Prevention of Occupational and Environmental Cancers in Canada:

A Best Practices Review and Recommendations

National Committee on Environmental and Occupational Exposures
Primary Prevention Action Group
Canadian Strategy for Cancer Control

May 2006

This Report prepared by the members of the **National Committee on Environmental and Occupational Exposures**, a tripartite and multi stakeholder sub-committee of the Primary Prevention Action Group of the Canadian Strategy for Cancer Control. Original research and data gathered for this report completed by Ms. Anne Wordsworth, Environmental Consultant.

Funding for this publication was provided by the Public Health Agency of Canada. The opinions expressed in this publication are those of the authors/researchers and do not necessarily reflect the official views of the Public Health Agency of Canada.

Glossary of Acronyms:

ALARA	As Low As Reasonably Achievable
BP	Best Practices
CAREX	International Information System on Occupational Exposure to Carcinogens
CEPA	Canadian Environmental Protection Act
GHS	Globally Harmonized System for the Classification and Labeling of Chemicals
NPRI	National Pollutant Release Inventory
OELs	Occupational Exposure Limits
WHMIS	Workplace Hazardous Materials Information System

Foreword

Since 1999, Health Canada (now the Public Health Agency of Canada) has been working in partnership with the Canadian Association of Provincial Cancer Agencies, the Canadian Cancer Society and the National Cancer Institute of Canada and other stakeholders to develop the Canadian Strategy for Cancer Control (CSCC).

The CSCC is a collective effort by the major cancer players to present an integrated and national approach to fight cancer. Led by a Council selected from the major stakeholders, health service providers, and non-governmental organizations and supported by a secretariat, the CSCC addresses all the components of the cancer control continuum, not just the therapeutic care of cancer patients. It includes efforts for preventing cancer, as well as supporting cancer patients and their families by way of psychosocial and palliative services. The CSCC implements its key priorities through six Action Groups, whose innovative projects will lead to major changes and improvements in the current cancer control system in Canada.

The CSCC seeks to optimize the benefits of current knowledge and available resources for cancer control, while enhancing the sustainability of the health care system through more collaborative planning, priority setting, public policy development and implementation. Integration and coordination of activities under the CSCC is expected to help reduce cancer incidence, morbidity and mortality rates and enhance the quality of life for those living with cancer. The CSCC aims to bring about the sustained, co-coordinated and comprehensive approach needed to meet the challenge of Canada's growing and aging population. In particular, the strategy focuses on the need for improved surveillance and the identification and implementation of best practices in prevention and control. More information on the CSCC available at www.cancercontrol.org.

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The prevention of occupational and environmental exposures associated with cancer has received limited attention in the arenas of research and public policy relative to exposures such as tobacco and the role of exercise and nutrition in cancer prevention.

Although the exact proportion of all cancers due to environmental and occupational exposures is the subject of debate, it is clear that for those people who are exposed the risk can be high and these exposures are preventable.
At its initial meeting on January 14, 2003, the National Committee on Environmental and Occupational Exposures (NCEOE) endorsed the application of the precautionary principle as part of an essential strategy in primary cancer prevention. The precautionary principle forms the basis for public policy addressing environment and human health and has been referenced in Canadian environmental legislation and throughout the European Community:

> **Whenever reliable scientific evidence is available that a substance may have an adverse impact on human health and the environment but there is still scientific uncertainty about the precise nature or the magnitude of the potential damage, decision-making must be based on precaution in order to prevent damage to human health and the environment.**[1]

The committee has also focused on confirmed and probable human carcinogens as classified by the International Agency for Research on Cancer (IARC). Evidence of carcinogenicity is based on thorough scientific reviews of epidemiologic and experimental data on carcinogenicity of chemicals, groups of chemicals, industrial processes, other complex mixtures, physical agents, and biologic agents to which humans are known to be exposed. See Table 1 for a list of Group 1 and 2A and some group 2B carcinogens.

This report describes best practices in the primary prevention of exposures to occupational and environmental cancer-causing agents (i.e., carcinogens) in Canada and compares 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.

The results of this review indicate that it is necessary to take action in the following key areas:

- To raise the profile of the primary prevention of the environmental and occupational exposures as a priority issue within provincial cancer control agencies/programs.
- To disclose the presence, use and release of classified carcinogens, as a necessary prerequisite to primary prevention in workplaces, the environment and the home.
- To develop further legislation, regulation and policy, as required for primary prevention.
- To focus efforts nationally and provincially more specifically on primary prevention of exposures to occupational and environmental carcinogens.
- To establish the elimination, when possible, and minimization of exposure at all times for Group 1 and 2A carcinogens as an objective for primary stakeholders and governments.
- To exploit opportunities for inter-sectoral collaboration in order to maximize our effectiveness and focus activity on primary prevention strategies

Furthermore, a 2003 analysis of IARC's reviews has identified the known and probable human carcinogens that are present in occupational settings.[1] The analysis found that occupational carcinogens account for 28 of the 89 definite human carcinogens, and 27 of 64 probable human carcinogens. The study also shows the occupations in which these carcinogens are used and the target organs. The identification of these occupational carcinogens could be used to prioritize chemicals or mixtures in the workplace for reduction or elimination.

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[1]Resolution of the European Council of Nice, December 2000, COM (2000) 1, 2.2.2000.
[2]Siemiatycki, J. et al., "Listing of Occupational Carcinogens", Environmental Health Perspectives, Vol. 112, 15, Nov. 2004.

Table 1. Occupation/industries evaluated by IARC as definitely (group 1), probably (group 2A), or possibly (group 2B) entailing excess risk of cancer among workers

Occupation or industry	Suspected substance	IARC Monograph Volume (year)*	Group	Site(s)
Aluminum production	Pitch volatiles, aromatic amines	Suppl. 7 (1987)	1	Lung[b], bladder[b]
Auramine manufacture	2-Naphthylamine, auramine, other chemicals, pigments	Suppl. 7 (1987)	1	Bladder[b]
Boot & shoe manufacture/repair	Leather dust, benzene & other solvents	Suppl. 7 (1987)	1	Leukemia[b], nasal[b], paranasal sinuses[b], bladder[b]
Carpentry & joinery	Wood dust	Suppl. 7 (1987)	1A	-
Coal gasification	Coal tar, coal-tar fumes, PAHs	Vol. 34 (1984)	1	Skin (incl. scrotum)[b], bladder[b], lung[b]
Coke production	Coal-tar fumes	Suppl. 7(1987)	1	Skin(scrotum)[b], lung[b], bladder[c], kidney[c]
Dry cleaning	Solvents & chemicals used in "spotting"	Vol. 63 (1995a)	2B	-
Furniture & cabinet making	Wood dust	Suppl. 7 (1987)	1	Nose & sinonasal cavities[b]
Hairdressers & barbers	Dyes (aromatic amines, amino-phenols with hydrogen peroxide), solvents, propellants, aerosols	Vol. 57 (1993b)	2A	Bladder[c], lung[c], non-Hodgkin lymphoma[c], ovary[c]
Hematite mining	Radon daughters, silica	Suppl. 7 (1987)	1	Lung[b]
Iron & steel founding	PAHs, silica, metal fumes, formaldeyhyde	Suppl. 7 (1987)	1	Lung[b]
Isopropanol manufacture, strong-acid process	Diisopropyl sulfate, isopropyl oils, sulfuric acid	Suppl. 7 (1987)	1	Paranasal sinuses[b], larynx[b], lung[c]
Magenta manufacture	Magenta, *ortho*-toluidine, 4,4'-methylene bis (2-methylaniline), *ortho*-nitrotoluene	Vol. 57 (1993b)	1	Bladder[b]
Painters		Vol. 47 (1989c)	1	Lung[b], bladder[c], stomach[c]
Petroleum refining	PAHs	Vol. 45 (1989b)	2A	Bladder[c], brain[c], leukemia[c]
Printing processes	Solvents, inks	Vol. 65 (1996)	2B	-
Production of art glass, glass containers, and pressed ware	Lead, arsenic, antimony oxides, silica, asbestos, other metal oxides, PAHs	Vol. 58 (1993a)	2A	Lung[c]
Rubber industry	Aromatic amines, solvents	Suppl. 7 (1987)	1	Bladder[b], stomach[c], larynx[c], leukemia[c], lung[c]
Textile manufacturing industry	Textile dusts in manufacturing process, dyes and solvents in dyeing and printing operation	Vol. 48 (1990b)	2B	-

[a] Most recent IARC evaluation; for those referenced as Supplement 7 (IARC 1987), it is possible that the 1987 review was quite perfunctory and that the essential evidence was accumulated at an earlier date.

[b] Authors judged that evidence for an association with this site was strong.

[c] Authors judged that evidence for an association with this site was suggestive.

The NCEOE has developed 7 priority recommendations, which seek to begin to address the main gaps in Canadian practice. These recommendations cover a broad range of activities, and will require our sustained commitment, concerted efforts, and resources. In addition, future activities, articulated in 12 additional recommendations, continue to target the key areas of surveillance, public disclosure, community education, and government policy. The NCEOE looks forward to working towards the implementation of these recommendations, in collaboration and partnership with governments, non-governmental and community organizations, industry, and labour organizations.

