

RECOMMENDATIONS

FOR  
THE

PRIMARY  
PREVENTION

OF

CANCER

Report of the Ontario Task Force on the Primary Prevention of Cancer

March 1995

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February 10, 1995

The Honourable Ruth Grier  
Minister of Health  
Ministry of Health  
Hepburn Block, 10th Floor  
Toronto, Ontario M7A 2C4

Dear Mrs. Grier,

On behalf of the members of the Ontario Task Force on Primary Prevention of Cancer, I am pleased to submit our Report to you.

The Task Force bases its recommendations on what we believe to be an appropriate interpretation of the recent initiatives of your Ministry and of other Ontario government departments relevant to health. We have recently benefitted from some discussions with officials of the Ministry of Agriculture, Food and Rural Affairs and of the Environment and throughout our deliberations from input from officials from your Ministry. We have tried to accommodate our recommendations to our understanding of the approaches being adopted by the Government of Ontario; if we have misinterpreted any of them it is because relative shortage of time made it difficult for us to familiarize ourselves adequately with all initiatives of the Government of Ontario.

Cancer is a complex disease. Indeed it is truly a term encompassing a number of different diseases. However, it is clear that cancer arises from an interaction between our genetic makeup and factors we encounter throughout our lives in our wider environment including our social, physical and lifestyle environment often induced by our cultures. Cancer is a chronic disease and part of the difficulty in identifying specific causes relates to the long interval that often is required for the initial exposure to a cancer causing factor and the expression of cancer in the individual.

Cancer is, however, in many instances a preventable disease, though the actions necessary to ensure that prevention may in many circumstances be required early in our lifetime. The last several decades have shown an explosion of our understanding of the causes of cancer. Research is ongoing to remove the uncertainty over many suspected causes and to identify other factors which we may not yet suspect as being a cause of cancer. However, the Task Force is convinced that even though further research will continue to refine our knowledge, action-based recommendations to reduce the incidence of and mortality from cancer in this province are feasible and timely. Our report is directed to identifying these.

Prevention is one of the important planks of cancer control, the others being early detection, treatment, rehabilitation and palliative care. Prevention of cancer is likely to be more cost-effective than many other approaches because many of the causes of cancer are also causes of other chronic conditions in our society, most importantly cardiovascular disease, obesity, respiratory disease, and diabetes. Many of our recommendations relate to factors which will have a wider impact in improving the health of Ontarians than just the prevention of cancer and it is on these that we largely concentrate in the first part of our report. However, many other causes of cancer, as yet not fully defined, also deserve action because they are congruent with the concerns of the public of Ontario over the health of mankind within our environment.

In finalizing our report we have tried to ensure that the basis of our recommendations is clear but we recognize that we may not have been entirely successful in that respect. The Task Force therefore although formally at an end of our task, would be pleased to meet with you or with your officials to clarify any residual uncertainty.

Yours sincerely,



Anthony B. Miller, M.B., F.R.C.P., Chairman,  
Ontario Task Force on Primary Prevention of Cancer



*This report is dedicated to the memory of  
M. David Kassirer,  
a member of the Task Force who passed away  
in October 1994.*

*David maintained a close interest in the work  
of the Task Force, and made a number of  
constructive suggestions that helped to  
shape its recommendations.*

*A cancer survivor, David was a dedicated activist  
for cancer prevention as part of a new  
Cancer Strategy for Ontario.*

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# Executive Summary

Cancer is one of the leading causes of mortality in Ontario, accounting for over 20,000 deaths per year. Approximately 27% of all deaths in Ontario are attributable to cancer. The degree of pain and suffering associated with cancer, both physical and emotional, places an enormous burden on patients and their families. The financial cost of cancer is also substantial. Ontario spends over \$1 billion dollars annually on cancer treatment alone, in addition to which there are substantial indirect costs and other social costs.

The incidence of cancer in Ontario and elsewhere is on the rise, a phenomenon in part attributable to an aging population. However, the incidence of the disease, and the attendant personal, social and economic costs, can ultimately be reduced, as many forms of cancer are preventable.

In recognition of the importance of preventive measures for reducing the cancer burden in Ontario, a Task Force on the Primary Prevention of Cancer was appointed by the Ontario Minister of Health in February 1994. The purpose of the Task Force was to advise the Minister with respect to the development of an action-based, effective and feasible plan detailing recommendations for the primary prevention of cancer.

The Task Force recognizes that many of the eventual benefits of cancer prevention may be delayed, and that there may be substantial barriers to immediate action. Yet we urge action now. Our knowledge of the causes of cancer may be imperfect, but we have no excuse for delaying action in response to our current knowledge.

The Task Force trusts that the following recommendations will assist the Ontario government in implementing appropriate and effective approaches to cancer prevention. It is the hope of the Task Force that its recommendations will be addressed through a comprehensive, coordinated approach which, in addition to reducing the incidence of cancer, can be expected to promote the health and well-being of Ontario residents of this generation, and of generations to follow.

## Tobacco

- To minimize increases in tobacco-related cancer mortality arising from the reductions on tobacco taxes, the Task Force strongly urges the Ontario government to work with its federal and provincial counterparts to restore tobacco taxation rates to their former peak levels. Subsequent tobacco tax increases should be set above the rate of inflation.
- The Task Force recommends the continued rigorous enforcement of sales to minors legislation coupled with retailer education programs in order to maximize the health impacts of the Ontario Tobacco Control Act.
- In light of the evidence on the cancer risks posed by environmental tobacco smoke (ETS), the Task Force calls upon the province to give increased priority to the reduction/elimination of ETS exposure.

Specific measures that the government could adopt to reduce/eliminate ETS exposure include:

- work with municipal governments to strengthen legislation banning tobacco use in public areas. Smoking in these venues should be restricted to separately ventilated areas;
- work with employers and relevant ministries to strengthen legislation banning tobacco use in the workplace. As is the case with public areas, smoking in workplaces should be restricted to separately ventilated areas;
- develop strategies to protect children from exposure to ETS.
- To broaden the possible scope of preventive efforts, the Task Force urges the Ontario government to work with its provincial and federal counterparts to include tobacco in the Canadian Hazardous Products Act.
- The Task Force calls for the provincial government to ban the use of tobacco product names, trademarks, colours and logos in all tobacco sponsorship advertising.
- The Task Force urges the provincial government to work with others to seek innovative ways to reduce the

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incentive for sports and cultural groups to accept sponsorship from the tobacco industry.

- The Task Force urges the province to hold the tobacco industry accountable for the economic costs of tobacco-induced illness. The federal and provincial governments should investigate the utility of initiating legal action or recovery mechanisms against tobacco manufacturers.

The Task Force:

- recommends that the Ontario government consider establishing a Royal Commission to investigate the practices of the tobacco industry;
- calls upon the Ontario government to establish an Ontario Tobacco Control Board or agency, with the following mandate:
  - carry out ministry policy, and report directly to the Ministry of Health;
  - licence or control access to tobacco products;
  - regulate promotional activities of the tobacco industry;
  - enforce cost-recovery of tobacco-related health costs;
  - investigate and control unethical practices of the tobacco industry;
  - establish intersectoral collaboration for information and educational strategies;
  - assist health professionals and institutions in counselling smoking cessation and prevention;
  - control the export of tobacco products.
- To ensure effective intersectoral collaboration, the task force recommends the adoption of the following policies:
  - ensure that current scientific information on the health effects of tobacco and strategies to prevent tobacco use (including information on the efficacy of various approaches) is available to health professionals, advocacy groups and the

general public in formats appropriate for their respective needs and levels of comprehension;

- increase collaborative efforts with Regional Cancer Networks, Public Health Units, Community Health Centres, the Canadian Cancer Society, the Ontario Public Health Association and other relevant non-government organizations to mobilize community forces in the fight against tobacco, and to reinforce educational appeals and advocacy efforts emphasizing the addictive nature of tobacco and its harmful consequences.
- In order to effectively promote the adoption of smoking cessation and ETS counselling by health professionals, the provincial government should secure collaboration with key stakeholder groups to ensure:
  - promotion of the concept of smoking cessation and reduction of ETS;
  - replenishment of educational materials for cessation support and ETS reduction;
  - provision of training and recognition for all health care professionals in smoking cessation and ETS counselling;
  - funding of accessible workplace smoking-cessation programs.

## Dietary Risk Factors

- The Task Force recommends that the government promote intersectoral collaboration between government and industry, including the agri-food industry, food retailers, and food services, to ensure the concerted implementation, monitoring and evaluation of policies promoting healthy eating habits.
- The Task Force recommends that the provincial government review its policies governing the production, storage and distribution of food products to ensure that all Ontario residents have access to a high-quality supply of nutritious food.

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- The Task Force recommends that government should seek collaboration with the food industry, in order to ensure the acceptance of policies ensuring access to a healthy food supply.
  - To encourage the adoption of policies and practices promoting healthy eating, the Task Force recommends that the Ontario government should work with, and support the development of, community-based healthy eating coalitions and local food policy councils.
  - The Task Force recommends that the Ontario Ministry of Health work with the Ontario Ministry of Agriculture, Food and Rural Affairs and other relevant ministries to develop an adequate nutrition labelling system that enables Ontario consumers to determine the nutritional value of all food products and to make informed, healthy choices. Educational efforts should also be undertaken to familiarize consumers with this new system.
  - The Task Force recommends that the following measures be considered by the Ontario government to reduce socio-economic inequities in nutritional status:
    - expand alternative distribution channels such as community kitchens, food buying clubs, field-to-table programs and community gardens to increase access to food;
    - encourage the food industry to donate all fresh produce (fruits and vegetables) and other nutritional food products that do not meet aesthetic grading criteria to food banks or community kitchens;
    - work with local school boards and community organizations to ensure that school breakfast and/or lunch programs are available to all children who need them;
    - design communities with consideration to access to food stores that provide adequate choices of nutritious and inexpensive foods, and the means for residents to grow their own food if they wish to do so, as in community gardens.
  - The Task Force recommends that the practices of all of Ontario's marketing boards encourage the greater production and availability of low-fat foods.
  - The Task Force encourages the Ontario government to recognize the importance that the application of differential taxation levels has on healthy food consumption. The Task Force further recommends that differential taxation systems be investigated as a means of promoting consumption of lower-fat foods and fruit and vegetables and discouraging consumption of high-fat foods.
  - To minimize the health risks associated with the consumption of popular, high-fat food products, healthier alternative food preparation practices should be promoted. The provincial government should work with the food industry to facilitate the adoption of healthy food production and manufacturing practices.
  - All community institutions (schools, hospitals, etc.) and workplaces that currently provide food products should be required to provide healthy food choices on their premises and post nutritional information about the foods served.
  - The Task Force recommends that educational efforts undertaken by the government to raise public awareness of the importance of a healthy diet emphasize Canada's guidelines for healthy eating:
    - Enjoy a *variety* of foods.
    - Emphasize cereals, breads, other grain products, vegetables and fruits.
    - Choose lower-fat dairy products, leaner meats, and foods prepared with little or no fat.
    - Achieve and maintain a healthy body weight by enjoying regular physical activity and healthy eating.
    - Limit salt, alcohol and caffeine.
  - The Task Force recommends that educational initiatives promoting healthy diets should be population-based, focusing on the promotion of healthy eating habits among all Ontario residents.



- The Task Force recommends the increased provision of healthy food preparation and shopping classes at the community level.
- The Task Force recommends that all educational initiatives promoting healthy diets – brochures, media appeals, etc. – should use simple, easy-to-understand language (Grade 6 reading level). Special efforts should be undertaken to convey nutrition information to people with low literacy levels.
- Educational initiatives encouraging the consumption of healthy diets need to recognize the ethno-racial diversity of the province. Where numbers warrant, educational materials and/or healthy food preparation classes should be geared towards cultural preferences.
- The Task Force recommends that the Ministry of Health work with the Ministry of Education to create school food policy and ensure that nutrition education be a mandatory component of comprehensive school health programs starting at the primary grades.
- The Task Force suggests that community mobilization efforts with parents be undertaken to encourage the provision of healthier food alternatives in the school. The Ministry of Health should also work with the Ministry of Community and Social Services to provide nutrition education for children in day-care settings.
- The Task Force encourages the provincial government to keep its existing monopoly system, rather than following the lead of other jurisdictions (e.g., Alberta, New Zealand) towards the de-regulation of alcohol sales.
- The Task Force recommends that the requirements for liquor licences be extended to include mandatory server training programs for the staff of all licensed establishments. These programs should be publicly administered, with periodic follow-up and monitoring to ensure compliance with server intervention guidelines.
- The Task Force recommends that school-based alcohol education programs be offered as part of community-based health education interventions that incorporate comprehensive approaches to health education (including promotion of no-smoking or other substance abuse, healthy diets and physical exercise). School-based programs may be most effective when offered during the “transition years” when children advance to other schools.
- To encourage the acceptance of policies and practices promoting less risky levels of alcohol consumption, the Task Force calls for increased community mobilization efforts around alcohol issues.

## Alcohol

- The Task Force endorses the Addiction Research Foundation guidelines for consumption of alcoholic beverages and encourages the Ministry of Health to increase public awareness and acceptance of these guidelines through information/educational campaigns.
- The Task Force recommends that calls for price reductions of alcoholic beverages should not be heeded by the provincial government, as the societal costs of increased consumption greatly outweigh the economic benefits to the alcohol and hospitality industries.
- The Task Force recommends that preventive interventions aimed at reducing excessive alcohol consumption should be population-based.

## Physical Activity

- The Task Force recommends that the provincial government place greater priority upon strategies to encourage active living in the population.
- Measures to facilitate the adoption of active living in urban areas, such as the introduction or expansion of bicycle lanes and walking paths, are of particular importance and should be expanded. The expansion of existing federal and provincial Active Living programs is another means of achieving this objective.
- In order to ensure that all Ontario students maintain an optimal level of physical activity, the Task Force recommends mandatory daily physical activity from kindergarten to the end of secondary school.

- The Task Force also calls for physical education programs that place greater emphasis on non-competitive physical activities to promote active lifestyles, such as walking, hiking or bicycling.

## Occupational Carcinogens

- The Task Force is supportive of the current endeavours in Ontario to reduce occupational exposure to carcinogens by attempting to ensure workers' right to know (Workplace Hazardous Materials Information System). However, government should insist upon prior testing for possible carcinogenicity of any new chemical agent that will be proposed for introduction in significant quantities into the occupational environment.

## Environmental Carcinogens

- Resources be directed towards the development of new scientific methods that permit the assessment of the human health impact of environmental toxins in the biophysical environment.
- Integrate pollution prevention with industrial policy so that business modernization initiatives and research and technology assessment programs foster progress towards the objective of virtual elimination of persistent, bioconcentrating toxic substances.
- Adopt the most stringent standards for controlling environmental carcinogens developed by Organization for Economic Cooperation and Development (OECD) member nations.
- Set realistic and measurable timetables for "sunsetting" persistent, bioconcentrating toxic substances that are known or suspected carcinogens.
- Government should establish timetables to sunset the use of chlorine-containing compounds as industrial feedstocks and examine the means of reducing or eliminating other uses of chlorine, bearing in mind the priority to ban substances established as carcinogens.
- Support the development and application of alternative, non-chemical, pest-control measures.

- Set realistic and measurable timetables for sunseting the following chemicals registered for use in Ontario that meet the International Agency for Research on Cancer (IARC) / United States Environmental Protection Agency (USEPA) criteria for known or suspected carcinogens:
  - *Group 2A (probable human carcinogens)*: ethylene oxide (insecticide, fungicide), formaldehyde (antimicrobial), creosote (wood preservative).
  - *Group 2B (possible human carcinogens)*: amitrole (herbicide), atrazine (herbicide), dichlorvos (insecticide), hexachlorocyclohexanes (lindane – gamma-HCH, insecticide, acaricide), pentachlorophenol (wood preservative), sodium ortho-phenylphenate (antimicrobial).
- Develop an inventory of sources of radionuclides in Ontario.
- Investigate the passage of radioactive isotopes through the food chain.
- Impose regulatory limits on radioactive contaminants using the same methodology as that used for chemical contaminants, which would result in more stringent standards.
- Conduct further studies on the emission of radioactive materials from energy production facilities and investigate ways of phasing out the release of these materials in instances where emission levels are found to pose a cancer risk.
- Decrease emissions from mobile sources such as cars, trucks and motorcycles as well as two-stroke engines (such as lawnmowers, chainsaws, minibikes, motorboats and some mopeds), which emit benzene and polycyclic aromatic hydrocarbons.
- Implement gasoline vapour recovery at fuel transfer facilities and gas stations to reduce fugitive benzene emissions.
- Support research on the development of alternative, environmentally benign fuels (e.g., hydrogen) that reduce overall impact on the environment, and technologies for the use of these fuels.

- Encourage walking and the use of bicycles and non-polluting public transit.
- Develop transition plans to help those negatively affected by the elimination of the use and production of persistent toxic substances.
- Implement a low but incrementally increasing taxation scheme to provide economic incentives for the reduction of toxic emissions during the phase-out period.
- Create a fund, through the charges noted above, to aid in the transition to a less toxic industrial society by exploring and demonstrating economically viable alternatives and by easing dislocations to affected workers and communities.
- Support the current SustainABILITY campaign for healthy environments.
- Develop school curricula, beginning at the elementary level, that will give students a strong grounding in science, statistics and the concept of risk, as well as an understanding of the relationship between environment and health.
- Promote science and technology curricula that will help Ontario develop skilled health and environmental professionals.
- Encourage cooperative efforts by industry, government and schools to strengthen science education in Ontario.
- Support non-government organizations in designing and delivering educational initiatives and developing community action plans.
- Support community action plans for prevention initiatives and intersectoral activities on environment and health.

## Sunlight

- Implement public education and communication campaigns encouraging the adoption of the Health Canada guidelines.

- Increase the adoption of preventive measures by children and young adults, who are especially vulnerable to the long-term effects of repeated exposure to sunlight, by directing information on the health effects of solar radiation to parents and modifying the health education curricula at the elementary and secondary school level.
- Conduct public education campaigns encouraging parents and caregivers to refrain from letting small children remain in the sun for long periods of time, and to ensure that children wear hats, protective clothing and sunscreen when engaging in outdoor activities.
- The Task Force proposes that shade trees and shaded areas be made available at all school yards, beaches, playgrounds, and other outdoor public places.
- Work with the Ministry of Labour to mount an educational campaign encouraging outdoor workers to take protective measures against prolonged exposure to sunlight, including the need to use sunscreen and wear hats, long-sleeved shirts and other protective articles of clothing.
- Where possible, ensure that adequate shaded areas are available at outdoor worksites, and that equipment used outside is provided with adequate shading.
- Institute a labelling system identifying the degree of UV protection for all articles of recreational clothing (caps, T-shirts, etc.).
- Implement a public education campaign emphasizing the need for preventive measures other than sunscreen to avoid UV-induced skin damage, the proper use of sunscreens, and the uncertainty of the degree of protection offered by sunscreen products.

## Reproductive Life and Related Factors

- The Task Force believes it is appropriate to include information on cancer-related reproductive risk factors in general health education for adolescents and young adults.

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- Concepts of cervical cancer prevention and screening should be integrated with sexuality education for both males and females in schools, and included in health promotion programs directed to all adolescents.

