals that enter the environment during manufacture or disposal, and Particulate matter. While particulates themselves may be an important vehicle of carcinogen transmission, nitrogen oxide and sulphur dioxide (the principle components of fine particulate matter) are not themselves thought to be carcinogens.
Toxics use reduction	A principle which focuses on the use of less toxic substances, that addresses the limitations of traditional control methods, ensuring that substances are not replaced with other substances of concern (due to other health or environmental characteristics).
Toxics Use Reduction Institute	A university centre established under the Toxics Use Reduction Act of Massachusetts. The Institute provides research, training, technical support and public awareness, and runs a number of programs
Weight of evidence approach	An approach which combines the results of many types of studies investigating harm, concluding that there is a need for action on a particular issue.

REFERENCES

[1] Canadian Cancer Society, National Cancer Institute of Canada. *Canadian Cancer Statistics 2007.* Toronto: Canadian Cancer Society, National Cancer Institute of Canada, Statistics Canada, Provincial/Territorial Cancer Registries, Public Health Agency of Canada; 2007.
[2] Canadian Cancer Society, Cancer Care Ontario. *Targeting Cancer: An Action Plan for Cancer Prevention and Detection. Cancer 2020 Background Report.* Toronto: Canadian Cancer Society, Cancer Care Ontario; 2003.
[3] Macfarlane R. *Report to the Cancer and the Environment Stakeholder Group.* Toronto: Building a Scientific Case Working Group; May 26, 2006.
[4] National Committee on Environmental and Occupational Exposures. *Prevention of Occupational and Environmental Cancers in Canada: A Best Practices Review and Recommendations.* Canadian Strategy for Cancer Control; May 2005.
[5] Ibid.
[6] Ibid.
[7] PollutionWatch. *PollutionWatch Fact Sheet. National Pollution Highlights*. Environmental Defence and the Canadian Environmental Law Association; 2003. Available at: pollutionwatch@cela.ca
[8] CTV.ca. *Politicians found to carry toxic chemical soup.* Jan 3, 2007. Available at: http://www.ctv.ca/servlet/ArticleNews/story/CTVNews/20070103/toxic_politicians_070103/20070103/ .
[9] Government of Canada. *The Canadian Environmental Protection Act, 1999 (CEPA 1999). CEPA 1999 at a glance. What it is, what it does, how it works*. Her Majesty the Queen in Right of Canada; 2005.
[10] Canadian Cancer Society, National Cancer Institute of Canada. *Canadian Cancer Statistics 2007.* Toronto: Canadian Cancer Society, National Cancer Institute of Canada, Statistics Canada, Provincial/Territorial Cancer Registries, Public Health Agency of Canada; 2007.
[11] Ibid.
[12] Canadian Cancer Society, Cancer Care Ontario. *Targeting Cancer: An Action Plan for Cancer Prevention and Detection. Cancer 2020 Background Report.* Toronto: Canadian Cancer Society, Cancer Care Ontario; 2003.
[13] Ibid.
[14] Ibid.
[15] Canadian Cancer Society, National Cancer Institute of Canada. *Canadian Cancer Statistics 2007.* Toronto: Canadian Cancer Society, National Cancer Institute of Canada, Statistics Canada, Provincial/Territorial Cancer Registries, Public Health Agency of Canada; 2007.
[16] Ziegler RG et al. *Migration patterns and Breast Cancer risk in Asian American women*. JNCI 1993; 85(22): 1819-27.
[17] Lihtenstein P, et al. *Environmental and Heritable Factors in the Causation of Cancer—Analyses of Cohorts of Twins from Sweden, Denmark and Finland*. New England Journal of Medicine 2000; 34(2)3: 78-85.
[18] Shay CM. Air Pollution. PP 406-417 *in Cancer Epidemiology and Prevention, 2nd ed.*Edited by D Schottenfeld & JF Fraumeni. New York: Oxford University Press; 1996.
[19] Canadian Cancer Society, Cancer Care Ontario and the Canadian Strategy for Cancer Control. *Proceedings of the Environmental Carcinogen Use Reduction Symposium*. Toronto; February 6, 2007.
[20] Canadian Cancer Society, Cancer Care Ontario. *Targeting Cancer: An Action Plan for Cancer Prevention and Detection. Cancer 2020 Background Report.* Toronto: Canadian Cancer Society, Cancer Care Ontario; 2003.
