Best Practices Review:
Primary Prevention of Exposures to Occupational and Environmental Carcinogens

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EXECUTIVE SUMMARY

The purpose of this report is to describe best practices in the primary prevention of exposures to occupational and environmental carcinogens in Canada, and to compare them with initiatives in the United States and Europe.

Best practices include: the identification and surveillance of hazards and exposed populations; the transmission of information through labeling and disclosure laws; education of the public, workers and communities; the reduction of exposures to carcinogens through substitution or process changes; and, legislation and regulation that contribute to cancer prevention.

Surveillance

Surveillance is the ongoing or systematic collection of data for the purposes of preventing disease. The surveillance of diagnosed cancer cases is important to identify new carcinogens and to find occupational and environmental cancers that were not previously recognized. However, because of the long latency period for cancer, these studies reflect exposures of twenty to forty years ago.

In contrast, the surveillance of carcinogens or hazard surveillance offers an opportunity to intervene to prevent cancer. It collects information on carcinogens and who is currently exposed to them. This information can be collected in registries or databases that track workers or communities and document their exposures to carcinogens.

In Canada, the best ongoing surveillance program of this kind is the National Dose Registry which monitors workers' exposure to a known carcinogen, ionizing radiation. In Europe, Finland has a registry, the ASA, that documents workers' exposures to carcinogens. The intention of these registries is to identify high levels of exposure and take action to reduce them.

In the European Union, the Finnish Institute for Occupational Health developed the International Information System on Occupational Exposure to Carcinogens (CAREX) to estimate the burden of occupational cancer. Studies to estimate occupational cancers in Ontario and British Columbia, using this system, are underway.

Environmental databases – such as the Northern Contaminants Program and the Alberta Community Exposure and Health Effects Assessment Program – also provide information on health indicators and environmental carcinogens that can be used to understand environmental threats and exposures.

Examples of best surveillance practices in the United States and Europe – SENSOR, THOR, and the Centers for Diseases Control biomonitoring studies -- are not focused on cancer, but have been selected to show the possibilities of monitoring and reporting that can be used to identify emerging problems. These programs for reporting illnesses provide models that could be adapted to focus on or include cancer. In the case of national biomonitoring studies, this research can indicate trends in chemical exposures over time.

Right to Know and Labeling

Information disclosure laws give the public access to information held by government and industry. They make it possible to identify substances that may cause cancer by providing information in safety data sheets, labeling hazards in workplaces and in consumer products, the labeling of ingredients in products, and the disclosure of specific monitoring results of drinking water or industrial releases.

A number of laws, incorporating right to know provisions, have been developed over the last 20 years. The United States -- both federal and state governments -- has been in the forefront of developing this kind of legislation. In Canada, right to know laws generally mirror American legislation, but are more limited in their scope.

In Canada the two most important information disclosure provisions are both federally mandated -- the Workplace Hazardous Materials Information System and the National Pollutant Release Inventory.

In the workplace, the Workplace Hazardous Materials Information System, known as WHMIS, guarantees workers the right to information about hazardous substances that they are exposed to, including information indicating whether a substance can cause cancer. It is a system of integrated provincial and federal laws that requires disclosure of hazard information to workers through labeling requirements, in material safety data sheets and through training programs.

Under the Canadian Environmental Protection Act, the federal government has established the National Pollutant Release Inventory (NPRI), a national inventory of chemicals released by companies to land, air and water. The inventory provides information on the releases and transfers of 268 key pollutants, including many known or suspected carcinogens. It is the only national, legislated and publicly accessible inventory.

Although provincial laws do require companies or employers to monitor workplace air, as well as their discharges to outside air and water, that information is not generally made public. An exception is information on drinking water testing. In Ontario, and everywhere in the United States, safe drinking

water laws entitle citizens to know which chemicals have been found in their drinking water.

In the United States, the most important federal information disclosure law is the Emergency Planning and Community Right to Know Act (EPCRA). This Act ensures that firefighters and communities know what hazardous materials are used and stored in facilities near them. Although the National Pollutant Release Inventory is the best practice in Canada, the American version, the Toxics Release Inventory, part of EPCRA, is more comprehensive and allows more access to information.

As well, the United States has the Fair Packaging and Labeling Act, an act that requires the listing of ingredients in personal care products and other consumer goods. This means that chemical ingredients, including carcinogens, that are used in these products are disclosed on the label.

States, such as California and New Jersey, have legislated expanded rights to information. California's Proposition 65 is the most directly relevant to primary cancer prevention. This legislation requires the identification of cancer-causing chemicals in drinking water and in all products available in the state through explicit warnings.

Another way to approach primary cancer prevention is to seek out labeling that identifies products that are free of hazardous chemicals, including carcinogens. This is a much more popular and widespread practice in Europe than in the United States or Canada.

Community Education and Action

Community groups, environmental organizations and committed groups of cancer survivors, particularly organizations of women affected by breast cancer, all across Canada have initiated their own public education and action campaigns around "everyday carcinogens" – carcinogens found in food, automobile exhaust, schools, air, water, and products such as cosmetics and household cleaners.

Often working on shoestring budgets with volunteer labour, they have been successful in raising public awareness of the link between exposures to environmental carcinogens and possible health effects, and they have helped the public recognize carcinogens and reduce their personal exposures to them. These educational efforts and action campaigns illustrate the best practices of community based groups in Canada to minimize the public's exposures to carcinogens.

In their educational efforts, groups such as the Labour Environmental Alliance Society, the Environmental Association of Nova Scotia, the Canadian Coalition

for Green Health Care and the Saunders-Matthey Cancer Prevention Coalition, publish reports and brochures, and maintain websites.

These groups also conduct seminars, conferences and workshops. And, many of them, like the Toronto Cancer Prevention Coalition and Reach for Unbleached, strive to influence government decisions to restrict or remove carcinogens from the environment and the workplace.

The most effective action in Canada, however, has been the cumulative success of many local campaigns in cities and towns across the country to ban or phase out the "cosmetic" use of pesticides.

In persuading municipalities to adopt bylaws restricting pesticide use, effective public education has translated into effective action. The coalitions promoting the pesticide bylaws have received broad support not only from labour and environmental groups but also from physicians' groups, women's and children's health groups, and the Canadian Cancer Society. Although some communities in other parts of the world have restricted pesticides, the momentum behind this movement is unique to Canada.

In both Europe and the United States the most effective environmental groups and community organizations have similarly focused their efforts on raising public awareness and the relationship between environmental carcinogens and cancer.

U.S. groups like The Breast Cancer Fund have carried on high-profile campaigns lobbying for protective legislation in places like California and Massachusetts. In Europe, groups such as Greenpeace and Friends of the Earth have done their own monitoring of carcinogens and other toxins as a way to prove the need for stronger chemicals regulation.

At the same time that they are mounting legislative campaigns and raising public awareness, these groups have also enlisted the public in consumer campaigns aimed at retailers.

Worker Education and Action

Union and workers' concerns over lung cancer, mesothelioma, and other work-related diseases led to the introduction of health and safety laws everywhere in Canada in the late 1970s. These laws gave them the right to know about workplace dangers, the right to participate in decisions affecting health and safety and the right to refuse unsafe work.

In the 1990s, disturbed by the unacceptable toll cancer was still taking on their friends and co-workers, unions initiated cancer prevention campaigns. They were successful in reducing or eliminating exposures to many carcinogens by

working with employers through joint health and safety committees and through collective bargaining.

There have been many health and safety activists and unions striving to remove carcinogens from the workplace --the Canadian Auto Workers, the United Steelworkers of America, the Communications, Energy and Paperworkers that represent workers in the chemical industry, as well as a broad range of public sector and service sector unions such as Public Service Alliance of Canada, Canadian Union of Public Employees, and United Food and Commercial Workers.

They started with intensive education programs and the development of strategies for carcinogens, followed up by action in the workplace. These campaigns targeted at reducing or eliminating exposures to carcinogens are examples of best practices in the workplace. The educational campaigns included workshops and training conducted by unions. They have used the information available to them through Material Safety Data Sheets to identify carcinogens in their workplaces and to use their influence to get rid of them.

Unions and health and safety activists are also using provisions in health and safety laws to reduce their exposures and to promote substitution by working with employers to replace one substance with a less hazardous one, to make process modifications, or through process substitution.

In the big automaking plants, unions and the companies have agreed to reduce exposures to metalworking fluids by replacing them with canola oils and creating their own acceptable levels of exposure. Through collective agreements several carcinogens including asbestos and vinyl chloride have been banned from these workplaces. Other workplaces have replaced solvents with water to clean metal parts. Less hazardous paints have been substituted for paints with heavy solvents at Canada Safeway after workers became ill. Unions representing mineworkers have made progress in reducing diesel exhaust emissions underground, and in substituting grease for lubricating oil in underground equipment. Workers in western Canada have been educated about cleaning products and they have switched to safer products in long-term care facilities, processing plants, hotels, restaurants, offices and schools.

In Europe, workers face the same issues and are similarly looking for substitutes to carcinogens in their workplaces. However, the Directives of the European Union and national occupational health and safety legislation, that promote substitution for carcinogens in the workplace, facilitate this.

Non-Governmental Organizations' Work in Cancer Prevention

Organizations such as the Workers' Health and Safety Clinics and the Canadian Cancer Society have taken up the challenge of preventing cancer. Because of

their front-line relationship with people who have been diagnosed with cancer, they are not only helping people with cancer but they are also trying to prevent the exposures that might have caused their disease.

The occupational health clinics offer inquiry services, medical diagnoses by doctors trained in occupational medicine, group services for workplace health and safety committees, and conduct research on occupational illness and injury. In addition to helping workers determine whether their cancer has been caused by their exposure at work, they play an active role in visiting workplaces and intervening to prevent more exposures.

The Canadian Cancer Society has publicly supported the use of the precautionary principle, and been active in the campaign to ban the ornamental use of pesticides on lawns and gardens. They have also called for the discontinuation of the use of pressure-treated lumber for domestic and recreational structures such as decks and playgrounds, and promoted the reduction of other exposures to environmental and occupational carcinogens.

Industry Reductions of Carcinogens

Many Canadian companies have eliminated or made significant reductions in the levels of carcinogens they release to the environment or in the workplace, as a result of government regulation or through pollution prevention programs.

Although government regulations are the most effective means of implementing environmental improvements, the federal government and many provincial governments have chosen to emphasize voluntary pollution prevention programs. Pollution prevention is defined as processes or practices that avoid or minimize the creation of pollutants and reduce the overall risk to human health and the environment.

Even though pollution prevention strategies have resulted in concrete reductions of carcinogens, they benefit workers and communities where they are applied, and penalize them where they are not.

The public interest in safer products has also stimulated some companies to create products such as heat-treated wood and industrial cleaners that eliminate the use of carcinogens or other toxins.

Companies that have instituted pollution prevention programs, that are considered to be examples of best practices, include:

- Novopharm, a pharmaceutical manufacturing company in Scarborough, modified their manufacturing process, switching from a solvent-based pill coating process using methylene chloride to an aqueous-based process.

- Interface, the world's largest flooring company, adopted an objective worldwide of committing the company to zero emissions to air and water. In Belleville, where it manufactures nylon carpet tiles, it changed its manufacturing processes and eliminated the need for dyes that were the products of heavy metals.
- The Campbell River Gold Mine, in northwestern Ontario near Red Lake, prior to 1992 operated a roaster to separate the gold from the ore, releasing high levels of arsenic into the air. They replaced the roaster with an autoclave that resulted in the company reducing its discharges of arsenic into the air and water by 99 per cent.
- Alcan in Quebec introduced a new low-level PAH coal tar pitch for its Soderberg plants. The new coal tar pitch reduced PAH levels inside their Quebec plants by 30 to 70 per cent and reduced emissions to the outside by 35 to 50 per cent.
- The Ottawa Hospital stopped incinerating their biomedical waste, replacing it with a hydroclave system that is considered the best environmental technology for the decontamination and reduction of biomedical waste.
- The Carriage Trade Cleaning Centre was one of the first large cleaning plants in Canada to convert completely from using perchloroethylene for dry cleaning to wet cleaning.

However, for the most significant examples of best practices in primary cancer prevention – initiatives that have a broader impact on industry, it is necessary to look beyond Canada.

In the United States, the Massachusetts Toxics Use Reduction Act has led to dramatic reductions in the use, emissions and disposal of toxic chemicals throughout the state of Massachusetts. It has led the way in reducing the use of toxic chemicals through the introduction of mandatory pollution prevention planning.

The Massachusetts experience also demonstrates the importance of technical advice and support programs in helping industries make those reductions. There are only two programs in Canada that offer this kind of help.

In Sweden, the principle of substitution has become a working and workable strategy and an example of best practice that is an integral part of all industrial and commercial activity. It has been practiced by companies operating in that country for many years, and now the European Union has incorporated the principle of substitution into several important pieces of legislation.

Moreover, Europe has recently introduced legislation that makes industry responsible not only for the way in which they manufacture products but for taking the products back at the end of their useful life. Complementary legislation also restricts the electric and electronics industry from using certain toxic chemicals in the manufacturing process.

Legislation and Regulation

Legislation and regulation can be powerful tools for reducing or eliminating carcinogens. Where they have been introduced, they have been effective in reducing carcinogens in the workplace, eliminating their use in products and limiting their dispersal into the environment.

There are only two occupational health and safety legislation statutes in Canada that have explicit provisions for substitution -- the federal Labour Code and British Columbia's Workers Compensation Act. The substitution provisions in these Acts is a direct way in which workers, unions and companies are able to work towards the use of less harmful alternatives in the workplace. These two occupational health and safety laws represent the best practices in Canada because of their potential application to the reduction or elimination of carcinogens.

In the environmental field, the Canadian Environmental Protection Act and its regime for managing toxic chemicals is the most effective legislative tool in Canada for controlling carcinogens in the environment, and another example of a best practice. Once a substance is declared toxic, the federal government has a range of control options available to them. Options include controlling chemicals through mandatory pollution prevention plans or by regulation. Although very few carcinogens have been regulated, regulations have reduced releases to the environment and, in some cases, almost eliminated them from designated sources. Dioxins and furans, for example, have been almost completely eliminated from the effluent of pulp and paper mills.

Even municipalities can use their powers to control carcinogens, if there is a willingness to act. The City of Toronto has used its Sewer Use By-law to require toxics use reduction planning, modeled after Massachusetts' Toxics Use Reduction Act. As a result of this bylaw, for example, cadmium releases to the sewage treatment plant from metalfinishing companies have been reduced. This is another example of a regulatory best practice – in this case, at a municipal level.

In Europe, the Nordic countries, Sweden and Denmark in particular, have led the way in their efforts to eliminate carcinogens. They have been the most aggressive in instituting bans or restrictions, and influencing the European Union to follow their lead. The Swedish government has adopted a policy objective of achieving a non-toxic environment by 2020, and this has stimulated many innovative programs aimed at eliminating hazardous chemicals.

The most important new legislative development in chemicals management is the regulation proposed by the European Union, known as REACH -- the Registration, Evaluation and Authorisation of Chemicals. Europe is the largest

producer of chemicals in the world and its desire to reform the way in which chemicals are introduced and managed in our society will have a far-reaching effect on future chemicals policy.

1. Introduction

The purpose of this report is to describe best practices in the primary prevention of occupational and environmental exposures to cancer-causing agents in Canada. Primary prevention means identifying carcinogens, and reducing or eliminating exposures to them, as a way of stopping cancer before it can start.

This report examines the strategies and activities -- considered to be best practices -- that have been used by governments, industry, university researchers, labour, community and environmental groups to reduce or eliminate exposures to carcinogens. The criteria, established by the National Committee on Environmental and Occupational Exposures, for best practices include:

- the identification and effective surveillance of hazards and exposed populations;
- the transmission of information through right to know legislation and labeling;
- measurable reductions of exposures to carcinogens through substitutions or process changes;
- education of the public, communities and workers about the presence of carcinogens and how to prevent exposures;
- the reduction of exposures to carcinogens through substitution or process changes, and,
- the successful application of legislation and regulatory initiatives, including bans and restrictions of carcinogens.

Examples of best practices from other jurisdictions – the United States and Europe – are described in order to provide a basis for comparison with Canadian activities and to suggest other possible models for cancer prevention initiatives. In surveying best practices in primary cancer prevention, the gaps and barriers to the effectiveness of primary prevention programs in Canada are also identified.

Although it was not possible in a short time period to ensure that every practice in Canada, the United States and Europe was surveyed, this report highlights those examples that meet the criteria of best practices in primary cancer prevention activities that are the most well-known and that are generally regarded as the most effective.

This report was compiled through extensive research on the internet and through more than 100 key informant interviews with experts and people knowledgeable and experienced in these fields in Canada, the United States and Europe. These interviews were conducted either by telephone, through email correspondence, or in person. The report also benefited from the guidance and expertise of the members of the National Committee on Environmental and Occupational

Exposures, who recommended the criteria and helped to formulate what constitutes best practices in primary cancer prevention.

Cancer[1] itself is a largely preventable group of diseases that continues to affect more and more people throughout the world. Cancer research and cancer programs during the past thirty years have been dominated by the debate over specific causes. Despite this discussion, there is not yet an established consensus within the scientific community regarding the degree of cancer risk posed by different factors such as lifestyle, genetic susceptibility, viruses, reproductive factors and occupational and environmental exposures.

However, regardless of the degree of risk represented by the different causes, there is agreement that occupational and environmental exposures are a part of the overall cancer burden. Moreover, even a small elevated cancer risk extending over a large population can account for a significant number of people being exposed to a preventable risk.

It is the assumption of The National Committee on Environmental and Occupational Exposures that, whatever the particular contribution of occupational and environmental exposures to the number of cancer cases in our society, it nevertheless represents a significant, and in some cases avoidable, risk for the affected population. The aim of primary cancer prevention in this context, then, is to reduce exposures and the risk of harm by eliminating or reducing carcinogens from the workplace and the environment, where it is possible.

This report also assumes that overall the best practice is a precautionary one – that "when an activity raises threats of harm to human health or the environment, precautionary measures should be taken even if some cause and effect relationships are not fully established scientifically"[2]. Any known, probable or even possible carcinogen is assumed to raise the possibility of harm.

2. Surveillance

Introduction

Surveillance refers to the ongoing or systematic collection, evaluation and dissemination of data, in this case related to cancer[3]. The purpose of collecting this data is to identify those at risk of getting cancer, the carcinogens[4] to which they are exposed, and to reduce their risk of developing and dying from cancer.

Various chemicals and compounds have been evaluated for their ability to cause cancer by the International Agency for Research on Cancer (IARC), part of the World Health Organization. These chemicals and compounds are classified into different groups: those that are known to cause cancer in humans (Group 1), those that probably cause cancer in humans (Group 2A) and those that possibly cause cancer in humans (Group 2B)[5]. IARC, and the United States National Toxicology Program[6], both publish lists of chemicals and compounds that are carcinogenic. These two programs set the international standard for the identification of carcinogens, those substances that are known to cause cancer. In this report, all substances identified as carcinogens are listed either under IARC Group 1 or Group 2A (Appendix I).

