Protection from second-hand tobacco smoke in Canada: Applying health science to occupational health and safety law

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This paper was written
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Foreword

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At the request of the Ontario Ministry of Health, the Ontario Tobacco Research Unit (OTRU) coordinated the preparation of a report similar to this one. A first draft of the OTRU report was prepared by Mr. Neil E. Collishaw, Research Director of Physicians for a Smoke-Free Canada, according to the following terms of reference:

- Review existing meta-analyses, other reviews of the scientific literature (including criticisms of scientific reviews), and recent studies not included in previous reviews linking exposure to environmental tobacco smoke (ETS) and various diseases. Make conclusions about the public health consequences of exposure to ETS.

- Determine, through a review of the scientific literature, whether a safe and/or acceptable level of exposure for ETS exists.

- Evaluate the scientific evidence and determine whether ventilation of indoor air is an effective approach to eliminate the risk of diseases caused by ETS.

An expert panel met in Toronto on October 2, 2000 to review the first draft.

The panel assessed the draft report critically, accepted it as a good basis for a final report, and made suggestions for revisions. Comments of the panel were incorporated into the next draft of the report.

The second draft was again reviewed by members of the expert panel. After some further revisions, all endorsed it as a complete, correct assessment of the evidence on the health effects of second hand smoke and the inadequacy of ventilation solutions to the problem of exposure to second-hand smoke.

Members of the panel included:

Dr. Mary Jane Ashley
Professor
Department of Public Health Sciences
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Dr. Roberta Ferrence
Director
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Ms. Jennifer Jinot
Environmental Health Scientist
National Centre for Environmental Assessment
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Dr. Kenneth C. Johnson
Senior Epidemiologist
Cancer Bureau, Health Canada
Ottawa, Ontario

Dr. Howard Morrison
Chief, Risk Assessment Division
Cancer Bureau
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Mr. James Repace
Second Hand Smoke Consultant
Bowie, Maryland, USA

Dr. A. Judson Wells
Chemist
Kennett Square, Pennsylvania, USA

Subsequently, Neil Collishaw and Heidi Meldrum of Physicians for a Smoke-Free Canada (PSC) reviewed the occupational health and safety legislation and regulation in federal jurisdiction and all ten provinces in order to prepare the current report. It incorporates all the research and findings from the Ontario report issued by OTRU concerning health effects of second-hand smoke, ventilation, and action to control second-hand smoke in selected jurisdictions. In addition, it incorporates recent research on the economic impact of bans on smoking in bars and restaurants in California and the results of PSC's assessment of the legislative basis for effective protection from tobacco smoke in workplaces under federal and provincial jurisdiction.

Few issues have been subject to as many scientifically rigorous reviews as second-hand smoke. The conclusions from these reviews and our own review are clear:

- **Exposure to second-hand smoke causes the following diseases and conditions:**
  - *In adults*
    - Heart disease
    - Lung cancer
    - Nasal sinus cancer
  - *In children*
    - Sudden infant death syndrome
    - Foetal growth impairment including low birth-weight and small for gestational age

        - Bronchitis, pneumonia and other lower respiratory tract infections
        - Asthma exacerbation
        - Middle ear disease
        - Respiratory symptoms

- **Exposure to second-hand smoke has also been linked to other adverse health effects. The relationships may be causal. These include:**
    - *In adults*
        - Stroke
        - Breast cancer
        - Cervical cancer
        - Miscarriages
    - *In children*
        - Adverse impact on cognition and behaviour
        - Decreased lung function
        - Asthma induction
        - Exacerbation of cystic fibrosis.

- **It is estimated that exposure to second-hand smoke causes between 1100 and 7800 deaths per year in Canada.**

- **All involuntary exposure to tobacco smoke is harmful and should be eliminated.**

- **Ventilation provides no solution to the problem of exposure to second-hand tobacco smoke.**

- **Full compliance with health and safety legislation in most Canadian jurisdictions would require eliminating all tobacco smoke from workplaces.**

Executive Summary

A synthesis of knowledge on second-hand smoke

This report reviews current knowledge about the health effects of involuntary exposure to tobacco smoke. It discusses the inadequacy of ventilation options for providing protection from involuntary exposure to tobacco smoke. Finally, the current status of legislative protection from second-hand smoke in federal and provincial jurisdictions is reviewed.