[21] Ibid.
[22] National Committee on Environmental and Occupational Exposures. *Prevention of Occupational and Environmental Cancers in Canada: A Best Practices Review and Recommendations.* Canadian Strategy for Cancer Control; May 2005.
[23] Clapp R, Howe GK and Jacobs MM. *Environmental and Occupational Causes of Cancer: A review of scientific literature.* Massachusetts: Boston University School of Public health and Environmental Health and Environmental Health Initiative; 2005.
[24] Environment Canada. *Pollution Prevention-A new way of doing business.* The Environmental Protection Hierarcy. The Green Lane; 2004. Available at: http://www.ec.gc.ca/pollution/strategy/en/p3.cfm.

[25] Macfarlane R. *Report to the Cancer and the Environment Stakeholder Group.* Toronto: Building a Scientific Case Working Group; May 26, 2006.
[26] Canadian Cancer Society, Cancer Care Ontario and the Canadian Strategy for Cancer Control. *Proceedings of the Environmental Carcinogen Use Reduction Symposium.* Toronto; February 6, 2007.
[27] National Committee on Environmental and Occupational Exposures. *Prevention of Occupational and Environmental Cancers in Canada: A Best Practices Review and Recommendations.* Canadian Strategy for Cancer Control; May 2005.
[28] Ibid.
[29] Ibid.
[30] Ibid.
[31] Ibid.
[32] Ibid.
[33] Human Resources and Social Development Canada. *Organizational Profiles: Husky Injection Molding Systems.* Available at: www.hrsdc.gc.ca.
[34] Hyndman B. *Strategies for the Reduction and Control of Environmental Carcinogens in Canada: What's Happening? What's Missing?*. Prepared for Cancer Care Ontario. Toronto: The Alder Group; 2005.
[35] Danish EPA. *Chemicals – a Danish Priority. December 2000 (updated 2003).* Available at: http://www.mst.dk/chemi/01020000.htm
[36] Ibid.
[37] Ibid.
[38] Lofstedt, RE. *Swedish Chemical Regulation: An Overview and Analysis.* Risk Analysis 2003;23 (2):411-421.
[39] Government offices of Sweden. *Environmental legislation.* Stockholm: Government offices of Sweden; 2006. Available at: http://www.sweden.gov.se/sb/d/5400/a/43593;jsessionid=aNYmvnakvDoe.
[40] Ibid.
[41] KemI. Phase Out. Accessed at: http://www.kemi.se/templates/PRIOEngpage___4193.aspx.
[42] Advisory Committee on Pesticides. *Swedish System of Comparative Assessment/Substitution.* Available at: http://www.pesticides.gov.uk/acp.asp?id=691.
[43] Ibid.
[44] Thorpe B, Rossi M. *The Louisville Charter. Background Paper for Reform no.1 of the Louisville Charter for Safer Chemicals*. August 2005. Available at http://www.louisvillecharter.org/
[45] Ministry of Sustainable Development. *Chemicals policy in Sweden, the EU and globally*. Stockholm: Government offices of Sweden: 2007. Available at: http://www.sweden.gov.se/sb/d/2969/a/17212.
[46] Lofstedt, RE. *Swedish Chemical Regulation: An Overview and Analysis.* Risk Analysis 2003;23 (2):411-421.
[47]Pesticides News. *Swedish experience of chemical substitution*. No.58, December 2002, pgs 14-15. Available at: http://www.pan.uk.org/pestnews/pn58p14.htm.
[48] European Commission. *REACH in brief.* Enterprise and Industry Directorate General and Environment Directorate General: 2006.
[49] Ibid.
[50] Ibid.
[51] Ibid.
[52] Ackerman F. *REACH—Europe's precautionary chemicals regulation*. Center for Progressive Reform; 2005.
[53] Euractiv.com. REACH*: impact study will not end controversial lobbying struggle*. Accessed at: http://www.euractiv.com/en/environment/reach-impact-study-controversial-lobbying-struggle/article-138689
[54] European Commission. *Environment fact sheet: REACH—a new chemicals policy for the EU.* European Commission: 2006.
[55] The swan website. Available at : http://www.svanen.nu/Eng/about/.
[56] EUROPA. *The European Eco-label scheme: part of a wider strategy on Sustainable Production and Consumption.* EUROPA: 2005. Available at: http://ec.europa.eu/environment/ecolable/whats eco/scheme en.htm.