Surveillance

Gaps
• Limited funding for occupational and environmental cancer/ carcinogen research • Provincial cancer treatment centres do not routinely record information about the occupational histories or environmental exposures • No central agency responsible for disseminating information to affected occupational groups and communities • No systematically collected publicly available information on current occupational exposures to classified carcinogens in Canadian workplaces • No registry of chemical carcinogens in the workplace comparable to the National Dose Registry for radiation or the Finnish ASA

Surveillance is the tracking and forecasting any health event or health determinant through the ongoing collection of data, and the integration, analysis and integration of the data, for the purposes of planning intervention.

The surveillance of confirmed cancer cases is one approach that can help identify carcinogens and their role in causing cancer, be it in an occupational or environmental setting. However, because of the long latency period for cancer, these examinations of cancer cases reflect exposures that were experienced as much as twenty to forty years ago. The surveillance of cancer cases, therefore, does not lend itself readily to primary cancer prevention.

In contrast, the exposure surveillance of carcinogens offers an opportunity to intervene to prevent cancer. This process collects information on exposure to carcinogens. The extent of exposures is monitored, and the information on worker or community exposure to carcinogens is collected in registries or databases.

Recommendations
1. In order to properly identify individual cases of environmental and occupational cancer it is necessary to collect a thorough occupational and environmental history. Provincial cancer control agencies/ programs should actively promote the collection of this information. (This will assist in documentation where association to carcinogen exposure is both known and for further work regarding ongoing research into possible new associations.) 2. Encourage the development and application of an International Information System on Occupational Exposure to Carcinogens (CAREX) and carcinogen exposure worker registry program in Canadian jurisdictions. 2.1 Workplace monitoring and collection of data should be required by regulators for all Group 1 and 2A carcinogens listed in Table 1, in use or produced. 2.2 There should be a harmonization of exposure limits for Group 1 and 2A carcinogens (listed in Table 1) in workplaces throughout Canada. The ALARA principle should be applied.[2]

In Canada, the best ongoing hazard surveillance program of this kind in the occupational health area is the National Dose Registry, which monitors workers' exposure to ionizing radiation, a confirmed carcinogen. It tracks, among others, healthcare workers, uranium miners and nuclear power workers.

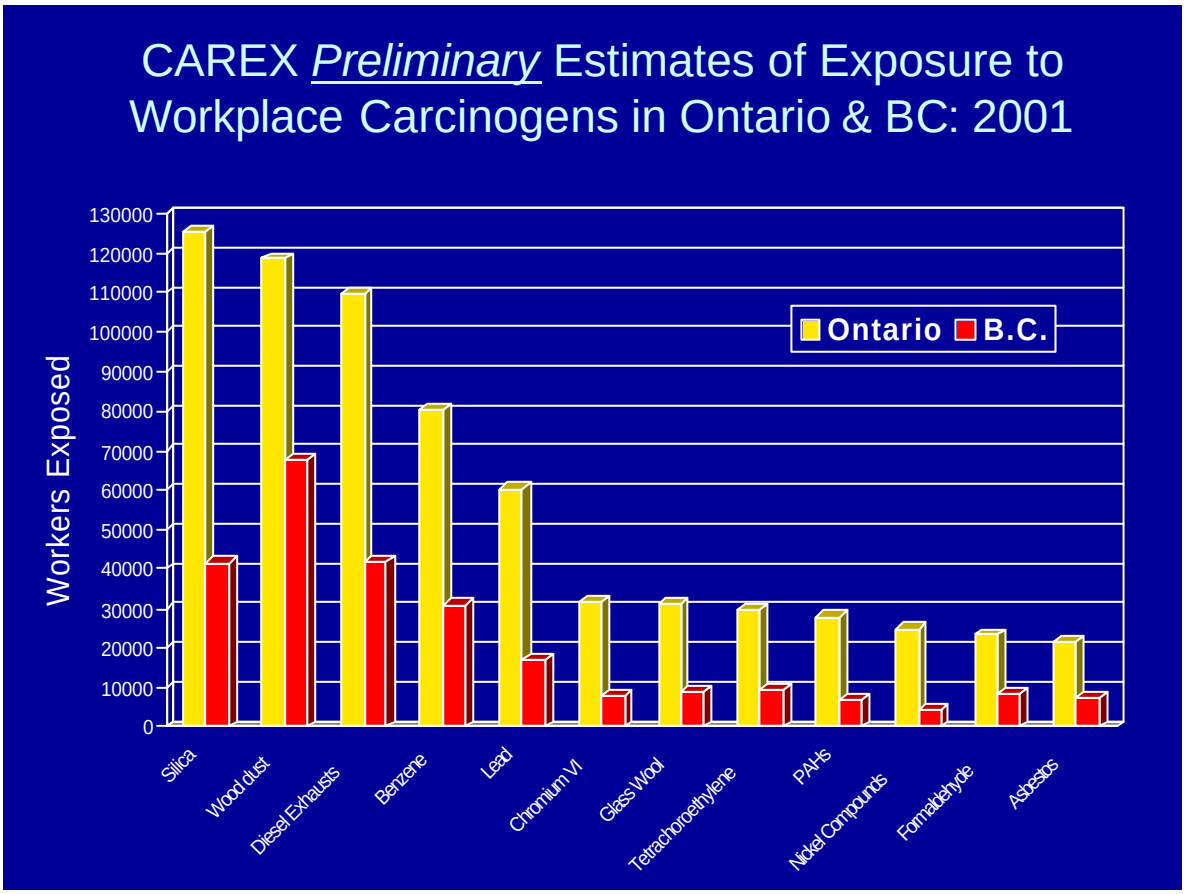
[2] The NCEOE sent a letter to the OELs Update Project, Ministry of Labour in November 2004 recommending that the Ontario government harmonize its occupational health legislation with British Columbia's by incorporating requirements for substitution where Group 1, 2A and 2B carcinogens are used and by adopting the ALARA principle (as low as reasonably achievable) for exposures to carcinogens.

In Europe, Finland has a registry (the ASA) that documents workers' exposures to classified and listed carcinogens. The intention of these registries is to monitor trends in levels of exposure, to take action to reduce them and to ensure that workers are not exposed to levels of carcinogens above the allowable limits.

In the European Union, the Finnish Institute for Occupational Health developed the International Information System on Occupational Exposure to Carcinogens (CAREX) to estimate exposures to occupational carcinogens in different occupations and industries. The NCEOE has identified the lack of systematic hazard surveillance as a major gap in Canadian practice. We have supported current studies to estimate occupational exposure to carcinogens in Ontario and British Columbia, using this system, which are underway. Preliminary data from these studies indicate that there are thousands of workers at risk of exposure to classified human carcinogens. This is of concern, requires our attention, and further intervention. (See recommendation #2 above) Prevention of exposures now will result in fewer cancer cases in the future.

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 for preventive intervention.

Examples of best surveillance practices in the United States and Europe – SENSOR, THOR, and the Centers for Diseases Control and Prevention biomonitoring studies -- are not focused on cancer, but 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.



From the UBC School of Occupational and Environmental Hygiene/Cancer Care Ontario Project

Information Disclosure and Labeling

Gaps

- Consumer Chemical Regulations do not require carcinogen disclosure
- No central repository or audit for workplace MSDSs
- No community and limited first responder information disclosure
- Limited NPRI data (Thresholds, exemptions pesticides, transport, maintenance)
- See Government Intervention: Legislation/Regulation and Policy recommendations addressing these gaps

Recommendations

1. Heath Canada's WHMIS Division should develop a national program for auditing the accuracy and completeness of MSDS in collaboration with HMIRC and the provinces.

   1.1 Regulators must look at better enforcement of WHMIS requirements for accurate MSDS, and training of the workforce regarding the significance of MSDS disclosure information pertaining to classified carcinogens. (See p. 12 for additional recommendations)

A number of laws providing for information disclosure have been developed over the last 20 years, particularly in the United States. Information disclosure laws provide access to information held by government and industry, and, where they identify carcinogens, give the public and workers knowledge that may enable them to avoid or reduce exposures.

The two most important information disclosure laws in Canada are the Workplace Hazardous Materials Information System and the National Pollutant Release Inventory.

The Workplace Hazardous Materials Information System, known as WHMIS, is a system of integrated provincial and federal laws that require disclosure of hazard information to workers through material safety data sheets, labeling requirements and training programs. Material safety data sheets (MSDSs, in particular, can be used by workers to find out whether a substance causes cancer.

However, MSDSs do not always accurately describe all properties of hazardous ingredients in a product. The Hazardous Materials Information Review Commission, which reviews requests for trade secret exemptions, reports on the violations regarding information disclosure requirements in the MSDS it reviews. Errors in disclosure of toxicological properties such as carcinogenicity are of particular concern.

Under the Canadian Environmental Protection Act, the federal government established the National Pollutant Release Inventory (NPRI), a national inventory of chemicals released by large facilities to land, air and water, and shipped off-site for disposal, treatment or recycling. Facilities are required to report the releases and transfers of 324 key pollutants, including many confirmed and probable carcinogens. This reporting is made public. Community groups, such as the Toronto Environmental Alliance, have used NPRI reporting to identify carcinogens present in the City of Toronto. The NCEOE has recommended that systematic hazard mapping, using the NPRI, be done for all Canadian communities to determine which areas are subject to exposures of concern.