## **Infections**

- Measures applicable to reduce HIV transmission (similar to those advocated for prevention of cancer of the cervix above) should be vigorously pursued.

## **Medications**

- The Task Force recommends that women are fully informed by their physicians on both the potential risks from cancer induction as well as the potential benefits from symptom control and reduction in cardiovascular disease risk and osteoporosis before prescriptions are given for hormone replacement therapy.

## **Socio-Economic Determinants of Cancer**

- Ensure that members of all groups in society are involved in the development and implementation of cancer prevention programs addressing their needs.

- Tailor the content and method of delivery of information about cancer prevention to the groups for which it is intended.
- Conduct more extensive research on the barriers to accessing knowledge on cancer prevention experienced by different groups in society and on inequalities in cancer prevention and control.

## **Strategies for Implementing the Task Force Recommendations**

- The Ministry of Health conceptual framework for health promotion be adopted to guide the implementation of the Task Force recommendations for the primary prevention of cancer.
- The Task Force recommends that a Cancer Prevention Network be established to help in implementing the recommendations in this report, that would work with the Heart Health Network, the Provincial and Regional Cancer Networks, and the Provincial Cancer Agency to foster cancer prevention in Ontario.

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# Members of the Ontario Task Force on the Prevention of Cancer

Dr. Norman Boyd

*Division of Epidemiology, Ontario Cancer Institute,  
and Division of Preventive Oncology,  
Ontario Cancer Treatment and Research Foundation,  
Toronto, Ontario*

Dr. Kenneth Carroll

*Centre for Human Nutrition, Division of Biochemistry,  
University of Western Ontario, London, Ontario*

Dr. William K. Evans

*Ontario Cancer Treatment and Research Foundation,  
Ottawa, Ontario*

Dr. Walter Ewing

*Simcoe County District Health Unit, Barrie, Ontario*

Dr. Roberta Ferrence,

*Ontario Tobacco Research Unit,  
Addiction Research Foundation, Toronto, Ontario*

Dr. Norman Giesbrecht

*Social and Evaluation Research,  
Addiction Research Foundation, Toronto, Ontario*

Dr. James Gowing

*Cambridge Memorial Hospital, Cambridge, Ontario*

Dr. Trevor Hancock

*Kleinberg, Ontario*

Dr. Donald Iverson

*Behavioural Research and Program Evaluation,  
National Cancer Institute of Canada, Toronto, Ontario*

Ms. Jeanne Jabanoski

*Environmental Protection Office, City of Toronto  
Department of Public Health, Toronto, Ontario*

Mr. M. David Kassirer

*Willowdale, Ontario*

Ms. Marilyn Mackenzie

*Canadian Cancer Society, Toronto, Ontario*

Dr. Anthony Miller (Chair)

*Department of Preventive Medicine and Biostatistics,  
University of Toronto, Toronto, Ontario.*

Dr. David Muir

*Occupational Health Program, McMaster University,  
Hamilton, Ontario*

Dr. Grahame Owen

*Oakville, Ontario*

Dr. Graham Pollett

*Middlesex-London Health Unit, London, Ontario*

Dr. Irving Rootman

*Centre for Health Promotion, University of Toronto, Toronto, Ontario*

Dr. Beth Savan

*Environmental Health Program, Innis College,  
University of Toronto, Toronto, Ontario*

Mr. Jack Shapiro

*Ontario Cancer Treatment and Research Foundation, Toronto, Ontario*

Ms. Marion Stevens

*Toronto, Ontario*

## Ex Officio Members

Mr. Charles Clayton

*Health Promotion Branch, Ontario Ministry of Health,  
Toronto, Ontario*

Dr. Les Levin

*Policy, Programs and Research Branch, Ontario Ministry of Health,  
Toronto, Ontario*

Dr. Sandy Nuttall

*Policy, Programs and Research Branch,  
Ontario Ministry of Health, Toronto, Ontario*

Dr. Richard Schabas

*Public Health Branch, Ontario Ministry of Health, Toronto, Ontario*

Mr. Adam Socha

*Ontario Ministry of Environment and Energy, Toronto, Ontario*

## Resource Staff

Mr. Brian Hyndman

*Addiction Research Foundation, Toronto, Ontario*

Mr. Phil Regli

*Policy and Programs Division, Ministry of Agriculture, Food and  
Rural Affairs, Toronto, Ontario*

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# Introduction

The Ontario Task Force on the Primary Prevention of Cancer was appointed by the Minister of Health (the Honourable Ruth Grier) in February 1994 with the following purpose and objectives:

## *Purpose*

To advise the Minister of Health with respect to the development of an action-based, effective and feasible plan for the primary prevention of cancer:

## *Objectives*

1. To review the literature on risk factors associated with cancer and on the effectiveness of primary intervention approaches.
2. To consider evidence on risk factors and interventions presented by external experts.
3. To prepare an action plan detailing recommendations for primary prevention strategies and targets for reduction of site-specific cancer incidence.

## *Process Adopted by the Task Force*

The Task Force has had eight meetings. At our first meeting, we reviewed our mandate, and agreed on a strategy to complete our report. Primary prevention of cancer results from the removal of humans from exposure to the causes of cancer, neutralising the effect of such factors, or increasing the resistance of humans to these factors. We have concentrated largely on the known causes of cancer, and addressed them as factors to which the public in Ontario are exposed, and for which reduction in or abolition of exposure seemed to be feasible.

In order to reach agreed-upon conclusions and recommendations, several of us (depending upon our expertise) prepared a review of the literature relating to specific exposures, and presented the draft at one of our meetings. In addition, we issued a call for submission of briefs for our consideration, and in a few instances requested those who had submitted a brief to present it to

us. We also sought individuals with particular expertise to make presentations to us.

We are grateful to those who made presentations and to those who submitted briefs. Each received careful consideration. Many of the briefs contained useful background information additional to the other sources we consulted. Those who submitted briefs are listed in Appendix I. Much of the information received was helpful for our deliberations. We have not prepared a formal response to any of the briefs. In practise, our response to the briefs is found in the relevant section of the report (though none of the briefs are referred to specifically in these sections).

We sought and welcomed specific involvement from staff in the Ministries of Health, Agriculture and Rural Affairs, and Environment and Energy. They were a helpful resource to the Task Force and are listed as "ex officio" or "resource staff" following the list of Task Force members. As such they participated in our discussions, and often made very helpful suggestions relating to our drafts. However, the Task Force members alone are responsible for the content of this report.

During the process of preparing this report, we sought and have achieved consensus. It was not necessary to hold a formal vote on any issue. Each of us has given a little in achieving this consensus, so that although there are sections where as individuals we might have preferred greater or less emphasis, we are all agreed upon our recommendations.

In making our recommendations, we are very conscious that we were not working in a vacuum. This is particularly true in relation to provincial actions on tobacco control. Early in our deliberations, it became clear that Bill 119, now the Ontario Tobacco Control Act, had reached a major watershed in its deliberations in the legislature. We therefore released an interim statement, affirming our support for this legislation, which we hold to be among the most advanced of any jurisdiction in the world.



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## Cancer as a Disease

Cancer is characterized by the partial or complete loss of control of cellular division, and the development of tumour masses that invade locally, spread within the region of the body affected, and often spread to distant organs through a process called metastasis. Cancer kills either through local spread destroying essential body functions, or through the effects of metastases on other vital organs, such as the brain, liver or lungs. Cancer consists of multiple diseases, often with overlapping causes, many also being a cause of other chronic diseases (as well as several infectious diseases). Many of the cancers are named according to the site of the body where they first appear (such as breast, lung, stomach). Cancer also includes diseases of the blood-forming tissues and the immune system, cancers that go by the name of haematopoietic cancers (including leukemia) and the lymphomas, respectively.

Cancer is the most important cause of premature mortality in both sexes. It is the second most common cause of death in Ontario after all forms of cardiovascular disease. The National Cancer Institute of Canada (1995) has estimated that in Ontario there will be 48,500 newly diagnosed cases of cancer in 1995, and 22,400 deaths from cancer. Cancer has grown in importance with the decline in mortality from cardiovascular diseases that has occurred in this province (in common with the whole of North America and many countries of Western Europe and Australasia in the last 30 years), and the aging of the population. Unless there is a decline in cancer mortality, it is likely that cancer will be the number one cause of mortality early in the next century.

## Cancer Prevention As a Part of Cancer Control

Cancer control is directed to reducing the morbidity and mortality from cancer, through the appropriate combination of prevention, early detection, treatment, rehabilitation and palliative care. Unfortunately, the resources currently invested in cancer prevention are very

small, compared to those invested in cancer treatment (approximately \$1 billion annually) (Chief Medical Officer of Health, 1994). If cancer were an easy disease to treat, and if treatment were highly effective, there might be some sense in investing the vast majority of the resources within the "cancer envelope" in treatment. However, treatment for most advanced cancers is not curative, though it can contribute to a better quality of life; but even when treatment is curative, it is never easy or free of morbidity.

Hence, it is appropriate to invest in cancer prevention, in spite of the delay in seeing an effect of preventive manoeuvres, and the increasing demand for better and better cancer therapies, many of which are expensive. Thus, although the Task Force does not have the mandate to consider prevention versus other approaches to cancer control, the Task Force wishes to point out that there is an opportunity cost associated with every new strategy for the control of cancer, and that the cost-effectiveness of every measure needs to be carefully considered. Preventive manoeuvres often have the advantage that the benefit from a successful strategy may be much greater than prevention of future cancers, that some of the strategies we recommend may have as great an impact on prevention of other chronic diseases, and that impact is often more immediate than the beneficial effect upon cancer. Thus the Task Force is convinced that cancer prevention is important in any provincial cancer strategy.

A great deal has already been achieved in Ontario to control some of the major causes of cancer, achievements that are now beginning to be seen with a reduction in the incidence and mortality from some of our major cancers, including lung cancer in men and stomach and colorectal cancer in both sexes. Many of these achievements are due to the foresight and action of many in government and government agencies, though the voluntary agencies (especially the Canadian Cancer Society) and others in the private sector can share the credit. The difficulties those interested in improving cancer prevention face are illustrated by the fact that for at least one of the cancers with falling incidence and mortality (stomach cancer),

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there is still uncertainty over which contributory action(s) led to the decline. Forty years ago stomach cancer was the most important cancer in Ontario and in the world, and now it has fallen to number 11 place in Ontario for both sexes combined.

Perhaps foremost among these difficulties is the long natural history of cancer, the fact that for many cancers (including breast and stomach cancer) events in childhood as well as later in life may influence cancer risk in adulthood and throughout subsequent life, so that actions taken now may have a twenty to forty-year latent period before we know whether or not they have been appropriate, let alone successful. The Task Force, mindful of this truism, recognizes that it may sometimes be difficult for government to act now, when the eventual return may be uncertain, and far away in time. Yet we urge action now. Our knowledge of the causes of cancer may be imperfect, but we have no excuse for delaying application of the knowledge we now have, both for our own benefit in our later years, and the benefit of our children and grandchildren.

We trust that our recommendations will be helpful to Government in making decisions on the appropriate approaches to cancer prevention; that they may make a beginning on a coordinated approach to the prevention of cancer as part of the overall Cancer Strategy for this province; will contribute to the wider endeavour to prevent the major chronic diseases that afflict the public of Ontario; and help promote the health and well-being of the population.

## Structure of the Report

In the ensuing sections of this report, we review the evidence that makes us recommend increased emphasis on cancer prevention as a major plank of cancer control. For those exposures where the evidence is well known and readily available, only brief summaries of the evidence are presented. For those exposures where there is controversy, we have acknowledged it, but still attempted to develop a set of recommendations congruent with the evidence, even as we recognize the uncertainty of our knowledge.

In view of these uncertainties in much of the data that are available, the Task Force recognizes that it may be necessary to modify its recommendations in due course. However, this is clearly within the framework of scientific decision making, which must always be based on the best available evidence at any particular time. We have not attempted to develop a set of recommendations for specific cancer sites, though an indication of the potential reduction in cancer incidence that might result from following recommendations such as ours was part of the input into the Canadian Cancer 2000 process (Miller, 1992). In addition, we have rarely made specific recommendations on a possible research agenda, in part because we did not regard this as part of our specific mandate, and in part because a working group of the Provincial Cancer Network is addressing such issues.

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# Tobacco

The effects of tobacco smoking in increasing the risks of a number of cancers have been reviewed by numerous national and international groups and the Task Force felt it was not necessary to review this evidence here. There is *sufficient* evidence for the carcinogenicity of tobacco smoke to humans (IARC, 1986).

Although the proportion of smokers in the population has declined substantially over the past 25 years, the use of tobacco products is still the primary preventable cause of premature mortality. In Ontario, one in five adult deaths can be attributed to tobacco use, chiefly from cancer, cardiovascular disease and chronic obstructive lung disease (Chief Medical Officer of Health Report, 1994).

In Ontario approximately 90% of all lung cancers in men, and 80% in women – which prove to be fatal within five years of diagnosis in almost nine out of ten cases – are caused by tobacco use. An estimated 5,700 Ontarians will die of lung cancer in 1995 (National Cancer Institute of Canada, 1995). Many of these deaths will occur in former smokers. It is important to recognize that although cessation of cigarette smoking reduces risk in former smokers compared to continuing smokers, the risk in former smokers remains elevated compared to lifelong non-smokers (Halpern et al., 1993). Therefore the best strategy to prevent smoking-associated cancer deaths is never to smoke. For smokers, the earlier in life that smoking ceases, the greater the benefit.

Tobacco use is also a cause of other cancers: smokers have a higher risk of developing cancers of the lip, mouth, pharynx, larynx, esophagus, bladder, kidney and pancreas. There is also an association between smoking and cancer of the cervix. Users of smokeless tobacco products (chewing tobacco, snuff) have a higher risk of developing cancers of the mouth.

Non-smokers are vulnerable to tobacco-related cancers as well. Second-hand smoke, also known as environmental tobacco smoke (ETS), is recognized as a cause of lung cancer in non-smokers and respiratory problems in young children and adults.

In the light of its significance, the Task Force agreed that tobacco would be its highest priority. Detailed information on the efficacy of the main countermeasures to tobacco use, including education, counselling, school and workplace programs and regulatory measures, was reviewed by the Task Force to guide the development of its recommendations.

Over the course of considering strategies to reduce the prevalence of tobacco use, Task Force members acknowledged the proactive policies introduced at the provincial level to date. In particular, the Task Force commends the Ontario government for its initiation of the Ontario Tobacco Strategy, which is one of the most advanced systems of countermeasures against tobacco use in the world. As such, it can be expected to have a significant impact on the health status of Ontarians by deterring young people from acquiring the smoking habit, encouraging smokers to quit, and protecting the public from the health risks associated with ETS.

While acknowledging the positive contribution of the Ontario Tobacco Strategy and related initiatives, the Task Force proposes a number of measures for strengthening the effect of current provincial efforts to combat tobacco use. The Task Force feels that the implementation of these proposals, outlined in the following section, will further reduce the burden of tobacco-related illness by complementing and enhancing the impact of existing initiatives.

## Taxation

There is strong scientific evidence supporting the impact of pricing on the consumption of tobacco products. For example, a doubling of Canadian cigarette prices between 1979 and 1991, almost all of which was due to federal and provincial tax increases, was correlated with a 60% reduction in the prevalence of smoking among young people (Health Canada Statistics, 1993).

Given the proven efficacy of taxation as a tobacco control strategy, the Task Force is very concerned about the recent reductions in tobacco taxation at both the federal and

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provincial levels. The combined tax cuts have lowered the cost of a carton of cigarettes in Ontario from \$41 to about \$23 or less, a decrease which restores cigarette prices to 1986 levels.

The Task Force is especially concerned about the impact of the recent tax policy changes on children and youth, whose buying habits are far more price-sensitive than adult. A recent survey conducted by the Addiction Research Foundation revealed that, for the first time in over two decades, the prevalence of smoking among Grade 7 students increased significantly, from 6.1% to 9.4% (Ontario Student Drug Use Survey, 1993). This increase, which took place prior to the federal and provincial tax cuts, was, in part, attributed to greater access to lower priced contraband tobacco products. A 1994 survey of Grade 10 students carried out in southwestern Ontario as part of the Waterloo Smoking Project showed that a substantial proportion of children had increased their smoking since the tax cut. The Addiction Research Foundation also surveys adults in Ontario each year. The 1994 survey showed that the downward trend in smoking prevalence had ended and that smoking appeared to be increasing (Ontario Alcohol and Other Drug Opinion Survey, 1994).

Decreases in the price of tobacco products may also deter adult smokers from quitting. In particular, the recent tax reductions may have a significant impact on the cessation efforts of low-income smokers, who are more sensitive to cost than the general population. The most reliable projections of the impact of tobacco tax reductions point to an increase in the proportion of smokers in the population.

**To minimize increases in tobacco-related cancer mortality arising from the reductions on tobacco taxes, the Task Force strongly urges the Ontario government to work with its federal and provincial counterparts to restore tobacco taxation rates to their former peak levels. Subsequent tobacco tax increases should be set above the rate of inflation.**

Any resurgence of tobacco smuggling resulting from these policies should be addressed by export tax increases on tobacco products, by lobbying the U.S. federal and state governments to raise their respective taxes on tobacco products, and by other measures that deter exports.

## **Enforcement of Sales to Minors Legislation**

The deterrence of tobacco sales to minors is critical for preventing the initiation of smoking by young people. Although a minimum age for the purchase of tobacco existed prior to the introduction of the Ontario Tobacco Control Act, its impact on the smoking behaviour of young people was minimal as it was only sporadically enforced.

**The Task Force recommends the rigorous enforcement of sales to minors legislation coupled with continued retailer education programs in order to maximize the health impacts of the Ontario Tobacco Control Act.**

## **Measures to Prevent Exposure to Environmental Tobacco Smoke**

The 1986 report of the U.S. Surgeon General concluded that involuntary exposure to ETS was a causal factor for tobacco-related diseases, including lung cancer (Surgeon General, 1986). This landmark document supplemented the focus of preventive efforts upon personal health (i.e., the risks for smokers) with environmental changes aimed at reducing the health risks to non-smokers.

A recent report from the U.S. Environmental Protection Agency (EPA) has strengthened the impact of the Surgeon General's conclusions by classifying ETS as a Class A carcinogen, the most certain category of cancer-causing agents (U.S. Department of Health and Human Services and U.S. Environmental Protection Agency, 1993). The report concluded that ETS, which is a combination of sidestream and exhaled smoke, causes lung cancer in non-smokers and impairs the respiratory health of infants and children.

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**In light of the evidence on the cancer risks posed by environmental tobacco smoke (ETS), the Task Force calls upon the province to give increased priority to the reduction/elimination of ETS exposure.**

Specific measures that the government could adopt to reduce/eliminate ETS exposure include:

- **work with municipal governments to strengthen legislation banning tobacco use in public areas. Smoking in these venues should be restricted to separately ventilated areas;**
- **work with employers and relevant ministries to strengthen legislation banning tobacco use in the workplace. As is the case with public areas, smoking in workplaces should be restricted to separately ventilated areas;**
- **develop strategies to protect children from exposure to ETS.**

Specific areas that need to be considered in the latter strategies are the home and in vehicles.