[57] Ibid.

[58] IEFE- Universita Bocconi. *EVER: Evaluation of EMAS and Eco-label for their Revision. Executive Summary*. December 2005.
[59] The Campaign for Safe Cosmetics website. The Breast Cancer Fund: San Francisco. Available at: http://www.breastcancerfund.org/site/pp.aspx?c=kwKXLdPaE&b=70918&printmode=1.
[60] Canadian Cancer Society, Cancer Care Ontario and the Canadian Strategy for Cancer Control. *Proceedings of the Environmental Carcinogen Use Reduction Symposium*. Toronto; February 6, 2007.
[61] EPA Records Schedule 153. http://www.epa.gov/records/policy/schedule/sched/153.htm
[62] Canadian Cancer Society, Cancer Care Ontario and the Canadian Strategy for Cancer Control. *Proceedings of the Environmental Carcinogen Use Reduction Symposium*. Toronto; February 6, 2007.
[63] Hyndman B. *Strategies for the Reduction and Control of Environmental Carcinogens in Canada: What's Happening? What's Missing?*. Prepared for Cancer Care Ontario. Toronto: The Alder Group; 2005.
[64] Lubick N. *Measuring chemicals in Californians.* Policy News; 2006: 40(20) October 11. Available at: http://pubs/acs.org/subscribe/journals/esthag-w/2006/oct/policy/nl_californians.html.
[65] Environment California. *Detecting Toxic Chemicals*. Available at: http://www.environment California.org/environmental-health/chemicals.
[66] Canadian Cancer Society. *Mandatory labeling of cosmetics in Canada*. Available at http://www.cancer.ca/ccs/internet/standard/0,3182,3172_1359949023_langId-en,00.html.
[67] New Jersey Technical Assistance Program for Industrial Pollution Prevention. *The New Jersey Pollution Prevention Act.* Newark; New Jersey Technical Assistance Program: 1999. Available at: http://www.ycees.njit.edu/njtap/njppa.htm
[68] Ibid.
[69] Toxics Use Reduction Institute website. Available at: http://turadata.turi.org/whatistura/overviewoftura.html.
[70] Canadian Cancer Society, Cancer Care Ontario and the Canadian Strategy for Cancer Control. *Proceedings of the Environmental Carcinogen Use Reduction Symposium*. Toronto; February 6, 2007.
[71] Toxics Use Reduction Institute. Available at: http://turadata.turi.org/whatistura/overviewoftura.html.
[72] Canadian Cancer Society, Cancer Care Ontario and the Canadian Strategy for Cancer Control. *Proceedings of the Environmental Carcinogen Use Reduction Symposium*. Toronto; February 6, 2007.
[73] http://www.cleanersolutions.org.
[74]University of Massachusetts. *Database Offers Companies CleanerSolutions* Available at: http://www.uml.edu/Media/eNews/print_1_105195_105195.html.
[75] Toxics Use Reduction Institute. *CleanerSolutions On-Line Tool for Solvent Substitution in Surface Cleaning*. Available at: http://www.cleanersolutions.org/?action=about.
[76] University of Massachusetts. *Database Offers Companies CleanerSolutions* Available at: http://www.uml.edu/Media/eNews/print_1_105195_105195.html.
[77] National Committee on Environmental and Occupational Exposures. *Prevention of Occupational and Environmental Cancers in Canada: A Best Practices Review and Recommendations.* Canadian Strategy for Cancer Control; May 2005.
[78] Ibid.
[79] Environmental Health Research Foundation. Biomonitoring Info. Available at: http://www.biomonitoringinfo.org/
[80] National Committee on Environmental and Occupational Exposures. *Prevention of Occupational and Environmental Cancers in Canada: A Best Practices Review and Recommendations.* Canadian Strategy for Cancer Control; May 2005.
[81]California Air Resources Board. *California Air Resources Board Homepage*. Available at: http://www.arb.ca.gov/homepage.htm
[82] Government of Canada. *The Canadian Environmental Protection Act, 1999 (CEPA 1999). CEPA 1999 at a glance. What it is, what it does, how it works*. Her Majesty the Queen in Right of Canada; 2005.
[83] Ibid.