The report does not attempt to repeat what has already been thoroughly documented elsewhere, but rather to bring together information from other syntheses of knowledge in order to provide in one concise document a summary of established scientific knowledge on the health effects of second-hand smoke, as well as best practices for control of this known health hazard. The most effective options for control of this known health hazard can best be determined based on a thorough understanding of the nature of the health hazards involved and the effectiveness of various control options.

Health effects of involuntary exposure to tobacco smoke

Six major scientific reviews carried out in the 1990s have identified fifteen diseases or conditions as known or suspected to be caused by exposure to second-hand smoke (See Table 2). These include four developmental diseases or conditions, seven respiratory diseases or conditions, three cancers and coronary heart disease.

On the basis of recent research, breast cancer and cerebrovascular disease should be added to the list of diseases for which second-hand smoke is a suspected cause.
It is concluded that:

- **Exposure to second-hand smoke causes the following diseases and conditions:**
  - *In adults*
    - Heart disease
    - Lung cancer
    - Nasal sinus cancer
  - *In children*
    - Sudden infant death syndrome
    - Foetal growth impairment including low birth-weight and small for gestational age
    - Bronchitis, pneumonia and other lower respiratory tract infections
    - Asthma exacerbation
    - Middle ear disease
    - Respiratory symptoms
- **Exposure to second-hand smoke has also been linked to other adverse health effects. The relationships may be causal. These include:**

- *In adults*
  - Stroke
  - Breast cancer
  - Cervical cancer
  - Miscarriages
- *In children*
  - Adverse impact on cognition and behaviour
  - Decreased lung function
  - Asthma induction
  - Exacerbation of cystic fibrosis.

- **Exposure to second-hand smoke causes between 1100 and 7800 deaths per year in Canada.**

Recommendations of scientific review reports

Recommendations in the reports of major scientific reviews have been expressed in many different ways. However, the message from all of them is clear, consistent and unanimous:

- **All involuntary exposure to tobacco smoke is harmful and should be eliminated.**

No solution through ventilation

The American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE), the world's leading ventilation standard-setting organization, no longer provides standards for air with tobacco smoke in it, only for smoke-free air. Searches for ventilation solutions have proven fruitless. A panel of 14 experts in ventilation technology recently concluded that existing dilution ventilation technology could not effectively remove much tobacco smoke from indoor air. However, they speculated that under ideal conditions, displacement ventilation might be able to remove up to 90% of tobacco smoke from air.

A noted expert on second-hand smoke risk assessment, James Repace, analyzed these findings using risk assessment procedures and concluded that dilution ventilation would have to improve by a factor of 20,000 and displacement ventilation by a factor of 2000 in order to meet the level of public health protection normally expected against environmental contaminants.

Accommodation of tobacco smoke in the workplace, the solution proposed by the tobacco industry, was found to have no basis in science or public health protection. Its advocacy by members of the hospitality industry is similarly lacking in public health motivation. The tobacco industry has made payments to the hospitality industry to implement its Courtesy of Choice campaign.

Given all knowledge accumulated to date in the health, risk assessment and ventilation sciences, it is most unlikely that tobacco smoke in indoor environments could ever be reduced to safe levels through the application of ventilation technology.

- **Ventilation provides no solution to the problem of exposure to second-hand tobacco smoke.**

Effective workplace protection can be implemented

In North America, California and British Columbia offer good protection from exposure to second-hand smoke. California provides protection to 100% of its workers, while British Columbia protects 85% of its workers.

Bans on smoking in bars and restaurants have been operating for several years in many cities in British Columbia and in Waterloo, Ontario. Since August 2001, Ottawa has had an effective ban on smoking in all municipally regulated indoor workplaces and public places, including bars and restaurants. All these municipal bans are working well. They provide good public health protection from second-hand smoke, and have had no lasting adverse effect on the overall bar and restaurant business.

Legislative basis for effective protection from tobacco smoke in Canada

Canada - federal jurisdiction: The *Non-Smokers' Health Act* limits smoking to separate smoking rooms for the 8% of workers under federal jurisdiction. The law is widely respected, but guarantees less than complete protection from second-hand smoke. Strict application of health and safety legislations would require elimination of tobacco smoke from all federally regulated workplaces.