## **Designation of Tobacco as a Hazardous Product**

The designation of tobacco as a hazardous product would enable the adoption of additional smoking prevention measures, including plain packaging, larger package warnings and an opportunity to tax tobacco at the point of production and manufacture.

**To broaden the possible scope of preventive efforts, the Task Force urges the Ontario government to work with its provincial and federal counterparts to include tobacco in the Canadian Hazardous Products Act.**

## **Promotional Efforts by the Tobacco Industry**

The Task Force strongly supports restrictions on tobacco advertising at the federal and provincial levels. There is,

however, concern that the impact of these restrictions are undermined by the publicity the tobacco industry garners from its sponsorship of special events and other marketing initiatives, many of which feature the logos of cigarette brands in their marketing campaigns.

**The Task Force calls for the provincial government to ban the use of tobacco product names, trademarks, colours and logos in all tobacco sponsorship advertising.**

A mechanism that has worked in the State of Victoria, Australia, is to remove the incentive for sports organizations and cultural groups to accept sponsorship from the tobacco industry. Thus, the Victoria Health Promotion Foundation was formed, funded by taxes on tobacco, with the mandate to support such organizations. In Canada, government should accept the responsibility to replace tobacco industry support for the arts and sports, conditional on the supported organization agreeing to refuse tobacco industry sponsorship. Government could work with cancer and other health interests to pool resources to provide such support, preferably by using some of the revenue from tobacco taxation. The eventual return could help reduce the cost of health care, while increasing the quality of life for Ontarians.

**The Task Force urges the provincial government to work with others to seek innovative ways to reduce the incentive for sports and cultural groups to accept sponsorship from the tobacco industry.**

## **Cost-Recovery Mechanisms for Tobacco-Related Illness**

Tobacco-related illness and disability place a tremendous economic burden on society: at present, tobacco-related disease costs the Canadian government about \$9.5 billion per year. There is growing concern that the tobacco industry, which continues to enjoy large profit margins on the sale of cigarettes and other tobacco products, is not assuming its fair share of these costs.

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In an effort to recover the cost of treating diseases attributable to smoking, several U.S. states have launched lawsuits against the tobacco industry. Other jurisdictions have considered increased taxation on the tobacco industry as a means of seeking recompense for the harm resulting from the sale of its products.

**The Task Force urges the province to hold the tobacco industry accountable for the economic costs of tobacco-induced illness. The federal and provincial governments should investigate the utility of initiating legal action or recovery mechanisms against tobacco manufacturers.**

## **Investigating the Practices of the Tobacco Industry and Restricting Access to Tobacco Products**

The Task Force has noted that questionable and, in our view in several instances, unethical practices are carried out by the multinational tobacco industry in Canada and/or elsewhere to maintain its profit margins. Examples include the suppression of evidence linking tobacco to ill health; the replacement of nicotine during cigarette manufacturing to maintain, if not enhance, the addictive properties of tobacco; the dissemination of misleading information about the consequences of smoking; advertising campaigns that in practice target vulnerable groups (e.g., children, young women, low-income individuals); and the export of tobacco products to third-world nations, often accompanied by advertising flagrantly directed to minors.

In Canada, the widespread availability of tobacco products hinders efforts aimed at reducing consumption. In the past, permitting sales of tobacco products in pharmacies, encouraged the belief that tobacco products are not hazardous to health. However, tobacco sales are still allowed at corner stores without restriction. Governments should consider the licensing of all sales outlets, as well as the prohibition of sales in pharmacies. Further regulation of distribution only through retail outlets controlled by the province would reduce incentives to smoke that result from tobacco's widespread availability.

There are several approaches which could help in the development of strategies to prevent unethical practices of the tobacco industry and reduce access to tobacco products. One might be that the province establish a Royal Commission, with the power of subpoena, to investigate the practices of the tobacco industry. Another approach would be the establishment of an Ontario Tobacco Control Board or agency, which could assume responsibility for the control of tobacco products and be a focus for continuing coordinated pressure to bring about reduction of exposure to such products, and would have as one of its highest priorities the right to investigate the practices of the tobacco industry.

**The Task Force:**  
**recommends that the Ontario government consider establishing a Royal Commission to investigate the practices of the tobacco industry; calls upon the Ontario government to establish an Ontario Tobacco Control Board or agency, with the following mandate:**

- **carry out Ministry policy, and report directly to the Ministry of Health;**
- **licence or control access to tobacco products;**
- **regulate promotional activities of the tobacco industry;**
- **enforce cost-recovery of tobacco-related health costs;**
- **investigate and control unethical practices of the tobacco industry;**
- **establish intersectoral collaboration for information and educational strategies;**
- **assist health professionals and institutions in counselling smoking cessation and prevention;**
- **control the export of tobacco products.**



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## **Collaborative Efforts Involving Key Stakeholders**

The Task Force realizes that the successful implementation of a comprehensive anti-tobacco strategy requires the coordinated efforts of key stakeholders.

**To ensure effective intersectoral collaboration, the Task Force recommends the adoption of the following policies:**

- **ensure that current scientific information on the health effects of tobacco and strategies to prevent tobacco use (including information on the efficacy of various approaches) is available to health professionals, advocacy groups and the general public in formats appropriate for their respective needs and levels of comprehension;**
- **increase collaborative efforts with Regional Cancer Networks, Public Health Units, Community Health Centres, the Canadian Cancer Society, the Ontario Public Health Association and other relevant non-government organizations to mobilize community forces in the fight against tobacco, and to reinforce educational appeals and advocacy efforts emphasizing the addictive nature of tobacco and its harmful consequences.**

## **Counselling by Health Professionals**

Evidence indicates that physicians and other health professionals can serve as a positive influence on the behaviour of smokers by providing advice and support for cessation, as well as pointing out the risks of ETS to others. Unfortunately, many do not provide such counselling services to their patients.

To encourage the wider provision of counselling by physicians and other health professionals on tobacco and ETS, several barriers must be addressed. One of the major barriers is the fact that many do not feel comfortable about counselling patients due to their lack of knowledge and experience.

The Task Force recognizes that many health professionals, including nurses, pharmacists, nurse practitioners, dentists, dermatologists and community health workers, can serve as valuable sources of advice for smoking cessation and counselling on ETS, and efforts in these areas should be expanded.

**In order to effectively promote the adoption of smoking cessation and ETS counselling by health professionals, the provincial government should secure collaboration with key stakeholder groups to ensure:**

- **promotion of the concept of smoking cessation and reduction of ETS;**
- **replenishment of educational materials for cessation support and ETS reduction;**
- **provision of training and recognition for all health care professionals in smoking cessation and ETS counselling;**
- **funding of accessible workplace smoking-cessation programs.**

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# Dietary Risk Factors

Dietary risk factors have been linked to a number of common cancers, including stomach, breast, colon and prostate (Muir and Sasco, 1990). Protective factors, especially derived from plant foods, have been associated with reduced risk for the same and other cancers (Miller et al., 1994). Most commentators, (e.g. Doll and Peto, 1981; Tomatis et al., 1990) have agreed that diet is the second leading modifiable cause of cancer. It was the consistency between evidence from humans and animal studies that led to the early recommendations on dietary modification as an important means of preventing cancer (Committee on Diet and Cancer, 1982). These have largely been reinforced subsequently (Committee on Diet and Health, 1989).

In humans, ecological studies have consistently shown a strong positive correlation between levels of dietary fat and meat consumption and the incidence of and mortality from breast and colon cancer, as well as cancers of the endometrium, ovary, kidney and, in some studies, lung. However, ecological studies provide evidence only at the level of the group and not the individual, and point to hypotheses, rather than testing them. Analytical studies, especially case-control and cohort studies, have generally provided weaker, though often suggestive evidence.

Methodological difficulties in defining a relationship between diet and cancer include the difficulty in measuring dietary intake accurately, the correlations that exist between many components of the diet, the possibility of confounding between dietary and non-dietary factors that may particularly affect ecological studies, and the long interval that may elapse between the initiation of cancer and its diagnosis, combined with the possibility that diet in early life may be particularly important in the development of some cancers, especially of the stomach and breast. Thus, the extent to which the diet-cancer associations that have been reported to date in human populations are causal is uncertain.

However, the evidence associating some elements of diet varies for different cancers. Thus, although the evidence for breast cancer is inconsistent, there is fairly consistent evidence of an association of dietary fat consumption,

especially saturated fat, with colon, advanced prostate and ovarian cancer, as well as red meat consumption with colon and advanced prostate cancer. Further, there is increasingly consistent evidence that daily consumption of fresh fruits and vegetables may reduce the risks of a number of cancers, including mouth, pharynx, esophagus, stomach, colon, rectum, larynx, lung, breast and bladder (Miller et al., 1994).

Many of the associations noted have been to foods containing high amounts of fibre. However, it is not clear that it is the fibre *per se* that is protective, rather it may be other substances in the fruits and vegetables from which the estimates of fibre consumption were made. Hence it is appropriate to promote increased consumption of fruits and vegetables, rather than concentrating on high fibre-containing foods (Committee on Diet and Health, 1989; Miller et al., 1994). Estimates of the proportion of cancer attributable to diet have varied from a low of 15% to a high of 75% (Doll and Peto, 1981), but have more recently tended to approximate to 20% (Miller, 1992) to 30% (Willett, 1994).

In addition to potentially reducing the risk of cancer, the adoption of a healthy diet serves as a protective factor against a number of other chronic diseases, including heart disease and stroke (Committee on Diet and Health, 1989). Well-nourished people are generally healthier and less vulnerable to illness. There is evidence from the United States that high educational attainment is associated with recommended dietary intake patterns (Shimakawa et al., 1994).

Over the course of its deliberations on the links between diet and cancer, the Task Force considered the site-specific neoplasms associated with diet, the type of methodological approaches that would provide a sufficient level of evidence to sustain public health recommendations regarding diet, and current initiatives by government and the food industry to promote the adoption of healthy eating practices. Based on the current evidence, recognizing that even in a climate of uncertainty it is not appropriate to fail to provide guidance on an optimal diet, the Task Force concludes that government policy in

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Ontario should be directed towards promoting adherence of as large a segment of the Ontario population as possible with the dietary recommendations in Canada's Food Guide. A number of health benefits can be anticipated to flow from measures to promote healthier diets, perhaps particularly from efforts to increase fruit and vegetable consumption. Such benefits include reduction in heart disease, obesity and possibly adult onset diabetes as well as some cancers.

To achieve adherence of as large a segment of the Ontario population as possible with the dietary recommendations in Canada's Guide to Healthy Eating, two strategies are required. First, government-initiated healthy public policies are needed to ensure that all Ontarians have access to a healthy, high-quality food supply, and to support them in making healthier dietary choices. Second, government-supported educational efforts are needed to raise public awareness of the benefits of a healthy diet and to bring about positive changes in eating habits. The following section outlines specific recommendations for the implementation of these strategies.

## Public Policies

### Promoting Healthy Diets

#### *Intersectoral Collaboration*

The promotion of healthy diets for all Ontarians can be achieved through a combination of policies involving various sectors at various levels of responsibility. Significant improvements in nutrition require coordinated efforts of relevant government ministries, agencies and offices with mandates for agriculture, food, health, water, finance, education, industry, social services and trade.

**The Task Force recommends that the government promote intersectoral collaboration between government and industry, including the agri-food industry, food retailers and food services, to ensure the concerted implementation, monitoring and evaluation of policies promoting healthy eating habits.**

The Premier's Council is one possible mechanism for facilitating collaborative strategies between key sectors.

#### *Access to a Healthy Food Supply*

For cancer prevention, it is important that Ontario residents have a nutritionally balanced diet while avoiding excess dietary fat intake and increasing fruit and vegetable consumption. To do so, requires access to high-quality nutritious foods.

**The Task Force recommends that the provincial government review its policies governing the production, storage and distribution of food products to ensure that all Ontario residents have access to a high-quality supply of nutritious food.**

#### *Collaboration with the Food Industry*

In order to ensure the acceptance of policies ensuring access to a healthy food supply, innovative approaches will be required to promote partnerships between government and the food industry.

Such partnerships should include those elements of the food industry responsible for the production of fruit, vegetables and high-fibre grain products, as well as the producers and distributors of lower-fat meat and dairy products.

Despite advantages potentially offered by entering into partnerships with the food industry, governments need to be wary of ventures promoting specific brand-name food products, which are often more expensive and less nutritious than generic alternatives (e.g., bulk cereals). Collaborative initiatives that could potentially increase the market share of less nutritious food products due to the publicity gained by the participating corporation (e.g., breakfast cereals with high levels of sugar) should also be avoided.

**The Task Force recommends that government should seek collaboration with the food industry, in order to ensure the acceptance of policies ensuring access to a healthy food supply.**

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## *Community Involvement*

Healthy public policies for improved nutrition must acknowledge the fact that the active support of Ontario residents is essential for ensuring social change. Local community involvement is a prerequisite for initiating and sustaining measures promoting healthy eating habits.

Special efforts must be made to ensure the genuine participation of Ontario residents, including members of marginalized groups, in the decisions and actions which enable them to improve their nutritional well-being.

**To encourage the adoption of policies and practices promoting healthy eating, the Task Force recommends that the Ontario government should work with, and support the development of, community-based healthy eating coalitions and local food policy councils.**

## *Nutrition Labelling*

A 1994 consumer survey by the Grocery Manufacturers of Canada revealed that 74% of Canadian grocery shoppers regarded nutrition as either very important or extremely important. The most trusted source of nutrition information was found to be nutrition experts and package labels. Although package labels are an important source of information, shoppers expressed less satisfaction in 1994 than in the past. The public is often confused over the nature of specific food products, especially foods subject to extensive processing and synthetic products, often designed to mimic natural products, such as cheese, pizzas, processed meats, fish substitutes, manufactured fats, etc. In order for the public to be in a position to make informed food choices, it is essential that such foods be carefully identified and labelled.

Nutritional information on food labels should be expressed in terms which are relevant and understandable to consumers. In the Grocery Products Manufacturers survey of 1994, 77% of Canadian shoppers mentioned the amount of fat as essential nutrition information on food products. Consumers might have a greater appreciation of the fat content of a food product if it were expressed as a total

percentage as well as the total number of grams. Labelling should also provide information on the country of origin. Depending on the nature of the food product, nutritional information could be placed directly on the packaging or made available through information provided at the point-of-purchase.

There is also a need for programs educating consumers about labelling and food safety. The Task Force is concerned that the nutritional information accompanying food products is sometimes misleading. For example, many high-fat foods, such as potato chips, are promoted as "cholesterol free," a practice which conveys false perceptions about the nutritional value of these food products. Ontario consumers need to be aware of the nutritional content of their food purchases in order to make healthy, informed choices.

**The Task Force recommends that the Ontario Ministry of Health work with the Ontario Ministry of Agriculture, Food and Rural Affairs and other relevant ministries to develop an adequate nutrition labelling system that enables Ontario consumers to determine the nutritional value of all food products and to make informed, healthy choices. Educational efforts should also be undertaken to familiarize consumers with this new system.**

## *Ensuring Food Security for Low-Income Ontario Residents*

In 1991, 11.2% of Ontario families were living below the poverty line (based on Statistics Canada low-income cutoff, 1986 figures). Approximately 15% of Canadians do not have an income that ensures access to nutritious food. Poverty is associated with decreased physical activity, as well as the increased risk of chronic diseases associated with dietary risk factors.

Due to insufficient funds for transportation, many low-income families purchase food at small convenience stores, where the quality and selection of healthy food products, such as fresh vegetables, are limited and the prices are generally higher than those at suburban grocery stores.

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To ensure that low-income groups have access to nutritious, affordable food, the Task Force has identified a need for macro and community-level policies aimed at reducing socio-economic inequities in nutritional status.

**The Task Force recommends that the following measures be considered by the Ontario government to reduce socio-economic inequities in nutritional status:**

- **expand alternative distribution channels such as community kitchens, food buying clubs, field-to-table programs and community gardens to increase access to food;**
- **encourage the food industry to donate all fresh produce (fruits and vegetables) and other nutritional food products that do not meet aesthetic grading criteria to food banks or community kitchens;**
- **work with local school boards and community organizations to ensure that school breakfast and/or lunch programs are available to all children who need them;**
- **design communities with consideration to access to food stores that provide adequate choices of nutritious and inexpensive foods, and the means for residents to grow their own food if they wish to do so, as in community gardens.**

### *Marketing Board and Producer Association Practices*

Ontario marketing boards and producer associations are an important part of the food producer and distribution system. Most of these boards and associations are involved in the production of fruits, vegetables and grains, and their activities tend to encourage healthy eating practices in Ontario. In recent years, boards and associations in the meat and dairy industry have attempted to respond to consumer concerns and have made progress in ensuring the availability of lower-fat products. Unfortunately, although changes were made over 20 years ago that encouraged the provision of leaner meat, the producer

payment practices of some of Ontario's marketing boards still sometimes favour the production of higher-fat food products.

This undesirable practice has recently been aggravated in Canada. A new grading system has been introduced for beef whereby the amount of fat in beef will be greater in what the consumer will regard as the highest-quality grades (AAA) compared to a lower-quality grade (A). The justification for this change is said to be improved palatability of the AAA (contains small or greater marbling; i.e. visible fat) compared to the A (must contain at least traces of marbling), in spite of surveys that indicated consumers were very concerned about the fat content of beef. Beef with no visible fat is graded B. This is a most retrograde step; it largely removes the gains that have occurred in the production and consumption of lower-fat beef over the last two decades. "High quality" Canadian beef must therefore revert to its previous status as a high-fat-containing food potentially dangerous to health.

**The Task Force recommends that the practices of all Ontario's marketing boards and producer associations encourage the greater production and availability of low-fat foods.**

The Task Force acknowledges that the adoption of multiple component milk pricing (based on butterfat, protein and solids such as lactose and minerals) by the Ontario Milk Marketing Board is superior to the previous system based exclusively on butterfat content.

### *Taxation*

Taxation is one of the most effective regulatory measures for encouraging the adoption of health-promoting actions. Smoking rates in Canada underwent a marked decline during the period of large tobacco tax increases in the 1980s. This suggests that taxation could be an effective means for encouraging healthy food consumption. Currently, most nutritious foods are not taxed while many foods of limited nutritional value, such as snack foods, candy and soft drinks, are taxed. The Task Force believes that this principle could be extended. Sales tax systems are

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undergoing review currently by the federal and provincial government. Such review provides the opportunity for further revision to help promote healthy food choices.

**The Task Force encourages the Ontario government to recognize the importance that the application of differential taxation levels has on healthy food consumption. The Task Force further recommends that differential taxation systems be investigated as a means of promoting consumption of lower-fat foods and fruit and vegetables and discouraging consumption of high-fat foods.**

The Task Force acknowledges that such a policy could be challenged as potentially having a regressive impact on low-income groups. If that proved to be so, the revenues gained from such taxes should be used to alleviate the potential burden for economically disadvantaged consumers.

### *Alternative Food Preparation Practices*

While measures should be taken to encourage the substitution of high-fat food products by healthier alternatives, the Task Force acknowledges that changing the food preferences of the general public will not be easy.