[84] Environment Canada. *Identifying Risk Management Tools for Toxic Substances Under CEPA 1999.* Green Lane: 2005. Available at: http://ec.gc.ca/CEPARegistry/gene_info/fact_02.cfm.
[85] Government of Canada. *Chemical Substances*. Government of Canada: 2007.
[86] Environment Canada. *Identifying Risk Management Tools for Toxic Substances Under CEPA 1999.* Green Lane: 2005. Available at: http://ec.gc.ca/CEPARegistry/gene_info/fact_02.cfm.
[87] Ibid.

[88] Ibid.
[89] Ibid.
[90] Ibid.
[91] Ibid.
[92] Ibid.
[93] Government of Canada. *What Does Toxic Mean under CEPA 1999?* Green Lane: 2005.
[94] Environment Canada. *Identifying Risk Management Tools for Toxic Substances Under CEPA 1999.* Green Lane: 2005. Available at: http://ec.gc.ca/CEPARegistry/gene_info/fact_02.cfm.
[95] Government of Canada. *Prohibition of Certain Toxic Substances Regulation, 2005*. Canada Gazette Vol 139 (5), March 9, 2005. Available at: http://canadagazette.gc.ca/partII/2005/20050309/html/sor41-e.html. .
[96] Government of Ontario. Canada-Wide Standards in Ontario. Toronto: Queen's Printer for Ontario; 2007.
[97] Health Canada. *Assessment and Management of Cancer Risks from Radiological and Chemical Hazards*. Environmental and Workplace Health. Available at: http://www.hc-sc.gc.ca/ewh-semt/pubs/radiation/98ehd-dhm216/discussion_e.html.
[98]National Committee on Environmental and Occupational Exposures. *Prevention of Occupational and Environmental Cancers in Canada: A Best Practices Review and Recommendations.* Canadian Strategy for Cancer Control; May 2005.
[99] Government of Canada. *What is Risk assessment?* Chemical Substances; 2007. Available at: http://www.chemicalsubstanceschimiques.gc.ca/assess-eval/what-quoi/index_e.html
[100] Health Canada. *Integrated Framework for the Health-Related Components of Categorization of the Domestic Substances List Under CEPA 1999: Questions & Answers* Environmental and Workplace Health: December 15, 2006. Available at: http://www.hc-sc.gc.ca/ewh-semt/contaminants/existsub/categor/question-1_e.html#9
[101] Government of Canada. *What is categorization*? Environmental and Workplace Health: 2007.. Available at: http://www.chemicalsubstanceschimiques.gc.ca/categor/what-quoi/index_e.html
[102] Government of Canada. *The Government of Canada "Challenge" for chemical substances that are a high priority for action. Notice of Intent - Chemical Substances in Batch One.* Available at: http://www.chemicalsubstanceschimiques.gc.ca/challenge-defi/notice-avis_e.html#2
[103] National Committee on Environmental and Occupational Exposures. *Prevention of Occupational and Environmental Cancers in Canada: A Best Practices Review and Recommendations.* Canadian Strategy for Cancer Control; May 2005.
[104] Ibid.
[105] National Pollutant Release Inventory. *Are your required to report?* NPRI 2005.
[106] Government of Canada. *The Canadian Environmental Protection Act, 1999 (CEPA 1999) and the National Pollutant Release Inventory (NPRI).* April 2005.
[107] PollutionWatch. *Shattering the Myth of Pollution Progress in Canada: A National Report*. Toronto: Environmental Defence, Canadian Environmental Law Association: 2004. Available at: www.pollutionwatch.org.
[108] Ibid.
[109] Ministry of the Environment. *Managing Pesticides in Ontario*. Pibs 4525e. Green Facts. Toronto: Ministry of the Environment; November 2003.
[110] Ibid.
[111] National Committee on Environmental and Occupational Exposures. *Prevention of Occupational and Environmental Cancers in Canada: A Best Practices Review and Recommendations.* Canadian Strategy for Cancer Control; May 2005.
[112] Ministry of the Environment. *Managing Pesticides in Ontario*. Pibs 4525e. Green Facts. Toronto: Ministry of the Environment; November 2003.
[113] Pest Management Regulatory Agency. *Science Policy Notice*. *Technical Paper: A Decision Framework for Risk Assessment and Risk Management in the Pest Management Regulatory Agency*. Health Canada. SPN2000-01. December 22, 2000.
[114] Ibid.