As authoritative as they are, however, these lists do not cover all chemicals. Of the thousands of chemicals either naturally occurring or in commercial use, we do not have sufficient knowledge about the potential hazards of these chemicals. The U.S. National Institute for Occupational Safety and Health estimates that less than 2 per cent of the chemicals in commerce have been tested for carcinogenicity[7].

Moreover, chemicals are continually being added or moved from list to list, as our understanding of their carcinogenicity improves. Most recently IARC added formaldehyde to its list of known human carcinogens[8], and in its last report, the National Toxicology Program added wood dust, nickel compounds, beryllium and oral contraceptives, among others[9]. Beryllium, which had previously been identified as "reasonably anticipated to be a human carcinogen, was confirmed as a "known" carcinogen. Identifying the substances that cause cancer is critical to knowing which ones should be priorities for cancer prevention.

Overview

There are two different ways of approaching surveillance – there is 1) the surveillance of cancer, and 2) the surveillance of carcinogens that pose a risk of developing cancer.

The surveillance of cancer counts the diagnosed cases of cancer and looks at what agents in the workplace or the environment might have caused them. The surveillance of carcinogens looks at carcinogens, identifies who is exposed to them, and offers opportunities for intervention. The surveillance of carcinogens can also be referred to as "hazard surveillance".

The Surveillance of Cancer

From the cancer statistics collected by provincial and territorial cancer agencies, we know how many people get cancer in Canada every year, how many people die from it and where it occurs[10]. These statistics are based on information such as hospitalizations and pathology reports, collected by provincial cancer agencies[11]. They are used by Health Canada, the Canadian Cancer Society and other agencies to monitor cancer incidence, and to study cancer patterns and trends.

This information tells us, for example, that the number of new cancer cases is rising across Canada and that in the next twenty years, the total number of cancer cases will increase by 60 per cent[12].

However, even though we know the number of cancers, there is very little precise information that links the incidence of cancer in Canada to its causes.

In May 2000, a report for Health Canada prepared by the Working Group on Environmental and Occupational Health Surveillance looked at the needs and opportunities for improving surveillance in Canada. Their report, "Strengthening Environmental and Occupational Health Surveillance in Canada", found environmental and occupational health surveillance lagged behind that of other health and safety domains and that there were "many significant gaps and shortcomings that call for substantial investment".[13]

Information on occupational or environmental exposures of people who develop cancers – work or residential histories -- is rarely systematically collected and usually only for special studies.

The one national database in Canada of confirmed occupational cancers is kept by the Association of Workers' Compensation Boards of Canada[14] in the "Canadian Work Injuries and Diseases Databases". This data represents workers who have contracted cancer as a result of exposures to carcinogens in their workplaces, who have filed successful claims and been compensated. It is obtained from the compensation boards of each of the provinces.

Although this database has some information on workplace cancers, it is recognized as "the tip of the iceberg"[15]. It underestimates the number of occupational cancers in Canada for many reasons. For example, even for

mesothelioma, a cancer that is known to be caused by working with asbestos, less than half the diagnosed cases in the British Columbia Cancer Registry were compensated because no claim for compensation was submitted[16]. People who contract cancer in the workplace and their physicians who are responsible for filing their claims may not know that their workplace exposure caused the disease. Cancer may be diagnosed many years later, often when they are retired, and they do not make the link between their exposure at work and the development of cancer. In addition, workers and their physicians may not realize that a work-related cancer, even though it occurred many years after employment ended, is still entitled to compensation. Moreover, provincial compensation boards have different criteria that they apply to different occupational groups for which cancers they will compensate.

To fill the gaps that exist with respect to understanding what causes cancer and who is exposed, government and university-based researchers have used epidemiological studies to link occupational and environmental exposures with cancer.

The British Columbia Cancer Agency's Cancer Control Research Program, for example, conducted many studies into the links between cancer incidence and workplace and environmental exposures to carcinogens. The objective of their research was to lower the rate of cancer incidence and deaths in British Columbia by making the data available to workers, employers and researchers as part of the collaborative effort to reduce disease. This work is critical to identifying new carcinogens and occupational and environmental cancers that were not previously recognized.

Surveillance programs differ from other forms of epidemiologic research in that they are not targeted to examine the risk of cancer associated with specific suspected carcinogens. Instead they use less detailed information to see if there are unusual patterns of cancer associated with a wide variety of substances or groups, such as people employed in different industries, that might have exposures that differ from those in the general population.

For example, the B.C. Cancer Agency also had a comprehensive research program, funded by the Workers' Compensation Board of British Columbia, that identified occupational risk factors and potential carcinogens in the workplace. British Columbia, unlike most other provinces, kept death certificates with coded occupation and industry data, and the B.C. Cancer Agency was able to do large occupational mortality studies identifying elevated risks of cancer and other diseases associated with specific occupations for the period from 1950 to 1995[17]. Welders, for example, were found to have an excess risk of lung cancer.

Because cancer registries in Canada do not collect information on occupation or work histories, they took these histories themselves from cancer patients.

Through self-administered questionnaires, information was collected on occupational history and other suspected risk factors. In one study of women with breast cancer, they found certain occupations had higher rates of breast cancer, particularly ones that involved exposure to solvents and pesticides[18]. They also looked at prostate cancer, brain cancer, ovarian cancer, skin cancer and non-Hodgkins lymphoma.

In Ontario, the Windsor Occupational Health Clinic for Ontario Workers, in collaboration with the Windsor Regional Cancer Care Centre, also tried to link occupational exposures with the incidence of cancer by asking newly-diagnosed cancer patients about their work histories. In their study, called CROME (Computerized Recording of Occupations Made Easy), they obtained occupational information through personal interviews and by asking patients to record the information on a computer. Their study found evidence of an association between farming and breast cancer risk.[19]

On the environmental side, there have also been efforts by the federal government and university researchers to study the links between environmental carcinogens and cancer.

A national database was established to look at environmental links with cancer. This database, the National Enhanced Cancer Surveillance System, is maintained by Health Canada[20]. Up until 1997, it collected data from provincial cancer registries on newly diagnosed cancer cases. Using a questionnaire, 20,000 people provided information on their smoking histories, occupations, residential histories and oral contraceptive use. Another database was also created – the Environmental Quality Database – which collected publicly available information on air and water pollution. These two databases together have the potential to allow for detailed evaluation of air and water quality concerns in relation to a range of cancer types and to provide information to local public health officials advising them of hot spots. The usefulness of the Enhanced Cancer Surveillance System is limited, however, since Health Canada is no longer collecting information.

In some cases, epidemiological studies have been very useful for reducing exposures to carcinogens. A Canadian study of chlorinated drinking water showed that the risk of bladder cancer increased with both the duration and concentration of exposure to trihalomethanes [21]. Trihalomethanes are the byproducts of chlorine, which form when chlorine is added to drinking water to kill bacteria.

In the United States, this study, and others with similar findings, contributed to lowering the standard for trihalomethanes in drinking water -- from 100 micrograms per litre to 80[22]. The Canadian government is also considering lowering its guideline.

In addition to identifying new carcinogens and occupational and environmental cancers that were not previously recognized, cancer surveillance can be used to inform public policy, to set exposure limits and to improve the success of compensation claims. However, because of the long latency period for cancer, these studies reflect exposures of twenty to forty years ago.

Surveillance of Carcinogens or Hazard Surveillance

In contrast, the surveillance[23] of carcinogens or hazard surveillance offers an opportunity to intervene to prevent cancer. The surveillance of carcinogens collects information on carcinogens and who is currently exposed to them. This information can be collected in registries or databases that track workers or communities, and document their exposures to carcinogens.

In Canada, the best ongoing hazard surveillance program is the National Dose Registry which monitors workers' exposure to a known carcinogen, ionizing radiation. In Europe, Finland has a registry that documents workers' exposures to carcinogens. It was established to try and prevent the incidence of workplace cancers.

In the European Union, the International Information System on Occupational Exposure to Carcinogens (CAREX) was developed by the Finnish Institute of Occupational Health as part of a European project to estimate the burden of occupational cancer[24]. It estimates the number of people with potential occupational exposure to all IARC Group 1 and 2A, selected 2B carcinogens and ionizing radiation.

The other examples of best surveillance practices that have been conducted in Canada, the United States and Europe are not focused on cancer, but have been selected to show the possibilities of monitoring and reporting that can be used to identify emerging problems. These programs for reporting illnesses provide models that could be adapted to focus on or include cancer. In the case of national biomonitoring studies, this research can indicate trends in chemical exposures over time.

Best practices in Surveillance in Canada

An alternative approach to surveying cases of cancer is to survey carcinogens and exposures to them. By measuring exposures to carcinogens in a workplace or in the environment, it is possible to intervene to reduce or eliminate exposures. Best practices in surveillance, then, would be practices that offer the most opportunity to reduce exposures to carcinogens and prevent cancer.

The criteria for best practices, with respect to environmental and occupational surveillance, are those that:

- identify carcinogens;
- monitor the levels and possible health effects;
- collect exposure information in a central database or registry;
- inform workers or communities of the degree of their exposures; and,
- take action to minimize or eliminate exposures to carcinogens.

Occupational Surveillance of Carcinogens or Hazard Surveillance

If workers are knowingly exposed to carcinogens, then the best practice would be to establish a registry that would track the intensity and the length of time during which they are exposed. In the field of occupational health in Canada, the federal government has established such a registry for workers exposed to ionizing radiation.

The National Dose Registry[25] offers a model for monitoring workers who are exposed to a known carcinogen in the course of their work. The Registry is a centralized radiation dose record system established in 1987, and operated by the Radiation Protection Bureau of Health Canada. It includes radiation doses recorded from dosimeters worn by all workers who are exposed to radiation at levels above the public average.

Workers wear badges, rings, bracelets, earrings and headbands, depending on what part of the body is being exposed to radiation. These dosimeters are given to radiation workers in more than 80 different occupations – including dentists, radiologists, laboratory technicians, uranium miners and nuclear power workers.

The badges are sent for processing to the National Dosimetry Services. The exposure data is kept together with a record that includes personal information (name, sex, birth date, social insurance number, address of employers and job classification), year and period of monitoring, the type of radiation, radiation dose and employer information. The radiation exposures of over 550,000 individuals have been monitored, of which 130,000 of these are currently being monitored and checked for overexposures.

Exposure limits are set by the Canadian Nuclear Safety Commission – 5 year limits, annual limits, pregnancy limits and monthly limits. However, the individual provinces also have set their own exposure limits, with British Columbia and New Brunswick being the lowest at 20 milliseiverts per year.

If a worker is found to have been exposed to radiation above the limits, a report is sent to the Canadian Nuclear Safety Commission (CNSC) who will investigate. In the case of an overexposure, the CNSC instructs the employer to re-assign

the worker to another area of work where they will not be exposed to radiation. Dose histories are also provided to individual workers on request.

The Registry may not provide a perfect record of all radiation exposures because in some cases employers may judge incorrectly that a worker will not be exposed to higher than average radiation exposure. Data from this registry are used in epidemiological studies to determine whether radiation exposures increase cancer risk.

The Ontario government also has a limited Asbestos Workers Registry[26] for workers who are removing or encapsulating asbestos. Information is collected by the Ministry of Labour under the Regulation respecting Asbestos on Construction Projects and in Building and Repair Operations under the Occupational Health and Safety Act. Employers who use their own employees or outside contractors are required to file information for each worker on the kind of asbestos that was handled and the number of days of exposure. After 2000 hours of asbestos exposure (the equivalent of one year's employment), workers are notified of the need to have chest x-rays. However, it is not known how fully employers comply with their obligations to the registry, or whether workers always receive notification when their exposures reach this limit.

Future Plans for Environmental and Occupational Surveillance

In Canada, researchers from Cancer Care Ontario and the University of British Columbia have begun pilot projects to develop a CAREX program funded by the Ontario Workplace Safety and Insurance Board and the B.C. Workers' Compensation Board. The projects will use Canadian, Finnish, and U.S. exposure data, in combination with labour force data from Statistics Canada, to estimate the number of people exposed to workplace carcinogens.

In addition, Health Canada announced plans in May 2004 to establish the National Collaborating Centre for Environmental Health in British Columbia, one of six national centres dedicated to public health[27]. The Centre would look at occupational and environmental health issues related to chemical agents, air and water quality, and would play a role in national health surveillance.

Environmental Surveillance of Carcinogens

On the environmental side, the best practices in surveillance in Canada are limited to a very few surveillance programs that monitor environmental exposures – the Northern Contaminants Program and Alberta's Community Exposure and Health Effects Assessment Program.

The Northern Contaminants Program[28] monitors contaminants in humans and animals in the far North, primarily persistent organochlorines that build up in the food chain. It also includes carcinogens such as cadmium and PCBs. The goal

of this program is to reduce contaminants in fish and animals so that communities in Northern Canada can continue to eat traditionally harvested foods. The data is used by the federal government to regulate persistent organic pollutants and to negotiate restrictions on their use through international agreements.

The Alberta government has the only provincial program that monitors people's exposures to industrial air pollution -- the Alberta Community Exposure and Health Effects Assessment Program[29]. The health department of Alberta has done community assessments on towns such as Grande Prairie and Fort Saskatchewan, generally because of energy or utility board hearings into industrial expansions. The monitoring includes carcinogens such as benzene and arsenic. Using volunteers equipped with personal air monitoring equipment, the health department has studied contaminants to which people in communities are exposed, they have used questionnaires and done urine and blood sampling. Through this program, they have collected baseline data on health and environmental pollutants that could help to identify future problems.

Best Practices in Surveillance in the United States

An important best practice in the United States is the biomonitoring work done by the Centers for Disease Control and Prevention. Their "National Report on Human Exposure to Environmental Chemicals"[30] provides an ongoing assessment of exposure to environmental contaminants. Although some biomonitoring has been done by the Canadian government, no comparable national program has been undertaken yet in Canada.

Biomonitoring uses analyses of blood or urine to identify the toxic chemicals that we carry as a result of our exposure to environmental chemicals. Although the presence of an environmental chemicals in blood or urine does not mean that the chemical causes disease, biomonitoring shows which chemicals get into our bodies and at what concentrations. The data can establish reference ranges to determine people or groups who may have unusually high exposures, and it can indicate trends in chemical exposures over time.[31]

In January 2003, the Centers for Disease Control and Prevention (CDC) published their second "National Report on Human Exposure to Environmental Chemicals". A third report is scheduled for next year. One of the key findings of the CDC's biomonitoring study was that children had levels of chlorpyrifos, a commonly used organophosphate pesticide, that were twice as high as those found in adults.

Another government-initiated surveillance program in the United States is the SENSOR program – the Sentinel Event Notification System for Occupational Risks[32]. Started in 1987, the SENSOR program monitors occupational diseases.

It is run by the National Institute for Occupational Safety and Health (NIOSH) to build its surveillance capacity for occupational illnesses and injury. In collaboration with several state governments, SENSOR documents cases of occupational asthma, silicosis, carpal tunnel syndrome, noise-induced hearing loss and injuries to working teenagers. The reports are based primarily on physicians reporting to the state as well as hospital discharge data and death certificates. SENSOR is also used to survey acute pesticide-related illness and injury in 11 states. The Department of Pesticide Regulation in California, for example, requires that physicians report all pesticide-related illnesses to the State[33]. The SENSOR pesticides program also identifies outbreaks and emerging pesticide problems.

Best Practices in Surveillance in Europe

Finland

In Europe, the best practice in the surveillance of workplace exposure to carcinogens is the ASA[34] in Finland. The ASA is a registry exclusively focused on carcinogens in the workplace. Although it is largely limited to monitoring chemical carcinogens, it is considered a best practice in Europe because it draws the attention of employers and workers to the presence of carcinogenic substances in the workplace. It also provides data on occupational exposures signed by employers for use in future compensation cases. The registration has contributed to the decrease of carcinogenic exposures in the workplace.

Established in 1979, the ASA is a national Register on Employees Exposed to Carcinogens that legally requires employers to report annually on the carcinogens used in their workplaces, the amount used and the names of employees who are exposed to them. The most common exposures were chromium and nickel.

If exposure is uncertain or the levels are low, employees are considered to be exposed if they handle carcinogens during more than 20 work days a year. The reports are sent to the Labour Protection Districts in Finland and forwarded to the Institute of Occupational Health where they are entered into a database.

The notification form is supposed to include the signature of the health and safety representative to ensure that they are aware of the information being provided by the employer[35].

The objective of the ASA is to prevent occupational cancer in Finland. It aims to stimulate prevention by the substitution of carcinogens, improvement of local

ventilation and personal protection. Government inspectors use this registry in order to set priorities for prevention.

Britain

In Britain a reporting scheme known as The Health and Occupation Reporting network, THOR[36], has been set up at the University of Manchester to collect information on occupational injuries and diseases. The importance of the British scheme is its ability to deliver immediate and relevant information on ongoing occupational disease problems.

It encompasses the original clinic-based reporting scheme for respiratory diseases called SWORD, the Surveillance of Work-related and Occupational Respiratory Disease. It also includes six other specialized reporting systems -- dermatological and audiological problems, infectious disease, stress and mental illness, and musculoskeletal problems. It relies on systematic, voluntary and confidential reporting by participating occupational physicians. Although many cases of work-related disease are not captured by THOR and cancer is not a priority, it provides an important database for identifying occupational problems and trends in disease.

A pilot study, Propulse[37] based on the British SWORD system, was set up in Quebec between 1992 and 1993 to identify occupational respiratory disease. All Quebec chest physicians and allergists were asked to report suspected new cases of occupational respiratory disease to the Montreal Health Department. They found cases of occupational disease that were not reported to the Workers' Compensation Board, and concluded that a physician based reporting procedure could be helpful in understanding the occurrence of occupational respiratory disease.

Gaps in Occupational and Environmental Surveillance in Canada

There is limited funding for occupational and environmental research – for either cancer surveillance or carcinogen surveillance. It is estimated that the major funding bodies for cancer research in Canada allocate 90 to 95 per cent of their grants to cure and treatment research, and only 5 to 10 per cent to the identification of causes of cancer and the prevention of exposure to carcinogens.

Provincial cancer treatment centres do not routinely record information about the occupational histories or environmental exposures of cancer patients. Information on environmental and occupational exposures to carcinogens is only collected when specific surveys are done.

The prevention of occupational and environmentally related cancers depends on the dissemination of research findings that result in changes to work processes and reduction of exposures to carcinogens[38]. The B.C. Cancer Control Agency is one of the few organizations in Canada that has conducted systematic analyses of cancers and occupation. Yet, when risks for breast cancer such as solvents are identified, there is no agency directly responsible for identifying or confirming the causes, disseminating the information and developing prevention strategies.

There is a lack of current information on occupational exposure to carcinogens. For example, the former Medical Officer of Health for Toronto reported that "there is no systematically collected publicly available information on current occupational exposure levels to contaminants in Ontario workplaces"[39]. Occupational hygienists working for the Ministry of Labour in Ontario stopped air monitoring of workplaces in 1996. Similarly, the Workers' Compensation Board of British Columbia no longer routinely performs air monitoring in the workplace.

There are also significant gaps in surveillance and a lack of knowledge about carcinogens in the environment.