**To minimize the health risks associated with the consumption of popular, high-fat food products, healthier alternative food preparation practices should be promoted. The provincial government should work with the food industry to facilitate the adoption of healthy food production and manufacturing practices.**

French fries heated in an oven, for example, have a much lower fat content than fries prepared in a conventional deep fryer.

### *Availability of Healthy Food Choices in Institutional and Workplace Settings*

**All community institutions (schools, hospitals, etc.) and workplaces that currently provide food products should be required to provide healthy food choices on their premises, and post nutritional information about the foods served.**

One possible means of enforcing this measure could involve stipulating nutritional requirements in the terms of catering contracts.

## **Education/Public Awareness Initiatives**

### *Dietary Guidelines for Cancer Prevention*

The Task Force recommends that educational efforts undertaken by the government to raise public awareness of the importance of a healthy diet emphasize Canada's Guide to Healthy Eating:

- **Enjoy a variety of foods.**
- **Emphasize cereals, breads, other grain products, vegetables and fruits.**
- **Choose lower-fat dairy products, leaner meats, and foods prepared with little or no fat.**
- **Achieve and maintain a healthy body weight by enjoying regular physical activity and healthy eating.**
- **Limit salt, alcohol and caffeine.**

Canada's Guide to Healthy Eating provides indications of the desirable number of portions. For example, people should aim to consume at least 5 or 6 portions of fruits and vegetables a day.

### *Population-Based vs. Targetted Approaches to Educational Programs*

When considering strategies to promote healthy diets, the Task Force discussed whether educational initiatives should be aimed at the entire population or directed towards the most nutritionally vulnerable groups in the population.

Ontario Health Survey data indicate that unhealthy eating practices are prevalent throughout the entire population, and not restricted to any one subgroup. For example, approximately 88% of Ontarians obtain more than 30% of their total calories from fat (Ontario Health Survey, 1990).



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**The Task Force recommends that educational initiatives promoting healthy diets should be population-based, focusing on the promotion of healthy eating habits among all Ontario residents.**

Such initiatives should entail a combination of provincially-sponsored, media-based public awareness campaigns and community programs. At the same time, however, supplemental educational efforts may be required to address the needs of vulnerable groups (e.g., low-income Ontarians, people with low literacy levels).

### ***Food Preparation and Shopping Skills Workshops***

Knowledge of healthy food preparation and shopping skills is essential for the adoption of diets that protect Ontarians from cancer and other chronic diseases. Many Ontario residents are not aware of the principles of healthy food preparation, a phenomenon which is, in part, attributable to the increased use of fast-food outlets, microwavable food products, etc. To rectify this situation:

**The Task Force recommends the increased provision of healthy food preparation and shopping classes at the community level.**

The Task Force acknowledges the relevant initiatives the Ministry of Health has implemented to date, such as the Community Food Advisor Program, sponsored jointly by the Ministries of Health and Agriculture, Food and Rural Affairs, which provides training in nutrition, food safety and food preparation to volunteers at community health centres and other venues, and the Canadian Cancer Society's Healthy Food Choices Program, which advises the public on the relationship between diet and certain cancers. The wider implementation of similar activities is encouraged to foster the adoption of healthy shopping and food preparation practices. Increased use of other forms of communication, such as media campaigns, to promote healthy food preparation skills is also encouraged.

### ***Requirements for Educational Material***

The Task Force recommends that all educational initiatives promoting healthy diets – brochures, media appeals, etc. – should use simple, easy-to-understand language (Grade 6 reading level). Special efforts should be undertaken to convey nutrition information to people with low literacy levels.

Educational initiatives encouraging the consumption of healthy diets also need to recognize the ethno-racial diversity of the province. Where numbers warrant, educational materials and/or healthy food preparation classes should be geared towards cultural preferences.

### ***School-Based Nutrition Education***

The Task Force recommends that the Ministry of Health work with the Ministry of Education to create school food policy and ensure that nutrition education be a mandatory component of comprehensive school health programs starting at the primary grades.

The mixed messages that young people receive about eating habits in the school setting (e.g., the prevalence of foods low in nutritional value or high in fat in school cafeterias and vending machines) are a cause for concern. To rectify this situation:

**The Task Force suggests that community mobilization efforts with parents be undertaken to encourage the provision of healthier food alternatives in the school. The Ministry of Health should also work with the Ministry of Community and Social Services to provide nutrition education for children in day-care settings.**

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# Alcohol

Alcohol is generally considered to be an important cause of cancer; approximately 10% of cancer mortality in Ontario is, at least in part, attributable to alcohol consumption (Addiction Research Foundation, 1992). Alcohol has been identified as a cause of oral, pharynx, larynx and esophageal cancers (especially in conjunction with heavy smoking), primary liver cancer, and a possible cause of breast and colorectal cancers (IARC 1988; Longnecker et al., 1994).

The cancers attributable to alcohol are largely preventable, as are the other adverse health, social and economic consequences linked to excessive drinking. The adoption of the following public health strategies will have a substantial impact on the reduction of alcohol-related harm.

## Guidelines for the Consumption of Alcoholic Beverages

In 1993, the Addiction Research Foundation recommended that alcohol drinkers limit their consumption of alcoholic beverages to no more than the equivalent of two (standard-sized) drinks daily and 12 drinks per week. (A standard-size drink is 1 1/2 oz. of 40% strength liquor, 12 oz. of 5% strength beer or 5 oz of 12% strength wine.) Those with lower than average body weight, or with risk factors for certain diseases or conditions, should drink less. These guidelines are substantiated by research indicating that the risk of alcohol-related problems increases when consumption levels exceed the recommended limits, as well as recent evidence indicating the potential health benefits of moderate alcohol consumption. However, for some cancers there may be no safe level of consumption.

**The Task Force endorses the Addiction Research Foundation guidelines for consumption of alcoholic beverages, and encourages the Ministry of Health to increase public awareness and acceptance of these guidelines through information/educational campaigns.**

## Price Deterrents

As is the case with tobacco products, pricing policies, including differential rates of taxation on the basis of the alcohol content of beverages, are one of the most effective regulatory mechanisms for reducing the consumption of alcoholic beverages (Moskowitz, 1989; Edwards et al., 1994). The Task Force strongly supports current provincial pricing policies for alcoholic beverages and is concerned about the potential erosion of these deterrents.

The Task Force is aware of the fact that the recent increase in alcohol smuggling has resulted in the alcohol industry intensifying its lobbying efforts for lower prices. Efforts to curtail smuggling of alcoholic beverages should be increased and actively pursued through collaborative inter-governmental efforts. These should include, at a minimum, frequent border spot-checks conducted at random; improved detection methods for imported goods; increased inspection of likely point-of-sale venues, such as certain licensed premises; increased penalties for sellers and purchasers of such beverages; and widespread complementary public education campaigns.

**The Task Force recommends that calls for price reductions of alcoholic beverages should not be heeded by the provincial government, as the societal costs of increased consumption greatly outweigh the economic benefits to the alcohol and hospitality industries.**

## Population Health Promotion Strategies

One of the myths about alcohol consumption is that heavy drinkers are a species apart from the general public and cannot, therefore, be reached by preventive efforts aimed at the entire population. In reality, studies have consistently revealed that the proportion of heavy drinkers (and alcohol-related problems) is related to the consumption patterns of the entire population (Edwards et al., 1994).

**The Task Force recommends that preventive interventions aimed at reducing excessive alcohol consumption should be population-based.**

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An emphasis on population-based approaches, however, does not preclude supplemental preventive measures for vulnerable groups on an as-needed basis.

## **Monopoly System of Alcohol Distribution**

A state-controlled monopoly on alcohol distribution is a proven deterrent to alcohol-related problems. The Task Force strongly supports Ontario's current monopoly system, which controls the sale of a large share of alcoholic beverages in provincially run outlets (LCBO) and only licenses establishments conforming with provincial (LLBO) regulations. However, the government should reduce or eliminate the active promotion of alcohol-containing products, which has increased in recent years.

**The Task Force encourages the provincial government to keep its existing monopoly system, rather than following the lead of other jurisdictions (e.g., Alberta, New Zealand) towards the de-regulation of alcohol sales.**

The government should resist proposals that erode controls on access to alcohol. Control on access to alcohol has been shown to curtail the risks of alcohol-related problems; it is difficult to reintroduce controls, once removed or otherwise modified. Current controls on advertising and promotion of alcoholic beverages, legal drinking age, hours and days of retail sales, as well as current levels of outlet density, should not be removed or compromised so as to encourage easier access to alcoholic beverages.

## **Server Intervention Programs**

Server intervention programs (SIPs) offer training in the responsible service of alcohol to the staff of licensed establishments. Several studies indicate that fewer alcohol-related problems occur at premises where staff have undergone SIP training (Saltz, 1988). In addition to its value as a deterrent to the social consequences of excessive drinking, including automobile accidents and violence, SIP is a useful means of promoting and reinforcing moderate drinking levels as a social norm.

**The Task Force recommends that the requirements for liquor licences be extended to include mandatory server training programs for the staff of all licensed establishments. These programs should be publicly administered, with periodic follow-up and monitoring to ensure compliance with server intervention guidelines.**

## **School-Based Education and Community Programs**

It is important to attempt to reduce the harmful consequences linked to early experimentation with alcohol by young people. There is evidence that school-based alcohol education programs are effective in delaying onset of regular consumption of alcohol (Rundall and Bruvold, 1988). School instruction should be a component of larger community-based interventions that target adults as well as children (Carlson, 1990).

**The Task Force recommends that school-based alcohol education programs be offered as part of community-based health education interventions that incorporate comprehensive approaches to health education (including promotion of no-smoking or other substance abuse, healthy diets and physical exercise). School-based programs may be most effective when offered during the "transition years" when children advance to other schools.**

## **Community Mobilization for Alcohol Control Measures**

As was noted previously, active involvement and support at the community level is crucial for the successful implementation and maintenance of healthy public policies.

**To encourage the acceptance of policies and practices promoting less risky levels of alcohol consumption, the Task Force calls for increased community mobilization efforts around alcohol issues.**

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# Physical Activity

There is evidence that even moderate levels of physical activity will help to reduce the incidence of breast and colon cancers and perhaps other cancers as well (Macfarlane and Lowenfels, 1994; Bernstein et al., 1994; U.S. Public Health Service, 1994). Moreover, physical activity in conjunction with a balanced diet ensures that individuals maintain an appropriate body weight as well as consuming an adequate level of scarce micro-nutrients, both of which are associated with a reduced risk of cancer.

**The Task Force recommends that the provincial government place greater priority upon strategies to encourage active living in the population.**

## Promoting Active Living

Given that even moderate levels of exercise appear to reduce the incidence of some cancers, the provincial government should give greater priority to measures that encourage active living among the adult population.

Measures to facilitate the adoption of active living in urban areas, such as the introduction or expansion of bicycle lanes and walking paths, are of particular importance and should be expanded. The expansion of existing federal and provincial Active Living programs is another means of achieving this objective.

## School-Based Physical Activity Programs

To promote adequate levels of physical activity, lifelong habits need to be established and reinforced throughout the school-age years. Establishing such habits early in life may be of particular benefit for cancer prevention, as well as for cardiovascular disease prevention. For breast cancer, for example, there is evidence that adverse factors early in life increase risk, and the evidence that has accrued points to the benefit of exercise in early life in reducing subsequent breast cancer risk. The Task Force therefore feels that some aspects of the current education system should be revised to increase opportunities for physical activity among Ontario students.

In particular, the Task Force is concerned about the fact that only one credit in physical education is required at the secondary school level. This policy may encourage many young people to adopt a sedentary lifestyle.

**In order to ensure that all Ontario students maintain an optimal level of physical activity, the Task Force recommends mandatory daily physical activity from kindergarten to the end of secondary school.**

The Task Force also calls for physical activity programs that place greater emphasis on non-competitive physical activities to promote active lifestyles, such as walking, hiking or bicycling.

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# Occupational Carcinogens

Many reviews of workplace exposures and carcinogenicity have been undertaken, of which the most important is probably the ongoing process at the International Agency for Research on Cancer (e.g., IARC, 1987a; 1994). The "state of the art" to 1989 was summarized by Tomatis et al. (1990). In the past, the extent of occupational exposure to carcinogens was often severe, with sometimes large proportions of even small workforces eventually dying of cancer. However, as epidemiology studies gradually revealed the risks, often initially as a result of the identification of an unusual cluster of cases, mechanisms have been put in place to reduce exposure, with zero exposure to recognized carcinogens in the workplace being the principal control objective.

Banning carcinogens from the workplace is the ideal control strategy. Sometimes, however, either when the substance was essential to a process, or when there was concern that any substitute might have as severe a consequence, removing workers from exposure by engineering controls has substantially reduced the extent of exposure (such as has proven largely effective for vinyl chloride, for example), aided if necessary by protective clothing and other equipment, and, in the case of some exposures (such as radon daughters in mines) improved ventilation. Thus, for many recognized carcinogenic exposures in the workplace, exposure has been reduced to the extent that it is no longer possible to show that recent workers have incurred any greater risk than the general population, a situation that may now be true for hard rock miners, for example (IDSP, 1994). In such circumstances, it seems possible that those who entered the workforce in the last few years will have a low risk of occupationally induced cancer.

However, occupationally induced cases will continue to occur among those who entered the workforce before sufficient controls were introduced, many occurring after retirement. Further, there is still room for concern over exposures in many small businesses; while evidence is still not sufficient to exonerate exposure from many chemicals introduced in the last two decades that have not been fully tested for carcinogenicity.

In Ontario there have been well-documented examples of occupational exposure to lung carcinogens, the most important factors probably being exposure to asbestos, radiation in mines, and the sinter operation in nickel refining, though foundry workers, gold miners, and those exposed to chromate and bis-chlor methyl ether are also at risk. Some subgroups of hard rock miners are probably at increased risk, particularly nickel and gold miners who were in the work force prior to 1945 (IDSP, 1994). Although there is suspicion that the risk in hard rock miners may in part be due to exposure to radon daughters, there is some evidence that silica may be a carcinogen in its own right (IARC, 1987b), and arsenic and other exposures may also have been in excess (Kusiak, 1991). Some occupational exposures act multiplicatively with cigarette smoking, especially exposure to asbestos and probably radon daughter exposure (Tomatis et al., 1990). Therefore, there is overlap between the attributable risk estimates for occupation and smoking. Those for occupation will vary from area to area depending on the importance of occupation as a risk factor in the relevant area (Tomatis et al., 1990).

Some occupations may also increase the risk of gastrointestinal cancer. In particular severe asbestos exposure, after a latent period of 20 or more years, may double the risk of stomach and colorectal cancer (Miller, 1978). The amount of such cancers accounted for by occupational factors is probably very low, however.

Bladder cancer has been recognized for some time as associated with occupational exposure to certain chemicals (IARC, 1987a). The attributable risk varies according to the frequency of occupational exposures in the population from 0 to 19% (Vineis and Simonato, 1986). In Canada an attributable risk of 27% in males was found when risk from exposure to *a priori* high-risk industries and exposure to dust and fumes was combined, but only 8% in females (Howe et al., 1980). However, as for lung cancer, there is considerable overlap between risk attributable to smoking and to occupation.

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Occupational associations for kidney cancer have been identified for coke oven workers (Tomatis et al., 1990).

There has been some interest in the possibility that occupational factors may increase risk of brain tumours, particularly in the petroleum industry. Brain tumours have also been suspected as associated with exposure to electromagnetic fields.

There is increasing interest in the possibility that exposure to herbicides and pesticides increases the risk of lymphoma, especially in agricultural workers (Council on Scientific Affairs, 1988; Miller, 1992). In Canada, a cohort study of farmers in Saskatchewan found a significant dose-response relationship between the risk of non-Hodgkin's lymphoma and acres sprayed in 1970 with herbicides (Wigle et al., 1990). Davis, Blair and Hoel (1992) examined 20 studies of pesticide-using farmers from eight countries. Compared to the general population, the farmers in these studies were found to suffer from significantly higher rates of Hodgkin's disease, multiple myeloma, leukemia, skin melanomas and cancers of the lip, stomach and prostate.

Occupational exposure to benzene is accepted as a causal risk factor for leukemia (Tomatis et al., 1990). Control of exposure to benzene whenever possible is clearly desirable. Benzene is present in gasoline and in some adhesives in new buildings.

Radiation is a risk factor for leukemia among radiation workers (IARC Study Group, 1994) though it is not yet clear if the risk extends to Ontario Hydro nuclear workers. Leukemia is, however, one of the malignancies suspected as being associated with exposure to electromagnetic fields, with a positive finding for Ontario Hydro workers (Theriault et al., 1994).

Lymphoma is another of the cancers of interest in relation to a possible risk of electric and magnetic fields. However, the tri-utility study of Ontario Hydro workers did not find a significant association (Theriault et al., 1994).

Governments have recognized for some time the obligation to introduce regulations to reduce or if possible prevent the exposure of workers to carcinogens in the workplace. In the absence of abolition of exposure, governments have recognized the obligation to compensate for cancer caused by occupational exposure, and the Workers' Compensation Board is the mechanism to put such compensation in place. For most established carcinogens, these principles are followed. However, for new chemicals introduced into the occupational environment, there needs to be an additional mechanism to ensure that those that are suspected as carcinogenic are not used without adequate worker protection, and that chemicals that could be carcinogenic are identified as such.

Two separate approaches have been advocated in the past. The first approach, now enshrined in legislation, is the workers' "right to know." The relevant legislation that put in place the Workplace Hazardous Materials Information System (WHMIS) ensures that hazardous chemicals are identified, and that material safety data sheets are available to those who use the chemical. The second approach requires the prior testing of chemicals to provide an early warning of possible carcinogenicity. The mechanism to do so is available: the testing for mutagenicity of any new chemical agent that will be proposed for introduction into the occupational environment. Any chemical that is positive to a short-term test for mutagenicity, and is likely to be used in more than kilogram quantities, should be tested in adequate carcinogen animal bioassays in at least two species and found to be negative before being released. This approach was advocated several years ago by the Advisory Committee on Occupational Safety and Health of the Ministry of Labour (Mustard et al., 1982), but to our knowledge these recommendations have never been given the force of law.

**The Task Force is supportive of the current endeavours in Ontario to reduce occupational exposure to carcinogens by attempting to ensure workers' right to know (WHMIS). However,**



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**government should insist upon prior testing for possible carcinogenicity of any new chemical agent that will be proposed for introduction in significant quantities into the occupational environment.**

The limits for exposure to radiation and carcinogenic chemicals must be reviewed periodically. This process and the enforcement of the statutory exposure limits must continue. Thus the Task Force endorses the approach to occupational carcinogenesis set out in the Occupational Health and Safety Act.

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# Environmental Carcinogens

It has been recognized for some time that the majority of human cancers are caused by external factors. These factors include those associated with human lifestyles, such as tobacco smoking and dietary patterns, as well as factors encountered by workers in the occupational environment, discussed in the previous section of this report. In this section we discuss the other factors in the environment in air, water and food to which the public is exposed. In a separate section, immediately following, we discuss sunlight as an environmental cause of skin cancer.