[115] Pest Management Regulatory Agency. *Science Policy Notice. Children's Health Priorities within the Pest Management Regulatory Agency.* Health Canada SPN2002-01. January 3, 2002.

[116] Pest Management Regulatory Agency. *Information Note: Assessing Human Health Risks During Pesticide Review in Canada.* Health Canada: August 14, 2006. Available at: http://www.pmra-arla.gc.ca/english/highlights/in20060814-e.html.
[117] Pest Management Regulatory Agency. *Information Note: The New Pest Control Products Act*. Health Canada: 2006. Available at http://www.pmra-arla.gc.ca/english/highlights/in20060621-e.html.
[118] Ibid.
[119] Ibid.
[120] Ibid.
[121] Pest Management Regulatory Agency. *Fact Sheet on the Regulation of Pesticides in Canada*. Health Canada. March 2003.
[122] Canadian Cancer Society, Cancer Care Ontario. *Insight on Cancer: environmental exposures and cancer.* Toronto: Canadian Cancer Society, Cancer Care Ontario. Volume 4, June 2005.
[123] Ibid.
[124] Pest Management Regulatory Agency. *Information Note. Roles of the Three Levels of Governments Regarding Pesticides in Canada.* Health Canada. January 11, 2005.
[125] Ministry of Agriculture, Food and Rural Affairs. *SR9128-Survey of Pesticide Use and evaluation of the Changes in Pesticide Risk on Agricultural Crops in Ontario*. Toronto: Government of Ontario; 2007. Available at: http://www.omafra.gov.on.ca/english/research/new_directions/projects/2003/sr9128.htm
[126] Ministry of the Environment. *Managing Pesticides in Ontario*. Pibs 4525e. Green Facts. Toronto: Ministry of the Environment; November 2003.
[127] Pest Management Regulatory Agency. Information Note. Roles of the Three Levels of Governments Regarding Pesticides in Canada. Health Canada. January 11, 2005.
[128] Ministry of the Environment. *Managing Pesticides in Ontario*. Pibs 4525e. Green Facts. Toronto: Ministry of the Environment; November 2003.
[129] Canadian Cancer Society, Cancer Care Ontario. *Insight on Cancer: environmental exposures and cancer.* Toronto: Canadian Cancer Society, Cancer Care Ontario. Volume 4, June 2005.
[130] Environment Canada. *Who is responsible for clean air*? The Green Lane: 2006. Available at: http://www.pyr.ec.gc. Ca/air/clean_air_responsible_e.htm.
[131] Ibid.
[132] Ibid.
[133] Environment Canada. *Air Quality Services*. The Green Lane: 2005. http://www.msc-smc.ec.gc.ca/aq_smog/on/on_e.cfm
[134] Grant C. *Overview of Ontario Regulation 419: Air Pollution-Local Air Quality (O.Reg.419/05). Air & Waste Management Association (AWMA)/MOE session Toronto-October 13, 2006.* Toronto: Ontario Ministry of the Environment. 2006.
[135] Ibid.
[136] Canadian Cancer Society, Cancer Care Ontario. *Insight on Cancer: environmental exposures and cancer.* Toronto: Canadian Cancer Society, Cancer Care Ontario. Volume 4, June 2005.
[137] Standards Development Branch. *Summary of O.REG.419/05 STANDARDS and POINT OF IMPINGEMENT GUIDELINES & AMBIENT AIR QUALITY CRITERIA (AAQCs)* Toronto: Ontario Ministry of the Environment; 2005.
[138] Ministry of the Environment. *Fact Sheet: New and Updated Standards for 40 Air Pollutants.* Toronto: The Queen's Printer for Ontario; 2007. Available at: http://www.ene.gov.on.ca/envision/news/2005/082901mb3.htm.
[139] Ibid.
[140] Ministry of the Environment. *Ontario's Plan for Clean Air.* Toronto: Queen's Printer for Ontario; 2006. Available at http://www.ene.gov.on.ca/envision/air/airquality/clap.htm .
[141] Ministry of the Environment. *Fact Sheet: New Regulations Ensure Cleaner Air in Ontario*. Toronto: Queen's Printer for Ontario, 2006. Available at: http://www.ene.gov.on.ca/envision/news/2005/082901mb.htm.
[142] Ibid.
[143] Ibid.