There is no registry for chemical carcinogens in the workplace in Canada, comparable to the National Dose Registry or the Finnish ASA that collects information on workers' exposures.

3. Right to Know and Labeling

Introduction

Information disclosure laws are laws that give the public access to information held by government and industry. This type of legislation is often referred to as right to know legislation. These laws are important to primary cancer prevention because the information they provide makes it possible to identify substances that may cause cancer.

Where monitoring and surveillance programs, for example, have shown the presence of carcinogens in products, in air, soil, water, waste, or even in human bodies, the intent of information disclosure laws is to ensure that the people who may be at risk are informed. This gives them the opportunity to reduce or eliminate their exposures.

Information disclosure laws require information to be provided in safety data sheets, require labeling, and sometimes warnings, of hazards in consumer products and in workplaces. They can also require the disclosure of ingredients in products, and the disclosure of specific monitoring results of drinking water or industrial releases.

Overview

A number of laws, incorporating right to know provisions, have been developed over the last 20 years. The United States -- both federal and state governments -- has been in the forefront of developing right to know legislation. In Canada right to know laws generally mirror American legislation, but are more limited in their scope.

Although Europe also has legislation that allows for transparency, more importance is attached to legislation or practices that governments or employers take to protect citizens from exposures to carcinogens and other toxic chemicals.

The criteria for best practices with respect to information disclosure are those laws or practices that:

- offer or require the disclosure of information relevant to primary cancer prevention activities;
- give workers and communities the ability to identify carcinogens in the workplace and in the environment;

- in some cases, warn workers, affected communities and the public that carcinogens are present and convey information on possible health effects; and,
- disclose information that can be used to promote the reduction or elimination of carcinogens or exposures to them.

In Canada the two most important information disclosure provisions are both federally mandated -- the Workplace Hazardous Materials Information System (WHMIS) and the National Pollutant Release Inventory.

Although provincial laws do require companies or employers to monitor workplace air, as well as their discharges to outside air and water, that information is not generally made public. For example, regulations for arsenic or benzene under occupational health and safety legislation require that companies do air monitoring. Also, under the terms and conditions of environmental permits, companies are required to take samples to ensure that they meet legislated requirements. However, this kind of occupational and environmental information is held by companies and governments, and is not accessible through most right to know legislation.

An exception is information on drinking water testing. In Ontario, and everywhere in the United States, safe drinking water laws entitle citizens to know which chemicals have been found in their drinking water. This is another example of a best practice with respect to information disclosure in the specific environmental context of drinking water.

In the United States, the most important federal information disclosure law is the Emergency Planning and Community Right to Know Act (EPCRA). This Act, born out of bitter experience, ensures that firefighters and communities know what hazardous materials are used and stored in facilities near them. Although the National Pollutant Release Inventory is the best practice in Canada, the American version, the Toxics Release Inventory, part of EPCRA, is more comprehensive and allows more access to information.

As well, the United States has the Fair Packaging and Labeling Act, an act that requires the listing of ingredients in personal care products and other consumer goods. This means that chemical ingredients, including carcinogens, that are used in these products are disclosed on the label. In contrast, Canada's Cosmetic Regulations under the Food and Drugs Act do not currently require ingredient disclosure, although Health Canada is seeking to amend this[40]. In Europe, no carcinogens are allowed in cosmetics.

States, such as California and New Jersey, have their own legislation with expanded rights to information. California's Proposition 65 is the most directly relevant to primary cancer prevention. This legislation requires the identification of cancer-causing chemicals in drinking water and in all products available in the

state through explicit warnings. This is also, in terms of primary cancer prevention, an example of best practice in information disclosure. The act of identifying carcinogens in products has led manufacturers to reformulate products in order to avoid this labeling.

However, just as there are limits to the information available through surveillance, there are limits to the information available through right to know legislation. This may be due to the unreliable quality of information that has been developed, or because of the difficulty of monitoring the thousands of chemicals present in the environment.

In Europe, many different approaches have been used to discourage the use of toxic chemicals, particularly carcinogens, in the workplace and in products. Both Sweden and Denmark have developed lists of hazardous chemicals that are widely distributed to industry and to the public. They serve as an early warning system that these chemicals are likely to be the targets of future regulation. They are also used to alert professional buyers that products containing these chemicals should be avoided.

Another way to approach primary cancer prevention is to seek out labeling that identifies products that are free of hazardous chemicals, including carcinogens. This is a much more popular and widespread practice in Europe than it is in the United States or Canada.

The so-called 'ecolabeling' screens products to ensure that they do not contain chemicals that are harmful to the environment and human health, including carcinogens. Although this approach does not identify specific ingredients, it gives a general guarantee that these products do not contain chemicals of concern. These labels offer governments, companies and consumers an opportunity to buy carcinogen-free products.

Best Practices in Right to Know in Canada

Workplace

In the workplace, the Workplace Hazardous Materials Information System, known as WHMIS[41], guarantees workers the right to information about hazardous substances to which they are exposed, including information indicating whether a substance can cause cancer.

WHMIS is a system of integrated provincial and federal laws that require disclosure of hazard information to workers handling hazardous products.

The WHMIS legislation ensures that information is available through labeling requirements, in material safety data sheets (MSDSs) and through training programs.

Employers must ensure that controlled products used, stored, handled, or disposed of, in the workplace are properly labeled. They must ensure that Material Safety Data Sheets are made available to workers and that workers receive education and training to ensure the safe storage, handling and use of controlled products. Requirements for Material Safety Data Sheets and for labeling are set out under the federal Hazardous Products Act and the Controlled Products Regulations.

All provincial and territorial agencies responsible for occupational health and safety have established their own WHMIS requirements, consistent with the federal legislation.

Material Safety Data Sheets do not list all ingredients in a product, only those that are considered to be hazardous and make up more than 1 per cent of the product. Ingredients, that are deemed to be particularly hazardous such as carcinogens, are listed if they constitute more than .1 per cent of the product.

Material Safety Data Sheets have helped to inform workers about the risks of many chemicals or products to which they are exposed in the workplace, including carcinogenicity. Proactive employers, joint health and safety committees and unions have used the information in Material Safety Data sheets to develop agreements on the reduction and elimination of carcinogens.

The company health and safety officer in cooperation with workers at Coast Mountain Bus Lines in the Greater Vancouver Area, for example, used material safety data sheets to discover a glue, with which they were painting the floors of their buses, contained toxic solvents such as toluene. It was replaced with a safer, higher quality and more economic substitute[42].

Material Safety Data Sheets, however, do not always accurately identify all hazardous ingredients present in a product. In an audit done by Human Resources Development Canada, three products were investigated and found to have incomplete ingredient disclosures[43]. In the case of one product, the information failed to adequately describe the hazards and the required protective measures.

The Canadian Hazardous Materials Information Review Commission has also reported high levels of non-compliance for Material Safety Data Sheets[44]. The Commission reviews Material Safety Data sheets when companies file a claim for exemption from the requirement to disclose the chemical identity of one or more trade secret hazardous ingredients. In 2003/2004, the Commission reported more than 2000 violations in just 225 claims. There were an average number of

9 violations in each Material Safety Data Sheet. The largest number of errors occurred in the category of toxicological properties that includes violations such as the failure to identify carcinogenicity of a substance or compound.

In the United States, there are similar requirements that ensure workers' rights to know the risks of the hazardous chemicals that they are handling. The Occupational Safety and Health Administration (OSHA) of the U.S. Department of Labor is responsible for implementing and enforcing the OSHA Hazard Communication Standard[45]. This Standard, like WHMIS, requires that employers have on site safety data sheets for each hazardous chemical in the workplace, requires that workers are trained and given information about hazardous chemicals in their work area, and that hazardous chemicals are labeled.

Labeling and classification of hazardous substances is also an important aspect of workers' right to know. Canada has recently introduced improvements to the classification and labeling requirements for hazardous chemicals. In 2003, the federal government revised the Consumer Chemicals and Containers Regulations of the Hazardous Products Act. Under these regulations, a classification system for labeling hazards, including the use of hazard symbols and warning statements, has been adopted. This system emphasizes acute toxicity and requires warning symbols for substances that are toxic, corrosive, quick-skin bonding, flammable or in pressurized containers. However, it does not require labeling for long-term hazards such as carcinogenicity. Nor does it require disclosure of the ingredients contained in a product.

In addition, an international standard for the right to know about chemical hazards has been developed under the auspices of the United Nations, and is now available for worldwide implementation. It is called the Globally Harmonized System for the Classification and Labeling of Chemicals (GHS)[46]. This system is intended to introduce uniform classification of chemicals according to their hazards, and to convey this information through labels and safety data sheets. It covers not only workplace chemicals but also hazardous consumer products, including pesticides.

Environment

The most important federal environmental statute providing access to environmental data is the Canadian Environmental Protection Act 1999 (CEPA). Under this Act, the federal government has established the National Pollutant Release Inventory (NPRI)[47], a national inventory of specific chemicals released by companies to land, air and water.

The inventory provides information on the releases and transfers of 268 key pollutants, including many known or suspected carcinogens, by industries across Canada. It is the only national, legislated and publicly accessible inventory

established in Canada. It requires facilities with more than ten employees to report each year releases of any of the 268 listed substances, which they use in quantities exceeding ten tonnes, and in concentrations exceeding one per cent.

This information is available in an annual public report and through an on-line database. The NPRI includes information on the company, its location, the number of employees, and the nature of the activities carried on by the company. As well, it reveals the quantity of all listed chemicals that are released to water, air or land, injected underground or transferred off site for disposal or recycling. Companies are also required to report the reasons for changes in yearly releases, information on anticipated changes and any pollution prevention activities they have undertaken.

This information is critical for enabling people to identify carcinogens and other toxic substances being released in their communities. The NPRI gives them the concrete data to assess the need for reductions of chemical releases by industries. In Windsor the Citizens' Environment Alliance have published a summary of the releases to their local area, including 41 designated carcinogens, based on this data[48].

According to Environment Canada, the publication of this information motivates companies to reduce their emissions. In addition, it allows the government to monitor pollution trends, set priorities for action and develop regulatory initiatives.

NPRI data is also available through the PollutionWatch[49] website, coordinated by the Canadian Environmental Law Association and Environmental Defence. The environmental groups have made it possible for the public to more readily access information on the carcinogens being released in their communities.

Provincial Initiatives

Ontario Safe Drinking Water Act

In Ontario, as in the United States, citizens have a right to know what chemicals, including certain carcinogens, are in their drinking water[50].

As a result of the seven deaths in Walkerton in May 2000 from exposure to contaminated drinking water, the provincial government enacted the Ontario Safe Drinking Water Act, 2002 and converted drinking water guidelines into legally binding standards. These limits are now captured in the Ontario Drinking-Water Quality Standards Regulation[51].

Ontario's new legislation requires not only that drinking water be tested for specific substances, including many carcinogens, but that this information be available to the public. The list of monitored chemicals includes many known or

suspected carcinogens such as cadmium, arsenic, benzene, and various radionuclides.

Before the new Safe Drinking Water Act, the public could request information on drinking water quality and test results, but there was no obligation on the part of municipalities to release it. Now, water suppliers, primarily municipalities, must make test results available to the public on demand and must prepare an annual report that includes these results. If a drinking water system serves more than 10,000 people, the supplier must post the annual reports on the internet. Unlike the U.S. Safe Drinking Water Act, however, the water supplier does not have to explain the health effects of chemicals that have been found to exceed the drinking water standards.

Best Practices in Right to Know Legislation in the United States

The United States has traditionally led the way for Canada in the development of right to know legislation. The best practices in American federal legislation are the Emergency Planning and Community Right to Know Act, the Fair Packaging and Labeling Act, and the Safe Drinking Water Act.

Their statutes include key provisions that are missing from, or extend beyond the proscribed reach of, Canadian legislation.

The Emergency Planning and Community Right to Know Act

Galvanized by the tragic gas leak at a Union Carbide plant in Bhopal, India, that killed and injured thousands of people, as well as several serious domestic chemical spills, the United States passed the Emergency Planning and Community Right to Know Act (EPCRA)[52] in 1986.

It established 3 major provisions: planning for chemical emergencies, emergency notification of chemical accidents and releases, and reporting of hazardous chemical inventories and toxic chemical releases.

The Act set up state emergency response commissions and local emergency planning committees to develop emergency response plans. Under the Act, companies were required to submit either material safety data sheets or a list of hazardous chemicals used or stored on-site to the emergency response committees and to the local fire department in every town and city in the United States.

Canadian legislation has provisions for emergency planning under the Canadian Environmental Protection Act, but they do not require the same information

disclosure as EPCRA. The "Environmental Emergency Regulations"[53] create a regulated list of more than 100 substances that would cause an environmental emergency if they were released. The location of these substances must be made known to the Minister of Environment, and emergency plans must be drawn up by the companies that use them. However, the Regulations do not oblige these companies to involve communities in the emergency planning, or ensure that this information is conveyed to local police or fire departments. In Canada, firefighters are still dependent on the cooperation of large companies willing to share information with them through voluntary corporate initiatives, such as the Community Awareness Emergency Response plan in Ontario.

Although the focus was initially emergency response, the Emergency Planning and Community Right to Know Act also required facilities using hazardous substances to report their releases. This established the Toxics Release Inventory (TRI)[54] on which Canada's National Pollutant Release Inventory (NPRI) was modeled. It required companies to report to the Environmental Protection Agency annually on the release of 650 designated chemicals into the air, water or land. Although these 650 chemicals are a fraction of the total number of chemicals used and released, the NPRI only requires reporting for 268 chemicals in Canada. And, unlike the TRI, the NPRI does not require reporting on pesticides.

The United States Environmental Protection Agency (EPA) is required to make the information available to the public through a national computerized database accessible through personal computers. In 12 years of reporting – from 1988 to 2000 – releases of listed chemicals dropped by 48 per cent[55], according to the EPA, which regards the Toxics Release Inventory as a cost effective pollution prevention strategy.

The Toxics Release Inventory has also become a powerful tool for U.S. citizens and communities like the Bucket Brigades who are fighting local polluters (See Section 4). An American environmental group, Environmental Defense, operates a program called Scorecard[56]. Scorecard helps citizens find the potential health hazards in their communities by plotting pollution releases on local, state and national maps based on zip codes. It also provides information on the potential health hazards related to these chemicals. Environmental Defense has reported that over 4 billion pounds of toxic chemicals are released each year by industry, including 72 million pounds of recognized carcinogens[57].

Minnesota has expanded the toxic release reporting requirements to include transportation, electric and gas services, hospitals, medical labs, photofinishing labs, colleges and correctional facilities[58].

Safe Drinking Water Act Amendments, 1996

The 1996 amendments to the original Safe Drinking Water Act introduced broader rights to know about contaminants found in drinking water. The Act requires water suppliers to inform their customers when they exceed contaminant levels or fail to monitor drinking water. These contaminants include carcinogens such as arsenic, asbestos, radon, benzene and cadmium.[59] The Safe Drinking Water Act also requires suppliers to mail to every customer an annual "consumer confidence report"[60] describing the levels of each contaminant that has been detected in the drinking water and the health concerns associated with it.

Fair Packaging and Labeling Act

Ingredients in cosmetics[61] are not required to undergo approval before they are offered for sale and some companies use carcinogens in the formulation of their products. However, the Fair Packaging and Labeling Act requires an ingredient declaration on every cosmetic product offered for sale to consumers, in descending order of quantity. This makes it possible for consumers to identify ingredients in cosmetics that may be carcinogenic, even if there is no explicit warning or identification of the ingredient as a carcinogen.

Some carcinogenic substances, such as vinyl chloride, are prohibited or restricted in cosmetics in the United States. However, for other possible carcinogens, some of which are used in hair dyes, the industry associations have only recommended that they not be used. The European Union also requires cosmetic companies to list ingredients on their labels, but no carcinogens are allowed for use in cosmetics in Europe. Health Canada is seeking an amendment to the Cosmetic Regulations that will require disclosure of ingredients on product labels like the U.S. requirements.

California Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65)

The California Safe Drinking Water and Toxic Enforcement Act of 1986, better known as Proposition 65[62], is the only legislation in North America that specifically targets carcinogens for information disclosure. It was created through the ballot initiative process in California, and passed by voters.

The Act requires that the Governor publish a list of all chemicals that are known to cause cancer or reproductive harm. California maintains a list of approximately 600 substances linked to cancer or reproductive toxicity.

Businesses who "knowingly and intentionally" expose individuals to listed substances must provide a "clear and reasonable warning" of the exposure. The duty to warn can be done through labels, in-store signs or toll free information services.

Many businesses have chosen to substitute less toxic chemicals or to modify their practices in order to avoid having to carry a Proposition 65 warning on their products. This has led to the elimination or reduction of carcinogens in numerous consumer products such as ceramics, nail polish removers, lead foil caps on wine bottles, submersible well water pumps, lead-free faucets, calcium supplements and hair dyes.

New Jersey Worker and Community Right to Know Act

In 1983 New Jersey became the first state to pass right to know legislation when it passed the Worker and Community Right to Know Act[63]. The Act says "Individuals have the inherent right to know the full range of the risks they face so that they can make reasoned decisions and take informed action concerning their employment and their living conditions".

It requires more extensive disclosure of toxic releases from industrial facilities than the federal legislation. Employers covered by the Act must complete surveys listing the names and amounts of hazardous chemicals stored and used at their site. Employers are also required to label containers and train their employees about hazardous substances at the workplace.

Best Practices in Right to Know in Europe

In 1995 at the North Sea Conference held by northern European countries to address pollution problems, the Ministers agreed to a declaration that adopted what is now called the "generational goal" – to move towards eliminating chemical substances that threaten human health and the environment within one generation[64]. This generational goal has been an inspiration for many innovative programs in Europe dedicated to reducing or eliminating carcinogens and other toxic substances.

Both Denmark and Sweden have adopted programs to actively eliminate toxic substances[65]. One strategy they have used is to provide information to industries and professional buyers through published lists of hazardous substances.

In Denmark, the list is called the "List of Undesirable Substances"[66]. It contains information on 68 chemicals or chemical groups which are not banned but which should be avoided where possible. The list was widely used by companies and authorities in their procurement policies at the local and national levels. The lists were also intended as an early warning signal to buyers and manufacturers that they should be seeking alternatives to these substances because these chemicals may be the target of future regulatory action.

In Sweden, a similar list called "The Observation List"[67], has now been replaced by PRIO. PRIO[68] is an internet list of chemicals, primarily for businesses and environmental managers, to alert them to chemicals, like carcinogens, whose properties may pose major risks to human health and the environment.

The European Union also has legislation[69] applying to both workplace and consumer uses that requires manufacturers of hazardous products to classify and label products according to the type of hazard they pose. This legislation is known as the Dangerous Substances Directive (Directive 67/548/EEC)[70]. All substances must be classified according to the definition of "dangerous" under the Directive. As well as applying to classifications like "corrosive" or "flammable", "carcinogenicity" is also defined as dangerous. The law specifically requires that products containing ingredients classified as carcinogenic, mutagenic or toxic to reproduction, must carry warning labels if the concentration is .1 per cent or more. Similar requirements exist for chemical preparations (mixtures or solutions composed of two or more substances) under the Dangerous Preparations Directive (Directive 99/45/EC). However, under the Limitations Directive it is prohibited to place substances and preparations on the market for sale to the general public if they are classified as known carcinogens.