The accumulation of persistent toxic substances in our air, water and food supply has been increasingly recognized as posing a major threat to human health. Since persistent toxic substances remain in the biophysical environment for long periods of time and become widely dispersed, and since many of these substances bioconcentrate in plants and animals, including humans, that comprise the food chain, the ecosystem is unable to break down many of these substances (International Joint Commission, 1992). The fact that some persistent toxic substances are not naturally occurring chemicals for which metabolic pathways for detoxification have been developed also poses a barrier to their absorption in the ecosystem; indeed, many of these chemicals have been developed precisely because they are not readily metabolized and detoxified. The presence of toxic substances in the ecosystem has been linked to a number of adverse health effects, including cancer in animals and humans. A number of methodological barriers (discussed later in this section) hinder the acquisition of conclusive evidence, however, which has led to uncertainty about the extent to which environmental contaminants contribute to cancer.

In the face of this uncertainty, the Task Force considers that the only prudent approach to safeguarding the health of the public from known and suspected environmental carcinogens is to be precautionary while the necessary research efforts are being made to resolve the uncertainty. It is the mandate of the Task Force to recommend measures to prevent cancer, and this must include protecting the public from exposure to known or suspected human and animal carcinogens, as no dose of a carcinogen can be deemed to be safe.

During its deliberations on the identified and suspected links between environmental toxins and cancer, the Task Force considered lists of known and suspected environmental carcinogens, the site-specific neoplasms associated with environmental carcinogens, the methodological limitations impeding a greater understanding of the relationship between cancer and the biophysical environment, the other health risks (e.g., reproductive disorders) posed by environmental carcinogens, and strategies for reducing or, where feasible, eliminating exposure to environmental toxins. These issues are summarized in the following section of the report, which concludes with recommendations for dealing with the cancer risks posed by pollutants in the biophysical environment.

## Evidence on Environmental Pollutants and Human Cancer

Knowledge on the cancer risks to humans posed by toxic substances in the environment is derived from an accumulating body of epidemiological and toxicological evidence. Examples include:

- Studies, including those on the emission of diesel exhaust, that have identified air pollution as a cause of lung cancer (IARC, 1977; National Academy of Sciences, 1981; National Institute for Occupational Safety and Health, 1988). Other studies have revealed excess lung cancer rates in communities located near large petrochemical plants (Gottlieb et al., 1979). One Canadian study reported an association between sulphur dioxide and ground-level ozone emissions and the incidence of colon and breast cancer (Gorham et al., 1989).
- Ecological studies that point to proximity of residence to hazardous waste sites as being associated with increased risks of breast and other cancers (Griffith et al., 1989; Upton, Kneip and Toniolo, 1989).
- Animal studies that show a plausible association between organochlorines and breast cancer (National Cancer Institute, 1977; Scribner and Moffet, 1981; Hayes et al.,

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1991). Davis et al. (1993) pointed to the possible link between breast cancer and exposure to "xeno-estrogens," estrogen-like substances released into the environment as some pesticides and several industrial chemicals (a high percentage of which are organochlorines) which accumulate in body fat. The epidemiology of breast cancer suggests that the more estrogen women are exposed to during their lifetimes, the greater the risk of breast cancer. However, epidemiological evidence for a causal association between organochlorines and human breast cancer is inconclusive. Recent studies have generated contradictory results (Wolff et al., 1993; Kreiger et al., 1994), while an earlier study in Israel interpreted as showing a decline in breast cancer following the banning of DDT has not been supported (Shames et al., 1994).

- Exposure to hazardous levels of radiation is a recognized cause of leukemia. Leukemia is also one of the types of cancers suspected to be related to exposure to electromagnetic fields (Miller, 1992).
- As a result of a meta-analysis, Morris et al. (1992) estimated that water disinfection by-products, chlorinated organics formed by combining chlorine with naturally occurring humic and fulvic acids, may be responsible for some 10,000 bladder and rectal cancer deaths per annum in the United States.

## Known and Suspected Carcinogens in the Environment

In October 1993, the Ontario Ministry of Environment and Energy released primary and secondary lists of "Candidate Substances for Bans, Phase-Outs or Reductions" (OMEE, 1993). The primary list identifies 20 substances present in, or discharged to, the Ontario environment that were found to be inherently hazardous due to their persistence in water, sediment, air or soil, their potential to bioaccumulate and their toxicity, out of over 1,000 substances assessed. Fifteen of the substances on the primary list were classified as Group 1 or 2 carcinogens according to the criteria used by the World Health Organization's International Agency for Research on

Cancer (IARC, 1994). IARC's list largely coincides with a similar list periodically updated by the U.S. Environmental Protection Agency (EPA).

A similar list of persistent toxic substances compiled by the Accelerated Reduction/Elimination of Toxics (ARET) project, an environmental advocacy group comprising industry, health and professional associations and federal and provincial governments, contained over 70 identified or suspected carcinogens. Carcinogens on ARET's A-1 list, the category denoting substances which met or exceeded ARET's criteria for toxicity, bioaccumulation and persistence, include all polychlorinated biphenyls, polycyclic aromatic hydrocarbons (PAHs), 1, 8-dinitropyrene and five types of chlorinated organics (ARET, 1994).

The Table in Appendix II includes the known and suspected human carcinogens on the OMEE, ARET and U.S. EPA lists, as well as IARC-identified human carcinogens. These substances are classified according to the following criteria developed by the IARC (1994):

- *Group 1:* The agent (mixture) is carcinogenic to humans. The exposure circumstance entails exposures that are carcinogenic to humans.
- *Group 2A:* The agent (mixture) is probably carcinogenic to humans. The exposure circumstance entails exposures that are probably carcinogenic to humans.
- *Group 2B:* The agent (mixture) is possibly carcinogenic to humans. The exposure circumstance entails exposures that are possibly carcinogenic to humans.

When assessing the overall carcinogenicity to humans of an agent, the IARC considers the body of evidence as a whole. The assignment of an agent to one of the above groups is a matter of scientific judgment, reflecting the strength of evidence of carcinogenicity obtained from studies in humans, experimental studies on animals, and other relevant data, including data on possible mechanisms of action. It should be emphasized that the categorization scheme refers to the strength of evidence that an agent is carcinogenic, and not to carcinogenic strength or potency (IARC, 1994).

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## Human Exposure to Environmental Carcinogens

Humans are exposed to a large number of known or suspected carcinogens on a daily basis. These exposures emanate from water, air, food and soil pathways through ingestion, inhalation and dermal absorption.

A study by the City of Toronto Health Department revealed the presence of 160 trace toxic compounds in Toronto air, including four human carcinogens and another 27 suspected carcinogens (City of Toronto Dept. of Public Health, 1993). Although the levels of "air toxins" in Toronto were not found to exceed provincial ambient air quality standards, many of these substances exceeded levels predicted to increase cancer rates, suggesting the need to revise air quality standards.

A two-year study was done in response to community concerns about the quality of outdoor and indoor air in Windsor, Ontario, and concerns about air pollution drifting across the Canada/U.S. border into Ontario (Windsor Air Quality Committee, 1994). Forty air pollutants were investigated, with a focus on ten that have the highest potential to cause risks to human health in the long term. Five of these ten pollutants were found to be present at concentrations in indoor and/or outdoor air that could cause increased risks of cancer; i.e.:

- *Increased cancer risk via exposure to outdoor and indoor air:* benzene, 1,3-butadiene and chromium (VI); [Exposure while commuting and while indoors. The indoor levels were higher than those associated with outdoor exposure.]
- *Increased cancer risk via exposure to indoor air:* cadmium, carbon tetrachloride, 1,4 dichlorobenzene, formaldehyde and PAHs including benzo[a]pyrene.

Vehicle emissions have been identified as one of the primary sources of carcinogens in the air supply of many Western countries (Kieding, 1993). Exhaust emissions from cars and other vehicles powered by fossil fuels contain a number of suspected carcinogens, including benzene and polycyclic aromatic hydrocarbons (IARC, 1994).

Persistent toxic substances in our water and soil may ultimately enter the food chain. In a pilot study of human exposure routes to selected toxic chemicals in the Great Lakes Basin, Davies (1986; 1988) estimated that approximately 85% of total non-occupational exposure for these chemicals comes from food products. A follow-up study, involving a larger sample of food products, published by the Ontario Ministry of Agriculture and Food and the Ontario Ministry of the Environment (1988) found that residue levels of organochlorine compounds were lower in food than the Davies (1986) study. The Ontario government study estimates that 95% of our exposure to one group of contaminants, polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans, comes from the food we eat. The potential absorption of these substances into our food chain is one of the most compelling reasons for "sunsetting" persistent, bioconcentrating, toxic substances that are known or suspected human carcinogens.

## Other Health Risks Posed by Environmental Contaminants

Persistent, bioconcentrating toxic substances have been associated with a number of pathologies in animals and humans, including reproductive, immunologic, developmental and behavioral disorders (IJC, 1992; Webster, 1994). For example, endometriosis, a non-cancerous disorder of the female reproductive system in which cells lining the uterus grow and proliferate outside of that organ, has been linked with exposure to dioxin (Webster, 1994). Ground-level ozone, formed from the reaction of traffic and industry gases in the presence of sunlight, has been linked to decreased lung function and other respiratory problems in humans (Bates and Sitzo, 1987; Horstman et al., 1989).

Some of the most compelling evidence for the adverse health impacts of environmental contaminants has been derived from wildlife studies in regions proximal to industrial activity. Wildlife exposed to industrial chemicals and pollutants, for example, display abnormally high levels of birth defects and reproductive disorders, a phenomenon

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attributed to the disruption of biological processes by environmental contaminants mimicking the effect of naturally produced hormones (Raloff, 1994).

Some of these indicators of non-cancer adverse health risks associated with environmental pollutants can be considered as an early warning of potential future adverse effects on cancer as well. Thus, similar to most of the other exposures we have considered, measures taken to reduce or eliminate human exposure from environmental pollutants can be expected to yield other health benefits as well. Cancer prevention is but one of the reasons for controlling these substances.

## Proportion of Cancer Attributable to Environmental Pollutants

Estimates of the proportion of human cancers arising from exposure to environmental carcinogens vary considerably, ranging from Doll and Peto's (1981) estimate of 2% of cancer deaths being attributable to pollution and 3% to geophysical factors (largely sunlight) to Epstein's (1979) estimate of 20%. The level of uncertainty surrounding the extent to which environmental contaminants contribute to human cancer is heightened by the fact that most estimates, including that cited by Epstein (1979), but not that of Doll and Peto (1981), combine exposures in the biophysical environment with occupational exposures in the workplace. Epstein's (1979) estimate can be placed in better perspective when it is recognized that Doll and Peto's (1981) estimate of the proportion of cancer deaths attributable to occupational exposure was 4% (with a range of 2-8%) and Miller's (1992) estimate was 9% (again for deaths).

## Limitations of Studies of Environmental Carcinogens

All estimates of the proportion of human cancers attributable to environmental carcinogens should be interpreted with caution, as a number of methodological

limitations affect epidemiological and toxicological studies on cancer in human populations that investigate suspected carcinogens in the biophysical environment.

### *Limitations of epidemiology*

- *Accuracy in exposure assessment:* Humans are exposed to an enormous variety of environmental pollutants on a daily basis. In many instances, multiple exposures to ubiquitous toxicants occur within a social context (e.g., poverty, workplace environment, unhealthy lifestyles) that creates added health risks. Assessing the impact of these confounding exposures is difficult.
- *Lack of control populations:* For many substances, especially those contaminants that are ubiquitous in the environment, unexposed control groups no longer exist, nor do the differentials of exposure within the population needed to make accurate estimates of effects. Most human populations, for example, carry detectable levels of known or suspected carcinogens (e.g., DDT, PCBs) in their body fat.
- *Length of time required for rigorous studies:* For example, cohort studies for cancer endpoints are hindered by small numbers of subjects with identified exposure, long latency periods, problems of subject mobility and withdrawal and high costs.

### *Limitations of toxicology*

The problems over assessing the potential impact of identified exposure to environmental contaminants is not restricted to epidemiology studies. Thus, for a number of reasons it is not practical to substitute toxicological evidence for epidemiology:

- *Logistical considerations:* There is a dearth of toxicological data on the acute and chronic effects of over 80% of the 45,000-100,000 chemicals in common use; data on chronic effects are especially limited (Small et al., 1988). However, to date, over 1,000 chemicals or complex mixtures have been assessed for evidence on human carcinogenicity by the IARC and only 30

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designated as having sufficient evidence for carcinogenicity in humans (IARC, 1994). Although a number of substances have been assessed as being probable or possible human carcinogens, which may yet be designated as having sufficient evidence after further study, it is important to recognize that substances are selected by the IARC for assessment based on preliminary evidence that they are carcinogenic, and it is possible that many of the yet untested or unassessed substances may not be carcinogenic to humans.

- *Lack of consensus on the validity of existing data:* Much of the existing data on the effects of toxic chemicals are disputed due to disagreements over interpretation of the high doses to which animals are exposed, the inter-species significance of the results, and the extrapolation/models/assumptions used to impute human health risks.

The end result of the above limitations is that for untested or poorly tested environmental contaminants, there may not be conclusive data upon which policy makers can rely. The chief danger arising from this situation is the risk to human health (and to the ecosystem in general) emanating from unidentified carcinogenic environmental contaminants that are not properly controlled due to a lack of evidence. It should not be assumed, therefore, due to lack of evidence of risk, that the chemical is harmless.

While it would be desirable to have precise, conclusive information on all known and suspected carcinogens in the biophysical environment, *the central issue facing those involved in the primary prevention of cancer attributable to environmental sources is how much evidence is required and how strong the evidence must be before remedial action is taken to reduce or eliminate exposures.* Hancock (1989) cautioned "Our decision making must be informed by science, to the extent that we have or can plausibly expect to have scientific evidence; but where that evidence is unlikely to be forthcoming, our decision making must be informed by our values, chief among which is the need to err on the side of caution." The Task Force agrees that if scientific evidence is to make a meaningful contribution to decision making aimed at the protection of human health, it must exist within a policy

framework composed of value-based principles for decision making.

## Research

Because of the limitations discussed above, for most environmental toxicants definitive studies designed to demonstrate causality (i.e., at exposures relevant to communities) have not been conducted.

In the absence of definitive studies on human populations, research initiatives should be geared towards a "weight of evidence" approach to assessing environmental health risks. Synthesizing the evidence garnered from a number of approaches, including laboratory research and wildlife observations, will contribute to a greater understanding of the nature and effects of suspected environmental carcinogens.

The Task Force recognizes that more research is needed but this should not preclude action. To advance the current state of knowledge about known and suspected environmental carcinogens, the Task Force recommends that:

**Resources be directed towards the development of new scientific methods that permit the assessment of the human health impact of environmental toxins in the biophysical environment.**

## Our Approach to Recommendations

Many of the recommendations that follow are based on those first proposed by provincial, national or international bodies, including the Premier's Council on Health Strategy, the Ontario Fair Tax Commission and the International Joint Commission. In general the Task Force agrees with the strategies proposed by these bodies to control environmental contaminants.

While some of our recommendations are specific to known or suspected human carcinogens, others are more generic in nature, addressing persistent toxic chemicals as a whole. This is due to the fact that it may be more effective to deal

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with multiple chemicals in common settings (incinerators, landfills, vehicle emissions). Moreover, in many cases, measures to control toxic chemicals in our air, water, soil and food supply will also have the effect of controlling those substances that are known or suspected human carcinogens. Similarly, educational strategies, such as public education and reports on health and the environment, should probably address the broad range of issues related to health and the biophysical environment, rather than focus specifically on cancer; the same applies to incentives to move industry towards environmentally benign technologies.

The recommendations are organized in several broad categories, although there are clearly overlaps (i.e., many known or suspected carcinogens are organochlorines, and are persistent and bioaccumulate in the environment).

### *Standards of Proof for Carcinogenicity/Non-Carcinogenicity*

The Task Force feels that in instances where the cumulative evidence for a suspected environmental carcinogen is not conclusive, decision makers should protect human health by adopting the following principles:

1. *Suspected carcinogens*: For all *suspected carcinogens*, the standard of proof required to *prove carcinogenicity* should be based on the balance of probabilities (i.e., similar to the civil standard of proof in the legal system).
2. *Proof of non-carcinogenicity for suspected carcinogens*: Once a substance has, on reasonable grounds, been suspected to be a carcinogen, proof beyond reasonable doubt should be required to justify regarding it as non-carcinogenic. The standard in this instance should be similar to the criminal standard of proof in the legal system.
3. *New substances*: Proof beyond reasonable doubt should also be the standard applied with respect to *new chemicals* released into the environment as non-carcinogens. This is similar to the approaches we recommend for chemicals introduced into the occupational environment, approaches that are already in place for

the control of other potentially harmful substances. (Ozonoff, 1993, p. 4).

### *Known or Suspected Environmental Carcinogens*

It is not possible to remove a persistent toxic substance from a source entirely once that substance has been used or generated; nor is it possible to retrieve that substance completely once it has been emitted and is present in the environment. Accordingly, the focus must be on preventing the use and generation of these substances in the first place, rather than attempting to control their release (International Joint Commission, 1992).

To prevent the further generation of environmental toxins, bans on production and imports are necessary, but are not sufficient on their own as these substances can enter the Canadian environment from elsewhere. Likewise, storage and disposal methods will not eliminate the problem. The focus should be on confronting the entire lifecycle of persistent toxic substances (Thornton, 1991; International Joint Commission, 1992).

“Sunsetting” is a comprehensive step-by-step process to restrict, phase out and eventually ban the production, generation, utilization, transport, storage, discharge and disposal of a persistent toxic substance. Sunsetting may necessitate a focus on the manufacturing processes and products associated with the production and use of a toxic substance, as well as the substance itself. Realistic, achievable timeframes are required to bring about the virtual elimination of persistent toxic substances. Effective sunsetting also requires a cooperative approach, with consultation and dialogue among all stakeholders, using a variety of mechanisms and partnerships.

To deal with the health risks posed by persistent, bioconcentrating toxic substances, the Task Force recommends the adoption of the following measures:

**Integrate pollution prevention with industrial policy so that business modernization initiatives and research and technology assessment**

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programs foster progress towards the objective of virtual elimination of persistent, bioconcentrating toxic substances.

**Adopt the most stringent standards for controlling environmental carcinogens developed by Organization for Economic Cooperation and Development (OECD) member nations.**

**Set realistic and measurable timetables for "sunsetting" persistent, bioconcentrating toxic substances that are known or suspected carcinogens.**

Clear and comprehensive criteria for defining such substances are provided in the Ontario Ministry of Environment and Energy's list "Candidate Substances for Bans, Phase-Outs or Reductions." The provincial and federal governments, as signatories to the Canada-Ontario Agreement Respecting the Great Lakes Basin Ecosystems, have also committed to collaborative development of criteria to identify currently registered pesticides that are persistent or bioaccumulative and may have adverse impacts on human or environmental health. Unfortunately, some of the pesticides on the Ontario Ministry of Environment and Energy candidate lists were deleted.

### *Persistent Toxic Chemicals*

Certain classes of persistent toxic chemicals are of particular concern. To effectively control these substances, it may be most efficient and expedient to deal with them as a class rather than one at a time. Organochlorines are a case in point.