[144] Ontario Drinking Water Advisory Council. *Annual Report 2005-2006.* Ontario Drinking Water Advisory Council. Accessed at: www.odwac.gov.on.ca/reports/073106%20ODWAC%20Annual%20Report%202005-2006.pdf -

[145] Government of Ontario. *MISA Municipal/Industrial Strategy for Abatement (MISA).* Toronto: Queen's Printer for Ontario; 2007. Available at: http://www.ene.gov.on.ca/envision/water/misa/.
[146]Ministry of the Environment. *Land*. Toronto: Queen's Printer for Ontario; 2007. Available at: http://www.ene.gov.on.ca/land.htm
[147] Ministry of the Environment. *Record of Site Condition*. Toronto: Queen's Printer for Ontario; 2006. Available at: http://www.ene.gov.on.ca/envision/land/decomm/condition .htm.
[148] Government of Ontario. *Brownfield Redevelopment in Small Urban and Rural Municipalities*. Toronto: Queen's Printer for Ontario; 2006. Available at www.brownfields.ontario.ca.
[149] Ibid.
[150]Ministry of the Environment. Brownfields Redevelopment. Toronto: Queen's Printer for Ontario: 2006. Available at: http://www.ene.gov.on.ca/envision/land/decomm/brownfields.htm.
[151] National Committee on Environmental and Occupational Exposures. *Prevention of Occupational and Environmental Cancers in Canada: A Best Practices Review and Recommendations.* Canadian Strategy for Cancer Control; May 2005.
[152] Ibid.
[153] Government of Ontario. *Financial Tools for Brownfields Redevelopment.* Toronto: Queen's Printer for Ontario; 2006. Available at www.brownfields.on.ca.
[154] Environment Canada. *Municipal Governments Action on Clean Air*. CleanAir Online; 2006. Available at: http://www.ec.gc.ca/cleanair-airpur/Taking_Action/Canadian_Governments?municipal_Gov.
[155] Cosmetics Design.com. *Canada Tightens up Cosmetic Regulations*. Decision News Media: 2006. Accessed at: http://www.cosmeticsdesign.com/news-by-product/news.asp?id=72284&idCat=63&k=canada-tightens-up
[156] Terrachoice. *Environmental Choice Program.* Terrachoice Environmental Marketing.2007.
[157] Environment Canada. *Canada's Environmental Choice* 2002. Available at: http://www.ns.ec.gc.ca/g7/eco-can.html
[158] NAPS. *NAPS Network Summary*. Environment Canada: 2001. Available at: http://www.etc-cte.ec.gc.ca/NAPS/naps_summary_e.html
[159] Government of Canada. *Human Biomonitoring of Environmental Chemical Substances.* Environmental and Workplace Health: 2007.
[160] Health Canada. *Drinking Water Information Management System (DWIMS) (Ontario). Inventory of Federal, Provincial and Territorial Environmental and Occupational Health Data.* Health Canada 2004. Accessed at: http://www.hc-sc.gc.ca/ewh-semt/pubs/eval/inventory-repertoire/dwims_e.html.
[161] National Committee on Environmental and Occupational Exposures. *Prevention of Occupational and Environmental Cancers in Canada: A Best Practices Review and Recommendations.* Canadian Strategy for Cancer Control; May 2005.
[162] Canadian Cancer Society. *Mandatory labeling of cosmetics in Canada.* Available at http://www.cancer.ca/ccs/internet/standard/0,3182,3172_1359949023_langId-en,00.html. Accessed on November 8, 2006.
[163] National Committee on Environmental and Occupational Exposures. *Prevention of Occupational and Environmental Cancers in Canada: A Best Practices Review and Recommendations.* Canadian Strategy for Cancer Control; May 2005.
[164] Toronto Public Health. *Healthy People Healthy Environment. Access to Environmental Information.* Toronto; Toronto Public Health; 2007. Available at: http://www.toronto.ca/health/hphe/enviro_info.htm.
[165] PollutionWatch. *Shattering the Myth of Pollution Progress in Canada: A National Report*. Toronto: Environmental Defence, Canadian Environmental Law Association: 2004. Available at: www.pollutionwatch.org.
[166] Toronto Public Health. Healthy People Healthy Environment. Access to Environmental Information. Accessed at: http://www.toronto.ca/health/hphe/enviro_info.htm. Accessed July 6, 2007.