MSDS Violations 2004-2005

(HMIRC Reviewed Claims Only)

	Number of Violation Occurrences		
	Original	Refiled	Total
Total	1815	288	2103
# of Claims	191	54	245
Average # of Violation occurrences per claim	9.5	5.3	8.6
Hazardous ingredients			
Chemical identity	47	7	54
CAS and PIN	24	6	30
Concentration	59	19	78
Concentration ration	87	5	92
Acute lethality values	157	35	192
Toxicological Properties			
Route of entry	13	2	15
Acute exposure	113	6	119
Chronic exposure	114	13	127
Exposure limits	74	11	85
Irritancy	13	3	16
Corrosivity	21	-	21
Sensitization	9	3	12
Carcinogenicity	11	5	16
Embryotoxicity	1	-	1
Teratogenicity	12	-	21
Reproductive toxicity	14	3	17
Fetotoxicity	36	6	42
Mutagenicity	58	9	67
Synergism	10	8	18

In addition, some provincial legislation provides the public with information on carcinogens. Ontario has established a regulation that requires large facilities to report air emissions. This information is publicly available on the Ministry of Environment's OnAIR website. The OnAIR registry lists more air contaminants than the NPRI, and, in some instances, at lower thresholds. Ontario also legislates the right of the public to information on drinking water testing. In Ontario, and throughout the United States, safe drinking water laws require drinking water operators to report annually on a proscribed list of chemicals, including carcinogens such as trihalomethanes, which have been detected in 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. It also set up the U.S. Toxics Release Inventory, after which the NPRI was modeled. The Toxics Release Inventory (TRI) is more comprehensive than the NPRI, covering approximately 660 listed chemicals. An analysis of air toxics between 1988 and 1991 found that plants whose emissions generated higher numbers of expected cancer cases reduced their emissions more than other companies.[3]

The City of Eugene, Oregon, has established a Toxics Right-to-Know program through a voter-initiated amendment to the Eugene City Charter. As a result, large companies in Eugene are required to do materials accounting and report all toxic emissions. The information is made publicly available. This program captures more information on toxic chemicals than the TRI.

The U.S. Fair Packaging and Labeling Act requires the listing of ingredients by chemical name on the labels of personal care products. As of November 2006, new regulations will make ingredient labeling mandatory for all cosmetic products sold in Canada as well. However, carcinogens are not identified by hazard phrases, pictograms or any specific markings to make consumers aware of their presence in cosmetics. Consumers are only able to identify carcinogens used in these products if they know which chemicals are listed carcinogens. The Globally Harmonized System of Classification and Labeling of Chemicals (GHS) has recommended that countries use plain language labeling that describes potential hazards, such as carcinogenicity, and uses standardized phrases and hazard symbols. In Europe, no known or suspected carcinogens are allowed in cosmetic products under the Cosmetics Directive.

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. It also requires that businesses that knowingly expose people to carcinogens give them "clear and reasonable" warning. This legislation led directly to manufacturers reformulating their products and eliminating carcinogens in order to avoid warning labels. Makers of fine china and plumbing supply manufacturers, for example, reduced or eliminated lead from their products.[4]

Although there is a system of labeling hazardous products in Canada with symbols, carcinogenicity, unlike flammability or corrosivity, is not a criterion for hazard labeling. Confirmed carcinogens like silica in abrasive cleaners, or suspected carcinogens such as the pesticide, lindane, would not have to be identified.

Another way for the public to avoid products containing carcinogens is to look for ecolabeling. This labeling identifies products, such as household cleaners, that are free of hazardous chemicals, including carcinogens. This is a much more popular practice in Europe than in the United States or Canada.

[3] Hamilton, J., "Exercising Property Rights to Pollute: Do Cancer Risks and Politics Affect Plant Emission Reductions?", Journal of Risk and Uncertainty, Vol. 18, 2, August 1999.

[4] Clifford Rechtschaffen, "How to Reduce Lead Exposures With One Simple Statute: The Experience of Proposition 65", Environmental Law Reports 29, 10581-10591.

Community Education and Action

Gaps

- Lack of infrastructure and linkage between community organizations
- Few expert resources and funding sources
- Secondary focus on primary cancer prevention: multiple issues, weak priority setting
- Little media attention and poor linkage between "health care crisis" and primary prevention

Community groups, environmental organizations and committed groups of cancer survivors, particularly organizations of women affected by breast cancer, have initiated public education and action campaigns related to primary cancer prevention.

Often working with minimal financial support and volunteer labour, they have raised awareness of the link between exposures to environmental carcinogens found in food, automobile exhaust, schools, air, water, and products such as cosmetics and household cleaners, and their possible health effects. In doing so, they have helped the public identify carcinogens and reduce their personal exposures to them.

Groups such as the Labour Environmental Alliance Society who have published the Cancer Smart Consumer Guide, the Environmental Health Association of Nova Scotia who developed a web-based Guide to Less Toxic Products, and the Saunders-Matthey Cancer Prevention Coalition publish reports, maintain websites, and conduct conferences and workshops. The Toronto Cancer Prevention Coalition works directly with the City of Toronto Public Health to restrict or remove carcinogens from the environment and the workplace.

One of the most effective prevention strategies, intended to reduce the risk of exposure to a number of toxicants, has been the ban or phase out of the "cosmetic" use of pesticides initiated by community activists in a significant number of Canadian cities and towns. In persuading municipalities to adopt bylaws restricting pesticide use, community-based coalitions have received broad support not only from labour and environmental groups but also from physicians' groups, women 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. The NCEOE believes that a similar focus on priority carcinogens, such as the top 20 occupational carcinogens identified in the CAREX studies mentioned aboved, is needed in Canada.

Recommendations

1. Municipalities should develop and implement primary prevention activities, such as:
   i. Community exposure profiles should be developed in collaboration with NPRI and community organizations.
   ii. Support for collaborations such as that between the Toronto Department of Health and the Toronto Cancer Prevention Coalition should be encouraged.
   iii. Community pollution prevention bylaws should be encouraged and BP examples disseminated.

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 campaigned for legislation such as biomonitoring in California and toxics reduction in 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 support the need for stronger chemicals regulation. At the same time they lobby for legislation, these groups have also mounted consumer campaigns aimed at retailers.

Worker Education and Action

Gaps

- Lack of resources and technical expertise to evaluate chemicals in use and to find information on safer substitutes
- Little knowledge of best practices in Canada and EU and lack of harmonization across provinces
- Different regulatory regimes prevent common prevention efforts
- Most collective agreements do not address primary prevention and occupational cancer controls.

Recommendations for Future Proposed Activities

1. Information bulletins should be developed to address cancer prevention and toxic use exposure/ reduction (TUR), substitution arrangements and best available technology.
2. The Mass. Toxic Use Exposure/ Reduction model should be further investigated and funding for a Canadian Federal or Provincial counterpart considered.

In the 1990s, disturbed by the apparent sustained prominence of cancer in their friends and co-workers, unions initiated cancer prevention campaigns.

As a result, many health and safety activists and unions -- the Canadian Auto Workers, the United Steelworkers of America, the Communications, Energy and Paper workers representing workers in the chemical industry, as well as a broad range of public and service sector unions such as Public Service Alliance of Canada, Canadian Union of Public Employees, and United Food and Commercial Workers -- focused their efforts on removing or reducing carcinogens in the workplace. These cancer prevention campaigns are examples of best practices in the workplace.

The campaigns started with intensive education programs, including workshops and training programs conducted by the unions. Strategies for the reduction or elimination of carcinogens were developed, followed by action in the workplace.

Unions and health and safety activists worked with employers through joint health and safety committees and through collective bargaining to achieve improvements. They were able to use provisions in existing health and safety laws that gave them the right to know about hazards in the workplace and the right to refuse unsafe work. They were also able to reduce their exposures by working with employers to replace dangerous substances with less hazardous ones, to make process modifications, or through process substitution. Legislation in British Columbia and Quebec with substitution provisions has facilitated this.

In Ontario, through the collective bargaining process unions and the big 3 auto makers agreed to reduce exposures to metalworking fluids by setting their own level of exposures in the plants, well below the provincial standard. In some working areas of the plants, the automakers agreed to replace metalworking fluids with canola oils. In addition, the collective agreements banned several carcinogens, among them asbestos and vinyl chloride.

Other workplaces have replaced solvents with water to clean metal parts. Less hazardous paints were substituted for paints with heavy solvents in British Columbia 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 many have switched to safer products in long-term care facilities, processing plants, hotels, restaurants, offices and schools.

In Europe, workers face the same hazards and are similarly looking for substitutes to carcinogens in their workplaces. Directives of the European Union, and national occupational health and safety legislation facilitate this. For example, the Occupational Carcinogens Directive stipulates that “the employer shall reduce the use of a carcinogen or mutagen 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 workers' health or safety, as the case may be.” (Article 4)

Carcinogens Eliminated from Ford and Chrysler plants by Collective Agreement:

Asbestos
Bis(choloromethyl)ether (BCME)
Carbon tetrachloride
Halons
Hydrobromofluorocarbons (HBFCs)
Methyl bromide
Methyl chloroform
Polybrominated biphenyls(PBBs)>0.001%
Polychlorinated biphenyls(PCBs)>0.001%
Polyclorinated terphenyls(PCTs)>0.001%
Tris (1-aziridinyl) phosphine oxide
Tris (2,3-dibromopropyl) phospate (TRIS)
Vinyl chloride monomer 0.001%

Non-Governmental Organizations' Work in Cancer Prevention

Organizations such as the Occupational Health Clinics for Ontario Workers (OHCOW)] and the Canadian Cancer Society not only help people with cancer but they also try to prevent the exposures that might have caused the disease.