Ecolabeling

In Europe, ecolabeling is one strategy used by governments to work towards their goal of a non-toxic environment by 2020. Labels such as "The Swan"[71], which is the official Nordic ecolabel, or the European Union's "Flower"[72] are used to assure consumers that the product has been checked for ecological and performance criteria. These symbols are used for products such as household cleaners, furniture and even hotels.

Denmark has run successful pubic information campaigns to raise the awareness and use of ecolabeled products. Canada, on the other hand, has made only limited efforts to promote environmentally acceptable products.

Products in Canada may contain carcinogenic substances since there are very few rules restricting their use in products. Environment Canada has an Environmental Choice program[73], and products approved by the program cannot be formulated with any proven or probable carcinogens, based on the IARC list.

Canada's Environmental Choice Program, however, is not directed at consumers. It is used primarily by businesses and government agencies to find environmental products when they have made a decision to "green" their procurement programs. The City of Toronto, for instance, has consulted the Environmental Choice program for its recommendations on non-toxic cleaning products[74].

Gaps in Right to Know and Labeling Legislation in Canada

The WHMIS program itself has a number of gaps:

- Although the Material Safety Data Sheets do convey information to workers, the quality of the information is not consistent and not necessarily complete. According to published studies, not all carcinogens are identified even when it is legally required. Furthermore, if carcinogens make up less than .1 per cent of the product, their presence does not have to be disclosed.
- There is no central repository for Material Safety Data Sheets. Nor are there regular audits for the accuracy of information contained in Material Safety Data Sheets.
- There is discussion by Health Canada's WHMIS Current Issues Committee regarding whether the enforcement of WHMIS regulations across Canada[75]is sufficient.
- There are many exemptions from MSDS disclosure requirements, including hazardous wastes, consumer products, pest control products, radioactive materials, tobacco, manufactured articles, and wood products. Recommendations by WHMIS Current Issues Committee to eliminate these exemptions have not been implemented federally[76]. However, at least two provinces, British Columbia and Manitoba, have extended provincial WHMIS requirements to cover hazardous wastes.

Community access to information on chemicals being used or stored in local companies or plants is extremely limited, if it is available at all. The Material Safety Data Sheets that would indicate what chemicals are being used or stored in a plant are not available in Canada to the broader community, as they are in the United States under the Emergency Planning and Community Right to Know Act. Canada's Environmental Emergency Regulations allow for, but do not require, disclosure of information on hazardous chemicals stored or used on company sites to firefighters or the local communities.

The National Pollutant Release Inventory provides only a limited amount of data, and does not require information on the same number or type of chemicals listed under the U.S. Toxics Release Inventory. The Canadian government does not require reporting of all carcinogens used or released by industry under the NPRI.

The NPRI's information requirements only apply to companies releasing large amounts of chemicals. The ten tonne threshold limit enables many industries to avoid reporting releases of carcinogens. Small industries such as dry cleaners or auto body shops that release known carcinogens are not subject to the NPRI reporting requirements.

Canadian Consumer Chemicals and Containers Regulations under the Hazardous Products Act require labeling that indicates a type of hazard and

some ingredient disclosure for consumer products. However, they do not require full disclosure of all potentially harmful ingredients, such as carcinogens. Proposals regarding whether Canada will adopt full disclosure requirements for consumer products, which is an option under the Globally Harmonized System for the Classification and Labeling of Chemicals, are currently being discussed.

Canada's Cosmetic Regulations do not require ingredient disclosure for cosmetics, although Health Canada has proposed amendments that would change this.

There is no approved ecolabeling program for consumers in Canada.

There are monitoring limitations that, in turn, limit the extent of information available to workers and the public. For example, drinking water is tested for only a relatively small number of chemicals for which drinking water standards exist although there are many carcinogens that could be present.

4. Community Education and Action

Introduction

Community groups, environmental organizations and committed groups of cancer survivors, particularly organizations of women affected by breast cancer, all across Canada have initiated their own public education and action campaigns around "everyday carcinogens"[77] – carcinogens found in food, automobile exhaust, schools, water, and products such as cosmetics and household cleaners.

Often working on shoestring budgets with volunteer labour, they have been successful in raising public awareness of the link between exposures to environmental carcinogens and possible health effects, and they have helped the public recognize carcinogens and reduce their personal exposures to them.

These groups generally advocate the precautionary principle in all aspects of daily living – that it is better to avoid activities or substances that pose a threat of harm rather than to wait for definitive scientific proof. They also promote the elimination and substitution of carcinogens in consumer products, and the reduction or elimination of carcinogens from the environment.

Overview

The best practices by community-based groups are those activities that:

- educate the public about the presence of carcinogens in products and in the environment;
- provide information and influence choices that would direct consumers, professional users, retailers and manufacturers away from the sale or use of products containing carcinogens;
- foster cooperation between unions, labour groups, industry, and governments to achieve the reduction or elimination of carcinogens;
- promote lobbying and direct actions, which affect government policies and legislation respecting carcinogens.

The organizations that are discussed in this Section have been chosen as examples of the work being done by hundreds of groups all across Canada to reduce the risks of carcinogens to the environment and to human health. These educational efforts and action campaigns illustrate the best practices in Canada by community based groups to minimize the public's exposure to carcinogens.

In their educational efforts, groups such as the Labour Environmental Alliance Society, the Environmental Association of Nova Scotia, the Canadian Coalition for Green Health Care and the Saunders-Matthey Cancer Prevention Coalition, publish reports and brochures, and maintain websites. These groups also conduct seminars, conferences and workshops. And, many of them, like the Toronto Cancer Prevention Coalition and Reach for Unbleached, strive to influence government decisions to restrict or remove carcinogens from the environment and the workplace.

The most effective action in Canada, however, has been the cumulative success of many local campaigns in cities and towns across the country to ban or phase out the "cosmetic" or "ornamental" use of pesticides.

In persuading municipalities to adopt bylaws restricting pesticide use, effective public education has translated into effective action. The coalitions promoting the pesticide bylaws have received broad support not only from labour and environmental groups but also from physicians' groups, women's and children's health groups, and the Canadian Cancer Society. Although some communities in other parts of the world have restricted pesticides, the momentum behind this movement is unique to Canada.

In both Europe and the United States, the most effective environmental groups and community organizations have similarly focused their efforts on raising public awareness of the relationship between environmental carcinogens and cancer.

In addition, groups like the U.S. Breast Cancer Fund have carried on high-profile campaigns lobbying for protective legislation in places like California and Massachusetts. In Europe, groups such as Greenpeace and Friends of the Earth, are doing their own monitoring of carcinogens and other toxins as a way to prove the need for stronger chemicals regulation.

At the same time that they are mounting legislative campaigns and raising public awareness, these groups have also enlisted the public in consumer campaigns aimed at retailers. These campaigns use pledge cards to pressure retailers to rid products of carcinogens and other toxic substances. In Britain, for example, retailers such as Marks and Spencer and Boots are reviewing the toxicity of the chemicals in their product lines.

Best Practices in community education and action in Canada

Pesticide Bylaws

In 1990, community activists in Hudson, Quebec, persuaded their town council to pass a bylaw restricting the use of cosmetic pesticides on public and private

property. A local doctor was concerned about the health effects of pesticides and the problems she was seeing in her patients. She and her supporters convinced the town council to enact a bylaw that would protect their community.

Bylaw advocates did not claim that these cosmetic pesticides necessarily caused cancer, but they wanted to reduce the possible risks of cancer and other health effects from unnecessary pesticide use.

Their bylaw was challenged in 1992 when two lawn-care companies were charged with violating it. The companies sought a declaration that the bylaw was invalid, but it was upheld in 1993 by the Quebec Superior Court, the Quebec Court of Appeal and in June 2001 by the Supreme Court of Canada[78].

Inspired by the success of Hudson and the confirmation of a municipality's right to enact such a bylaw, community activists across Canada launched grassroots campaigns to pass similar bylaws in other cities and towns. At least 66 municipalities in Canada have now passed pesticide bylaws[79]. The largest cities to adopt bylaws banning or phasing out the cosmetic use of pesticides have been Halifax, followed by Toronto, Montreal and Vancouver.

The impetus to restrict the cosmetic use of pesticides based on their association with cancer was reinforced by a study done by the Ontario College of Family Physicians, and released in April 2004[80].

The study, a comprehensive review of research on the effects of pesticides on human health, showed consistent links to serious illnesses such as cancer, including brain, prostate, kidney and pancreatic cancer. The study strongly recommended that people reduce their exposure to pesticides wherever possible. One of the authors, Dr. Margaret Sanborn from McMaster University, said, "Many of the health problems linked with pesticide use are serious and difficult to treat – so we are advocating reducing exposure to pesticides and prevention of harm as the best approach"[81].

An important supporter of the campaign, the Canadian Cancer Society, gave it credibility by supporting restrictions on the use of cosmetic pesticides, also on the basis of the precautionary principle.

The bylaws vary in scope across the country – from outright bans of pesticides for cosmetic purposes to voluntary measures including public education and social marketing. A study on the impact of bylaws and public education programs found that municipalities that implemented both bylaws and educational programs were more successful in reducing pesticide use (between 51 and 90 per cent) than municipalities that relied only on education and outreach (between 10 and 24 per cent)[82].

The movement to restrict the use of cosmetic pesticides originated in Quebec and spread to many communities throughout the province. From the heavily populated city of Montreal to tiny Sainte-Paule, with a mere 199 people, Hudson-style bylaws became very popular in cities and towns throughout Quebec.

The provincial government of Quebec responded in March of 2003 by tightening controls on all pesticide use in the province[83]. They enacted a new Pesticide Management Code[84] to regulate the storage, sale and use of pesticides in Quebec, setting the highest standard in North America. Using provincial powers to restrict the sales of pesticides contributes to the effectiveness of municipal bylaws that are limited to restricting their use.

As a result of this new legislation in Quebec, it is now prohibited province-wide to use the most harmful pesticides in public, semi-public and municipal green spaces. This prohibition will be extended to private and commercial lawns by 2005. The ban covers 23 pesticide active ingredients that are known or possible carcinogens or endocrine disruptors, including lindane, malathion, MCPA, permethrin, benomyl, captan and 2,4-D.

Loblaws, Canada's largest food distributor, responded to community concerns by phasing out chemical pesticides and offering its customers only organic alternatives at its 440 garden stores[85].

Labour Environmental Alliance Society

The Labour Environmental Alliance Society (LEAS)[86], a national coalition of labour and environmental groups based in Vancouver, British Columbia, combines persuasive public education with action campaigns. Their objective is to reduce the cancer risk by educating school children, workers and the public about products that contain carcinogens.

LEAS has published the CancerSmart Consumer Guide, that looks at some of the most toxic substances used in Canadian homes. They draw attention to carcinogens in common household products that should not be used, such as trichloroethylene in spot cleaners or methylene chloride in paint strippers. The CancerSmart Guide examines pesticides, cleaning products and food, describing the hazards and offering safe alternatives.

LEAS also presents their information at home shows and brings their message into the schools. When LEAS goes into a primary or a secondary school, they work with students and teachers to do a workplace audit. Through the audit, students identify hazardous products used in and around the schools, and propose safer substitutes. The students are also encouraged to do the same type of audit in their homes.

The Environmental Health Association of Nova Scotia

Another educational project that gives people the knowledge to reduce their exposures to carcinogens is the "Guide to Less Toxic Products"[87], produced by the Environmental Health Association of Nova Scotia (formerly the Nova Scotia Allergy and Environmental Health Association)[88]. Since the 1970s, a committed group of activists in the Halifax area have worked to raise the awareness of indoor air pollutants and the links to environmentally induced illness. Cancer is considered to be one of the most serious of the environmental illnesses, and in the "Guide to Less Toxic Products" carcinogens in products are identified. Alternative products are listed as "Best", "Good", "Less Toxic" and "Simply Unscented".

Not only is the Environmental Health Association an advocate for safer products in the home, they collaborate with other groups such as the Citizens for a Safe Learning Environment who are working to make the schools safer. The goal of the Citizens for a Safe Learning Environment is to protect children from exposure to hazardous and carcinogenic substances in the schools. These include asbestos, pesticides, polychlorinated biphenyls (PCBs) and silica dust.

The Citizens for a Safe Learning Environment (CASLE)[89] have been instrumental in ensuring that a recently built high school, Halifax West, was constructed with attention to every detail that might affect the children's health[90]. As a result of their work on this project, the Nova Scotia government has incorporated into their "Design Requirements Manual" standards of environmental design and construction learned from the construction of Halifax West that will be applied to future school and public buildings

CASLE has also developed guidelines for cleaning and maintenance products, even art supplies in the schools, and lists of chemicals to be avoided, including formaldehyde and toluene. Nova Scotia school boards have used the guidelines to develop their own purchasing policies for less toxic cleaning products. In addition, the Department of Education has supported these efforts and does regular monthly training programs for their maintenance staff to educate them about safer products[91].

Breast Cancer Survivors' Groups

In Canada, as in the United States, grassroots groups of breast cancer survivors have maintained that the high incidence of breast cancer is linked to environmental exposures. They have refused to accept cancer as an inevitable or chronic disease, and have been strong advocates for stopping cancer by ridding the environment and the workplace of carcinogens.

The Saunders-Matthey Cancer Prevention Coalition (formerly the Breast Cancer Prevention Coalition)[92], The Women's Healthy Environments Network[93] based in Toronto, Breast Cancer Action Montreal and the Breast Cancer Research and Education Fund in St. Catharines have all used the internet, educational materials and conferences to raise public awareness about environmental toxins and cancer.

The Women's Healthy Environments Network, has produced a film, "Exposure: Environmental Links to Breast Cancer", that has been shown on national television and featured at many conferences on breast cancer, women's health and general health conferences, both nationally and internationally. The film is used at "Training Trainers" workshops to help participants to become trainers themselves, and educate people about primary cancer prevention.

These groups were also instrumental in organizing the 1999 conference in Hamilton, Ontario, "Everyday Carcinogens: Stopping Cancer Before It Starts".

Toronto Cancer Prevention Coalition

The Toronto Cancer Prevention Coalition was created in 1998 with the support of the Board of Health[94], and is one of the few groups in Canada established to focus on the primary prevention of cancer. The Environmental and Occupational Carcinogens Working Group of the Toronto Cancer Prevention Coalition developed a strategy specifically for preventing occupational and environmental cancers, called "Preventing Occupational and Environmental Cancer"[95]. This was presented to the Toronto Board of Health as part of an overall action plan for the city, and has set the agenda for the City of Toronto's work on primary cancer prevention related to environmental and occupational exposures. The Working Group identified carcinogens in Toronto with clear evidence of health effects and widespread exposure as targets for prevention activities.

In 2002, the Toronto Board of Health followed up on their report with an assessment of both workplace and environmental exposures in Toronto called "Ten Key Carcinogens"[96]. The ten carcinogens were asbestos, benzene, 1,3-butadiene, cadmium, chromium, dioxins, formaldehyde, polycyclic aromatic hydrocarbons, tetrachloroethylene, and trichloroethylene. As a result of the Coalition's work with the Board of Health, the City of Toronto considers the problem of carcinogens in many aspects of government business from green procurement policies to decisions on buying low-sulphur fuels for City vehicles.

Canadian Coalition for Green Health Care

The Canadian Coalition for Green Health Care[97], formed in 2000, is a coalition that works with health care organizations and facilities. It is an active member of Health Care Without Harm, an international coalition working to ensure that the

health care industry is no longer a source of harm to people and the environment. The Canadian Coalition for Green Health Care focuses on encouraging pollution prevention, energy conservation, solid waste reduction, indoor air quality and environmentally responsible design and management within the health care system.

The Coalition published a report on "Green Hospitals: Success Stories of Environmentally-Responsible Health Care"[98] featuring 10 case studies of hospitals and health care centres that have made significant progress in improving their environmental practices. Hospitals like St. Mary's General Hospital in Kitchener, Ontario, for example, have adopted a "no chemical policy" for their lawn care.

In terms of primary cancer prevention, the Coalition for Green Health Care has worked to eliminate the use of polyvinyl chloride plastics in the health care industry. Instead, the Coalition promotes alternatives such as polyvinyl chloride-free medical devices with their green procurement policies, setting up a Green Lane of environmental vendors at medical conferences. It has also been effective at raising awareness around dioxin emissions of hospital incinerators and promoting the substitution of non-incineration waste treatment technologies[99].

Reach for Unbleached

Reach for Unbleached[100], based in Vancouver, British Columbia, is committed to educating people about the potential health problems associated with pulp mill pollutants. Although pulp and paper companies have significantly reduced dioxins and furans in their discharges to waterways, other pollutants still pose a threat to the health of workers and nearby communities. These include carcinogens such as formaldehyde.

They have published "The Pulp Pollution Primer" and "Pulp Mills, Pollution and Your Health" and regularly publish the MillWatch newsletter. They advocate action through official avenues such as permit applications. They do workshops and outreach, making presentations and distributing their educational material in towns where pulp and paper mills are located.

They have also helped citizens do their own air testing in order to document the air pollution problems in their communities, and they encourage an on-line citizen air log to record anecdotal reports of pollution. In addition, they operate a bulk office paper-buying club that promotes the purchase of elemental chlorine free paper.

Best Practices in Community Education and Action in the United States

Breast Cancer Survivors' Groups

In California and Massachusetts, breast cancer survivors' groups have taken the lead in gathering the evidence of the links between breast cancer and toxic exposures, and trying to help women reduce or eliminate their exposure to carcinogens in the environment.

An updated report, "State of the Evidence: What is the Connection Between the Environment and Breast Cancer?"[101] was recently published by The Breast Cancer Fund and Breast Cancer Action[102] in California. This report summarizes the new links between synthetic chemicals and radiation with the rising incidence of breast cancer.

The breast cancer groups advocate the phasing out of toxic chemicals, healthy purchasing and breast milk monitoring. They are the authors of a popular Action Card – six actions to reduce exposures to cancer-causing chemicals and environmental toxins.

In San Francisco, they have convinced the city government to integrate the precautionary principle into city and county wide policy[103]. They have also built support in the state legislature for a bill to monitor chemicals in breast milk. They are participants in the Safe Cosmetics Campaign -- "Think Before You Pink" -- that has successfully persuaded several cosmetic companies to sign pledges promising to reformulate their products and remove certain chemicals.

Similarly, the Massachusetts Breast Cancer Coalition[104], part of the Alliance for a Healthy Tomorrow, has been instrumental in a citizen-initiated proposal for an "Act for a Healthy Massachusetts: Safer Alternatives for Toxic Chemicals"[105]. The Act takes aim at an initial list of ten toxic chemicals, including formaldehyde, perchloroethylene, dioxins and furans. It would require the state environment department to develop an action plan to identify all potential substitutes[106] and phase them in where possible.

Environmental Working Group

The Washington, D.C.-based Environmental Working Group (EWG)[107] has been in the forefront of exposing toxic chemical threats -- in the body, in food and most recently in personal care products. Its work underscores the lack of regulation or controls in the United States on substances like carcinogens. Their mission is to find solutions through the power of information.