Newfoundland: New regulations of the *Smoke-Free Environments Act* would ban smoking in restaurants when children under could be present. However, strict application of health and safety legislation would require smoking to be banned in all workplaces all the time.

Nova Scotia: Smoking is banned by administrative rules in provincial government workplaces. The Cape Breton Regional Municipality recently passed a by-law that would convert bars, ice rinks, malls, restaurants, hotels, bowling lanes, bingo halls and casinos into smoke-free spaces within three years. There is strong public support for action to control second-hand smoke across the province. Three out of four Nova Scotians would support province-wide legislation similar to the Cape Breton by-law.

New Brunswick: Strict application of New Brunswick health and safety legislation would require smoking to be banned in all workplaces.

Prince Edward Island: Strict application of Prince Edward Island health and safety legislation would require smoking to be banned in all workplaces.

Quebec: Quebec's *Tobacco Act* ostensibly controls smoking in many places. However, there are many exceptions, meaning that the law if far from complete in protecting people from exposure to second-hand smoke. However, strict application of Quebec health and

safety legislation would require smoking to be banned in all workplaces.

Ontario: Rigorous application of the Ontario Tobacco Control Act would require the elimination of tobacco smoke in all Ontario bars, and possibly all restaurants as well.

Regulations under the Occupational Health and Safety Act ban any workplace exposure to seventeen chemicals known to be in tobacco smoke. Current data exist documenting the presence of seven of these chemicals in the sidestream smoke emitted by all major brands of Canadian cigarettes. Ontario law therefore, in effect, bans smoking in all workplaces under provincial health and safety jurisdiction. Failure to enforce the law would leave the door open to a great many workers exercising their right to refuse work on the grounds that they are being exposed to a known danger – second-hand tobacco smoke – from which they should expect to be protected by toxic substance regulations.

The Ontario Health Protection and Promotion Act affords the Medical Officers of Health broad discretionary power to protect community health. If, for example, a Medical Officer of Health was of the opinion, on reasonable and probable grounds, that there was no safe level of exposure to tobacco smoke in any workplace, the Act grants the Medical Officers of Health discretionary power to order the elimination of tobacco smoke from all workplaces in their health unit.

Full compliance with the Ontario Occupational Health and Safety Act and its regulations would require eliminating all tobacco smoke from Ontario workplaces. Medical Officers of Health could issue orders to this effect.

Manitoba: Full compliance with the Manitoba Workplace Health Hazard Regulation would require eliminating all tobacco smoke from Manitoba workplaces.

Saskatchewan: Unlike the other provinces, Saskatchewan's health and safety legislation does not have lists of potentially dangerous chemical and their threshold limit values.

The effect of the two Saskatchewan laws that deal with tobacco smoke in the workplace, the *Saskatchewan Occupational Health and Safety Act* and the *Saskatchewan Tobacco Control Act* is to restrict smoking to enclosed smoking rooms, or in certain circumstances to permit smoking in smoking areas that are not enclosed.

Alberta: Full compliance with Alberta health and safety legislation would require eliminating all tobacco smoke from Alberta workplaces.

British Columbia: Smoking is banned in 85% of workplaces in British Columbia. The ban is a widely respected and an effective public health protection measure. While the Workers' Compensation Board had proposed that the ban be extended to bars and restaurants, new regulations of the Ministry of Labour allow some exposure to second-hand smoke in bars and restaurants.

Canada – all jurisdictions:

The federal government and the provinces of Newfoundland, Quebec, Ontario, Saskatchewan and British Columbia have adopted laws that in whole or in part seek to restrict exposure to second-hand smoke in the workplace.

In addition occupational health and safety legislation in federal legislation and all provinces except Saskatchewan indicate that there should be no exposure at all in workplaces to two or more chemicals present in tobacco smoke.

The effect of the health and safety legislation in federal jurisdiction and nine provinces (Saskatchewan is the exception) would require tobacco smoke to be eliminated from the workplace, were the legislation strictly applied. This is because all these jurisdictions list as dangerous regulated chemicals a number of chemicals with no safe level of exposure that are nonetheless present in tobacco smoke. The number of chemicals present in tobacco smoke to which no exposure is permitted varies according to province from 2 (federal government, Newfoundland, Nova Scotia, New Brunswick, Quebec, Manitoba, Alberta) to 17 in Ontario.