The Occupational Health Clinics for Ontario Workers (OHCOW) 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. For instance, the Windsor OHCOW clinic has initiated the collection of occupational histories of cancer patients in collaboration with the Windsor Regional Cancer Centre since 1994. Currently there is a research project to collect the occupational histories of over 1000 women with breast cancer and 1000 community controls to determine whether occupational and environmental factors are contributing to breast cancer risk[5].

The Canadian Cancer Society has publicly supported the use of the precautionary principle, and, on this basis, took part in the campaign to ban the ornamental use of pesticides on lawns and gardens. They have also called for the discontinuation of pressure-treated lumber for decks and playgrounds because of its potential to expose children and families to arsenic, and promoted the reduction of exposures to environmental carcinogens.

Provincial cancer societies have also promoted cancer prevention. The Alberta Cancer Board, for example, has co-sponsored and organized a national conference on primary cancer prevention with the NCEOE. The BC & Yukon Division (CCS) has initiated a BC Primary prevention Action group with an important focus on documenting and reducing occupational & environmental exposures.

[5] Brophy JT, Keith MM, Gorey KM, Luginaah I, Laukkanen E, Hellyer D, Reinhartz A, Watterson A, Abu-Zahra H, Maticka-Tyndale E, Schneider K, Beck M, Gilbertson M. (2006). Occupation and breast cancer: a Canadian case-control study. Annals of the New York Academy of Sciences (in press).

Employer/Industry Reductions of Carcinogens

Gaps

- Limited focus by employer/industry associations
- Limited information sharing regarding alternatives and substitutes
- Limited technical assistance programs to assist companies to make substitutions for particular chemicals or processes.
- Weak coordination with OSH agencies or Ministries of the Environment: elimination and substitution
- Limited financial incentives or fiscal policies promoting pollution prevention for carcinogens

Recommendations for Future Proposed Activities

1. Employer/Industry should audit MSDSs for Group 1 and 2A carcinogens to ensure they comply with WHMIS information disclosure requirements.
2. Employers/Industry should audit their procedures/policies regarding the handling of carcinogens.
3. Incentives for Toxic Use Reporting Programs at all three levels of government should be investigated.

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

Although government regulations are the most effective means of implementing broad- based 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.

The public interest in safer products has also stimulated some companies to create products such as heat-treated wood and industrial cleaners that do not contain carcinogens or other toxins.

Companies with pollution prevention programs that are good 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 dichloromethane, a suspect carcinogen, to an aqueous-based process.
- Interface, the world's largest flooring company, adopted an objective worldwide of zero emissions to air and water. In Belleville, where it manufactures nylon carpet tiles, it eliminated the need for dyes that were the products of heavy metals through process changes.
- The Campbell River Gold Mine, in northwestern Ontario, prior to 1992 operated a roaster to separate the gold from the ore, releasing high levels of arsenic into the air. The company replaced the roaster with an autoclave that reduced its discharges of arsenic into the air and water by 99 per cent.
- Alcan 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 its 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 practices that have a broader impact on reducing carcinogens, 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, emission and disposal of toxic chemicals. These reductions are the result of the statewide 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 very few programs in Canada that offer this kind of help
In Sweden, the principle of substitution is an example of a best practice that has become an integral part of all industrial and commercial activity in the country. Swedish companies, such as the construction company, Skanska, or the retailer, Hennes and Mauritz (H&M) have practiced it for many years. The European Union has also 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. Based on the principle of extended producer responsibility, European directives require manufacturers of vehicles and electric and electronic equipment to take back used products. Complementary legislation also restricts the electric and electronics industry from using certain toxic chemicals in the manufacturing process. This has led to the elimination of carcinogens such as cadmium and hexavalent chromium in electric and electronic equipment either through substitution of less hazardous chemicals or process changes.

Government Intervention: Legislation/Regulation and Policy

Gaps
• Substitution and ALARA requirements lacking in most jurisdictions
• No harmonization of exposure limits and implementation of the precautionary principle in establishing Canadian limits for carcinogens
• No registration and evaluation prior to import or sale (PMRA exception)
• No requirement to report and audit workplace use of carcinogens
• Toxic Use Reduction Planning is not mandatory
• CEPA enforcement and regulatory tools unclear or voluntary
• No requirement to disclose carcinogens in consumer products labeling or domestic use pesticides
• Consumer Chemical Regulations do not require carcinogen disclosure
• Limited NPRI data (Thresholds exemptions pesticides, transport, maintenance)

Legislation and regulation are key tools for reducing or eliminating exposure to carcinogens.

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

In some instances, these provisions have been very effective. For example, a Quebec inspector successfully convinced Domfoam International in Montreal to replace an adhesive containing dichloromethane, a suspect carcinogen, with water-based glue in order to protect the workers manufacturing polyurethane foam. However, overall it is difficult to evaluate the effectiveness of these provisions because little is known about their application or enforcement. The NCEOE has recommended that the federal and provincial governments focus strongly on applying these provisions. They recommend workplace audits be done to determine the use and presence of carcinogens and the opportunities for substitution.

Recommendations

1. Federal legislation should require disclosure of all Group 1 and 2A carcinogens (listed in Table 1) through labeling on all consumer products, including pesticides. i.e. Hazardous Products Act (Health Canada (CCCR)), Pest Control Products Act (PMRA) etc.
- Use of standard hazard phrase and symbols should be adopted which indicate a product contains classified carcinogens, as recommended by the GHS. The use of a standard symbol to indicate a product does not contain classified carcinogens should be explored. There should be an expansion of the environmental choice program of Environment. Canada and its application in the consumer field.

2. CEPA 1999 should be updated and require pollution prevention programs for federally regulated sites using or producing Group 1and 2A carcinogens.[6]
3. There should be a public review and gap analysis of the EU Directives and proposed REACH legislation with ongoing Canadian activities. The Federal government should pursue international harmonization concerning disclosure, use, registration, authorization, and prohibition of classified carcinogens.

"We have called upon governments and regulatory agencies to seek to harmonize their approach to exposure control in this critical area, and seek to eliminate or minimize exposures to recognized carcinogens whenever possible…"There should be a harmonization of exposure standards in workplaces throughout Canada. ALARA (as low as reasonably achievable) and substitution requirements should be generalized for classified 1 and 2A carcinogens." Your annual review of OEL's is an opportune time to seek to implement a harmonized approach, and to consider a generic substitution and ALARA requirement in Ontario."

Letter from the NCEOE to The OELs Update Project, Ontario Ministry of Labour, November 23, 2004

[7] The NCEOE prepared a submission to the House of Commons Standing Committee on Environment and Sustainable Development, with respect to the review of the Canadian Environmental Protection Act, recommending that all IARC Group 1 and 2A carcinogens be designated as CEPA Toxic and placed in Schedule 1, that CEPA move towards mandatory substitution for designated human carcinogens and that updated IARC 1, 2A and 2B lists be reviewed.

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 directed at specific carcinogens 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 have legal powers that can be used to control carcinogens. 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 metal finishing companies have been reduced.

"CEPA should be updated and require pollution prevention programs for federally regulated sites using or producing Group 1 and 2A carcinogens".

Submission from the NCEOE to the House of Commons Standing Committee on Environment and Sustainable Development on the Review of the Canadian Environmental Protection Act (CEPA, 1999), October 4, 2005

In Europe, the Nordic countries, Sweden and Denmark in particular, have led the way in efforts to eliminate carcinogens. They have instituted bans or restrictions on carcinogens such as cadmium, and have influenced the policies of the European Union. 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 chemicals legislation is the regulation proposed by the European Union, known as REACH -- the Registration, Evaluation and Authorization of Chemicals. Although it is not expected to be in force until April 2007, REACH will require, for the first time, companies importing or manufacturing chemicals to register them. For the more hazardous chemicals and for those used in large volumes, companies will have to submit safety testing with their registrations. This requirement will shift the burden of proof from government to industry to demonstrate the safety of chemicals. Companies using certain extremely hazardous chemicals will have to show that risks are adequately controlled, that social and economic benefits outweigh the risks or that no suitable alternative exists before they are granted an authorization to use them. For more information: http://europa.eu.int/comm/environment/chemicals/reach.htm

Europe is the one of the largest producers of chemicals in the world and REACH will likely have a far-reaching impact. It is anticipated that REACH will result in improved understanding of the chemicals in use and better management of their risks: "…To estimate the number of cancer cases requires information on the dose received, the potency of the carcinogen, the presence of other exposures (notably tobacco smoking) and the susceptibility of the group at risk. REACH is a response to a gap in knowledge regarding the intrinsic properties of substances already on the market and exposure to them."[7] Although the estimates of the number of cancer cases that would be avoided by implementing REACH is wide-ranging, a study of occupational health benefits prepared for the European Commission estimated that REACH would result in a reduction of between 17,000 and 54,000 cancer deaths in Europe over 30 years.[8]

[7] Commission of the European Communities' Staff Working Paper, REACH Extended Impact Assessment, Nov. 10, 2003

[8] Risk & Policy Analysts, "Assessment of the Impact of the New Chemicals Policy on Occupational Health", prepared for the European Commission-Environment Directorate-General, March 2003.