Its July 2004 report, "Skin Deep: a safety assessment of ingredients in personal care products"[108], found that 62 products, or one out of every 120 products assessed, listed known or probable human carcinogens as ingredients. These included shampoos, lotions, foundations and lip balms. They petitioned the United States' Food and Drug Administration to recall personal care products or issue warning labels on those products containing hazardous ingredients.

In 2003, EWG issued a Report Card on pesticides[109] in produce that identified fruits and vegetables with the highest and lowest levels of pesticide contamination. They created a "Wallet Guide" to help consumers choose less contaminated foods, and they recommended eating organic food as a way to reduce pesticide exposure and protect health.

Bucket Brigades

Also in the United States, in what could be described as barefoot surveillance, citizens have done their own monitoring with simplified air testing equipment that forced the government into action.

In the southern States, communities exposed to toxic air emissions from oil refineries and chemical plants started to do their own air sampling after government authorities were not following up on accidents and releases from the plants. These "bucket brigades"[110] were started in 1995 by Edward Masry, the lawyer who worked with Erin Brockovich, when he developed a simple air testing device called a bucket. Since then, buckets have been used by dozens of communities, particularly in California, Louisiana and Texas, to prove that unacceptably high levels of chemicals contaminate the air and to compel government agencies to enforce federal and state environmental laws.

The most successful campaign has been in Mossville in Calcasieu Parish, Louisiana, where residents found carcinogens like benzene and vinyl chloride at levels violating the State's standards. The U.S. Environmental Protection Agency followed up on the well-publicized sampling by levying fines and increasing their monitoring. This had the effect of significantly reducing accidental releases.

Best Practices in Community Education and Action in Europe

Greenpeace

In London, England, Greenpeace conducted a high-profile house dust project in 2002 and 2003 in which they vacuumed 100 homes in Britain. The purpose of the project was to alert people to the proliferation of hazardous industrial chemicals in every day products inside their home. The dust was analyzed and results published in a report "Consuming Chemicals"[111]. Chemicals of high concern, such as chlorinated paraffins which may be carcinogens, were found in virtually every home. Greenpeace also tested products and did biomonitoring of human bodies to document the widespread presence of hazardous chemicals.

Friends of the Earth

Chapters of Friends of the Earth[112] all around Britain have orchestrated a direct action campaign designed to persuade retailers to eliminate the most serious toxic chemicals from products. They hand out pledge cards to shoppers that ask retailers to phase out hazardous chemicals from household products. They have had commitments from Ikea, Body Shop, and Marks and Spencer to review the toxicity of the chemicals in their product lines

Chemsec

The Swedish government which wants to see a strong chemicals policy in the European Union has helped create and fund a coalition of non-governmental organizations in Europe. Chemsec[113] is an important organization that developed from a coalition of 4 major environmental groups in Sweden. Its goal is to work towards a toxic-free environment and to promote the precautionary principle in international chemicals policies. Their current focus is to strengthen REACH, the proposed European chemicals regulation.

Gaps in Community Education and Action in Canada

There is a lack of information and public education about carcinogens in the environment or in common household products.

There are only a few non-governmental organizations concerned with primary cancer prevention, and there is little government support or funding for these groups.

5. Worker Education and Action

Introduction

Union and workers' concerns over lung cancer, mesothelioma, and other work-related diseases led to the introduction of health and safety legislation across Canada in the late 1970s. These laws gave them the right to know about hazards in the workplace, the right to participate in decisions affecting health and safety and the right to refuse unsafe work.

In the 1990s, disturbed by the unacceptable toll cancer was still taking on friends and co-workers, unions initiated their own cancer prevention campaigns. They pushed the boundaries of this legislation in order to reduce their exposures to carcinogens, and, in many cases, worked successfully with employers to reduce or eliminate carcinogens.

Overview

The criteria for best practices in primary cancer prevention in the workplace with the goal of reducing occupational exposures are those that:

- educate workers about cancer and their exposure to carcinogens in the workplace;
- identify and develop strategies for the reduction or elimination of carcinogens;
- promote the substitution of carcinogens with less hazardous substances;
- result in actions that reduce or eliminate carcinogens.

In order to give workers the tools to protect themselves, unions started with developing intensive education programs and strategies for the elimination or reduction of carcinogens, followed up by action in the workplace. These educational efforts and action campaigns represent the best practices in workers' efforts to minimize their exposure to carcinogens.

Unions have conducted educational campaigns including workshops and training. They have used information available to them through Material Safety Data Sheets to identify carcinogens in their workplaces and to use their influence to get rid of them. They have used the right to refuse to work with carcinogens. At the joint health and safety committees, they have called for the elimination of carcinogens. And, they have used their powers of collective bargaining to formalize reductions of carcinogens.

Unions and health and safety activists have been successful in reducing their exposures to metalworking fluids, solvents, asbestos, diesel exhaust, polycyclic aromatic hydrocarbons, cleaning products and other substances that may have the potential to cause cancer.

Although the campaigns described in this Section are not drawn from a comprehensive survey, they have been chosen as examples to illustrate the range of activity in Canada, to highlight innovative solutions that have been found and to demonstrate how both large and small workplaces can benefit from a focus on cancer prevention.

In Europe, workers face the same issues and are similarly looking for substitutes to carcinogens in their workplaces. However, the Directives of the European Union and national occupational health and safety legislation, that promote substitution for carcinogens in the workplace, facilitate this.

Best Practices in Worker Education and Action

Prevent Cancer Campaigns

There have been many unions, and their health and safety activists, striving to remove carcinogens from the workplace. The extensive list includes: the Canadian Auto Workers, the United Steelworkers of America, the Communications, Energy and Paperworkers representing workers in the chemical industry, as well as a broad range of public sector and service sector unions such as the Public Service Alliance of Canada, the Canadian Union of Public Employees, and the United Food and Commercial Workers.

The Canadian Auto Workers (CAW) launched the first National Prevent Cancer Campaign[114] in December 1997. The CAW decided to act when a prominent labour activist, Bud Jimmerfeld, was diagnosed with cancer that the union believed came from years of exposure to metalworking fluids, and was denied compensation.

This campaign was the leading edge of a concerted workplace fight for cancer prevention, and inspired other labour organizations to start their own campaigns modeled on it.

In November 2001 the Canadian Labour Congress (CLC), representing all the major unions, dedicated its annual conference to launching a nation-wide Prevent Cancer Campaign[115] -- "Preventing Cancer and Occupational/Environmental Disease". This galvanized the labour movement across Canada to undertake local and national campaigns to prevent cancer.

The unions have consistently promoted the elimination of carcinogens and the substitution of less hazardous substances. Substitution has been accomplished in many workplaces by working with employers to replace one substance with a less hazardous one, to make process modifications, or through process substitution.

Education

To implement their Prevent Cancer Campaign, the Canadian Auto Workers[116] started with an extensive educational campaign for their own members across Canada. After launching their campaign in 1997, they held three national conferences on the issue of cancer prevention and regional conferences across the country.

With the help of the Occupational Health Clinics for Ontario Workers, they published a compendium of known carcinogens with strategies for their elimination and distributed these to local unions across the country. Two videos on occupational and environmental cancers were produced and shown at CAW conferences.

They distributed a book, "Workplace Roulette: Gambling with Cancer" to all local unions and trained union activists at their training centre in Port Elgin, Ontario, with their "Cancer Causing Substances: A Worker's Guide to Understanding and Eliminating Them From the Work Environment". One of their most effective publications, a booklet called "Devil of a Poison", combines information on cancer with a strategy for union activists.

Activists were taught to fight their exposures on several fronts -- to identify carcinogens in the workplace, to insist that they be removed and substituted with less hazardous substances, to put in compensation claims for all workers who are found to have cancer, and to ensure community support by informing the public about air and hazardous waste emissions from their workplaces.

Action: Case Studies

These are examples of some of the successful campaigns driven by union activists across Canada.

- Substitution of Canola Oils for Metalworking Fluids[117]

Many workplace health and safety committees and environment committees have pushed for the replacement of metalworking fluids with safer substitutes.

Metalworking fluids include straight mineral oils, soluble oils and synthetic oils used to cool and lubricate metal working processes. They are known to cause skin cancer, and, in a study of American autoworkers exposed to metalworking fluids, cancers of the larynx, esophagus, rectum, stomach and other organs were also linked to metalworking fluids[118].

The CAW Joint Workplace Environment Committee Representatives at Local 200 have worked with the Ford Motor Company in Windsor for several years to replace the petroleum based metalworking fluids with canola oil, developed in Sweden. Pilot tests were carried out with the more natural product to see if it could replace the mineral oils.

At Ford's Windsor Engine Plants and the Low Volume Line Annex Plant one-third of the petroleum-based coolant used in these plants has now been replaced with the canola oil. And, in May 2003 Ford's newest plant, the Annex 3 Valve Operations making three valve intakes for motors, went into full production using canola based cutting fluids[119].

The canola oil is not known to have the same long-term risks to health as the metalworking fluids. Nor does it need to be replaced as often, reducing the environmental impacts as well. However, there are still concerns that even with vegetable oils, biocides which are added to the product to control bacteria may pose problems for workers.

- Using the Collective Agreement to Phase Out Chemicals

Where the union wants to formalize their health and safety goals, they have used contract negotiations to further their objectives. For example, in their most recent collective bargaining with the Ford Motor Company and General Motors (GM) of Canada, the CAW and the companies successfully negotiated agreements to eliminate 14 hazardous substances, many of them carcinogens, including asbestos, carbon tetrachloride, PCBs and vinyl chloride[120].

In the same Ford and GM contracts, the CAW and the companies agreed to set their own limits for exposures to carcinogenic substances[121]. In order to improve protection, they established a reduction in the acceptable exposures of oil mists for machining and metalworking fluids in their plants. Except in British Columbia, the present legal limit throughout the country is 5 milligrams per cubic metre. The auto makers and the union agreed to achieve an internal level of 1 milligram per cubic metre with all existing equipment and to specify that new equipment be designed to attain a level of .5 milligrams per cubic metre.

A study done by the Occupational Health Clinic for Ontario Workers in Hamilton at the GM St. Catharines Components Plant on metalworking fluids found that prevention efforts were warranted on the basis of the association between aerosol concentrations and workers' symptoms[122].

- A Small Workplace and a Successful Solvent Replacement

In other workplaces, workers have been able to replace hazardous solvents with simple soap and water. At Delhi Industries, a small plant manufacturing blowers in Delhi, Ontario, a worker collapsed when he was exposed to vapour from the trichloroethylene tank[123]. Trichloroethylene is a carcinogenic solvent, that was kept in a vat for dipping and cleaning metal parts. This accident motivated the workers of a small CAW local on the joint health and safety committee to push for the elimination of trichlorotheylene from their workplace and to replace it with an aqueous cleaner. The aqueous cleaner resembles an oversized dishwasher, and uses only detergent and water to clean the metal.

- Joint Health and Safety Committees Reducing Hazards

Using grease instead of lubricating oil, initiated by the Steelworkers[124] at Inco in Sudbury, Ontario, is another example of a successful substitution. Working through the joint health and safety committee at South Mine, the local union and the company agreed in 1996 to experiment with substituting grease for lubricating oil in underground equipment. The lubricating oil, used in confined spaces, created mists that contaminated the air. Workers were concerned about carcinogens in the lubricating oil and about the potential for respiratory problems. In contrast, the grease does not become airborne.

The company and the union found that the grease worked very well with large equipment such as in-hole drills. At Inco they are still testing the grease in smaller drills. The CAW at Falconbridge Mines[125] in Sudbury has also been successful in working with the Falconbridge to replace lubricating oil with grease in underground mining equipment. Grease has worked out to be an effective and less hazardous substitute, reducing the risk underground for hundreds of miners in the Sudbury region.

- Rights in British Columbia to Safer Substitutes

Health and safety activists from the United Food and Commercial Workers were successful in finding alternatives to solvent-based paints when several of their members fell ill after spray painting industrial ovens.

The incident occurred in 2002 at a Canada Safeway supermarket in Vancouver[126]. Several members of a night stocking crew complained of headaches and dizziness after exposure to solvents. The solvents were carriers in an acrylic paint being spray painted onto industrial ovens in the bakery area. The unions' health and safety director and the health and safety coordinator for the company investigated the problems.

They reviewed the material safety data sheets for the paint and found not only were there solvents in the paints that caused the acute health effects, but the paints also contained several known or suspected carcinogens, commonly found in acrylic paint mixtures.

In British Columbia health and safety regulations require the substitution of non-carcinogenic materials whenever practicable. Because of this, there was an immediate decision to replace the acrylic-based paints with less toxic water-based paints. The company and the union agreed to ensure that paints used in all similar renovations would be reviewed and that throughout British Columbia the less toxic formulation would be used. Information was circulated to all health and safety committees throughout the region alerting them to review incoming Material Safety Data Sheets. This incident led to safer workplaces throughout British Columbia.

- Making Progress on Diesel Emissions in Mines

Another major cancer prevention initiative undertaken by the unions is the campaign to reduce exposures to diesel exhaust in underground mines. Diesel exhaust is a complex mixture regarded as a probable human carcinogen, possibly contributing to lung cancers[127].

The United Steelworkers of America represents hundreds of workers in underground mines, where diesel exhaust from mining equipment creates health problems for workers.

They have been working for years to reduce the hazards posed by the use of diesel as a fuel in underground mines. The union has directed their members to raise health problems at the meetings of the joint health and safety committees, and to talk to compensation representatives about claims if they have breathing problems or cancers that might result from these exposures.

They have also been involved in a research study, involving several partners including the federal government, that investigated alternative fuels and ways to reduce diesel emissions. This study, the Diesel Emissions Evaluation Program, DEEP[128], looked at the substitution of electric diesel equipment underground, the use of biodiesel fuels, pollution control devices such as catalytic converters and the effectiveness of a preventive maintenance program.

At Brunswick Mine, Bathurst, New Brunswick, the DEEP study showed that the use of diesel particulate filters reduced emissions in selected areas. Emission levels of diesel soot and oil particles where filters were used were considerably lower than zones of the mine where they were not used[129].

At the five Falconbridge Mines in Sudbury, the CAW, representing the underground miners, and Falconbridge in their most recent collective

agreements[130] negotiated maintenance requirements for all diesel-driven equipment after DEEP tests demonstrated that improved maintenance resulted in a 50 per cent reduction in emissions. They have also negotiated a provision that the company will switch to using ultra low sulphur diesel fuels. When maintenance has been successful in improving the running of the equipment, Falconbridge will add filters to the equipment to further reduce emissions.

- Labour Environmental Alliance Society Targets Carcinogens in the Workplace

Inspired by the Prevent Cancer campaigns of both the Canadian Labour Congress and the Canadian Auto Workers, the Labour Environmental Alliance Society in British Columbia has mounted its own cancer prevention campaign, doing educational work and initiating workplace actions across western Canada.

In addition to its work in the community and in schools (described previously in Section 4 of this report), the Labour Environmental Alliance Society (LEAS) has worked with joint health and safety committees in industries and in both public and private institutions.

With the B.C. Federation of Labour, they are co-sponsoring health and safety workshops on Toxins in the Workplace throughout British Columbia with workers from a wide range of occupations including mechanics, teaching, custodial, housekeeping, hotel, manufacturing, firefighting, recreation and others. The toxins they are targeting are carcinogens and endocrine disruptors. They have also done workshops with the Saskatchewan Federation of Labour, the Canadian Union of Public Employees' National Office, the Canadian Federation of Nurses and the Canadian Labour Congress.

In these workshops, they encourage workers to do hazard mapping of their workplaces and to use the requirement for substitution under B.C. occupational health laws. In other provinces, they encourage workers to use the right to refuse dangerous work to convince employers to substitute safe products for those containing carcinogens.

LEAS has used this strategy effectively in their "Cleaners, Toxins and the Ecosystem"[131] campaign, launched in 2001. In their research into the components of common cleaning products such as carpet treatments and floor strippers, they have found carcinogens like methylene chloride and silica. This information is contained in their "Cleaners and Toxins Guide", a booklet that provides specific information on the harmful substances that should be avoided in cleaning products. This project received the Pollution Prevention Award from the Canadian Council of Ministers of the Environment in 2002 in recognition of its effectiveness in both education and the elimination of toxic chemicals.

Like the CAW, LEAS has shown workers how to use material safety data sheets to identify carcinogens and other toxic chemicals in their cleaning products.

Through this project and their workshops, they have helped hundreds of workers in long-term care facilities, processing plants, hotels, restaurants, offices and schools find safer, environmentally preferable products. Not only has this created a safer workplace for janitors, housekeeping, laundry and kitchen employees, but it has also reduced exposures for the people who use or visit these facilities.

They have trained many union activists and workers who go back into their workplaces and set up screening programs using these techniques. For example, activists at Coast Mountain Bus Company, the bus company that provides public transit for the Greater Vancouver area, have convinced the company to set up an environment committee at each of their major properties[132]. The environment committees will screen the products being used by the company and eliminate products containing carcinogens where there are reasonable substitutes.

Best Practices in Worker Campaigns in Europe

In Europe, workers also face an ongoing struggle to eliminate or substitute safe chemicals or processes for carcinogens. Worker-driven campaigns, however, are more often targeted at particular substances such as asbestos, rather than against a particular disease such as cancer. For example, unions in Finland led a boycott of toxic paints in the construction trade and forced them from construction sites based on the evidence of their general acute and chronic toxicity[133]. Workers have also been successful in convincing 9 European countries to ban all forms of asbestos, and the European Commission to ban nearly all uses of it[134].

In Europe, workers do have the legislative direction from the European Union to promote substitution. Both the Occupational Carcinogens Directive and the Chemical Agents at Work Directive establish substitution as the highest priority for protecting workers against carcinogens.

The most important legislation in Europe governing carcinogens in the workplace is the Occupational Carcinogens Directive[135]. The goal of this Directive (90/394/EEC) is the protection of workers from the risks related to exposure to carcinogens at work. It explicitly strives to reduce the risks from carcinogens and calls for substitution. The Directive lists several processes that can lead to carcinogenic emissions or exposures that should be minimized[136].

Under Article 4(1), it states that *"the employer shall reduce the use of a carcinogen at the place of work, in particular by replacing it, in so far as is technically possible, by a substance, preparation or process which, under its conditions of use, is not dangerous, or is less dangerous to worker's health or safety, as the case may be".*

The Directive also refers directly to the precautionary principle, arguing that current scientific knowledge cannot establish a level below which risks to health cease to exist and therefore, a reduction in exposure to carcinogens will reduce those risks.

The other important Directive is the Chemical Agents at Work Directive[137] (89/391/EEC) that sets the minimum requirements for working with hazardous chemicals. It establishes a hierarchy of controls favouring substitution as the preferred method, followed by design changes and engineering controls, and by protective measures such as ventilation and personal protective equipment. It also establishes health surveillance to determine the state of workers' health based on their exposures to specific chemicals[138].

Gaps in Worker Education and Action in Canada

It is difficult for workers to prove the link between workplace exposures and the later development of cancer, and it is also difficult to prove that cancer cases were prevented by reducing exposures to carcinogens from the workplace.