[167] National Committee on Environmental and Occupational Exposures. *Prevention of Occupational and Environmental Cancers in Canada: A Best Practices Review and Recommendations.* Canadian Strategy for Cancer Control; May 2005.
[168] Ibid.
[169] PollutionWatch. *PollutionWatch Fact Sheet. National Pollution Highlights*. Environmental Defence and the Canadian Environmental Law Association; 2003. Available at: pollutionwatch@cela.ca

[170]CTV.ca. *Politicians found to carry toxic chemical soup.* Jan 3, 2007. Available at: http://www.ctv.ca/servlet/ArticleNews/story/CTVNews/20070103/toxic_politicians_070103/20070103/ .
[171] NAPS. *NAPS Network Summary*. Environment Canada: 2001. Available at: http://www.etc-cte.ec.gc.ca/NAPS/naps_summary_e.html
[172] National Committee on Environmental and Occupational Exposures. *Prevention of Occupational and Environmental Cancers in Canada: A Best Practices Review and Recommendations.* Canadian Strategy for Cancer Control; May 2005.
[173] House of Commons Canada. Standing Committee on Environment and Sustainable Development. Envi. 8, 1st Session, 39th Parliament. June 12, 2006.
[174] National Committee on Environmental and Occupational Exposures. *Prevention of Occupational and Environmental Cancers in Canada: A Best Practices Review and Recommendations.* Canadian Strategy for Cancer Control; May 2005.
[175] Pollutionwatch. *Reforming the Canadian Environmental Protection Act.* Submission to the Parliamentary Review of CEPA, 1999. Environmental Defence, Canadian Environmental Law Association; 2006.
[176] Ibid.
[177] Canadian Cancer Society, Cancer Care Ontario and the Canadian Strategy for Cancer Control. *Proceedings of the Environmental Carcinogen Use Reduction Symposium*. Toronto; February 6, 2007.
[178] Ibid.
[179] Thorpe B, Rossi M. *The Louisville Charter. Background Paper for Reform no.1 of the Louisville Charter for Safer Chemicals*. August 2005. Available at http://www.louisvillecharter.org/
[180] National Committee on Environmental and Occupational Exposures. *Prevention of Occupational and Environmental Cancers in Canada: A Best Practices Review and Recommendations.* Canadian Strategy for Cancer Control; May 2005.
[181] Thorpe B, Rossi M. *The Louisville Charter. Background Paper for Reform no.1 of the Louisville Charter for Safer Chemicals*. August 2005. Available at http://www.louisvillecharter.org/
[182] Canadian Cancer Society, Cancer Care Ontario and the Canadian Strategy for Cancer Control. *Proceedings of the Environmental Carcinogen Use Reduction Symposium*. Toronto; February 6, 2007.
[183] Ibid.
[184] Pollutionwatch. *Reforming the Canadian Environmental Protection Act.* Submission to the Parliamentary Review of CEPA, 1999. Environmental Defence, Canadian Environmental Law Association; 2006.
[185] Government of Canada. *News Release. Canada's New Government Improves Protection Against Hazardous Chemicals*. *www.gc.ca.*
[186] United States Environmental Protection Act. *America's Children and the Environment. Measures of Contaminants, Body Burdens and Illnesses*. Environmental Protection Agency: 2003. Accessed at: http://www.epa.gov/envirohealth/children/
[187] Agha M, DiMonte B, Greenberg M, Greenberg C, Barr R, and McLaughlin JR. *Incidence trends and projections for childhood cancer in Ontario*. International Journal of Cancer.2006; Jun 1; 118 (11): 2809-15.
[188] National Committee on Environmental and Occupational Exposures. *Prevention of Occupational and Environmental Cancers in Canada: A Best Practices Review and Recommendations.* Canadian Strategy for Cancer Control; May 2005.
[189] Cluskey W, Reed J, Affleck J, Barrett F et al. *Managing the Risks of Toxic Substances: Obstacles to Progress*. Report of the Commissioner of the Environment and Sustainable Development. Accessed at http://www.oag-bvg.gc.ca/domino/reports.nsf/html/c904ce.html.
[190] Ibid.
[191] Government of Canada. *The Canadian Environmental Protection Act, 1999 (CEPA 1999). CEPA 1999 at a glance. What it is, what it does, how it works*. Her Majesty the Queen in Right of Canada; 2005.