Organochlorines comprise a class of chemicals in which chlorine is bound to various organic compounds. Organochlorines include such chemicals as DDT, PCBs, dioxin, chlordane, and hexachlorobenzene. Some organochlorines have been found to be animal carcinogens (Walker et al., 1969; National Cancer Institute, 1977; Scribner and Mottet, 1981; Hayes et al., 1991) and possible human carcinogens (Wolff et al., 1993). In addition, organochlorines have been found to compromise immunologic functions and appear to foster estrogenic

activity leading to birth defects and reproductive disorders. Evidence also indicates that some organochlorines may act as tumour promoters (International Joint Commission, 1992; Raloff, 1994).

Organochlorines are readily absorbed into sediments and soils and are ultimately incorporated into the food chain, which constitutes the main source of human exposure to these chemicals. Residues of these chemicals have been found in the fatty tissues of birds, animals and humans (Onstot, Ayling and Stanley, 1987). They have also been found in human breast milk (Nsubuga, 1993).

Although some chlorinated organics, including PCBs and DDT, have been banned in Canada, other organochlorines continue to be used as pesticides; organochlorines are also used in the manufacture of PVC plastics and are produced during the pulp and paper bleaching process and the manufacture and incineration of other chlorine chemicals (Thornton, 1993). The continued use of organochlorines as pesticides and in industrial feedstocks is of great concern to the Task Force.

At the same time, the Task Force recognizes the value of chlorine for a number of preventive practices, including water purification, needle sterilization and the production of chlorinated pharmaceuticals. Although in some instances the use of safer alternatives may be feasible, there may also be chlorine compounds that can be used safely.

Nevertheless, sunseting of organochlorines as a class may be most efficient, as well as preferable under circumstances where there is difficulty on methodologic grounds in collecting human data. However, sunseting should be put in place recognising the different degrees of evidence now available. Thus, in establishing timetables for sunseting, early consideration should be given to ban those organochlorines that are themselves carcinogenic, or have been shown to result in the induction of carcinogens in the environment.

To address the possible cancer risks and other health risks associated with the production and use of organochlorines, the Task Force recommends:



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**Government should establish timetables to sunset the use of chlorine-containing compounds as industrial feedstocks and examine the means of reducing or eliminating other uses of chlorine, bearing in mind the priority to ban substances established as carcinogens.**

### *Use of Pesticides on Food*

The use of known or suspected carcinogenic pesticides has been a source of environmental and food chain contamination. This category includes a number of pesticides that are known animal and suspected human carcinogens and that are or were registered for use in Ontario. For some of the pesticides currently used in production of foods that are of concern to human health, it is suspected that the main problem is not the direct contamination of food with detectable residues. It is the concentration within the food chain of bioaccumulative substances from surface water, ground water, sediment, soil or air that has become contaminated due either to direct application or to drift and run-off.

Approximately 1,300 domestic farm wells in Ontario were sampled for pesticide residues in the winter of 1991-92 and re-sampled in the summer of 1992 (Agriculture Canada, 1993). About 8% of the wells in the winter and about 12% in the summer had detectable levels of pesticide residues. Two (0.15% of wells sampled) were found to have levels in excess of the Interim Maximum Acceptable Concentration (IMAC) values of 5 parts per billion, believed to be due to an accidental chemical spill.

The consumption of common foods containing the residues of 28 pesticides has been associated with some 20,000 excess annual cancer deaths in the United States (National Academy of Sciences, 1987). However, this estimate is controversial, and it has to be placed in perspective in relation to the preventive effects of fruits and vegetables on many cancers, an effect which would overwhelm any hazard from detectable pesticide residues in foods.

In 1988 the government introduced the Ontario Food Systems 2002 Program. The goal of Food Systems 2002 is

to reduce pesticide use in Ontario by 50% over 15 years. More than 50,000 Ontario growers have been certified in a grower-requested mandatory pesticide education program, and 22 integrated pest management programs have been developed for Ontario commodities. These programs have contributed to a 13% reduction in pesticide use in the last five years (Ministry of Agriculture, Food and Rural Affairs, 1994).

**In order to decrease cancer risks associated with exposure to pesticides further, the Task Force recommends the adoption of the following measures:**

**Support the development and application of alternative, non-chemical, pest-control measures.**

**Set realistic and measurable timetables for sunseting the following chemicals registered for use in Ontario that meet the IARC/USEPA criteria for known or suspected carcinogens:**

- *Group 2A (probable human carcinogens): ethylene oxide (insecticide, fungicide), formaldehyde (antimicrobial), creosote (wood preservative).*
- *Group 2B (possible human carcinogens): amitrole (herbicide), atrazine (herbicide), dichlorvos (insecticide), hexachlorocyclo-hexanes (lindane – gamma-HCH, insecticide, acaricide), pentachlorophenol (wood preservative), sodium ortho-phenylphenate (antimicrobial).*

### *Radioactivity*

The identification of radon in homes has led to concern that such exposures will increase lung cancer risk in the general population. Data do not permit a quantitative estimate of the degree of risk in Canada at present, although it is known that the extent of exposure varies substantially across the country. A study in Winnipeg (where high levels of radon exposure have been documented) of 738 lung cancer cases and an equal number of controls has evaluated this issue (Letourneau et al., 1994). No evidence of increased risk of lung cancer from radon exposure was found. A similar finding was

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derived from a study of 538 non-smoking women with lung cancer and 1,183 age-matched controls conducted in Missouri (Alavanja et al., 1994). Although these two studies are reassuring, they do not necessarily contradict the extrapolation of risk for homes estimated from studies in miners (Samet, 1994). Other studies are pending on this issue.

Exposure to hazardous levels of radiation has long been recognized as a cause of leukemia and other cancers (IARC, 1990). The evidence has largely been derived from the studies of subjects exposed to high radiation doses from medical exposures, and from the study of the Atomic Bomb survivors in Japan. These studies indicate that the management, storage and disposal of nuclear waste, if accompanied by human exposure, may be associated with a number of potential health effects, including cancer.

Tritium, a radioactive isotope of hydrogen, is a by-product of nuclear reactor operations in Ontario. Tritium, in common with other radionuclides, is classified as a human carcinogen by the U.S. Environmental Protection Agency (Advisory Committee on Environmental Standards, 1994).

There is some evidence that levels of tritium in Ontario drinking water (in excess of background) may be the result of emissions from nuclear facilities. In a 1991 study, Ontario Hydro found that tritium concentrations in drinking water taken from Lake Ontario at the Ajax, Whitby, Oshawa, Scarborough, and Toronto (Harris) treatment plants exceeded the Lake Ontario average of 8.7 Bq/L due to emissions to water at the Pickering and Darlington nuclear generating stations.

The Advisory Committee on Environmental Standards (1994) has recommended that the Ontario Drinking Water Objective for tritium be set immediately at 100 Bq/L, with the objective of reducing that standard to 20 Bq/L within five years, because of the many uncertainties in the risk assessment for tritium.

As a means of controlling the cancer risks associated with hazardous levels of radiation, and identifying where unrecognized hazards from radiation exposure may occur, the Task Force recommends the adoption of the following measures:

**Develop an inventory of sources of radionuclides in Ontario.**

**Investigate the passage of radioactive isotopes through the food chain.**

**Impose regulatory limits on radioactive contaminants using the same methodology as that used for chemical contaminants, which would result in more stringent standards.**

**Conduct further studies on the emission of radioactive materials from energy production facilities and investigate ways of phasing out the release of these materials in instances where emission levels are found to pose a cancer risk.**

### *Motor Fuel/Vehicle Emissions*

Cancer is but one of the health risks associated with vehicle emissions. Volatile organic compounds and nitrogen oxides found in emissions from burning fossil fuels create ground-level ozone, which has been linked to decreased lung functioning, premature aging of the lungs and other respiratory problems (Bates and Sitzo, 1987; Horstman et al., 1989). The negative environmental impacts of vehicle emissions, including global warming and acid rain, may be causing irreparable damage to our ecosystem and threatening our health (Premier's Council, 1993).

To address the health risks posed by vehicle emissions, the Task Force recommends the adoption of the following measures:

**Decrease emissions from mobile sources such as cars, trucks and motorcycles as well as two-stroke engines (such as lawnmowers, chainsaws, mini-bikes, motorboats and some mopeds), which emit benzene and polycyclic aromatic hydrocarbons.**

The regular testing of vehicles for hazardous levels of emissions is one possible strategy for achieving this objective.

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**Implement gasoline vapour recovery at fuel transfer facilities and gas stations to reduce fugitive benzene emissions.**

**Support research on the development of alternative, environmentally benign fuels (e.g., hydrogen) that reduce overall impact on the environment, and technologies for the use of these fuels.**

**Encourage walking and the use of bicycles and non-polluting public transit.**

Examples of the latter might include taxing car use to subsidize less-polluting forms of travel.

### *Transition Strategies*

The effective implementation of the above recommendations cannot be accomplished over the short term. Coordinated, multi-sectoral transition strategies are needed to assist the producers and users of persistent toxic substances in adopting clean alternatives.

The Task Force recognizes that many of the persistent toxic substances addressed in this report are utilized in the development of products that play an integral role in our society. The need to protect and generate employment opportunities for Ontario residents is readily apparent. Long-term economic sustainability, however, ultimately depends on a healthy environment and a healthy and productive work force (International Joint Commission, 1992). The Task Force believes that it is possible to bring about meaningful improvements in the quality of our biophysical environment without sacrificing economic competitiveness.

The reduction or elimination of toxic substances can, over the long term, result in reduced costs and enhanced competitiveness through the creation of new, environmentally sustainable products, industries and technologies. At present, many jurisdictions, particularly

some European countries, are developing feasible, cost-effective alternatives to many of the toxic substances currently used and produced in Ontario. Given the level of concern about these substances, these countries will be well poised to take advantage of the growing market for environmentally benign products and technologies (Kendall, 1994). The Task Force believes that Ontario should be at the forefront of this market for new technology and alternatives.

The Task Force recommends the adoption of the following measures to reduce Ontario's dependence on persistent environmental toxins and to ease the transition to environmentally sustainable alternatives:

**Develop transition plans to help those negatively affected by the elimination of the use and production of persistent toxic substances.**

**Implement a low but incrementally increasing taxation scheme to provide economic incentives for the reduction of toxic emissions during the phase-out period.**

**Create a fund, through the charges noted above, to aid in the transition to a less toxic industrial society by exploring and demonstrating economically viable alternatives and by easing dislocations to affected workers and communities.**

### *Public Education Initiatives*

The development and implementation of policy measures to control environmental carcinogens are influenced by public awareness: if people believe that there is a risk posed by environmental contaminants and put pressure on the system to make necessary changes, then the system will respond (Premier's Council on Health, Well-Being and Social Justice, 1993). Effective public awareness and education initiatives are central to the creation and maintenance of a healthy, sustainable environment.

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To increase public awareness of environmental health issues, the Task Force recommends the adoption of the following measures, most of which are based on recommendations originally proposed by the Premier's Council on Health, Well-Being and Social Justice (1993):

**Support the current SustainABILITY campaign for healthy environments.**

**Develop school curricula, beginning at the elementary level, that will give students a strong grounding in science, statistics and the concept of risk, as well as an understanding of the relationship between environment and health.**

**Promote science and technology curricula that will help Ontario develop skilled health and environmental professionals.**

**Encourage cooperative efforts by industry, government and schools to strengthen science education in Ontario.**

**Support non-governmental organizations in designing and delivering educational initiatives and developing community action plans.**

**Support community action plans for prevention initiatives and intersectoral activities on environment and health.**

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# Sunlight

Skin cancer is a common type of neoplasm. There are two basic categories of skin cancer: non-melanoma and melanoma. Non-melanoma skin cancers are basal and squamous cell carcinomas; they can be disfiguring if not recognized and treated but are rarely fatal. At present, non-melanoma skin cancers are not registered in Ontario, as they are usually treated in doctors' offices and may not have pathology confirmation, but from the data of other registries in Canada they seem likely to be the most common types of cancer in both sexes combined.

The incidence of melanoma is low but rising in both sexes in Canada. It can be fatal if not detected early. Over 1,390 Ontarians (810 males and 580 females) will develop melanoma in 1994 (OCTRF, 1994).

Repeated exposure to the sun's UV-A and UV-B rays, especially between the ages of one and 18, is the principal cause of all forms of skin cancer. Epidemiological evidence points to a very direct relationship between non-melanoma skin cancers and amount of sun exposure, geographic location and genetic susceptibility. Risk factors for the development of non-melanoma skin cancer include older age, male sex (possibly due to occupational exposures), geographic location of residence (inverse relationship between skin cancer and latitude), white skin, skin which tans poorly and burns easily, prolonged erythema (redness) after sun exposure, freckling, fair hair and blue- or light-coloured eyes (Wilson, Kaldbey and Kligman, 1981; Henriksen et al., 1990; Preston and Stern, 1992).

The relationship between malignant melanoma and exposure to sunlight is less direct than the link between sunlight and non-melanoma. There is, however, compelling epidemiologic evidence that repeated sun exposure during childhood is a primary risk factor for malignant melanoma, as studies of migrants from Europe to Australia have revealed (Khlat, 1992). As is the case with non-melanoma skin cancers, the risk of melanoma is greater among individuals with light hair, fair skin colour and the tendency to burn easily and tan poorly (Elwood et al., 1985). The most significant physical risk factors for melanoma are number of moles, freckles and red hair

(Swerdlow et al., 1984; Marrett et al., 1992). There also appears to be an inverse relationship between the incidence of melanoma and geographic latitude, with higher rates of melanoma noted in areas with lower latitudes, such as Australia (Jones, 1987). The incidence of malignant melanomas of the skin among fair-skinned populations is rising by 3-6% (Muir and Sasco, 1990).

The ozone layer consists of a band of ozone molecules in the stratosphere, which protects the earth from ultra-violet solar radiation. As synthetic chemicals, such as chlorofluorocarbons, enter the stratosphere, solar radiation splits ozone into oxygen atoms. Some of these atoms then bond with the synthetic chemicals instead of reforming as ozone molecules, resulting in a net loss of ozone and the increased penetration of ultra-violet radiation to the earth. Although the international community has responded to ozone depletion by agreeing to phase out the production of most ozone-depleting substances, the ozone layer is expected to sustain further damage for at least another 70 years. It is predicted that for every 1% decrease in ozone, there will be a 3% rise in the incidence of non-melanoma skin cancer (Environment Canada, 1993).

During its deliberations on the links between skin cancer and exposure to sunlight, the Task Force reviewed the epidemiological evidence on the incidence of, and mortality resulting from, skin cancer and discussed the efficacy of measures aimed at preventing skin cancer by minimizing prolonged exposure to sunlight. As is the case with other preventable risk factors for cancer, the Task Force feels that a combination of educational efforts and healthy public policy changes are needed to reduce the incidence of melanoma and non-melanoma skin cancers in Ontario. The Task Force notes that the adoption of the following recommendations will not result in reduced rates of skin cancer over the short term: a successful initiative to prevent sun-induced skin cancer may take up to 40 years to yield a positive impact, due to the time lapse between early, repeated exposures to sunlight and the onset of many forms of skin cancer.

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## Education

To reduce the risk of skin cancer due to prolonged exposure to sunlight, Health Canada recommends adoption of the following preventive measures:

- alter daily schedule to avoid outdoor activities during peak times of sun exposure;
- seek shade during peak times of sun exposure;
- wear appropriate clothing (hats and clothing made from tightly woven fabric that offers maximum UV protection);
- use sunscreens if necessary.

Although these simple measures have been promoted for several years, there are still large segments of the population who have either not been informed, or who have not taken action to protect themselves against sun exposure. Moreover, the impact of actions taken to prevent exposure to sunlight are often hampered by a lack of knowledge. The effectiveness of many sunscreens, for example, is often limited, due to a lack of knowledge about proper application procedures.

To ensure that Ontarians are equipped with the knowledge and skills needed to avoid prolonged exposure to solar radiation, the Task Force calls for the adoption of the following measures:

**Implement public education and communication campaigns encouraging the adoption of the Health Canada guidelines.**

**Increase the adoption of preventive measures by children and young adults, who are especially vulnerable to the long-term effects of repeated exposure to sunlight, by directing information on the health effects of solar radiation to parents and modifying the health education curricula at the elementary and secondary school level.**

## Reducing Prolonged Exposure to Sunlight Among Children

As children are especially susceptible to the long-term cancer risks posed by repeated exposure to sunlight, the Task Force recommends the following additional measures to ensure that the attendant risks of prolonged childhood exposure to sunlight are minimized:

**Conduct public education campaigns encouraging parents and caregivers to refrain from letting small children remain in the sun for long periods of time, and to ensure that children wear hats, protective clothing and sunscreen when engaging in outdoor activities.**

When the ultra-violet (UV) index is high, schools should be cautious about scheduling prolonged outdoor activities.

## Solar Radiation Protection in School Yards and Other Public Places

Many school yards in Ontario share a similar design. They are paved with concrete or asphalt and have few, if any, trees or shaded areas. As such, they offer little UV protection for children, who are the group at greatest risk from the long-term effects of repeated exposure to sunlight.

Shade trees and shaded areas play a key role in sun protection and also serve many other environmental and aesthetic functions. Concrete, by contrast, reflects UV rays and is therefore a poor surface for outdoor activities. Grass is preferred.

To ensure adequate protection from sunlight at school yards and other public places:

**The Task Force proposes that shade trees and shaded areas be made available at all school yards, beaches, playgrounds, and other outdoor public places.**

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## Occupational Exposures to Sunlight

There are significant sun-related risks from outdoor work. Public utility workers in Maryland, a group whose occupation involves extensive exposure to sunlight, were found to be at greater risk of squamous cell carcinoma and actinic keratoses (Vitasa et al., 1990). The cancer risks linked to prolonged occupational exposure to sunlight were also confirmed by a British study, which found that outdoor workers suffer from an increased incidence of squamous cell and basal cell carcinoma, as well as an excess of melanomas of exposed skin, including head, face and neck (Beral and Robinson, 1981). To minimize the impact of repeated exposures to sunlight among outdoor workers, the Task Force calls for the adoption of the following recommendations:

**Work with the Ministry of Labour to mount an educational campaign encouraging outdoor workers to take protective measures against prolonged exposure to sunlight, including the need to use sunscreen and wear hats, long-sleeved shirts and other protective articles of clothing.**

**Where possible, ensure that adequate shaded areas are available at outdoor worksites, and that equipment used outside is provided with adequate shading.**

## Protective Clothing

Protective clothing, including a wide-brimmed hat, long sleeves and long trousers, provides effective protection against sustained exposure to sunlight; even lightweight fabric blocks UV-B rays. The amount of UV protection afforded by an article of clothing depends on the density of the weave of the fabric. A lightweight fabric that offers maximum UV protection has recently been introduced in the U.S.

To ensure that the public is aware of the degree of UV protection offered by articles of clothing, the Task Force recommends the following measure:

**Institute a labelling system identifying the degree of UV protection for all articles of recreational clothing (caps, T-shirts, etc.).**

## Sunscreens

Sunscreens are classified on the basis of their ability to prevent sunburn/erythema. They may also be able to prevent sun-induced pigmentation, chronic photodamage and skin cancer.