Allowable exposure limits have not sufficiently protected workers from occupational diseases such as cancer.

Workers and their organizations lack the technical knowledge and the resources necessary to research, identify and recommend effective and safe substitutes to substances and processes.

Although some unions have been successful through the joint health and safety committees and collective bargaining in making workplaces safer, companies are often reluctant to invest in new, sometimes untested, technologies or products. Better technologies and products can be more expensive and not readily available.

There are no required audits of occupational carcinogens by region, by industry, or by workplace.

In most cases unionized workplaces comply with health and safety legislation, but non-unionized workplaces do not necessarily have the same compliance rate. Workers in unorganized workplaces are often exposed to greater hazards than workers in organized workplaces. [139]

6. Non-governmental Organizations' Work in Cancer Prevention

Introduction

Many organizations in Canada have a mandate to address issues related to cancer. However, very few of these organizations have taken up the challenge of preventing cancer by advocating the reduction or elimination of environmental and occupational exposures to carcinogens.

Because of their front-line relationship with people who have been diagnosed with cancer, organizations such as the workers' health and safety clinics and the Canadian Cancer Society have shaped an important role for themselves. They are not only helping people who have been diagnosed with cancer but they are also trying to prevent the exposures that might have caused their disease.

The best practices in organizations that have a mandate for cancer activities are the organizations that have taken public education as a starting point and transformed that into taking action to reduce exposures to carcinogens.

Workers' Health and Safety Clinics

Across Canada, there are a number of workers' health and safety clinics – in Alberta, Manitoba, Ontario and Quebec. They provide medical services to workers[140] who have been injured or developed illnesses, including cancer.

The clinics were established in the 1980s as workers became increasingly aware of injuries and illnesses caused by their working conditions that were not well-understood by the conventional medical system. The workers' health and safety clinics are specially funded clinics set up by labour organizations, workers' compensation boards and supported in some cases by universities.

The clinics offer inquiry services, medical diagnoses by doctors trained in occupational medicine, outreach and education, and group services for workplace health and safety committees and groups of workers. Ontario clinics also conduct research to investigate and report on occupational illness and injury.

In addition to helping workers determine whether their cancer has been caused by their exposure at work, they play an active role in visiting workplaces and intervening to prevent more exposures. In this way, they have become a force for primary prevention of cancers in the workplace.

In Ontario, there are 5 clinics funded by the Workplace Safety and Insurance Board in major industrial cities, and these clinics have been particularly active in cancer prevention[141].

As part of their diagnostic services, the medical staff consider a patient's work history and their exposures to carcinogens. They will decide whether the cancer or other illness is occupationally related and, if it is, they will recommend ways to prevent further problems. With the patient's consent, the information may be shared with the joint health and safety committee at their workplace. This allows the committee to understand the possible risks in the workplace and to make changes that would prevent other cancers. They also help workers to get compensation for their illnesses if they are work-related.

One of their most effective strategies for primary cancer prevention is the service offered to health and safety committees or groups of workers. Occupational hygienists visit workplaces usually at the invitation of the joint health and safety committee and with the agreement of the company. They do assessments by walking around the plant and taking note of safety problems or hazards.

In some cases, they identify carcinogens or other toxic substances being used in the plant and recommend a less hazardous substitute. In a visit to a tool and die maker in Essex County a hygienist recommended the substitution of water for metalworking fluids to clean the presses. The employer agreed, making the change and making the workplace safer[142].

The clinics have also been breaking new ground in occupational surveillance studies as part of their research mandate.

The Occupational Health Clinic for Ontario Workers in Windsor worked with the Windsor Regional Cancer Centre, a cancer treatment centre, on the CROME study (Computerized Recording of Occupations Made Easy), described in Section 2 of this report. All newly diagnosed cancer patients were asked to touch a computer screen and write the details of their work history.

The lack of occupational histories of cancer patients has been a major constraint in the ability to estimate the burden of occupational cancers in Canada, and the CROME study was one of the first attempts to fill this gap. An improved version of CROME, known as LOHR (the Lifetime occupational History Registry) has been developed for use in determining the relationship between cancers and occupational exposures.

The Windsor Occupational Health Clinic was also instrumental in bringing the problems of asbestos-exposed workers into public view and alerting the community to a major cancer epidemic.

When a former worker in the Holmes Foundry[143] in Sarnia came forward with lists of co-workers dead or dying from mesothelioma, the clinic staff and the Canadian Auto Workers held sessions in Sarnia to determine the extent of the problems. They did hazard mapping – using colours and symbols on drawings of the workplace to locate and identify hazards – to try and gauge the extent of the former workers' exposures. Combined with body mapping showing the location and kinds of illnesses the workers had, the Clinic and the CAW were able to make a convincing case that workers had been exposed to extremely high levels of asbestos. As a result of this work, many workers and their families became aware that their illnesses were work-related and received compensation.

The Canadian Cancer Society

The Canadian Cancer Society is a national organization of volunteers whose mission is the eradication of cancer and the enhancement of the quality of life for people living with it. The national office of the Canadian Cancer Society works collaboratively with staff in regional offices across the country to develop health and public policy statements[144].

They have been involved in trying to reduce the cancer risk for Canadians for many years, primarily through educating the public about tobacco use and environmental tobacco smoke, and the hazards of sun-induced skin cancer. Tobacco has long been accepted as a significant cause of cancer, and the Cancer Society itself has a strict no-smoking policy that eliminates any workplace exposures to environmental tobacco smoke.

In the last few years, however, the Canadian Cancer Society has become more engaged in the primary prevention of cancers related to environmental and occupational exposures.

They have publicly supported the use of the precautionary principle[145], and because of this policy, they have been active in the campaign to ban the ornamental use of pesticides on lawns and gardens. They identified known, probable or possible carcinogens used in formulating pesticides. Because these substances posed a threat of harm and had no countervailing health benefit, the Society argued that they should be banned.

They also called for the discontinuation of the use of pressure-treated lumber for domestic and recreational structures such as decks and playgrounds. Pressure-treated lumber is actually lumber treated with two known carcinogens, arsenic

and chromium. The Society took this position in order to reduce people's exposure to these carcinogens.

As part of their mission to eradicate cancer, the Canadian Cancer Society has an extensive and highly visible public education campaign, including community-based presentations and displays, internet sites for the national office and all their provincial offices, and print publications.

On their website, as well as their policies on the ornamental use of pesticides and pressure treated lumber, there is a policy statement on occupational exposures and health messages on environmental contaminants such as pesticides, electromagnetic fields, chlorinated water, air pollution and radiation. These messages provide helpful information to the public on how to minimize or avoid exposures that might cause cancer.

Moreover, the Canadian Cancer Society is developing a new cancer prevention strategy that will give more emphasis to prevention. They are shifting their focus from individual behaviour to advocacy, community mobilization and public education. In British Columbia, the B.C. and Yukon Division of the Canadian Cancer Society is already doing consultations in local communities and encouraging them to develop strategies to prevent cancer, including environmental and occupational-related cancers[146]. They are targeting towns with risk factors such as mill and mining towns, or communities in the Fraser Valley where there are smog problems.

7. Industry Reductions of Carcinogens

Introduction

Many Canadian companies have eliminated or made significant reductions in the levels of carcinogens they release to the environment or in the workplace.

According to an Environment Canada study[147], they are motivated by various factors – compliance with government regulations, concerns about Board of Director liability, pressure from labour and environmental groups, and voluntary pollution prevention programs. Although the study found that government regulations are the most effective means of implementing environmental improvements, the federal and provincial governments have chosen to emphasize voluntary pollution prevention programs as a way to reduce pollutants, primarily to the environment.

Pollution prevention is defined by the federal government as "the use of processes, practices, materials, products or energy that avoid or minimize the creation of pollutants and waste, and reduce overall risk to human health and the environment"[148]. Even though pollution prevention strategies have resulted in concrete reductions of carcinogens, without laws that require all industries to meet the same targets, reductions are accomplished in a piecemeal fashion. They benefit workers and communities where they are applied, and penalize them where it is not.

The public interest in safer products has also stimulated some companies to create products such as heat-treated wood and industrial cleaners that eliminate the use of carcinogens or other toxins.

Overview

Although the examples highlighted in this report do not come from a comprehensive survey of companies in Canada, they do illustrate the effectiveness of industry initiatives in reducing or eliminating exposures to carcinogens. The activities of these companies exemplify best practices in primary cancer prevention because:

- they have reduced or eliminated carcinogens from the environment or the workplace;
- they demonstrate that companies in various sectors facing different challenges can modify their processes and make substitutions;

- they show that it is technically feasible to eliminate or reduce carcinogens when there is a commitment to do so;
- they are in the forefront of their industry in developing and implementing best available technologies.

Many of them have been recognized by the Canadian Council of Ministers of the Environment in their annual awards[149], by Environment Canada who have published their stories under Success Stories in Pollution Prevention,[150] or by the Canadian Centre for Pollution Prevention[151] in Sarnia, a resource centre for pollution prevention activities in Canada.

However, for examples of best practices in primary cancer prevention – initiatives that have a broader impact on the reduction of toxic chemicals by industry, it is necessary to look beyond Canada.

In the United States, the Massachusetts Toxics Use Reduction Act has led to significant reductions in the use, emissions and disposal of toxic chemicals throughout the state of Massachusetts. Through the introduction of mandatory pollution prevention planning, it has achieved measurable success in reducing the use of toxic chemicals.

The Massachusetts experience also demonstrates the importance of technical advice and support programs in helping industries make those reductions. There are only two programs in Canada that offer this kind of help.

In Sweden, the principle of substitution has become a working and workable strategy, and an example of a best practice that is an integral part of all industrial and commercial activity. Companies operating in that country have practiced substitution for many years, and now the European Union has incorporated the principle of substitution into several important pieces of legislation.

Moreover, Europe has recently introduced legislation that makes industry responsible not only for the way in which they manufacture products but for taking the products back at the end of their useful life. Complementary legislation also restricts the electrical and electronics industry from using certain toxic chemicals in the manufacturing process.

Best Practices in Industry in Canada: Pollution Prevention

Case Studies

- Novopharm[152], Scarborough, Ontario

In 1998, Novopharm, a pharmaceutical manufacturing company in Scarborough with approximately 1000 employees, was the largest single emitter of

reductions were made under voluntary agreements between the company and the federal and Quebec governments. As Alcan phases out the older plants in Quebec over the next ten years, it is building new plants incorporating best available technology that almost completely eliminates PAHs[159].

- The Ottawa Hospital[160], Ottawa, Ontario

The Ottawa Hospital is the third largest hospital in Canada, and one of the largest generators of biomedical waste. The incineration of biomedical waste is a major source of dioxins and furans released to the air. In May 2001, The Ottawa Hospital closed down its on-site incinerator after an evaluation of the cost-effectiveness of continuing its use. The hospital invested in an alternative treatment technology – a hydroclave system – that is considered the best environmental technology for the decontamination and reduction of biomedical waste. This has eliminated the need for incineration.

- Carriage Trade Cleaning Centre[161], Oshawa, Ontario

Perchloroethylene (tetrachloroethylene) is a probable human carcinogen, an occupational risk and an environmental contaminant. It is used across Canada by dry cleaners as a solvent to clean clothes. For over a decade, a process called wet cleaning has been available that uses only water. It is an effective non-toxic alternative to dry cleaning. However, wet cleaning has not been widely publicized or adopted, despite the fact that Environment Canada demonstrated its economic feasibility and environmental desirability.

The Carriage Trade Cleaning Centre was one of the first large cleaning plants in Canada to convert completely from dry to wet cleaning. In 2002, the owner decided to stop using perchloroethylene and use only wet cleaning machines. Although the initial investment in wet cleaning equipment was expensive, his monthly bills for electricity and water are significantly lower and he avoids the expense of purchasing perchloroethylene[162]. Now Environment Canada has introduced new dry cleaning regulations under the Canadian Environmental Protection Act that limit perchloroethylene emissions to air and water but do not discourage the continued use of this carcinogen.

Opportunities for Environmental Products

There are a number of Canadian companies that have developed innovative new technologies and products that have the potential to reduce or eliminate carcinogens. These range from new technologies for treating wood or drinking water to new products such as non-toxic industrial and household cleaners.

- Pluricapital Industries[163], Jonquiere, Quebec

After 70 years of production, the United States and Canada have moved to stop the sale of wood treated with arsenic, copper and chromium, so-called pressure treated wood, from home and playground use. The U.S. Environmental

Protection Agency estimated that children who touch this wood have a significantly increased risk of developing lung and bladder cancer. Ninety per cent of all outdoor wooden structures in the United States are made of pressure treated wood.

A small Quebec company, Pluricapital Industries, has purchased technology developed in France that treats wood with heat. This technology avoids the problems associated with treating wood with arsenic or pentachlorophenol.

- Bebbington Industries[164], Halifax, Nova Scotia and Industrie ILI, Saguenay, Quebec

Other companies, Bebbington Industries and Industrie ILI, have substituted chemicals to make industrial cleaning products for a growing market of customers who want safer products.

Importance of Programs for helping Industry with Substitution and Clean Technology

An extremely important component of reducing or eliminating carcinogens from products and industrial processes is the availability of technical assistance. This has been the experience in Massachusetts where the Toxics Use Reduction Institute has provided technical advice to help companies reduce their use of toxic chemicals and replace them with safer substitutes.

In Germany, legislation requires that the Federal Institute for Occupational Safety and Health develop lists of safer substitutes by use category[165]. They promote chemical substitutions by publishing a "positive list" of safer chemicals, such as safer dyes and colorants.

The Eco-efficiency Centre[166] in Halifax, Nova Scotia, has recognized the importance of providing information to small and medium sized businesses in Nova Scotia in order to assist them in improving their efficiency. Since 1998 when they first established themselves in the Burnside Industrial Park, they have been promoting changes to products and processes so that less waste is generated through resource conservation, recycling, reuse and good environmental practice.

Another program offering technical and financial support to small and medium sized businesses has been very successful in Quebec. The program, called Enviroclub[167], is a partnership between Environment Canada and the private sector. It consists of about fifteen companies in any given region or sector who carry out pollution prevention projects with the help of a specialized consultant. One of the goals of the pollution prevention program is the substitution or reduction in the use of toxic substances.

Best Practices in Industry in the United States: Toxics Use Reduction

There are several laws in the United States that promote the reduction of toxic chemicals, but the Massachusetts Toxics Use Reduction Act[168] is the most effective and well funded. The Act requires companies in the state of Massachusetts to prepare toxic use reduction plans.

Passed in 1989, the Toxics Use Reduction Act was the first comprehensive pollution control law in the United States. Its objective was to reduce toxic waste generated in the state by 50 percent by 1997 – a goal that was reached one year later in 1998.

The Toxics Use Reduction Act requires firms that use more than a certain amount (over 10,000 pounds) of listed chemicals to prepare a plan in which they examine how and why toxic chemicals are used at their facility and evaluate their options for making reductions. The toxic chemicals on the list are the chemicals reportable under the Toxics Release Inventory, and include many carcinogens such as nickel, formaldehyde, and vinyl chloride.

The law does not require that these plans be implemented. However, the work of preparing these plans has translated into many substitutions and process changes with impressive results. Since the start of the program there has been a 50 per cent reduction in the generation of hazardous waste, a 40 per cent reduction in the use of toxic chemicals and a 30 per cent reduction in emissions. A cost benefit analysis showed savings to companies of $14 million. Other benefits included lowered environmental permitting, improved operation and maintenance, and products reformulated with non-toxic ingredients.

An important factor in helping companies make changes were the research laboratories at the affiliated Toxics Use Reduction Institute[169]. The laboratories identified solutions and helped to design company-specific alternatives. In addition, the Office of Technical Assistance for Toxics Use Reduction provided free confidential consultations for industry.

Although the legislation was driven by interest groups whose major concern was cleaning up the environment, the legislation has also benefited workers. In a study[170] done on the effect of the Massachusetts reduction plans on the work environment, investigators found that toxic use reduction activities not only reduced pollution but also resulted in improvements to the workplace. The Act defined toxics use reduction as "in-plant changes in production processes or use of raw materials that reduce, avoid, or eliminate the use of toxic or hazardous substances...without shifting risks between workers, consumers or parts of the environment ".

However, an important conclusion of the study was that these improvements were an inadvertent consequence of pollution prevention efforts and "rarely a direct concern". In fact, because technical experts were not trained in worker health and safety issues, it created the potential for adverse impacts on workers' health and safety and missed the opportunities to coordinate health and safety issues with pollution prevention activities.

New Jersey and Oregon have similar statutes aimed at reducing the use of toxic chemicals but the scope of their legislation and activities does not match the programs underway in Massachusetts. Oregon's Toxics and Hazardous Waste Reduction Program[171] helps primarily medium and small businesses.

Best Practices in Industry in Europe: Elimination and Substitution

Europe has adopted a more purposeful strategy for eliminating carcinogens from industrial use and from products with the intention of reducing risks and preventing cancer. Carcinogens, like mutagens, persistent and bioaccumulative substances, are regarded as substances that may cause irreversible harm once they are released into the environment.

In many European laws or directives, carcinogens are identified as hazardous substances that should be eliminated or substituted in favour of less hazardous substances or processes.

Sweden has incorporated the substitution principle into its Environmental Code, and Swedish companies have been operating on this basis for several years. Tetra Pak, Skanksa (one of the world's largest construction companies), Ikea and Hennes & Mauritz (H&M) have all phased out substances and materials that could be harmful. H&M, a popular European retailer, for example, has worked closely with suppliers to eliminate all carcinogenic dyes and a wide range of heavy metals from their clothing and other product lines[172]. Other countries – Germany and Norway – also have legislation requiring substitution.

In many directives of the European Union, the substitution of safer chemicals for carcinogens is now a legislated requirement. Substitution is an effective way to apply the precautionary principle. It requires that hazardous chemicals be substituted by less hazardous alternatives or preferably alternatives that are non-hazardous.

For example, the Biocidal Products Directive (Directive 98/8/EC)[173] governs pesticide products and their placement on the market. It promotes safer products by providing for the possibility that active ingredients in pesticides may be refused entry onto the European market if another substance is available that poses less risk to health or the environment. It also creates a list of "low risk"

products that are not allowed to contain any carcinogenic, mutagenic substances or chemicals toxic to reproduction. Biocidal products containing known or probable carcinogens are generally not authorized for use by the public[174].

In Europe, there is a complete prohibition on carcinogens in cosmetic products. This was put in place in February 2003 under an amendment to the Cosmetic Products Directive (Directive 76/768/EEC)[175]. It states that "given the special risks that substances classified as carcinogenic, mutagenic or toxic for reproduction...may entail to human health, their use in cosmetic products should be prohibited".

This prohibition applies not only to known and probable carcinogens but also for the first time, places restrictions on *possible* carcinogens in products. The amendment also includes requirements for labeling hazardous substances in cosmetics. Several toxic chemicals have been restricted in cosmetics as a result of this Directive. In comparison, relatively little has been done in Canada or the United States to address potentially hazardous substances in personal care products.