- **It is therefore concluded that strict application of federal and provincial health and safety legislation would result in tobacco smoke being eliminated from nearly all workplaces in Canada.**

Health effects of involuntary exposure to tobacco smoke

Review of reviews:

Findings and conclusions of six major recent reviews of the health effects of exposure to second-hand smoke

Since 1992, six major scientific reviews of the health effects of second-hand tobacco smoke have been published. These include reports of the United States Environmental Protection Agency published in 1992;[1] the Australian National Health and Medical Research Council in 1997; [2] the California Environmental Protection Agency published in 1997,[3] the United Kingdom Scientific Committee on Tobacco and Health in 1998;[4] the World Health Organization in 1999,[5] and the United States National Toxicology Program in 2000.[6]

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[1] United States Environmental Protection Agency. Respiratory Health Effects of Passive Smoking: Lung Cancer and Other Disorders. Office of Research and Development, EPA/600/6-90/006F, Washington, USA, December 1992

(http://www.epa.gov/ncea/smoking.htm)

also published as: National Institutes of Health. National Cancer Institute. Respiratory Health Effects of Passive Smoking: Lung Cancer and Other Disorders: The Report of the U.S. Environmental Protection Agency. Smoking and Tobacco Control Monograph Number 4. NIH Publication No. 93-3605, Washington, USA, August, 1993.

[2] National Health and Medical Research Council. The health effects of passive smoking. Australia, November, 1997.

(http://www.health.gov.au/nhmrc/publicat/synopses/ph23syn.htm)

[3] California Environmental Protection Agency. Health Effects of Exposure to Environmental Tobacco Smoke. Office of Environmental Health Hazard Assessment, September, 1997

(http://www.oehha.org/air/environmental_tobacco/index.html)

also published as: National Institutes of Health. National Cancer Institute. Health Effects of Exposure to Environmental Tobacco Smoke: The Report of the California Environmental Protection Agency. Smoking and Tobacco Control Monograph Number 10. NIH Publication No. 99-4645, Washington, USA, August,1999.

(http://rex.nci.nih.gov/NCI_MONOGRAPHS/MONO10/MONO10.HTM)

[4] Department of Health. Report of the Scientific Committee on Tobacco and Health. The Stationery Office. London, United Kingdom, March, 1998.

(http://www.official-documents.co.uk/document/doh/tobacco/contents.htm)

[5] World Health Organization. Tobacco Free Initiative. International Consultation on Environmental Tobacco Smoke (ETS) and Child Health: Consultation Report. WHO Technical Document Number WHO/TFI/99.10. 1999. (http://www.who.int/en/health/int-consult.html)

The United States Occupational Safety and Health Administration has also reviewed health evidence related to tobacco smoke as part of a larger review and rule-making procedure related to indoor air quality.[7] Recently the US National Academy of Sciences has published a report on asthma and indoor air exposures that discusses, among many other subjects, questions related to second-hand smoke and ventilation of indoor air.[8] These latter two reports, while of some relevance to the subject at hand, have not been included in this review of reviews. Insofar as they have examined the same subject matter as the other six reviews, their scientific conclusions are in substantial agreement with the six reports that will be considered more completely here.

The six reviews were all scrupulous in their scientific rigour. They were either carried out by panels of independent and respected scientists, or prepared by government agencies and reviewed by scientific expert panels. Three reviews were conducted in the United States, one in Australia, one in the United Kingdom and one by an international scientific panel. All of the reviews were conducted independently.

In reviewing the findings of all six reports, one is struck by the high degree of consensus that has emerged on the health hazards of second-hand smoke. Not all reports reviewed all of the possible health effects of second-hand smoke. However, where evidence was reviewed on the same disease outcomes, the reports came to very nearly the same conclusions, with remarkably little variation.

1992: Respiratory Health Effect of Passive Smoking: Lung Cancer and Other Disorders

This review, carried out by the United States Environmental Protection Agency (US EPA) and published in 1992, was restricted to respiratory disorders.