Sunscreens have been shown to decrease the incidence of actinic keratoses in humans (Thompson, Jolley and Marks, 1993). In theory, this should also lead to a decrease in the incidence of squamous cell carcinoma. Using a mathematical model derived from epidemiologic data on non-melanoma skin cancer, Stern et al. (1986) estimated that the lifetime risk of non-melanoma skin cancer would be reduced by 78% through regular sunscreen use during the first 18 years of life.

While the Task Force supports the use of sunscreens as a means of protecting the skin against UV ray damage, it recognizes that sunscreen is not a sufficient measure for preventing sun-induced skin cancer. The Task Force is concerned that, in some cases, the use of commercial sunscreens may lull people into a false sense of security, causing them to expose themselves to harmful UV rays for long periods of time while ignoring other, more effective countermeasures against skin damage (e.g., protective clothing, seeking shaded areas). To guard against this scenario, the Task Force recommends the adoption of the following measure:

**Implement a public education campaign emphasizing the need for preventive measures other than sunscreen to avoid UV-induced skin damage, the proper use of sunscreens, and the uncertainty of the degree of protection offered by sunscreen products.**

In Australia, the distribution of sunscreen at public beaches and outdoor recreational areas is a component of public education campaigns aimed at encouraging the adoption of actions to reduce prolonged exposure to sunlight at recreational facilities. The Task Force feels that in Ontario such a strategy may be less effective than one emphasizing protection against direct sun exposure.

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# Reproductive Life And Related Factors

## Risk Factors Related to Reproductive Life

Breast cancer is hormonally mediated and a number of risk factors associated with ovarian function are causally related to the disease, including age at first (and possibly subsequent) birth, parity, age at menarche, age at natural menopause and artificial menopause. None of these risk factors are amenable to prevention, except to the extent that women who plan to have children should probably be informed of the "age at first birth" effect in case they would wish to take this into account in their plans. There is also some evidence that suggests induced abortions may increase breast cancer risk (Daling et al., 1994). Estimates vary as to the proportion of breast cancer attributable to sexual and reproductive factors, but it is probably of the order of 15-20% (Miller, 1978b).

Endometrial cancer shares many epidemiological features and risk factors with breast cancer. Thus it is hormonally dependent, with the hormonal risk factors including early age at menarche (in premenopausal women), late age at menopause and nulliparity (never having given birth) increasing risk. There appears to be no association with age at first birth, however (Tomatis et al., 1990).

The incidence of ovarian cancer is quite strongly correlated with that of breast and endometrial cancer, and like them it is hormonally associated, so that it is not surprising that ovarian cancer shares many of the risk factors of breast and endometrial cancer. Thus nulliparous women are at higher risk than parous women, while factors associated with suppression of ovarian activity are protective (Tomatis et al., 1990). A recent study in Ontario showed that childbearing was protective for ovarian cancer, with increasing protection for each full-term pregnancy (Risch et al., 1994).

**The Task Force believes it is appropriate to include information on cancer-related reproductive risk factors in general health education for adolescents and young adults.**

People have a right to this information. Any education programs related to reproduction and sexuality should include information on cancer risk.

## Sexual Activity

Cancer of the cervix is strongly associated with early age at first intercourse and multiple sexual partners in both males and female. The incidence of the disease is high in many developing countries, and thus in some migrant groups, and in native Canadians. The evidence indicates that a sexually transmitted agent is the principal cause of the disease, and that barrier contraceptives are protective. This, together with the information on human papilloma virus (see section on infections), supports preventive measures designed to reduce sexually transmitted infections. Indeed the Task Force supports the recommendation of the National Workshop on Cervical Cancer Screening (Miller et al., 1991) that:

**Concepts of cervical cancer prevention and screening should be integrated with sexuality education for both males and females in schools, and included in health promotion programs directed to all adolescents.**

Risk factors associated with sexual activity have been suspected as relating to prostate cancer, yet there is no consistency and no indication currently for action.

However, circumcision is clearly protective against cancer of the penis (Tomatis et al., 1990).



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# Infections

Although cancer is not an infectious disease (i.e., it is not transmitted from one person to another), a number of infectious agents increase the risk of certain human cancers. It has been estimated that as much as 10% of cancer worldwide may be caused by infectious agents, though the proportion will be lower in Ontario, as several of the relevant cancers are more common in developing countries.

## Human papillomavirus (HPV) infections

Much evidence suggests that human papillomavirus (HPV) infections of the cervix may be a cause of cancer of the uterine cervix. Animal and experimental studies provide the strongest evidence suggesting that certain HPV types, including HPV 6, 11, 16, 18, 31, 33 and 35, play a role in the occurrence of some intraepithelial lesions and some cancers of the uterine cervix (Koutsky et al., 1988). HPV DNA is found in cell lines established from cervical cancers and most of these cell lines contain either HPV 16 or 18 DNA, which is integrated into the host cell genome. Experimentally, HPV 16 DNA can induce malignant transformation in rodent cells. HPV 6 and 11 are detected more frequently in mild dysplasia while HPV types 16 and 18 are the dominant types detected in severe dysplasia and in invasive cancers.

Recently, the epidemiological evidence linking HPV with cancer of the cervix has become much stronger, largely due to studies involving detection of prior HPV infection with refined (PCR) methodology. The evidence is particularly strong for dysplasia and carcinoma in situ (Cervical Intraepithelial Neoplasia) (Schiffman et al., 1993).

Research is still needed on the natural history of HPV infections in human populations. We lack longitudinal information on occurrence of HPV infection among uninfected women, and on the incidence of intraepithelial lesions or cervical cancer among infected women. One Canadian series suggests that mild to moderate cervical dysplasia associated with human papillomavirus infection eventually spontaneously disappears or, at worst, lingers

over many months in a mild to moderate form (Carmichael and Maskens, 1989). Therefore the significance of having an HPV infection remains unclear, as the data so far available do not preclude it being a "passenger" virus (Kjaer et al., 1990).

At the present time, therefore, an approach to the prevention of cervical cancer on the basis of reducing human papillomavirus transmission is neither appropriate nor feasible. However, the fact that cervical cancer risk is increased by a sexually transmitted agent reinforces the approaches generally adopted to reduce such transmission on other health grounds (use of barrier contraceptives, increased public awareness of the dangers of sexual activity with multiple partners, or with partners who have themselves had multiple partners). If the sexually transmitted cause of the disease is a necessary cause, and if it were possible to vaccinate against it, cancer of the cervix could be largely eliminated. Research is under way directed to this approach.

## Hepatitis B Virus Infection

Hepatitis B virus is now recognized as a human carcinogen, largely on the basis of research on liver cancer in a number of developing countries (IARC, 1994). It is the chronic carriers of the virus that are at risk of liver cancer. Transmission of hepatitis B virus occurs from mothers who are carriers during or shortly after birth in China, and in childhood in Africa. Liver cancer is relatively infrequent in Canada, and it is unlikely that a general programme of immunization against hepatitis B for the prevention of liver cancer would be justifiable for the whole population of Canada; though liver cancer prevention would follow from hepatitis B vaccination programs introduced for other reasons.

Recently, a program of immunizing Grade 7 students against hepatitis B has been introduced in Ontario. This will probably have little effect on liver cancer risk as it will not prevent the carrier state in the majority of those who become carriers. It would be different if this immunization program were to be offered early in life. Migrants to Canada from high-risk countries are demonstrably at much

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higher risk of liver cancer than Canadian-born people, and at the least infants born to mothers who are carriers should be immunized against hepatitis B infection as soon as possible after birth.

## Hepatitis C Infection

Hepatitis C virus infection has recently been identified as another cause of liver cancer. The main route of transmission of hepatitis C is needle sharing by injection drug users. Thus programs designed to prevent virus transmission by this means will also have an effect in reducing liver cancer.

## Human Immunodeficiency Virus (HIV) Infection

HIV infection is the recognized cause of AIDS, and AIDS increases the risk of Kaposi's sarcoma and lymphomas, but a recent study suggests no increase in other cancers (Rabkin and Yellin, 1994). Much of the increase in lymphomas that have been noted in young men can be attributed to AIDS.

**Measures applicable to reduce HIV transmission (similar to those advocated for prevention of cancer of the cervix above) should be vigorously pursued.**

## Epstein-Barr Virus Infection

Salivary gland tumours and nasopharyngeal cancers are elevated in incidence in the Canadian Inuit. Elsewhere both these tumours have been associated with Epstein-Barr virus infection. Nasopharyngeal cancer (NPC) is elevated in the Southern Chinese and has been associated with the Epstein-Barr virus (Tomatis et al., 1990). At the moment prevention based on this knowledge does not seem feasible.

## Helicobacter Pylori Infection

Recently there has been interest that an organism capable of surviving in the stomach (*Helicobacter pylori*) and associated with duodenal ulcers and chronic gastritis (believed by some to be a precursor lesion for stomach cancer) may have a role in the etiology of this cancer (Nightingale and Gruber, 1994). Indeed, an IARC working group recently concluded that there was *sufficient* evidence that *H. pylori* is carcinogenic to humans (IARC, 1994). Although increased use of antibiotics could have been associated with a decline in *H. pylori*, even now, in many studies, the prevalence of infection is of the order of 60% in controls and this seems unlikely to be associated with a decline of the magnitude seen for this cancer. It has been suggested that antibiotic therapy for those found to be carriers of the organism may be justifiable. However, even on the assumption that treating *H. pylori* infection with antibiotics would reduce the risk of stomach cancer by 30%, such an approach is unlikely to be cost-effective in Ontario. Clearly more definitive etiological data are required before screening for infection and treatment would be justifiable.

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# Medications

## Oral Contraceptives

Combination oral contraceptives (COCs, which combine an estrogen and a progestogen) are classified by the International Agency for Research on Cancer as category 1 carcinogen (*sufficient* evidence of carcinogenicity in humans) (IARC, 1987). The evidence was judged sufficient in terms of increasing the risk of hepatocellular cancers (primary liver cancer), a rare condition in Canada. However, a great deal of effort has been applied to determine whether oral contraceptives affect the risk of other cancers.

Given the hormonally related aspects of breast cancer, it is perhaps surprising that it has been so difficult to obtain agreement on whether or not oral contraceptives influence risk. Recently, increasing evidence has accumulated that oral contraceptives, if given for prolonged periods (at least four years) before first birth or age 25, increase breast cancer risk in premenopausal women (Romieu et al., 1990; Thomas, 1993). This could be the beginning of a cohort effect; i.e., women in the birth cohorts exposed to the possibility of taking oral contraceptives from early in their period of sexual activity who, as they age, will be shown to have greater risk of breast cancer from such usage as they reach their 50s (only now happening), 60s (in ten years) and 70s (in 20 years). However, it is not certain that increased risk will be found for those exposed to more modern contraceptives, which contain less estrogen.

For endometrial cancer, COCs are protective. A large study in women age 20-54 showed a relative risk of 0.6 for ever use of COCs (CDC, 1987). With 59% of the population-based controls exposed, 28% of endometrial cancer in this age group should be preventable by COC use. It will require study at a later date to determine whether previous COC use will also have a protective effect on endometrial cancer for women at older ages.

There is also a protective effect for ovarian cancer from COC use. A study in women age 20-54 showed a relative risk of 0.6 for ever use of COCs (CDC 1983). With 54% of the population-based controls exposed, 26% of ovarian

cancer in this age group should be preventable by COC use. A similar protective effect was found for COC use in a case-control study of ovarian cancer in Ontario (Risch et al., 1994).

The package inserts for oral contraceptives in Canada now carry a warning that increased risk of breast cancer may follow from prolonged use, while pointing out the beneficial effects on endometrial and ovarian cancer. It seems probable that the benefits from use of oral contraceptives outweigh the risks of breast cancer, and other than ensuring that women and their physicians are appropriately informed on the risk, the Task Force does not recommend any other action at present.

There is *sufficient* evidence that hormone replacement therapy is carcinogenic to humans (IARC 1987). The evidence largely relates to endometrial cancer.

For breast cancer, the evidence, at least from studies that did not use hospital controls, is becoming more consistent (IARC, 1987). There appears to be about a 50% increase in risk after a latent period of 10 years for prolonged use of estrogens for menopausal symptoms. This risk may not be reduced by the addition of progestogens (Bergkvist et al., 1989). In Canada 27% of breast cancers occur in women age 70 or more. If half of all women in Canada were to take prolonged courses of estrogens at the time of the menopause, with a relative risk of 1.5, 9% of breast cancer would be attributable to this cause.

For endometrial cancer, unopposed estrogen use at the menopause significantly increases risk (IARC, 1987). With the publicity concerning endometrial cancer and non-contraceptive estrogens, there was a reduction in use and a reduction in incidence in many areas that had previously shown a rise. Based on studies conducted before the fall in incidence, an attributable risk of 40% or more was calculated (Tomatis et al., 1990). Canada had a rise and then a fall in incidence also, with a peak in 1976 (National Cancer Institute of Canada, 1994). However, the rise was smaller than in many areas of the U.S. and thus it is likely

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that the population attributable risk (PAR) in Canada from the use of non-contraceptive estrogens was never as high as 40%, and now is probably much less.

As for oral contraceptives, it seems possible that if a cost-effectiveness analysis were performed incorporating all health benefits of non-contraceptive estrogens (including the effect on reducing cardiovascular disease and reduction in osteoporosis) as well as the risks, the benefits would outweigh the risks (Miller, 1991; Martin and Freeman, 1993). However, the prescription of progestogens together with estrogen for menopausal symptoms may reduce the risk of endometrial cancer but could have adverse effects on the incidence of breast cancer. This concern is heightened as the progestogen commonly used in North America is medroxyprogesterone acetate, a progestogen that may increase the risk of breast cancer when used as a contraceptive agent (The WHO Collaborative Study of Neoplasia and Steroid Contraceptives, 1991).

**The Task Force recommends that women are fully informed by their physicians on both the potential risks from cancer induction as well as the potential benefits from symptom control and reduction in cardiovascular disease risk and osteoporosis before prescriptions are given for hormone replacement therapy.**

### Anti-Cancer Chemotherapy

The majority of chemotherapy agents used for the treatment of cancer are category 1 carcinogens, increasing the risk of leukemia and probably some other cancers as well (Kaldor et al., 1986; IARC, 1987). This is one of the reasons that adjuvant chemotherapy for cancer can be controversial; for those with good prognosis cancers and a low probability of recurrence or death from cancer, the consequences of adjuvant chemotherapy in increasing the risk of leukemia could outweigh the benefits. For patients with advanced cancer, the risk of leukemia is probably outweighed by the benefits from increased disease-free survival from cancer. Regimens are increasingly being selected that are believed to have low leukemogenic potential, and are replacing those with higher leukemogenic potential.

### Chemoprevention

There has been interest for some time in the possibility that chemoprevention using anti-oxidants such as retinol and/or betacarotene may be of value as chemopreventives for lung and possibly other cancers (including bladder cancer). However, a randomized trial incorporating betacarotene as a chemopreventive agent in heavy smokers in Finland has reported an unexpectedly higher risk of lung cancer over a six-year period in those receiving betacarotene than in the controls (the Alpha-Tocopherol, Betacarotene Cancer Prevention Study Group, 1994). This suggests that caution needs to be applied in extrapolating from observational epidemiology studies to dietary supplements involving high (pharmacologic) doses of micronutrients.

The clear association of breast cancer with hormonal risk factors and the success of anti-estrogens in the therapy of breast cancer has led to the suggestion that an anti-estrogen, such as tamoxifen, may be of value as a prophylactic against breast cancer in high-risk women. This proposal has to be regarded as an indication for research rather than application in cancer control at present, particularly as tamoxifen may increase the risk of both endometrial and liver cancers. After pilot studies in the U.S. and U.K., major trials have been initiated, with Canadian participants enrolled in the American trial. Until these trials have been completed, it would not be advisable to use tamoxifen routinely for this purpose.

### Phenacetin and Analgesic Mixtures Containing Phenacetin

IARC (1987) has classified phenacetin as a group 2a carcinogen; i.e. *limited* evidence of carcinogenicity in humans but *sufficient* in animals. However, analgesic mixtures containing phenacetin are categorized as having *sufficient* evidence of carcinogenicity in humans. The evidence relates to increased risk of renal pelvis and other urothelial tumours. Phenacetin is no longer available in Canada, though acetaminophen, one of its metabolites, is widely used. It is not yet clear whether acetaminophen is devoid of carcinogenic potential.

The amount of renal cancer attributable to past phenacetin-containing analgesic use in Canada is probably low.

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# Genetics

There is increasing interest in the possibility that the advances in knowledge of the major genetic changes associated with cancer can be capitalized upon for the prevention, early detection and treatment of cancer. It is now very clear that most cancers arise because of changes in the genetic makeup of cells that are transformed into cancer cells. The genes associated with these events include those with tumour inducing and tumour suppressor functions. These are normal genes that have been changed by the action of external agents, the class of substances we call carcinogens. However, this does not mean that all cancer is inherited; present knowledge suggests that for all common tumours, inheritance of susceptibility is relatively rare. Familial cancer is due both to common environmental and common genetic factors in families. Thus, although for breast cancer, various estimates have been made that 10% to as much as 20% may be familial, the recent identification of the BrCa1 gene, and the recognition that there may be at least two other genes responsible for dominant inheritance of breast cancer, suggests that about 5% of breast cancer is associated with these genes.

For lung cancer, there is some evidence that there may be differences in the individual susceptibility to the effect of carcinogens in tobacco due to inherited (genetic) factors, though the specific genes have not yet been identified. For colorectal cancer, however, there are several well-recognized inherited syndromes, and several recently identified genes, suggesting that perhaps as much as 10% of cases may be genetically induced. Given that many more advances can be expected to follow from the human genome project, we are at an early stage in understanding the genetic basis of a number of cancers.

The implications of these advances on cancer prevention are still somewhat obscure. It seems very likely that cancers are induced through gene-environment (including lifestyle) interactions. Thus, preventing the effect of these external factors will potentially be just as important for carriers of genes associated with cancer as for those not known to be carrying the gene and for those cancers not associated with specific genetic events. A well-recognized example is the rare syndrome of xeroderma pigmentosa, which results in a substantially increased risk of skin cancers. However, the susceptibility is to the effect of ultraviolet light. If a child with the syndrome is protected from exposure to ultraviolet light, the skin cancers will not occur. The challenge for the future, therefore, will be to identify the relevant environmental factors for which exposure will have to be reduced in other genetic syndromes. This will potentially have a far greater effect than genetic engineering. A good example is the fact that no smoking will have the required effect on those susceptible to the effect of tobacco carcinogens, and that this is the correct strategy for such individuals, a strategy that can be applied whether they are recognized as being susceptible or not.

In the meantime, there are ethical issues over identifying the fact that someone is carrying a gene for cancer and the possible lack of a means to prevent that cancer occurring. These issues have to be subjected to careful study. The Task Force notes that an Ontario Cancer Genetics Network is being established within the Division of Preventive Oncology of the Ontario Cancer Treatment and Research Foundation (OCTRF), and that OCTRF has recognized the need for careful counselling of those found to be carriers of genes associated with increased cancer susceptibility, as well as for research on their appropriate management.