The Occupational Carcinogens Directive (Directive 90/394/EEC), discussed in Section 5, also calls for the substitution of carcinogens in order to protect workers.

The Principle of Extended Producer Responsibility: Clean Production and Takeback of end of life Products

Another important principle embraced by Europe is having the effect of reducing the use of hazardous substances in workplaces and in products. This is the concept of extended producer responsibility. It means that producers of products from cars to computers, from batteries to televisions, strive for "clean production" – manufacturing processes that do not use or create hazardous substances -- and that companies take responsibility for their products when they are finished their useful life. In Canada, this is referred to as "product stewardship".

Two new directives adopted by the European Union in February 2003 are focused on the electrical and the electronics industry, and advance the ideas of both cleaner production and responsibility for used products.

These two directives have already caused leading electronics companies worldwide to eliminate hazardous substances, including carcinogens, in their products and to shift to safe substitutes.

The Directive on the Restriction of the use of Certain Hazardous Substances in Electrical and Electronic Equipment (RoHS Directive)[176] prohibits the use of lead,

mercury, cadmium and hexavalent chromium in any new electrical and electronic equipment on the market after July 1, 2006. Although this directive applies to products that will be sold in Europe, many of the companies affected by the legislation are making design changes and adopting new processes that will lead to safer products being available world-wide. For example, Panasonic has already converted its television production facilities worldwide to the use of lead-free solder[177]. The restrictions contained in this regulation have been a driving factor in stimulating design and technologies aimed at substituting new processes or new materials for hazardous ones.

California has also adopted new electronics legislation that would match the European legislation and prohibit the sale of any electronic product in California that would not be allowed on the European market because of heavy metals[178].

The second directive, the Waste Electrical and Electronic Equipment Directive[179] WEEE Directive) makes the industry responsible for collecting electrical and electronic waste. When manufacturers are called upon to take back and recycle their products, there is an incentive to design products that are more easily recycled. This generally means changing the formulation or design of a product so that the producer does not have to handle hazardous wastes in the recycling efforts.

An American public interest group, the Computer Takeback Campaign[180], has been actively advocating for electronic companies in the United States to take the same responsibility for their used products.

The European Union has already had in place for several years a Directive on End-of-Life Vehicles (Directive 2000/53/EC) that promotes the recovery of end-of-life automobiles and other vehicles[181]. Under this Directive, vehicles on the European market after July 2003 may not contain lead, cadmium or hexavalent chromium.

Gaps in Industry Carcinogen Reductions in Canada

Although there are legislated requirements to reduce specific toxic chemicals, there is no "toxics use reduction" legislation in Canada.

There are no mandatory pollution prevention planning requirements that apply to all companies across Canada.

There are no policies aimed specifically at eliminating or substituting for carcinogens in the workplace, the environment or in products.

There is limited information and few technical assistance programs that would help companies make substitutions for particular chemicals or processes.

The initial capital costs of new technologies or processes make it financially challenging for companies.

8. Legislation and Regulation

Introduction

Legislation and regulation can be powerful tools for reducing or eliminating carcinogens. Where they have been introduced, they have been effective in reducing carcinogens in the workplace, eliminating their use in products and limiting their dispersal into the environment.

Health Canada has the primary responsibility for cancer control strategies in Canada. However, in the realm of legislation, federal and provincial departments of labour and environment have more direct legislative authority to eliminate or reduce carcinogens. Both environmental and occupational health and safety statutes have the potential to control carcinogens and reduce exposures.

Overview

The best practices in Canada with respect to the prevention of occupational and environmental exposures to carcinogens are those laws, regulations or policies that:

- allow for severe restrictions or phase-outs carcinogens in the workplace, in the environment or in products;
- promote the substitution of carcinogens with less hazardous substances or processes;
- require pollution prevention plans as one vehicle for reducing or eliminating the use of toxic chemicals;
- set targets for measurable reductions of carcinogens.

There are only two occupational health and safety laws in Canada that have explicit provisions for substitution -- the federal Labour Code and British Columbia's Workers Compensation Act. The substitution provisions in these Acts is a direct way in which workers, unions and companies are able to work towards the use of less harmful alternatives in the workplace. These two occupational health and safety laws represent the best practices in Canada because of their potential application to the reduction or elimination of carcinogens.

In the environmental field, the Canadian Environmental Protection Act 1999 and its regime for managing toxic chemicals is the most effective legislative tool in Canada for controlling carcinogens in the environment, and another example of a

best practice. Once a substance is declared toxic, the federal government has a range of control options available to them. Options include controlling chemicals through mandatory pollution prevention plans or by regulation. Although very few carcinogens have been regulated, regulations have reduced releases to the environment and, in some cases, almost eliminated them from designated sources.

Even municipalities can use their powers to control carcinogens, if there is a willingness to act. The City of Toronto has used its Sewer Use By-law to require toxics use reduction planning, modeled after Massachusetts' Toxics Use Reduction Act. As a result of this bylaw, for example, cadmium releases to the sewage treatment plant from metalfinishing industries have been reduced. This is another example of a regulatory best practice – in this case, at a municipal level.

In Europe, the Nordic countries, Sweden and Denmark in particular, have led the way in their efforts to eliminate carcinogens. They have been the most aggressive in instituting bans or restrictions, and influencing the European Union to follow their lead. The Swedish government has adopted a policy objective of achieving a non-toxic environment by 2020, and this has stimulated many innovative programs aimed at eliminating hazardous chemicals.

The most important new legislative development in chemicals management is the regulation proposed by the European Union, known as REACH -- the Registration, Evaluation and Authorisation of Chemicals. Europe is the largest producer of chemicals in the world and its desire to reform the way in which chemicals are introduced and managed in our society will have a far-reaching effect on future chemicals policy.

Best Practices in Occupational Health Legislation in Canada

Unlike Europe where occupational health legislation promotes substitution (described in Section 5), in Canada only the federal government and one province have legislation that promotes the elimination of hazardous substances through substitution. These requirements can be found in both the Canada Labour Code, and in British Columbia's Occupational Health and Safety Regulation.

Under the federal legislation, the Occupational Health and Safety Regulations of the Canada Labour Code, under Part X, Hazardous Substances, the law requires that:

Sec. 10.16. (1) No person shall use a hazardous substance in a work place where it is reasonably practicable to substitute a substance for it that is not a hazardous substance.

(2) Where a hazardous substance is to be used for any purpose in a work place and an equivalent substance that is less hazardous is available to be used for that purpose, the equivalent substance shall be substituted for the hazardous substance where reasonably practicable.

This legislation applies not only to employees of the federal government but to workers in other federal undertakings such as railways, airlines and post offices. The majority of workers in Canada, however, are subject to provincial occupational health and safety legislation.

Of all the provinces, British Columbia has the only occupational health and safety legislation that enshrines substitution in law. The B.C. regulation, amended in 1998, specifically targets carcinogens as substances in the workplace for which substitutes should be found. The Occupational Health and Safety Regulation, Part 5 Chemical and Biological Substances (5.57(1)), under the Workers Compensation Act, requires that if a substance (such as a carcinogen) is present in the workplace, "the employer must replace it, if practicable, with a material that reduces the risk to workers".

The regulations in British Columbia also provide for instances in which it may not be possible to find a suitable substitute. In that case, the regulation requires that, "if it is not practicable to substitute a material that reduces the risk to workers, in accordance with subsection (1), the employer must implement an exposure control plan to maintain workers' exposure *as low as reasonably achievable* below the exposure limit" (5.57(2)). In Canada, the ALARA principle, As Low As Reasonably Achievable, has been used in the nuclear industry to keep workers' exposures below the accepted legal limits.

The British Columbia legislation also bans 3 specific carcinogens, banned as well under European occupational health legislation -- 4-aminodiphenyl, 3,3-dichlorobenzidine, 4-nitrodiphenyl.

Other provinces[182], like Alberta, require that employers ensure that, if workers are exposed to harmful substances, these exposures are kept "as low as reasonably practicable" and not above the occupational exposure limits. This applies to many carcinogens such as arsenic, asbestos, cadmium, and vinyl chloride.

Workers must depend on acceptable limits under designated substances or special chemical regulations to protect them from carcinogens. Under these regulations, occupational exposure limits (OELs) are set for air exposures to carcinogens in the workplace.

Unlike many countries in Europe that set their own occupational exposure limits, most provinces in Canada rely on the American Conference of Governmental Industrial Hygienists (ACGIH) to recommend occupational exposure limits.

However, ACGIH, a private U.S.-based voluntary organization, has only limited resources to review a selected number of substances each year[183]. They do not advise that their standards be interpreted as health-based limits. Therefore, the exposure limits adopted by many provinces and their characterization of the hazard presented by these substances does not necessarily represent the highest level of protection.

A recent survey of the legislative regimes across Canada governing workplace carcinogens found a lack of consistency among various jurisdictions in legislated requirements for worker protection against exposure to workplace carcinogens[184]. This study, done by GE Canada for the National Committee on Environmental and Occupational Exposures, compared occupational exposure limits and key requirements for occupational carcinogens in all Canadian jurisdictions. The study identified 24 human carcinogens regulated by provincial and federal governments.

Some jurisdictions were found to have stronger protections in place than others. These jurisdictions, such as British Columbia, Alberta, Manitoba, Ontario, Quebec and Saskatchewan, had established designated lists of substances with strict standards relating to handling, use and exposure limits. Other jurisdictions, however, did not have the same high standards. The findings of this study demonstrated that legislative protections for workers across Canada are uneven.

Best Practices in Environmental Legislation in Canada

Although environmental legislation in Canada does not focus on carcinogens, many federal and provincial statutes have provisions for controlling pollution. The most important one is the Canadian Environmental Protection Act, 1999 (CEPA). It is the primary statute governing the management of toxic chemicals in Canada. The Act is jointly administered by Environment Canada and Health Canada, and its goal is the protection of human health and the environment. As such, it has the greatest legislative potential for the control of carcinogens.

Yet, even the federal Commissioner of the Environment and Sustainable Development in her 2002 Report to the House of Commons, has observed that the federal government's "ability to detect, understand, and prevent the harmful effects of toxic substances is still limited. The processes we observed seem to defy timely, decisive, and precautionary action"[185].

Currently Environment Canada and Health Canada are reviewing some 23,000 chemicals in commercial use to determine which ones require more in-depth assessment. These chemicals are part of an inventory known as the Domestic Substances List. As the assessment is being done, however, a number of chemicals have already been identified as "toxic substances". If they are added

to the List of Toxic Substances under CEPA, then the onus is on the government to develop a control program, either through regulation, pollution prevention plans or through voluntary procedures such as guidelines and memoranda of understanding.

Pollution Prevention Plans can be required by the federal government with respect to specific chemicals deemed to be toxic under CEPA. However, industries do not have to submit these plans to the federal government or make them public. They are only required to make declarations to the government that they have developed and are implementing a Pollution Prevention Plan[186].

If the Minister of Environment wants to assess the company's control actions, the Minister may require the plans to be submitted to the government by publishing a notice in the Canada Gazette. Unlike Massachusetts, the federal government uses pollution prevention plans to limit specific toxic substances rather than to require companies to do comprehensive planning and reductions. In Canada, it is not possible to evaluate the effectiveness of these Plans as a strategy for eliminating carcinogens and other toxic chemicals because of the lack of publicly available information.

In contrast, regulations for carcinogens under CEPA are legally binding, more transparent and have clearly articulated targets for reduction.

The federal government, using CEPA, has proposed to ban one carcinogen from use, nitrosodimethylamine (NDMA), and put restrictions on another, benzidine, as well as on hexachlorobenzene (listed as 2B, a possible carcinogen by IARC) under their "Total, Partial or Conditional Prohibition of Certain Toxic Substances Regulations". The provinces have banned very few substances and no carcinogens under their environmental protection legislation[187].

Other CEPA regulations have imposed some reductions on carcinogens. The Benzene in Gasoline Regulations, for example, promulgated in 1999, have been effective in reducing levels of benzene in Canada[188]. Urban ambient benzene concentrations have fallen almost 47 per cent since 1998, a year prior to the regulations, and rural ambient benzene concentrations have fallen by over 32 per cent.

The Regulations for the pulp and paper industry under the Fisheries Act, with complementary CEPA regulations, have also been effective. The Pulp and Paper Mill Chlorinated Dioxins and Furans Effluent Regulations, introduced by the federal government in 1992 under the Fisheries Act, set discharge limits and monitoring requirements for dioxins and furans from pulp mill effluents. The Pulp and Paper Effluent Regulations, under CEPA, required all mills to do environmental effects monitoring of their effluents.

As a result, most mills in Canada invested in control equipment and converted from using chlorine to chlorine dioxide in their processes. Discharges of chlorinated dioxins and furans have almost been eliminated, dropping from 288 grams per year in 1989 to 3 grams per year in 1997 – a reduction of 99 per cent[189]. Fish advisories have been lifted in most areas where levels of dioxins and furans in fish have declined since the regulations came into effect – evidence that regulations effectively eliminate carcinogens.

The most recent regulations under CEPA, the solvent degreasing regulations, were published in the Canada Gazette in August 2003. Both trichloroethylene and tetrachloroethylene (perchloroethylene) were assessed as toxic under CEPA.

Although IARC lists them as probable human carcinogens, carcinogenicity is only considered as one test of a chemical's impact on human health. It does not necessarily make a substance "toxic" under CEPA. According to Environment Canada's Pollution Prevention Office[190], the regulations were designed primarily to protect the environment from perchloroethylene and trichloroethylene wastes, although occupational health benefits such as a reduction in cancer were considered.

The regulations implement a three-year freeze in consumption of the two chemicals, followed by a 65 per cent reduction in the following years. The regulations apply to companies using more than 1,000 kilograms of solvent per year[191].

According to Environment Canada, the regulations will drive most large users to eliminate these chemicals or to find substitutes. Once any regulation is issued, companies prefer to find alternatives rather than be subject to the monitoring and reporting regimes required by the regulations. Environment Canada publishes a list of alternatives to solvent degreasers on its Pollution Prevention website.

Tetrachloroethylene Regulations have also been published for dry cleaning facilities to reduce releases of perchloroethylene to the environment. These regulations allow dry cleaners to attain reductions by requiring newer, more efficient dry-cleaning machines, rather than promoting substitution. They will likely result in overall reductions of perchloroethylene to the environment but they will not eliminate it by forcing a switch to cleaner technology.

Best Practices Using Municipal Bylaws

The City of Toronto's Sewer Use By-law[192] is another example of a best practice in primary cancer prevention in Canada. This bylaw is the only one in Canada to require pollution prevention planning. The City of Toronto has shown that even

on the scale of a city, it is possible to practice toxic use reduction and to reduce or eliminate carcinogens from industrial discharges to the sewer system.

Similar to the Massachusetts Toxics Use Reduction Act, the new sewer use bylaw requires certain industries to prepare pollution prevention plans to reduce or eliminate priority pollutants and submit a summary to the City, but does not require their implementation.

The priority pollutants include 11 heavy metals and 27 organics, including known carcinogens such as arsenic, nickel, cadmium and benzene. As a result of the pollution prevention planning, Toronto's metalfinishing companies have made significant reductions in carcinogens through substitution. For example, cadmium has been replaced with zinc as a plating material. As well, auto body refinishing operations have switched to water based paints; and discharges of mercury, although it is not a carcinogen, have been reduced by 40 per cent[193].

Best Practices in Legislation in Europe

Use of Bans and Restrictions

One of the most effective ways of reducing carcinogens in the workplace or the environment is through the enactment of clear laws banning or restricting their use. Bans and restrictions are used more frequently in Europe than in North America, although they are still imposed very cautiously.

Denmark has been the most aggressive country in Europe in banning or restricting dangerous substances. In the past 10 years they have moved to ban or phase out arsenic in treated wood as well as lead compounds and metallic lead in products[194]. Sweden has banned or restricted many of the same substances, as well as cadmium, trichloroethylene and pentachlorophenol.

Denmark has also used voluntary phase-outs in cooperation with their industries. For example, alkylphenolethoxylates, although not carcinogenic, have now been phased out of all detergents because of their potential impact on groundwater. Another strategy that Denmark has used to discourage the use of undesirable chemicals such as chlorinated solvents is to impose a chemicals tax.

The European Union's Limitations Directive has also been an important legislative tool for restricting carcinogens in consumer goods. Many of the restrictions have originated with countries like Sweden that seek broader European participation in controlling hazards.

The Limitations Directive allows for bans with exemptions or controlled use. In response to a European Council of Ministers' resolution on cancer prevention, this directive also prohibits the sale to the public of substances and preparations classified as known or probable carcinogens, mutagens or reproductive toxins. This has resulted in 42 substances and groups of substances being prohibited, or about 900 chemicals. It includes, for example, most uses of asbestos, benzene in toys and preparations, and nickel in jewellery. The limitation of the Limitations Directive is that it does not apply to final articles and products but only to substances and preparations.

Best Practices in Chemicals Management Including Carcinogens

One of the most important documents in Sweden is a policy that sets out Environmental Quality Objectives, adopted in 1999 by the Swedish Parliament. These objectives are now contained in a Government Bill, Swedish Environmental Quality Goals[195]. One of the 15 Environmental Quality Objectives is a Non-Toxic Environment[196]. This objective is driving Sweden's efforts to achieve an environment that is free from man-made substances and metals that represent a threat to human health or biological diversity within a generation. One sub-goal is the phasing out of substances of very high concern. The policy states that carcinogens (as well as other categories of hazardous chemicals) are to be eliminated from all products "to the extent possible" by 2007. Nor should they be used in production processes unless a company can prove that human health and the environment will not be harmed.

Sweden is also a strong supporter of the proposed European chemicals legislation, REACH, and its Non-Toxic Environment objective is aligned with the principles of REACH.

Through its proposed toxic chemicals policy, the European Union has tried to address the problems that have resulted from the harmful effects of toxic chemicals on human health and the environment, and to develop a new model for their management. This regulation, known as REACH – the registration, evaluation and authorisation of chemicals[197] -- represents a transformation in the current approach and management of chemicals. It has the potential to dramatically change the way in which chemicals are approved and used in our society.

Although it is still proposed, rather than a final regulation, REACH is expected to be implemented within the next few years. This gives the chemical industry time to prepare for the changes that will be ushered in by this regulation.

The regulation is designed as a three-stage process.

The first stage of the REACH regulation is the registration of all chemicals currently in use and all new chemicals. Manufacturers or importers of any substances in quantities of over 1 tonne per year must register them with an agency that will be created under this legislation -- the European Chemicals Agency. For substances manufactured or imported in quantities of over 10 tonnes per year, the registration information must include a chemical safety assessment. These requirements will fill in some of the existing data gaps, and give the European Union important information for chemicals already on the market. The registration provision also puts the onus on industry to manage the risks of chemicals they are using.

The second stage of REACH is the evaluation process. During evaluation, the different countries in the European Union will divide up the work of reviewing the registered substances. Countries may request that they review specific substances where there is a suspicion that the chemical may be harmful. The countries doing the evaluations may request more information from the manufacturer or importer in order to help with their review. If their evaluations show that specific chemicals pose a hazard to human health or the environment, these chemicals may be subject to authorisation or restricted.