Conclusion

In the course of their lifetimes almost all Canadians will encounter carcinogens either in their workplace or through contaminated air, water, soil or food.

Identifying the actual number of cancers caused by occupational or environmental exposures is difficult for a number of reasons. With rare exceptions, cancers with different causes look the same. In other words, there is no test that can be performed to identify the cause of a cancer. In addition, it is now recognized that the great majority of cancers have multiple causes, such as a combination of genetic, lifestyle and environmental factors. The implications of this for prevention are that if any one cause is removed, the risk of cancer may be significantly reduced. It is for this reason that the NCEOE has emphasized importance of primary cancer prevention through reducing or eliminating carcinogens, particularly for vulnerable groups. The recommendations that appear in this summary seek to address both environmental and occupational exposures to carcinogens.

Occupational exposures to carcinogens are targeted through a number of recommendations:

- The application of ALARA occupational exposure limits to these substances;
- Surveillance recommendations which seek to begin to profile current occupational exposures to these substances;
- Worksite audits conducted by prevention agencies and employers;
- Regulatory action including MSDS audits and exposure notification (CAREX is one program being piloted now); and,
- Occupational histories, particularly targeting potential exposure to IARC group carcinogens and the associated cancers

Environmental exposures are targeted through:

- Linkage to CEPA NPRI data;
- Pollution prevention programming through CEPA; Provincial and Municipal governments;
- Control of cosmetic pesticide use and exposures through municipal bylaws; purchasing policies; public education; and,
- Labeling of consumer products containing known Group 1 and 2A carcinogens.

The NCEOE believes that, if these recommendations were acted upon, exposures to occupational and environmental carcinogens and the risks of cancer from these exposures would be reduced.

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 – that may serve as 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 (NCEOE), for best practices include:

- The identification and effective surveillance of cancer-causing agents, and the populations exposed to these agents, in both occupational and environmental settings;
- The transmission of information through information disclosure 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 National Committee on Environmental and Occupational

Exposures, formulated criteria concerning what constitutes best practices in primary cancer prevention with respect to environmental and occupational carcinogens.

The NCEOE endorsed the application of the precautionary principle as part of an essential strategy in primary prevention. The precautionary principle forms the basis for public policy addressing environment and human health and has been referenced in Canadian environmental legislation and throughout the European Community:

Whenever reliable scientific evidence is available that a substance may have an adverse impact on human health and the environment but there is still scientific uncertainty about the precise nature or the magnitude of the potential damage, decision-making must be based on precaution in order to prevent damage to human health and the environment. [1]

The committee has also focused on confirmed and probable human carcinogens as classified by the International Agency for Research on Cancer (IARC), an agency of the World Health Organisation that is the most widely respected source for the classification of carcinogens. Evidence of carcinogenicity is based on thorough scientific reviews of epidemiologic and experimental data on carcinogenicity of chemicals, groups of chemicals, industrial processes, other complex mixtures, physical agents, and biologic agents to which humans are known to be exposed. See Table 1 in the Executive Summary for a list of Class 1 and 2A carcinogens.

In the course of their lifetimes almost all Canadians will encounter carcinogens either in their workplace or through contaminated air, water, soil, or food. Identifying the actual number of cancers caused by occupational or environmental exposures is difficult for a number of reasons. With rare exceptions, such as mesothelioma, cancers with different causes look the same. In other words, there is no test that can be performed to identify the cause of a cancer. In addition, it is now recognised the great majority of cancers have multiple causes, such as a combination of genetic, lifestyle, and environmental factors. The implications of this for prevention are that if any one cause is removed, the risk of cancer in an individual may be significantly reduced. For example, eliminating either exposure could have dramatically reduced the risk of lung cancers among persons who smoked and were exposed to asbestos. Most cancers develop slowly, often decades after a person was exposed and the risk of cancer increases with the level and length of exposure, which can often be very difficult to identify especially when the important events occurred far in the past.

The workers' compensation system should, in theory, compensate all victims of work-related disease and thus provide some estimate of the number of occupational cancers. However, it is widely recognized that only a very small proportion are compensated, largely for the reasons described above. For

example, mesothelioma is a rare and deadly cancer whose only known cause is exposure to asbestos and related minerals. It is extremely unusual because it is one of the few cancers with a single known cause. Despite this, it was found that less than half the victims of mesothelioma receive compensation in British Columbia because no claim was ever filed. The situation is similar in other provinces and stresses the need for improved medical education. However, it is far worse for cancers of environmental origin, because there is no system in place to either identify or compensate victims and it is even more difficult to document past exposures.

Because of the difficulties of identifying the causes of individual cancers, the task of identifying the proportion of cancer due to occupational or environmental origin has fallen to epidemiologists who are trained in identifying causes of disease in groups of people. Most work has been done in the area of workplace cancer but estimates of the proportion are somewhat controversial, in part because of the political and economic ramifications. The most widely quoted number comes from an estimate made over 20 years ago. [2]. In 1981, two famous British epidemiologists estimated that 2-8% of all cancers may be due occupational exposures. Usually 4% is quoted as the overall number, but the authors actually attempted to estimate proportions for each site of *fatal* cancer for both women and men. For example, they estimated that 10% of bladder cancers in men and 5% in women were work-related and for lung cancer, they estimated 15% and 5%, respectively.

Although Doll and Peto's report was considered ground breaking at the time, even they characterized their overall effort as "a stop-gap measure" based on the lack of necessary data to make more precise estimates. Many workplace carcinogens had not been identified at that time and the methods in the studies used by the authors to develop the estimates were extremely crude and outdated by today's standards. Their estimate that 2% of cancers due to environmental exposures was based on even cruder data. The field of environmental epidemiology has made significant advances in the past decade, such as in identifying the risks associated with particulate air pollution and contaminated water. Much less was known about the multi-causal nature of cancer 25 years ago and in addition, the field of gene-environment interaction research had not been born.

A much more modern approach was taken by researchers from the IARC who analyzed the results of many studies of newly diagnosed lung and bladder cancer [3]. They found that the proportion of lung cancers due to occupational exposures ranged from 1% to 40% while bladder cancer ranged from 0% to 24%. The reason for this variability was that the highest fractions for both lung and bladder cancer were from highly industrialized or other areas with a high prevalence and levels of exposure. Using a single number to characterize the risk does not make sense in the complex world we live in. The most important point is that among exposed people environmental and occupational carcinogens contribute significantly to the risk of cancer and that these exposures are preventable.

2. Surveillance

Introduction

Surveillance refers to the ongoing or systematic collection, evaluation and dissemination of data, in this case related to cancer. The purpose of collecting these 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) those that possibly cause cancer in humans (Group 2B), those that cannot be classified (Group 3) and those that are probably not carcinogenic (Group 4)[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 those substances that are known to cause cancer given up-to-date scientific knowledge. In this report, all substances referred to as carcinogens are listed as either IARC Group 1 or Group 2A (Table 1).

As authoritative as they are, however, these lists are not exhaustive because they contain information only on those substances that have been evaluated. Of the thousands of chemicals and compounds 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 and compounds 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 confirmed cases of cancer, and 2) the surveillance of carcinogens, i.e., those agents that put someone at increased risk of developing cancer.

Cancer surveillance involves documenting changes in the number of cancer cases over time, and by cancer site, in an attempt to provide clues as to how exposures to carcinogens are changing over time. In contrast, the surveillance of carcinogens exposures is useful for evaluating who is exposed to carcinogens, in an attempt to intervene to reduce the risk of future cancer cases.

The Surveillance of Cancer

From the cancer statistics collected by provincial and territorial cancer agencies, we know how many people in Canada are diagnosed with cancer every year, how many people die from cancer, and where these people resided at the time of diagnosis or death[10]. These statistics are based on information such as hospitalization data and pathology reports[11]. Health Canada, Statistics Canada, the Canadian Cancer Society and other agencies used them 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 claims and been compensated as a result. It is compiled from claims data from each of the provincial/territorial workers' compensation boards.

Although this database has some information on workplace cancers, it is recognized as "the tip of the iceberg"[15]. It is believed to underestimate 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. People who contract cancer as a result of workplace exposures and their physicians, who also play a role in filing claims for occupational disease, may not be aware that the condition was in part attributable to workplace exposures and may also not be aware of the process of filing a claim. Cancer is diagnosed many years following exposure, often after a person has retired, and so the link between cancer and workplace exposures is not often made. In addition, workers and their physicians may not realize that a work-related cancer, even though it occurred many years after exposures, and often after a change in the relevant employment, is still eligible for compensation. Another reason for the underestimate of the burden of work-related cancers is that workers' compensation boards do not insure all workers in their respective regions. This coverage also varies by jurisdiction. Moreover, the criteria used by compensation boards in the process of ruling on claims filed for occupational cancer vary by jurisdiction and by combinations of occupation and carcinogen.