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# Socio-Economic Determinants Of Cancer

The reduction of socio-economic inequities in health status is one of the fundamental challenges faced by public health. Regardless of the measure of socio-economic status (SES) used (income level, educational attainment or occupational class), epidemiological studies have consistently revealed significant inequities in the health status of people in lower socio-economic positions (Black et al., 1980; Lindheim and Syme, 1983; Whitehead, 1987). For example, a 1986 Health and Welfare Canada study linking life expectancy to neighbourhood income found that male residents of the wealthiest districts lived an average of 5.7 years longer than men from the poorest neighbourhoods, while the average lifespan of women from the richest neighbourhoods was almost two years longer than that of their low-income counterparts (National Council of Welfare, 1990).

Studies indicate that the incidence of cancer, like other chronic diseases, differs with SES, although the relationship is not uniform. A comprehensive review of the literature commissioned by the Cancer 2000 Task Force (1992) revealed that, when all cancers are considered together, there is evidence of a weak negative relationship between SES and cancer incidence/mortality for men (i.e. higher rates of cancer and higher cancer mortality rates at lower SES) and no relationship for women. There are, however, considerable SES differences in the incidence and mortality rates for specific cancers. Low SES is associated with a higher incidence of (and mortality from):

- stomach cancer (Leon, 1988; Pearce and Howard, 1986; Barker et al., 1990)
- lung cancer among males (Millar, 1983; Funch, 1985; Wilkins, Adam and Brancker, 1990)
- cervical cancer (McWhorter et al., 1989; Funch, 1986)
- cancers of the mouth, pharynx, larynx and esophagus (Pearce and Howard, 1986; Pukkala and Teppo, 1986; Ghadirian, Thonez and Simard, 1988)

High SES, by contrast, is associated with a greater risk of:

- skin cancer (Cooke, Skegg and Fraser, 1984; Levi et al., 1988; Rimpela and Pukkala, 1987)
- breast cancer (Leon, 1988; Gunch, 1986; Rimpela and Pukkala, 1987; Farley and Flannery, 1989)

- prostate cancer (Leon, 1988; Levi et al., 1988; McWhorter et al., 1989)
- colon cancer in men (Caygill et al., 1990; Pukkala and Teppo, 1986; Rimpela and Pukkala, 1987)

SES differences in the incidence of disease are often attributed to corresponding differences in health-related behaviours, such as smoking, alcohol consumption, eating habits and sexual practices. Reducing the significantly higher rates of smoking among economically disadvantaged groups is perhaps the most important priority for bringing about a reduction in socio-economic inequities in health status. SES differences in "lifestyle" behaviours, however, cannot be considered in the absence of the social, economic, environmental and political factors that serve as determinants of lifestyle and thus as barriers to the maintenance of good health. It is important that all Ontarians have access to the fundamental determinants of health (food, shelter, etc.).

The principal finding of the aforementioned review of socio-economic determinants of cancer commissioned by the Cancer 2000 Task Force was the paucity of relevant information, particularly in Canada. What information was available revealed socio-economic inequities in particular sectors of the population, including native Canadians and the elderly (Cancer 2000 Task Force, 1992). The lack of appropriate programs and services for many disadvantaged groups was identified as one of the primary causes of these inequities.

To address socio-economic differences in the incidence of cancer, the Task Force calls for the adoption of the following recommendations:

**Ensure that members of all groups in society are involved in the development and implementation of cancer prevention programs addressing their needs.**

**Tailor the content and method of delivery of information about cancer prevention to the groups for which it is intended.**

**Conduct more extensive research on the barriers to accessing knowledge on cancer prevention experienced by different groups in society and on inequalities in cancer prevention and control.**

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# Strategies for Implementing the Task Force Recommendations

## A Mechanism to Ensure That the Task Force Recommendations Are Implemented

The government is involved currently in developing a Cancer Strategy for Ontario. Clearly, as indicated in this report, prevention of cancer must be a major component of that strategy. In general, our recommendations are directed to government, and government or its designated agent will be responsible for setting up the mechanism to follow through on our recommendations.

One possible structure that could arise as part of the Cancer Strategy for this province is a strong Provincial Cancer Agency. Such an agency could be given the responsibility for carrying out our recommendations were it not for the fact, repeatedly emphasized in our report, that the benefit following from acceptance of and action upon our recommendations will not be restricted to cancer. Indeed, it is difficult to see how it will be possible for the Ministry of Health to divorce itself from having major responsibility for carrying out our recommendations, given the legislative requirements for many of them.

It is not the mandate of the Task Force to specifically recommend the structure that will have to be put in place for the effective implementation of a cancer prevention strategy in Ontario. However, we call upon the government to give this matter very careful consideration. What follows in this section are some suggestions for the types of structures that might facilitate the implementation of our recommendations.

## A Health Promotion Framework for the Primary Prevention of Cancer

The Task Force believes that the implementation of many of its recommendations is best achieved through a comprehensive, multisectoral strategy based on the principles of *health promotion*, "the process of enabling people to increase control over, and to improve, their

health" (World Health Organization, 1986, p. i). To achieve this objective, health promotion:

- requires a comprehensive approach (i.e., it uses a combination of interventions at the individual and community level);
- includes measures to prevent disease;
- focuses on enhancing or maintaining good health instead of treatment and rehabilitation.

The Ontario Ministry of Health (1991) has identified three main approaches to health promotion: education, policy and environmental support.

### Education

As an approach to health promotion, education helps people to make healthy decisions and participate in healthy activities by:

- increasing knowledge and motivation;
- changing attitudes;
- increasing the skills needed to maintain good health.

Health promotion initiatives include a number of educational strategies. One of the most widely used is *health communication*, the process of promoting health by disseminating information through media channels (e.g., posters, television) or interpersonal contacts.

The Task Force has identified a number of educational activities that have the potential to reduce the incidence of, and mortality from, cancer. Some examples include:

- training health professionals to provide counselling on smoking cessation and risks from exposure to environmental tobacco smoke;
- offering classes on healthy food preparation and shopping skills;
- maintaining current efforts to ensure the right of employees to know about hazardous substances in their workplaces (WHMIS);

- adopting public education initiatives to increase awareness of environmental health risks and measures that can be taken to address these risks.

## Policy

Healthy public policies promote the health of individuals and communities by:

- making it easier to adopt healthy practices;
- making it more difficult to adopt unhealthy practices;
- creating healthy social and physical environments.

There are two main approaches to fostering healthy public policies: health advocacy and community organization.

*Health advocacy* is the process of lobbying decision makers to take action on health-related issues. *Community organization*, often referred to as community development, is the process of mobilizing communities to take action on their shared health concerns. All efforts to facilitate community action should facilitate the process of *empowerment*, the ability of individuals and communities to control the factors affecting their health.

The Task Force has made numerous recommendations for healthy policy changes throughout its report. Some examples:

- restoring tobacco taxation rates to their former peak levels;
- introducing stronger legislation banning tobacco use in the workplace;
- developing a food labelling system that enables consumers to determine the nutritional value of food products;
- ensuring that healthy school breakfast and lunch programs are available to all children who need them;
- setting realistic and measurable timetables for “sunsetting” persistent bioconcentrating chemicals that are known or suspected carcinogens;
- implementing gasoline vapour recovery at fuel transfer facilities and gas stations to reduce fugative benzene emissions.

## Environmental Support

Environmental support consists of the tangible resources, practices and policies that make it easier for people to enhance or maintain their health. Some examples of environmental supports that help to reduce the incidence of cancer are:

- smoke-free public places;
- the ban on tobacco sales to minors;
- adequate levels of income to purchase nutritious food;
- the availability of healthy food choices in school and workplace cafeterias;
- workplaces free from hazardous levels of occupational carcinogens;
- pollution-free soil, air and drinking water.

The three main approaches to health promotion are complementary; each approach can strengthen the impact of the others. All three approaches are necessary to achieve the three purposes of health promotion: health enhancement, risk avoidance and risk reduction.

- *Health enhancement* reaches the entire population. Health enhancement activities are designed mainly to increase levels of good health, vitality and resilience in all people. Although health enhancement activities may also prevent disease or reduce health risks, their main focus is to enhance health rather than to reduce or prevent illness. For example, a population-based campaign encouraging people to become more physically active is a health enhancement activity that could help to bring about a reduction in the incidence of cancer.
- *Risk avoidance* reaches individuals who have not yet developed the health problems associated with a particular health risk. The goal of risk avoidance activities is to ensure that those at low risk of a particular health problem remain at low risk. A health education course aimed at deterring young people from experimenting with tobacco consumption is one example of how risk avoidance can be applied to prevent cancer.



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- *Risk reduction* reaches those at moderate or high risk of health problems. The goal of risk reduction activities is to modify the environmental conditions, behaviours or predisposing characteristics that are creating the risk for those vulnerable to a particular health problem. A policy to eliminate hazardous emissions of an occupational carcinogen at a work site is an example of a risk reduction activity aimed at preventing cancer.

The Ministry of Health's conceptual framework for health promotion is a useful resource for guiding the planning and implementation of the broad range of strategies needed to address the range of risk factors discussed in this report. Accordingly we recommend that:

**The Ministry of Health conceptual framework for health promotion be adopted to guide the implementation of the Task Force recommendations for the primary prevention of cancer.**

## **Contribution of Public Health Units to Cancer Prevention**

Given that many of our recommendations will require implementation at the local or regional level, the Task Force believes that in many instances Public Health Units will be a major player in their implementation, and in evaluating the impact of our recommendations. Public Health Units already have the responsibility for a number of mandatory public health programs. Local initiatives in reducing exposure of the public to ETS, and helping reduce local environmental contamination, have been initiated at the municipal level through the activities of local Boards of Health, and activated by the local Medical Officer of Health. We foresee a future in which Public Health Units will be major players in the implementation of cancer prevention programs in Ontario.

## **Coordinating the Implementation of the Task Force Recommendations**

Due to the large number of behavioral, social and environmental factors related to cancer, and the magnitude of the changes required to address these factors, the Task Force recognizes that no single organization is capable of coordinating the activities required to address its recommendations. To ensure the successful implementation of the recommendations, coordinated intersectoral collaboration among key stakeholders, including relevant government ministries, health professionals, businesses, advocacy groups and non-government organizations (NGOs; e.g., the Canadian Cancer Society) is required.

One possible means of fostering this intersectoral collaboration is the establishment of an Ontario Cancer Prevention Network with a mandate to oversee implementation of the Task Force recommendations. This would be similar to the approach used in developing the Ontario Tobacco Strategy. The size and composition of the Network would be determined by the province. Ideally, the Network would include representatives from the broad range of public agencies, NGOs, health professionals, labour unions, businesses, and advocacy and consumer groups with an interest in reducing cancer risk factors. Responsibility for coordinating Network activities should rest with the Ministry of Health, but other relevant ministries, including Education, Environment and Energy, and Agriculture, Food and Rural Affairs, should also be part of the Network.

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A Cancer Prevention Network could be mandated to carry out the following activities:

- develop a realistic timetable for the implementation of the Task Force recommendations;
- identify barriers to the implementation of the recommendations and, where possible, develop strategies addressing these barriers;
- coordinate the educational, public awareness, and lobbying and advocacy activities necessary to build support for the recommendations;
- support the development of coalitions addressing cancer-related risk factors at the community level (e.g., tobacco, nutrition, environmental carcinogens);
- establish intersectoral collaboration for information dissemination and education strategies;
- coordinate the evaluation of activities initiated in response to the recommendations;
- prepare periodic progress reports on measures taken to address the recommendations. These reports would be tabled in the provincial legislature.

**The Task Force recommends that a Cancer Prevention Network be established to help in implementing the recommendations in this report, that would work with the Heart Health Network, the Provincial and Regional Cancer Networks, and the Provincial Cancer Agency to foster cancer prevention in Ontario.**

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# Appendix I

## List Of Submissions Received By The Ontario Task Force On The Primary Prevention Of Cancer

The following individuals and groups responded to the call for submissions issued by the Task Force. Their contribution to the deliberations of the Task Force is gratefully acknowledged.

Fernando Ania, Ontario Homeopathic Association, Toronto, Ontario.

Liz Armstrong, Women's Network on Health and the Environment, Toronto, Ontario.

Kimberly Badovinac, North York Public Health Department, North York, Ontario.

Niki Carlan, Industrial Disease Standards Panel, Ontario Ministry of Labour, Toronto, Ontario.

Bernard C.K. Choi, Occupational and Environmental Health Unit, Department of Preventive Medicine and Biostatistics, Faculty of Medicine, University of Toronto, Toronto, Ontario.

Martha Chown, Toronto-Sunnybrook Regional Cancer Centre, North York, Ontario.

Rae Clemens, Middlesex-London Health Unit, London, Ontario.

Colleen Cooney, Ontario Health Advocacy Association, Orillia, Ontario.

Cora Lynn Craig, President, Canadian Fitness and Lifestyle Research Institute, Gloucester, Ontario.

Joseph E. Cummins, Department of Plant Sciences, University of Western Ontario, London, Ontario.

Mr. W. Alex Forbes, Sioux Lookout, Ontario.

Friends of the Earth, 251 Laurier Avenue, Suite 701, Ottawa, Ontario.

Drs. Lynn From and Cheryl Rosen, Women's College Hospital, Division of Dermatology, Toronto, Ontario

Greenpeace, Toronto, Ontario.

Cary Greenberg, Diet and Breast Cancer Prevention Trial, Ontario Cancer Institute/Princess Margaret Hospital, Toronto, Ontario.

Marlene Greenberg and Margaret Finch, Comprehensive Cancer Program, Toronto-Bayview Regional Cancer Centre, Toronto, Ontario.

Susan Hubay, Food Security Workgroup, Ontario Public Health Association, Toronto, Ontario.

J.Z. Losos, Laboratory Centre for Disease Control, Health Protection Branch, Health Canada, Ottawa, Ontario.

Neil MacKenzie, Co-Chair, Active Living Alliance of Ontario, c/o Windsor-Essex County Health Unit, Windsor, Ontario.

Gail McKeown-Eyssen, Department of Preventive Medicine and Biostatistics, University of Toronto, Toronto, Ontario.

Heather Moir, Etobicoke, Ontario.

Jay Palter, Greenpeace Chlorine-Free Campaign, Greenpeace, Toronto, Ontario.

Chris M. Podwysocki, Physiotherapy Department, Ottawa General Hospital, Ottawa, Ontario.

Dieter Riedel, Great Lakes Health Effects Program, Ottawa, Ontario.

Bonnie Walter, Pesticide Action Group – Cambridge Chapter, Cambridge, Ontario.

Elizabeth Wharton, Pesticide Action Group – Waterloo Chapter, Waterloo, Ontario.

# Appendix II

## Persistent Known Or Suspected Environmental Carcinogens

Name	CAS #	Classification	Agency	Comments	Used in Ontario as pesticides or herbicides	Currently in use	Never used in Canada
Carcinogenic to humans							
Arsenic	7440-38-2	1	IARC				
Benzene	71-43-2	1	IARC				
Chromium (VI)	18540-29-9	A	USEPA				
Asbestos	1332-21-4	1	IARC				
Benzidine	92-87-5	1	IARC				
2-naphthylamine	91-59-8	1	IARC				
Vinyl chloride	75-01-4	1	IARC				
Respirable form of Nickel		1	IARC				
Chlorinated organic compounds							
Hexachlorobenzene	118-74-1	2B	IARC				
2,3,7,8-Tetrachloro-dibenzo-p-dioxin	1746-01-6	2B	IARC				
1,4-Dichlorobenzene	106-46-7	2B	IARC				
Heptachlor	76-44-8	B2	USEPA				XX
Chlordecone	143-50-0	2B	IARC	precursor of mirex; banned for use in Ontario, 1994	XX		
Aldrin	309-00-2	3 B2	IARC USEPA	banned for use in Ontario, 1994	XX		
DDT and metabolites	50-29-3	2B	IARC	DDT banned for use in Ontario, 1988	XX		
Amitrole	61-82-5	2B	IARC		XX	XX	

Name	CAS #	Classification	Agency	Comments	Used in Ontario as pesticides or herbicides	Currently in use	Never used in Canada
Toxaphene	8001-35-2	2B	IARC	banned for use in Ontario	XX		
Carbon tetrachloride	56-23-5	2B	IARC				
1,2-Dichloroethane	107-06-2	2B	IARC				
Chlordane	12789-03-6	B2	USEPA	banned for use in Ontario, 1994	XX		
3,3'-Dichlorbenzidine	91-94-1	2B	IARC				
Mirex	2385-85-5	2B	IARC				XX
Dieldrin	60-57-1	3 B2	IARC USEPA	banned for use in Ontario, 1994	XX		
Dichlorvos	62-73-7	3 2B	IARC USEPA		XX	XX	
Atrazine	1912-24-9	2B C	IARC ('91) USEPA ('91)		XX	XX	
Chloroform	67-66-3	2B	IARC				
1,4-Dioxane	123-91-1	2B	IARC				
1,1,2,2-tetrachloroethylene	127-18-4	2B	IARC				
Nitro-polycyclic aromatic hydrocarbons							
1,8-Dinitropyrene	42397-65-9	3	IARC				
Polychlorinated biphenyls (PCBs)							
Arachlor 1016, 1221, 1232, 1342, 1248, 1254, 1260		B2	USEPA				
Polycyclic aromatic hydrocarbons (PAHs)							
Benz(a)anthracene	56-55-3	2A	IARC				
Benzo(b)fluoranthene	205-99-2	2B	IARC				
Benzo(k)fluoranthene	207-08-9	2B	IARC				
Dibenz(a,i)acridine	224-42-0	2B	IARC				

Name	CAS #	Classification	Agency	Comments	Used in Ontario as pesticides or herbicides	Currently in use	Never used in Canada
Dibenzo(a,i)pyrene	189-55-9	2B	IARC				
Benzo(a)pyrene	50-32-8	2A	IARC				
Benzo(j)fluoranthene	205-82-3	2B	IARC				
dibenz(a,h)anthracene	53-70-3	2A	IARC				
7H-Dibenzo(c,g)carbazole	194-59-2	2B	IARC				
Indeno(1,2,3-cd)pyrene	193-39-5	2B	IARC				
Other substances							
2-Nitropropane	79-46-9	2B	IARC				
Cadmium (respirable and soluble salts)	7440-43-9	B1	USEPA				
Methylene chloride	75-09-2	2B	IARC				
Ethylene oxide	75-21-8	2A	IARC		XX	XX	
Formaldehyde	50-00-0	2A	IARC		XX	XX	
4-Nitrosomorpholine	59-89-2	2B	IARC				
Beryllium compounds and respirable forms	7440-41-7	2A	IARC				
Ethylene dibromide	106-93-4	2A	IARC				
Lead and compounds	7439-92-1	B2	USEPA				
Creosote	8001-58-9	2A	IARC		XX	XX	
Sodium ortho phenylphenate	132-27-4	2B	IARC		XX	XX	
Hexachlorocyclohexanes	608-73-1	2B	IARC	The technical grade HCH contains a mixture of isomers and may contain Lindane or alpha-HCH	only Lindane (gamma HCH)	only Lindane (gamma HCH)	

**Sources:**

Accelerated reduction/elimination of toxics (ARET)  
International Agency for Research on Cancer (IARC)  
Ontario Ministry of the Environment and Energy (MOEE)  
Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA)  
US Environmental Protection Agency

Ministry of Health

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