Authorisation is the third phase of REACH. The use of chemicals that pose certain hazards will only be allowed with the authorisation of the European Commission. This includes carcinogens identified as category 1 and 2 by the European Commission and listed for authorisation. To obtain a time-limited authorisation, industries must demonstrate that they can adequately control the risks of handling the chemical. If they cannot show this, an authorisation is still possible if it can be justified by socio-economic factors and *if there are no suitable alternatives.* REACH allows applications for authorisations to be available on its website so that the public is given an opportunity to submit information on alternative substances or technologies[198].

Under REACH, all substances that are currently banned or restricted under the Limitations Directive are carried over and are categorized as Restricted under REACH.

Gaps in Canadian Occupational and Environmental Legislation

Although occupational health directives in Europe include provisions for substituting less hazardous chemicals for carcinogens, there are no requirements for substitutes to carcinogens in most provincial occupational health statutes in Canada.

There is a lack of toxicity data on thousands of chemicals in use, including information on carcinogenicity. Canada's process under CEPA for undertaking the evaluations of chemicals already in use may take decades to complete.

There are very few bans or restrictions on carcinogenic substances in the workplace, in the environment or in products in Canadian legislation.

Regulations that target toxic substances under CEPA, including probable carcinogens such as tetrachloroethylene or trichloroethylene, often promote pollution control rather than elimination or substitution.

In Canada there is no focus on carcinogens as chemicals of high concern, as there is in Europe, and there is no articulated policy or strategy for reducing or eliminating them. CEPA does not specifically target carcinogens.

Appendix I: IARC Overall Evaluations of Carcinogenicity to Humans

Group 1: Carcinogenic to humans

As evaluated in *IARC Monographs* Volumes 1-88

This list contains all agents, mixtures and exposures evaluated as being in Group 1 to date.
Where appropriate, chemical abstract numbers are given [in square brackets]. For details of the evaluation, the relevant Monograph should be consulted (volume number given in round brackets, followed by year of publication of latest evaluation).

Group 1: Carcinogenic to humans (95)

Agents and groups of agents

Aflatoxins (naturally occurring mixtures of) [1402-68-2] (Vol. 56, Vol. 82; 2002)
4-Aminobiphenyl [92-67-1] (Vol. 1, Suppl. 7; 1987)
Arsenic [7440-38-2] and arsenic compounds (Vol. 23, Suppl. 7;1987)
(NB: This evaluation applies to the group of compounds as a whole and not necessarily to all individual compounds within the group)
Asbestos [1332-21-4] (Vol. 14, Suppl. 7; 1987)
Azathioprine [446-86-6] (Vol. 26, Suppl. 7; 1987)
Benzene [71-43-2] (Vol. 29, Suppl. 7; 1987)
Benzidine [92-87-5] (Vol. 29, Suppl. 7; 1987)
Beryllium [7440-41-7] and beryllium compounds (Vol. 58; 1993)
(NB: Evaluated as a group)
N,N-Bis(2-chloroethyl)-2-naphthylamine (Chlornaphazine) [494-03-1] (Vol. 4, Suppl. 7; 1987)
Bis(chloromethyl)ether [542-88-1] and chloromethyl methyl ether [107-30-2] (technical-grade)
(Vol. 4, Suppl. 7; 1987)
1,4-Butanediol dimethanesulfonate (Busulphan; Myleran) [55-98-1] (Vol. 4, Suppl. 7; 1987)
Cadmium [7440-43-9] and cadmium compounds (Vol. 58; 1993)
(NB: Evaluated as a group)
Chlorambucil [305-03-3] (Vol. 26, Suppl. 7; 1987)
1-(2-Chloroethyl)-3-(4-methylcyclohexyl)-1-nitrosourea (Methyl-CCNU; Semustine) [13909-09-6] (Suppl. 7; 1987)
Chromium[VI] compounds (Vol. 49; 1990)
(NB: Evaluated as a group)

Ciclosporin [79217-60-0] (Vol. 50; 1990)
Cyclophosphamide [50-18-0] [6055-19-2] (Vol. 26, Suppl. 7; 1987)
Diethylstilboestrol [56-53-1] (Vol. 21, Suppl. 7; 1987)
Epstein-Barr virus (Vol. 70; 1997)
Erionite [66733-21-9] (Vol. 42, Suppl. 7; 1987)
Ethylene oxide [75-21-8] (Vol. 60; 1994)
(NB: Overall evaluation upgraded from 2A to 1 with supporting evidence from other data relevant to the evaluation of carcinogenicity and its mechanisms)
Etoposide [33419-42-0] in combination with cisplatin and bleomycin (Vol. 76; 2000)
Formaldehyde [50-00-0] (Vol. 88; in preparation)
[Gamma Radiation: see X- and Gamma (γ)-Radiation]
Gallium arsenide [1303-00-0] (Vol. 86; in preparation)
Helicobacter pylori (infection with) (Vol. 61; 1994)
Hepatitis B virus (chronic infection with) (Vol. 59; 1994)
Hepatitis C virus (chronic infection with) (Vol. 59; 1994)
Herbal remedies containing plant species of the genus *Aristolochia* (Vol. 82; 2002)
Human immunodeficiency virus type 1 (infection with) (Vol. 67;1996)
Human papillomavirus type 16 (Vol. 64; 1995)
Human papillomavirus type 18 (Vol. 64; 1995)
Human T-cell lymphotropic virus type I (Vol. 67; 1996)
Melphalan [148-82-3] (Vol. 9, Suppl. 7; 1987)
8-Methoxypsoralen (Methoxsalen) [298-81-7] plus ultraviolet A radiation (Vol. 24, Suppl. 7; 1987)
MOPP and other combined chemotherapy including alkylating agents (Suppl. 7; 1987)
Mustard gas (Sulfur mustard) [505-60-2] (Vol. 9, Suppl. 7; 1987)
2-Naphthylamine [91-59-8] (Vol. 4, Suppl. 7; 1987)
Neutrons (Vol. 75; 2000)
(NB: Overall evaluation upgraded from 2B to 1 with supporting evidence from other data relevant to the evaluation of carcinogenicity and its mechanisms)
Nickel compounds (Vol. 49; 1990)
(NB: Evaluated as a group)
Oestrogen therapy, postmenopausal (Vol. 72; 1999)
Oestrogens, nonsteroidal (Suppl. 7; 1987)
(NB: This evaluation applies to the group of compounds as a whole and not necessarily to all individual compounds within the group)
Oestrogens, steroidal (Suppl. 7; 1987)
(NB: This evaluation applies to the group of compounds as a whole and not necessarily to all individual compounds within the group)
Opisthorchis viverrini (infection with) (Vol. 61; 1994)
Oral contraceptives, combined (Vol. 72; 1999)
(NB: There is also conclusive evidence that these agents have a protective effect against cancers of the ovary and endometrium)
Oral contraceptives, sequential (Suppl. 7; 1987)
Phosphorus-32, as phosphate (Vol. 78; 2001)

Plutonium-239 and its decay products (may contain plutonium-240 and other isotopes), as aerosols (Vol. 78; 2001)
Radioiodines, short-lived isotopes, including iodine-131, from atomic reactor accidents and nuclear weapons detonation (exposure during childhood) (Vol. 78; 2001)
Radionuclides, α-particle-emitting, internally deposited (Vol. 78; 2001)
(NB: Specific radionuclides for which there is *sufficient* evidence for carcinogenicity to humans are also listed individually as Group 1 agents)
Radionuclides, β-particle-emitting, internally deposited (Vol. 78; 2001)
(NB: Specific radionuclides for which there is *sufficient* evidence for carcinogenicity to humans are also listed individually as Group 1 agents)
Radium-224 and its decay products (Vol. 78; 2001)
Radium-226 and its decay products (Vol. 78; 2001)
Radium-228 and its decay products (Vol. 78; 2001)
Radon-222 [10043-92-2] and its decay products (Vol. 78; 2001)
Schistosoma haematobium (infection with) (Vol. 61; 1994)
Silica [14808-60-7], crystalline (inhaled in the form of quartzor cristobalite from occupational sources) (Vol. 68; 1997)
Solar radiation (Vol. 55; 1992)
Talc containing asbestiform fibres (Vol. 42, Suppl. 7; 1987)
Tamoxifen [10540-29-1] (Vol. 66; 1996)
(NB: There is also conclusive evidence that this agent (tamoxifen) reduces the risk of contralateral breast cancer)
2,3,7,8-Tetrachlorodibenzo-*para*-dioxin [1746-01-6] (Vol.69; 1997)
(NB: Overall evaluation upgraded from 2A to 1 with supporting evidence from other data relevant to the evaluation of carcinogenicity and its mechanisms)
Thiotepa [52-24-4] (Vol. 50; 1990)
Thorium-232 and its decay products, administered intravenously as a colloidal dispersion of thorium-232 dioxide (Vol. 78; 2001)
Treosulfan [299-75-2] (Vol. 26, Suppl. 7; 1987)
Vinyl chloride [75-01-4] (Vol. 19, Suppl. 7; 1987)
X- and Gamma (γ)-Radiation (Vol. 75; 2000)

Mixtures

Alcoholic beverages (Vol. 44; 1988)
Analgesic mixtures containing phenacetin (Suppl. 7; 1987)
Areca nut (Vol. 85; in preparation)
Betel quid with tobacco (Vol. 85; in preparation)
Betel quid without tobacco (Vol. 85; in preparation)
Coal-tar pitches [65996-93-2] (Vol. 35, Suppl. 7; 1987)
Coal-tars [8007-45-2] (Vol. 35, Suppl. 7; 1987)
Mineral oils, untreated and mildly treated (Vol. 33, Suppl. 7;1987)
Salted fish (Chinese-style) (Vol. 56; 1993)
Shale-oils [68308-34-9] (Vol. 35, Suppl. 7; 1987)
Soots (Vol. 35, Suppl. 7; 1987)
Tobacco products, smokeless (Vol. 37, Suppl. 7; 1987)

Wood dust (Vol. 62; 1995)

Exposure circumstances

Aluminium production (Vol. 34, Suppl. 7; 1987)
Arsenic in drinking-water (Vol. 84; in preparation)
Auramine, manufacture of (Suppl. 7; 1987)
Boot and shoe manufacture and repair (Vol. 25, Suppl. 7; 1987)
Coal gasification (Vol. 34, Suppl. 7; 1987)
Coke production (Vol. 34, Suppl. 7; 1987)
Furniture and cabinet making (Vol. 25, Suppl. 7; 1987)
Haematite mining (underground) with exposure to radon (Vol. 1, Suppl. 7; 1987)
Involuntary smoking (Vol. 83; 2004)
Iron and steel founding (Vol. 34, Suppl. 7; 1987)
Isopropanol manufacture (strong-acid process) (Suppl. 7; 1987)
Magenta, manufacture of (Vol. 57; 1993)
Painter (occupational exposure as a) (Vol. 47; 1989)
Rubber industry (Vol. 28, Suppl. 7; 1987)
Strong-inorganic-acid mists containing sulfuric acid (occupational exposure to) (Vol. 54; 1992)
Tobacco smoking (Vol. 38, Suppl. 7, Vol. 83; 2004)

Group 2A: Probably carcinogenic to humans

As evaluated in *IARC Monographs* Volumes 1-88

This list contains all agents, mixtures and exposures evaluated as being in Group 2A to date.

Group 2A: Probably carcinogenic to humans (66)

Agents and groups of agents

Acrylamide [79-06-1] (Vol. 60; 1994)
(NB: Overall evaluation upgraded from 2B to 2A with supporting evidence from other data relevant to the evaluation of carcinogenicity and its mechanisms)
Adriamycin [23214-92-8] (Vol. 10, Suppl. 7; 1987)
(NB: Overall evaluation upgraded from 2B to 2A with supporting evidence from other data relevant to the evaluation of carcinogenicity and its mechanisms)
Androgenic (anabolic) steroids (Suppl. 7; 1987)
Aristolochic acids (naturally occurring mixtures of) (Vol. 82; 2002)
Azacitidine [320-67-2] (Vol. 50; 1990)
(NB: Overall evaluation upgraded from 2B to 2A with supporting evidence from other data relevant to the evaluation of carcinogenicity and its mechanisms)

Benz[*a*]anthracene [56-55-3] (Vol. 32, Suppl. 7; 1987)
(NB: Overall evaluation upgraded from 2B to 2A with supporting evidence from other data relevant to the evaluation of carcinogenicity and its mechanisms)
Benzidine-based dyes (Suppl. 7; 1987)
(NB: Overall evaluation upgraded from 2B to 2A with supporting evidence from other data relevant to the evaluation of carcinogenicity and its mechanisms)
Benzo[*a*]pyrene [50-32-8] (Vol. 32, Suppl. 7; 1987)
(NB: Overall evaluation upgraded from 2B to 2A with supporting evidence from other data relevant to the evaluation of carcinogenicity and its mechanisms)
Bischloroethyl nitrosourea (BCNU) [154-93-8] (Vol. 26, Suppl.7; 1987)
1,3-Butadiene [106-99-0] (Vol. 71; 1999)
Captafol [2425-06-1] (Vol. 53; 1991)
(NB: Overall evaluation upgraded from 2B to 2A with supporting evidence from other data relevant to the evaluation of carcinogenicity and its mechanisms)
Chloramphenicol [56-75-7] (Vol. 50; 1990)
(NB: Overall evaluation upgraded from 2B to 2A with supporting evidence from other data relevant to the evaluation of carcinogenicity and its mechanisms)
α-Chlorinated toluenes (benzal chloride [98-87-3], benzotrichloride [98-07-7], benzyl chloride [100-44-7]) and benzoyl chloride [98-88-4] (combined exposures) (Vol. 29, Suppl. 7, Vol. 71; 1999)
1-(2-Chloroethyl)-3-cyclohexyl-1-nitrosourea (CCNU) [13010-47-4](Vol. 26, Suppl. 7; 1987)
(NB: Overall evaluation upgraded from 2B to 2A with supporting evidence from other data relevant to the evaluation of carcinogenicity and its mechanisms)
4-Chloro-*ortho*-toluidine [95-69-2] (Vol. 77; 2000)
Chlorozotocin [54749-90-5] (Vol. 50; 1990)
(NB: Overall evaluation upgraded from 2B to 2A with supporting evidence from other data relevant to the evaluation of carcinogenicity and its mechanisms)
Cisplatin [15663-27-1] (Vol. 26, Suppl. 7; 1987)
(NB: Overall evaluation upgraded from 2B to 2A with supporting evidence from other data relevant to the evaluation of carcinogenicity and its mechanisms)
Clonorchis sinensis (infection with) (Vol. 61; 1994)
(NB: Overall evaluation upgraded from 2B to 2A with supporting evidence from other data relevant to the evaluation of carcinogenicity and its mechanisms)
Dibenz[*a,h*]anthracene [53-70-3] (Vol. 32, Suppl. 7; 1987)
(NB: Overall evaluation upgraded from 2B to 2A with supporting evidence from other data relevant to the evaluation of carcinogenicity and its mechanisms)
Diethyl sulfate [64-67-5] (Vol. 54, Vol. 71; 1999)
(NB: Overall evaluation upgraded from 2B to 2A with supporting evidence from other data relevant to the evaluation of carcinogenicity and its mechanisms)
Dimethylcarbamoyl chloride [79-44-7] (Vol. 12, Suppl. 7, Vol. 71; 1999)
(NB: Overall evaluation upgraded from 2B to 2A with supporting evidence from other data relevant to the evaluation of carcinogenicity and its mechanisms)

1,2-Dimethylhydrazine [540-73-8] (Vol. 4, Suppl. 7, Vol. 71; 1999)
(NB: Overall evaluation upgraded from 2B to 2A with supporting evidence from other data relevant to the evaluation of carcinogenicity and its mechanisms)
Dimethyl sulfate [77-78-1] (Vol. 4, Suppl. 7, Vol. 71; 1999)
(NB: Overall evaluation upgraded from 2B to 2A with supporting evidence from other data relevant to the evaluation of carcinogenicity and its mechanisms)
Epichlorohydrin [106-89-8] (Vol. 11, Suppl. 7, Vol. 71; 1999)
(NB: Overall evaluation upgraded from 2B to 2A with supporting evidence from other data relevant to the evaluation of carcinogenicity and its mechanisms)
Ethylene dibromide [106-93-4] (Vol. 15, Suppl. 7, Vol. 71; 1999)
(NB: Overall evaluation upgraded from 2B to 2A with supporting evidence from other data relevant to the evaluation of carcinogenicity and its mechanisms)
N-Ethyl-*N*-nitrosourea [759-73-9] (Vol. 17, Suppl.7; 1987)
(NB: Overall evaluation upgraded from 2B to 2A with supporting evidence from other data relevant to the evaluation of carcinogenicity and its mechanisms)
Etoposide [33419-42-0] (Vol. 76; 2000)
(NB: Overall evaluation upgraded from 2B to 2A with supporting evidence from other data relevant to the evaluation of carcinogenicity and its mechanisms)
Glycidol [556-52-5] (Vol. 77; 2000)
(NB: Overall evaluation upgraded from 2B to 2A with supporting evidence from other data relevant to the evaluation of carcinogenicity and its mechanisms)
Human papillomavirus type 31 (Vol. 64; 1995)
Human papillomavirus type 33 (Vol. 64; 1995)
Indium phosphide [22398-80-7] (Vol. 86; in preparation)
IQ (2-Amino-3-methylimidazo[4,5-*f*]quinoline) [76180-96-6] (Vol. 56; 1993)
(NB: Overall evaluation upgraded from 2B to 2A with supporting evidence from other data relevant to the evaluation of carcinogenicity and its mechanisms)
Lead compounds, inorganic (Vol. 87; in preparation)
Kaposi's sarcoma herpesvirus/human herpesvirus 8 (Vol. 70; 1997)
5-Methoxypsoralen [484-20-8] (Vol. 40, Suppl. 7; 1987)
(NB: Overall evaluation upgraded from 2B to 2A with supporting evidence from other data relevant to the evaluation of carcinogenicity and its mechanisms)
4,4′-Methylene bis(2-chloroaniline) (MOCA) [101-14-4] (Vol.57; 1993)
(NB: Overall evaluation upgraded from 2B to 2A with supporting evidence from other data relevant to the evaluation of carcinogenicity and its mechanisms)
Methyl methanesulfonate [66-27-3] (Vol. 7, Suppl. 7, Vol. 71; 1999)
(NB: Overall evaluation upgraded from 2B to 2A with supporting evidence from other data relevant to the evaluation of carcinogenicity and its mechanisms)
N-Methyl-*N*′-nitro-*N*-nitrosoguanidine(MNNG) [70-25-7] (Vol. 4, Suppl. 7; 1987)
(NB: Overall evaluation upgraded from 2B to 2A with supporting evidence from other data relevant to the evaluation of carcinogenicity and its mechanisms)
N-Methyl-*N*-nitrosourea [684-93-5] (Vol. 17, Suppl.7; 1987)
(NB: Overall evaluation upgraded from 2B to 2A with supporting evidence from other data relevant to the evaluation of carcinogenicity and its mechanisms)
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Procarbazine hydrochloride [366-70-1] (Vol. 26, Suppl. 7; 1987)
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