To fill the gaps that exist with respect to understanding what causes cancer and who is exposed to cancer-causing agents, 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, which 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 conduct occupational mortality studies identifying elevated risks of cancer and other diseases associated with specific occupations for the period from 1950 to 1995[16]. Welders, for example, were found to have an increased risk to developing 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[17]. 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.[18]

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[19]. It consists of data collected on 20,000 cancer cases diagnosed from 1993 through 1997, as well as 5000 controls (i.e., people without cancer). A questionnaire was used to collect information on smoking, diet, physical activity, reproductive history, residential history and occupational history. 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.

In some cases, epidemiological studies have been very useful for reducing exposures to carcinogens. A Canadian study of chlorinated drinking water showed that the potential risk of bladder cancer increased with both the duration and concentration of exposure to trihalomethanes [20]. 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[21]. 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 may reflect exposures of twenty to forty years ago.

Surveillance of exposure to carcinogens

In contrast, the surveillance[22] of exposure to carcinogens offers an opportunity to intervene to prevent cancer. The surveillance of exposure to 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 surveillance program is the National Dose Registry that 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[23]. 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 in an attempt to reduce future cancer cases. Best practices in surveillance, then, would be practices that offer the most opportunity to reduce exposures to carcinogens to 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 exposure to carcinogens

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[24] 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.

The Canadian Nuclear Safety Commission sets Exposure limits – 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 millisieverts per year.

If it is found that a worker has 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[25] 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 Cancer Care Ontario, 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[26]. 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[27] 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 (polychlorinated biphenyls). 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 federal government uses the data 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[28]. 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. The health department has studied contaminants to which people in communities are exposed by using personal air monitoring equipment, questionnaires and urine and blood sampling. Through this program, they have collected baseline data on potential 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"[29] provides an ongoing assessment of exposure to environmental contaminants. Although the

Canadian government has done some biomonitoring, 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 chemical 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.[30]

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[31]. Started in 1987, the SENSOR program monitors occupational diseases and 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[32]. 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[33] 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 workdays 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[34].

The objective of the ASA is to reduce the incidence of 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[35], has been set up at the University of Manchester to collect information on diagnosed occupational injuries and diseases. The importance of the British scheme is its potential 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 THOR does not capture many cases of work-related disease and cancer is not a priority, it provides an important database for identifying occupational problems and trends in disease.

A pilot study, Propulse[36] 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[37]. The B.C. Cancer 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, "there is no systematically collected publicly available information on current occupational exposure levels to contaminants in Ontario workplaces"[38]. 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.

In addition, 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.

Priority Surveillance Recommendations

1. In order to properly identify individual cases of environmental and occupational cancer it is necessary to collect a thorough occupational and environmental history. Provincial cancer control agencies/ programs should actively promote the collection of this information by primary health care providers and consider including this information in tumour registry databases for surveillance purposes.

2. Encourage the development and application of an International Information System on Occupational Exposure to Carcinogens (CAREX) and carcinogen exposure worker registry program in Canadian jurisdictions.

    1.1 Workplace monitoring and collection of data should be required by regulators for all Class 1 and 2A carcinogens listed in Table 1, in use or produced.
    1.2 There should be a harmonization of exposure limits for Class 1 and 2A carcinogens (listed in Table 1) in workplaces throughout Canada. The ALARA principle should be applied.

3. Information Disclosure and Labeling

Introduction

Information disclosure laws give the public the right to access information held by government and employers. 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, animals or humans, 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 information disclosure provisions have been developed over the last 20 years. The United States -- both federal and state governments -- has been in the forefront of developing information disclosure legislation. In Canada information disclosure laws generally mirror American legislation, but are more limited in their scope.

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 hazardous 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, provincial regulations for arsenic or benzene under occupational health and safety legislation require that employers do air monitoring. Also, under the terms and conditions of environmental permits, employers are required to take samples to ensure that they meet legislated requirements. However, this kind of occupational and environmental information is held by employers and governments, and is not accessible through most information disclosure legislation, except through Freedom of Information Acts.

An exception is Ontario's new air regulation that requires large facilities to report air emissions. This information is available through the Ministry of Environment's OnAIR website. Another 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 ensures that firefighters and communities know what high risk 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 all chemical ingredients used in these products are disclosed on the label. As of November 2006, changes to Canada's Cosmetic Regulations under the Food and Drugs Act that will require companies to list ingredients on cosmetic labels in Canada as well.[39] 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 all chemicals in drinking water and in all the 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 information disclosure 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 hazardous 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 Information Disclosure in Canada

Workplace

In the workplace, the Workplace Hazardous Materials Information System, known as WHMIS[40], 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 0.1 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[41].

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[42]. 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[43]. 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[44]. 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 information disclosure for both workers and consumers. 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 full 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)[45]. 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)[46], a national inventory of specific chemicals released by companies to land, air and water.

The inventory provides information on the releases and transfers of 324 key pollutants, including many confirmed and probable 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 hazardous 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[47]. In Toronto, the Toronto Environmental Alliance have also used the information to publish a map of the City highlighting areas with the highest emissions.

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[48] 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 Airborne Contaminant Discharge Monitoring and Reporting Regulation

Ontario's air regulation, under the Environmental Protection Act, requires large and medium-sized companies to file annual reports on more than 300 contaminants. These reports are posted on the OnAIR database of the Ministry of Environment's website. There are some chemicals which must be reported in Ontario that are not reported under the NPRI, and, in some cases, the regulation

requires reporting of chemicals at lower thresholds. Nevertheless, much of the information in the OnAIR database is also available on the NPRI.

Ontario Safe Drinking Water Act

In Ontario, as in the United States, citizens have a right to know what chemicals, including certain confirmed and probable carcinogens, are in their drinking water[49].

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[50].

Ontario's new legislation requires not only that drinking water be tested for specific substances, including many confirmed and probable carcinogens, but that this information be available to the public. The list of monitored chemicals includes many confirmed and probable 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 Information Disclosure Legislation in the United States

The United States has traditionally led the way for Canada in the development of information disclosure 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)[51] 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"[52] 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 the companies that use them must draw up emergency plans. 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)[53] 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 324 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[54], according to the

EPA, which regards the Toxics Release Inventory as a cost effective pollution prevention strategy. In addition, an analysis of air toxics between 1988 and 1991 found that plants whose emissions generated higher numbers of expected cancer cases reduced their emissions more than other companies.[55]

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].

The City of Eugene, Oregon, has also built on the Toxics Release Inventory to establish a Toxics Right-to-Know program. This was established through a voter-initiated amendment to the Eugene City Charter. As a result large companies in Eugene are not only required to report toxic emissions but they are required to do materials accounting, a comprehensive toxics evaluation that measures toxic inputs as well as outputs. As a result of the materials accounting requirement, this program captures more information than the TRI. This information is made publicly available.

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 confirmed and probable 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 potentially 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 suspected 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 under the Cosmetics Directive no carcinogens are allowed for use in cosmetics in Europe. Health Canada has published Regulations Amending the Cosmetic Regulations in the Canada Gazette, that will make ingredient labeling mandatory for cosmetics, similar to the U.S. requirements. These regulations are in effect as of November 16, 2006.

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.[63]

New Jersey Worker and Community Right to Know Act

In 1983 New Jersey became the first state to pass information disclosure legislation when it passed the Worker and Community Right to Know Act[64]. 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 Information Disclosure 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[65]. 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[66]. 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"[67]. 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 targets of future regulatory action.

In Sweden, a similar list called "The Observation List"[68], has now been replaced by PRIO. PRIO[69] is an Internet list of chemicals, primarily for businesses and environmental managers, to alert them to chemicals whose properties may pose major risks to human health and the environment.

The European Union also has legislation[70] 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)[71]. 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"[72], which is the official Nordic ecolabel, or the European Union's "Flower"[73] 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[74], 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[75].

Gaps in Information Disclosure and Labeling Legislation in Canada

The WHMIS program itself has a number of gaps:

- Although the Material Safety Data Sheets (MSDS) do convey information to workers, the quality of the information has been seen to be inconsistent and possibly incomplete. 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.
- There are no 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[76] 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[77]. 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 (NPRI) 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 known 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 listed substances. 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.

Information Disclosure Priority Recommendation

1. Health Canada's WHMIS Division should develop a national program for auditing the accuracy and completeness of MSDS in collaboration with HMIRC and the provinces.
    1.1 Regulators must look at better enforcement of WHMIS requirements for accurate MSDS, and training of the workforce regarding the significance of MSDS disclosure information pertaining to classified carcinogens.

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"[78] – carcinogens found in food, automobile exhaust, schools, water, and products such as cosmetics and household cleaners.

Often working with minimal financial support and 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 known 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, the community of 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[79].

The success in Hudson, Quebec and the confirmation of a municipality's right to enact such a bylaw, inspired communities 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[80]. 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 precautionary restriction of cosmetic use of pesticides was recently endorsed by the Ontario College of Family Physicians, in a paper released in April 2004[81].

The Ontario College review of research on the effects of pesticides on human health noted evidence of pesticide exposure related 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"[82].

An important supporter of the restricted use of cosmetic pesticides, the Canadian Cancer Society, also supports restrictions on the use of cosmetic pesticides, also on the basis of the precautionary principle.

Bylaws vary in scope across the country – from complete 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)[83].

The movement to restrict the use of cosmetic pesticides originated in Quebec and has 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 increasing controls on all pesticide use in the province[84]. They enacted a new Pesticide Management Code[85] to regulate the storage, sale and use of pesticides in Quebec, setting the highest standard in North America. Using provincial legislation 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 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 endocrine disruptors or probable or possible carcinogens.

Canada's largest food distributor Loblaws, responded to community concerns by phasing out chemical pesticides and offering its customers only organic alternatives at its 440 garden stores [86].

Labour Environmental Alliance Society

The Labour Environmental Alliance Society (LEAS)[87], 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 Cancer Smart 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 present their information at home shows and bring 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"[88], produced by the Environmental Health Association of Nova Scotia (formerly the Nova Scotia Allergy and Environmental Health Association)[89]. Since the 1970s, this group in the Halifax area has 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".

The Environmental Health Association collaborates 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, such as; asbestos, pesticides, polychlorinated biphenyls (PCBs) and silica dust.

The Citizens for a Safe Learning Environment (CASLE)[90] contributed to ensuring that a recently built high school, Halifax West, was constructed minimizing the use of substances that might affect the children's health[91]. 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 and art supplies, 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[92].

Breast Cancer Survivors' Groups

In Canada, as in the United States, groups of breast cancer survivors have maintained that the high incidence of breast cancer is linked to environmental exposures. They do not accept cancer as an inevitable or chronic disease. They have focused their efforts on reducing the incidence of cancer by reducing the exposure to carcinogenic substances in the environment and at the workplace.

The Saunders-Matthey Cancer Prevention Coalition (formerly the Breast Cancer Prevention Coalition)[93], The Women's Healthy Environments Network[94] 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 contributed to 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[95], 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"[96]. 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"[97]. 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 risk 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[98], formed in 2000, is a group that works with health care organizations and facilities. It is an active member of Health Care Without Harm, an international group working to ensure that the health care industry does not pose a risk 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"[99] 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[100].

Reach for Unbleached

Reach for Unbleached[101], based in Vancouver, British Columbia, is 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 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 perform their own air testing in order to document the air pollution problems in their communities, and they support 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?"[102] was recently published by The Breast Cancer Fund and Breast Cancer Action[103] in California. This report summarizes the new links between synthetic chemicals and radiation with the rising incidence of breast cancer.

The breast cancer groups support the phasing out of toxic chemicals, healthy purchasing and breast milk monitoring. They are the authors of the "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 countywide policy[104]. 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[105], part of the Alliance for a Healthy Tomorrow, supported a citizen-initiated proposal for an "Act for a Healthy Massachusetts: Safer Alternatives for Toxic Chemicals"[106]. The Act focuses on 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[107] and phase them in where possible.

Environmental Working Group

The Washington, D.C.-based Environmental Working Group (EWG)[108] highlights the risks of exposing the body, food and personal care products to hazardous chemicals. 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"[109], 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 [110] 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

By doing their own monitoring with simplified air testing equipment, citizens in the United States 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"[111] 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 high levels of chemicals contaminate the air and to ask 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 has also significantly reduced accidental releases.

Best Practices in Community Education and Action in Europe

Greenpeace

In London, England, Greenpeace conducted a 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 existence of hazardous industrial chemicals in every day products inside their home. The dust was analyzed and results published in a report "Consuming Chemicals"[112]. 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[113] all around Britain designed a campaign 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 that 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[114] is an organization that developed from the joining 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 not a lot 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.

Community Education and Action Priority Recommendations

1. Municipalities should develop and implement primary prevention activities, such as:
    a. Community exposure profiles should be developed in collaboration with NPRI and community organizations.
    b. Support for collaborations such as that between the Toronto Department of Health and the Toronto cancer Coalition should be encouraged.
    c. Community pollution prevention bylaws should be encouraged and BP encouraged and disseminated.

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 sustained prominence of cancer 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 by 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 reduce 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 collective bargaining to formalize reductions of carcinogens.

Unions have been successful in reducing their members' 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 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, this is facilitated by the Directives of the European Union and national occupational health and safety legislation.

Best Practices in Worker Education and Action

Prevent Cancer Campaigns

There have been many unions 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[115] in December 1997. The CAW decided to act when one of their representatives, Bud Jimmerfield, was diagnosed with cancer that the union believed came from years of exposure to metalworking fluids, and was denied compensation.

This campaign was the beginning of an increased awareness for cancer prevention in the workplace 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, focused its annual conference to launching a nation-wide Prevent Cancer Campaign -- "Preventing Cancer and Occupational/ Environmental Disease". The CLC's "How to Prevent Cancer in the Workplace: A Practical Manual" [116] is the first practical guide on how to conduct prevent cancer

campaigns. This contributed to mobilizing 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 (CAW)[117] started an 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 representatives 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 representatives.

Representatives were taught to seek to reduce their exposures on several fronts -- to identify carcinogens in the workplace, to recommend 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 [118]

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[119].

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[120].

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 that are added to the product to control bacteria may pose a risk for workers.

- Using the Collective Agreement to Phase Out Chemicals

Unions have used contract negotiations to further their objectives and formalize their health and safety goals. 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[121].

In the same Ford and GM contracts, the CAW and the companies agreed to set their own limits for exposures to carcinogenic substances[122]. 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[123].

- 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[124]. Trichloroethylene is a suspected 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[125] 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[126] 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 representatives 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[127]. 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 confirmed and probable 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[128].

The United Steelworkers of America represents hundreds of workers in underground mines, where diesel exhaust from mining equipment risk to create 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[129], 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[130].

At the five Falconbridge Mines in Sudbury, the CAW, representing the underground miners, and Falconbridge in their most recent collective agreements[131] 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"[132] 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 representatives and workers who go back into their workplaces and set up screening programs using these techniques. For example, representatives 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[133]. 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 are also campaigning 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[134]. 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[135].

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[136]. The goal of this Directive (2004/37/EC) 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[137].

Under Article 4(1), it states that *"the employer shall reduce the use of a carcinogen or mutagen 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[138] (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[139].

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 reducing exposures to carcinogens from the workplace prevented cancer cases.

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. The Canadian Labour Congress reports that workers in unorganized workplaces are often exposed to greater hazards than workers in organized workplaces. [140]

Worker Education and Action Recommendations

1. See Appendix 1

6. Non-governmental Organizations' Work in Cancer Prevention

Introduction

Many organizations in Canada have a mandate to address issues related to cancer. However, few of these organizations focus on preventing cancer by supporting the reduction or elimination of environmental and occupational exposures to carcinogens.

Because of their direct 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[141] 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[142].

As part of their diagnostic services, the medical staff considers 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[143].

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 provide details of their work history.

The minimal knowledge of cancer patients' occupational histories 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 contributed to 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[144] 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[145].

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[146], 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 Copper Chromium Arsenate (CCA) pressure-treated lumber for domestic and recreational structures such as decks and playgrounds. CCA Pressure-treated lumber is actually lumber treated

with a known carcinogen, arsenic. The Society took this position in order to reduce people's exposure to this carcinogen.

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 cosmetic 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[147]. 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. Employer/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[148], 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"[149]. 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[150], by Environment Canada who have published their stories under Success Stories in Pollution Prevention,[151] or by the Canadian Centre for Pollution Prevention[152] 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[153], Scarborough, Ontario

In 1998, Novopharm, a pharmaceutical manufacturing company in Scarborough with approximately 1000 employees, was the largest single emitter of dichloromethane (methylene chloride), a suspected carcinogen, in Canada. The

company discharged almost 500 tonnes per year of methylene chloride, a probable carcinogen, into the air. It was used as a carrier solvent in the pill coating process. As part of the National Pollutant Release Inventory, Novopharm was required to report these discharges every year. Over a five year period, Novopharm modified their manufacturing process, switching from a solvent-based coating process to an aqueous-based coating one. Air emissions of methylene chloride are negligible now, and workers' exposures in the plant have been eliminated. The average cost savings -- no longer having to purchase methylene chloride and using water instead -- is estimated at $1 million per year[154].

- Interface Flooring Systems[155], Belleville, Ontario

Interface, the world's largest flooring company, is a key contributor in formulating environmental best practices. It 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 in 1994 so that instead of printing its designs onto carpets, the designs and colours are woven into the carpets at the tufting stage. Through this major process change, the company eliminated the need for dyes that were the products of heavy metals. The carpet tiles it produces are non-toxic, and Interface no longer uses any toxic or carcinogenic substances that would be released inside the plant or to the water and air outside the plant[156]. Because of this, Interface Flooring is approved as an Environmental Choice product.

- Placer Dome[157], Campbell Mine, Red River, Ontario

The Campbell River Gold Mine, in northwestern Ontario near Red Lake, prior to 1992 operated a roaster to separate the gold from the ore. In the process of roasting, they released high levels of arsenic into the air. The company made an economic decision to modify its processes and introduced an autoclave (a pressure oxidation system similar to a pressure cooker) for the ore separation process, replacing the roaster. The environmental improvements were also an important consideration for the company. The autoclave technology is considered the best available technology for smelting, and is used by only a few mines in North America. The conversion to an autoclave process resulted in the company reducing its discharges of arsenic into the air and water by 99 per cent. This process change also eliminated the potential for arsenic inhalation for workers who did the maintenance work on the roaster[158].

- Alcan[159], Quebec

High levels of polycyclic aromatic hydrocarbons (PAHs), a known human carcinogen, has been a hazardous byproduct with the traditional processing of aluminum in both Quebec and British Columbia plants for several decades, causing occupationally-related lung and bladder cancers. In 2001, 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. These

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[160].

- The Ottawa Hospital[161], 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[162], 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[163]. 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[164], 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 with higher exposures to arsenic from play sets and decks treated with CCA may have a significantly increased risk of developing cancer[165]. 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[166], 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[167]. They promote chemical substitutions by publishing a "positive list" of safer chemicals, such as safer dyes and colorants.

The Eco-efficiency Centre[168] 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[169], 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[170] 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.

The research laboratories at the affiliated Toxics Use Reduction Institute[171] were an important contributing factor to companies making changes. 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 interest groups whose major concern was cleaning up the environment drove the legislation, the legislation has also benefited workers. In a study[172] 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. New Jersey's program is similar to Massachusetts in the requirement for materials use accounting. Oregon's Toxics and Hazardous Waste Reduction Program[173] helps primarily medium and small businesses.

Best Practices in Industry in Europe: Elimination and Substitution

Europe has adopted a 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[174]. 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)[175] 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[176].

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)[177]. It states, "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 or probable carcinogens but also 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

The concept of extended producer responsibility also has the effect of reducing the use of hazardous substances in workplaces and in products. 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)[178] 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 worldwide. For example, Panasonic has already converted its television production facilities worldwide to the use of lead-free solder[179]. 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[180].

The second directive, the Waste Electrical and Electronic Equipment Directive[181] 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[182], is promoting the concept that electronic companies in the United States 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[183]. 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 is 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.

Employer/Industry Action Recommendations

See Appendix 1

8. Government Intervention: Legislation/Regulation and Policy

Introduction

Legislation and regulation are key 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.

The Public Health Agency of 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 three occupational health and safety laws in Canada that have explicit provisions for substitution – the federal Labour Code, British Columbia's Workers Compensation Act and Quebec's Act Respecting Occupational Health and Safety. 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 pass laws 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 metal finishing 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 focused on 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.

One of the most potentially important legislative developments 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 two provinces have legislation that promotes the elimination of hazardous substances through substitution. These requirements can be found in the Canada Labour Code, in British Columbia's Occupational Health and Safety Regulation and in Quebec's Regulation Respecting Occupational Health and Safety.

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 most specific 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.

Quebec also has provisions for substitution or replacement of hazardous substances in workplace air, in its Regulation Respecting Occupational Health and Safety, Division 5, Air Quality, under its health and safety Act. Section 39, Replacement, stipulates that, "insofar as possible, dangerous substances that are sources of dusts, fumes, mists, vapours or gases shall be replaced with substances that are not dangerous or are the least dangerous possible."

For carcinogens and isocyanate substances specifically, Quebec legislation seeks to achieve minimal air quality exposures in the workplace. Section 42 of the Regulation states that, "when a worker is exposed to a substance identified in Schedule 1 as having a known or suspected carcinogenic effect on humans or

being diisocyanate or isocyanate oligomers, such exposure shall be reduced to a minimum, even when it remains within the standards provided under this schedule".

In some instances, these provisions have been very effective. For example, a Quebec inspector successfully convinced Domfoam International in Montreal to replace an adhesive containing dichloromethane, a suspect carcinogen, with a water based glue in order to protect the workers manufacturing polyurethane foam.[184] However, overall it is difficult to evaluate the effectiveness of these provisions because little is known about their application or enforcement.

Other provinces[185], 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[186]. 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 inconsistencies among various jurisdictions in legislated requirements for worker protection against exposure to workplace carcinogens[187]. 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"[188].

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[189].

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[190].

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[191]. 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[192]. 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[193], 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[194].

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.

Under CEPA, the Federal Departments of Health and Environment must categorize all of the approximately 23000 substances on the Domestic Substances List (a list of substances in use in Canada) by September 2006. The substances are categorized by virtue of being potentially Persistent, Bioaccumulative or Toxic, or having the Greatest Potential for Human Exposure. Substances meeting these criteria must undergo a subsequent Screening Level Risk Assessment (SLRA). High priority substances will be assessed first, and Some SLRAs are currently out for stakeholder comment. This screening is a formidable effort. Greater focus needs to be placed on screening confirmed and probable human carcinogens (IARC) on the list, and consideration of these chemicals and compounds as CEPA Toxic.

Best Practices Using Municipal Bylaws

The City of Toronto's Sewer Use By-law[195] 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 metal finishing 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[196].

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 at the forefront 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[197]. 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[198]. One of the 15 Environmental Quality Objectives is a Non-Toxic Environment[199]. 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[200] -- 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 in force by April 2007. 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 Chemicals Agency and different countries in the European Union will divide up the work of reviewing the registered substances for which there is some concern about their safety. 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. To obtain an authorisation, industries must demonstrate that they can adequately control the risks of handling the chemical, that there are socio-economic benefits from the use of the chemical or that there are no suitable alternatives.

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

Europe is the one of the largest producers of chemicals in the world and REACH will likely have a far-reaching impact. It is anticipated that REACH will result in improved understanding of the chemicals in use and better management of their risks: "…To estimate the number of cancer cases requires information on the dose received, the potency of the carcinogen, the presence of other exposures (notably tobacco smoking) and the susceptibility of the group at risk. REACH is a response to a gap in knowledge regarding the intrinsic properties of substances already on the market and exposure to them."[201]

Although the estimates of the number of cancer cases that would be avoided by implementing REACH is wide-ranging, a study of occupational health benefits prepared for the European Commission estimated that REACH would result in a reduction of between 17,000 and 54,000 cancer deaths in Europe over 30 years.[202]

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.

Government Intervention Recommendations

1. Federal legislation should require disclosure of all Class 1 and 2A carcinogens (listed in Table 1) through labeling on all consumer products, including pesticides. Hazardous Products Act (Health Canada (CCCR)), Pest Control Products Act (PMRA
    a. Use of standard hazard phrase and symbols should be adopted which indicate a product contains classified carcinogens, as recommended by the GHS. The use of a standard symbol to indicate a product does not contain classified carcinogens should be explored. There should be an expansion of the environmental choice program of Environment. Canada and its application in the consumer field.

2. CEPA 1999 should be updated and require pollution prevention programs for federally regulated sites using or producing Class 1and 2A carcinogens.

3. There should be a public review and gap analysis of the EU Directives and proposed REACH legislation with ongoing Canadian activities. The Federal government should pursue international harmonization concerning disclosure, use, registration, authorization, and prohibition of classified carcinogens.

9. Conclusion

The Canadian Strategy for Cancer Control has identified primary prevention as a key area of activity. This review of best practices in primary prevention of occupational and environmental cancers indicate that it is necessary to take action in a number of areas.

- Public disclosure of the presence, use, and release of known and presumed human carcinogens is a necessary prerequisite to primary prevention in workplaces, the environment, and the home.

- Further legislative, regulatory, and policy development is required if Canada is to adopt best practices in primary prevention.

- It is necessary to raise the profile of the primary prevention of environmental and occupational exposures as a priority issue within provincial cancer control agencies and programs

The National Committee on Environmental and Occupational Exposures (NCEOE) has developed 7 priority recommendations, which seek to begin to address the main gaps in Canadian practice. These recommendations cover a broad range of activities, and will require our sustained commitment, concerted efforts, and resources. In addition, future activities, articulated in 12 additional recommendations, continue to target the key areas of surveillance; public disclosure; community education; and government policy. The NCEOE looks forward to working towards the implementation of these recommendations, in collaboration and partnership with governments, non-governmental and community organizations, industry, and labour organizations.

APPENDIX 1: RECOMMENDATIONS FOR FUTURE ACTIVITY

SURVEILLANCE

1. Creation of both health surveillance and hazard surveillance data should be encouraged and be available through a centrally managed network/clearinghouse.
2. In order to properly identify individual cases of environmental cancer it is necessary to begin collecting environmental exposure data and to investigate the development of pilot projects linking environmental exposure data with environmental health surveillance

INFORMATION DISCLOSURE

1. Statutes should be amended so that Communities and First Responders have access to hazardous materials data.

COMMUNITY EDUCATION AND ACTION

1. A priority list of carcinogens, based on exposure information collected, should be developed and widely disseminated.
2. The Canadian Cancer Society and its provincial organizations should be encouraged in their efforts to increase emphasis on primary prevention activities in this field.

WORKER EDUCATION AND ACTION

1. Information bulletins should be developed to address cancer prevention and toxic use exposure/ reduction (TUR), substitution arrangements and best available technology.
2. The Mass. Toxic Use Exposure/Reduction model should be further investigated and funding for a Canadian Federal or Provincial counterpart considered.

EMPLOYER/INDUSTRY ACTION

1. Employer/Industry should audit MSDS for Class 1 and 2A carcinogens to ensure they comply with WHMIS information disclosure requirements.
2. Employers/Industry should audit their procedures/policies regarding the handling of carcinogens.
3. Incentives for Toxic Use Reporting Programs at all three levels of government should be investigated.

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