Based on the total weight of available scientific evidence available up to the time of the review (1992), the US EPA reached the following major conclusions concerning exposure to environmental tobacco smoke:

In adults

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[6] U.S. Department of Health and Human Services. Public Health Service. National Toxicology Program. 9th Report on Carcinogens. Washington, USA, 2000.

(http://ehis.niehs.nih.gov/roc/ninth/known/ets.pdf)

[7] United States Department of Labour. Occupational Safety and Health Administration. Notice of proposed rulemaking; notice of informal public hearing. Federal Register, Indoor Air Quality – 59:15968-16039, 1994.

http://www.osha-slc.gov/FedReg_osha_data/FED19940405.html.

[8] National Academy of Sciences. *Clearing the Air: Asthma and Indoor Air Exposures,* Washington, 2000. http://books.nap.edu/books/0309064961/html/index.html.

- Environmental tobacco smoke is a human lung carcinogen, responsible for approximately 3,000 lung cancer deaths annually in U.S. non-smokers.
- Environmental tobacco smoke has subtle but significant effects on the respiratory health of non-smokers, including reduced lung function, increased coughing, phlegm production, and chest discomfort.

In children

- Environmental tobacco smoke exposure is causally associated with an increased risk of lower respiratory tract infections such as bronchitis and pneumonia. This report estimates that 150,000 to 300,000 cases annually in infants and young children up to 18 months of age are attributed to ETS.

- Environmental tobacco smoke exposure is causally associated with an increased prevalence of fluid in the middle ear, symptoms of upper respiratory tract irritation, and a small but significant reduction in lung function.

- Environmental tobacco smoke exposure is causally associated with additional episodes and increased severity of symptoms in children with asthma, and this report estimates that 200,000 to 1,000,000 asthmatic children have their condition worsened by exposure to ETS.

- Environmental tobacco smoke is a risk factor for new cases of asthma in children who have not previously displayed symptoms.

The US EPA report reviewed the evidence on the relationship between lung cancer and exposure to second-hand smoke in great detail and reached the following additional conclusion:

> Based on the assessment of all the evidence considered in Chapters 3, 4 and 5 of this report and in accordance with the EPA Guidelines and causality criteria above for the interpretation of human data, this report concludes that ETS is a Group A human carcinogen, the EPA classification 'used only when there is sufficient evidence from epidemiological studies to support a causal association between exposure to the agents and cancer.'

1997: Health Effects of Passive Smoking

This 1997 Australian report provided estimates of the public health impact of second-hand smoke in the home:

> The scientific evidence shows that passive smoking causes lower respiratory illness in children and lung cancer in adults and contributes to the symptoms of asthma in children. Passive smoking may also cause coronary heart disease in adults. It is estimated that passive smoking contributes to the symptoms of asthma in 46,500 Australian children each year and causes lower respiratory illness in 16,300 Australian children.

1997: Health Effects of Exposure to Environmental Tobacco Smoke

Of the six major reviews examined here this review by the California Environmental Protection Agency was the most comprehensive, covering numerous health outcomes of exposure to second-hand smoke, and the most thorough. The report was five years in the making and is over 400 pages in length. In the preface to the NCI republication of the report (1999), Dr. David Satcher, United States Surgeon-General and Assistant Secretary for Health stated:

> The California Environmental Protection Agency spent 5 years preparing this document, and it solicited input from all interested parties – including the tobacco industry and its consultants. Cal/EPA held several public workshops to solicit input and made drafts available for public comment and criticisms. The final draft was peer reviewed by California's Scientific Review Panel, a body created under California law to provide independent peer review of many scientific aspects of the state's toxic air contaminants and air pollution programs.

The report reached the following conclusions:

- **Effects causally associated with ETS exposure**
  - *Developmental effects*
    - Foetal growth: low birth-weight or small for gestational age
    - Sudden infant death syndrome (SIDS)
  - *Respiratory effects*
    - Acute lower respiratory tract infections in children (e.g. bronchitis and pneumonia)
    - Asthma induction and exacerbation in children
    - Chronic respiratory symptoms in children
    - Eye and nasal irritation in adults
    - Middle ear infections in children
  - *Carcinogenic effects*
    - Lung cancer
    - Nasal sinus cancer
    - Cardiovascular effects
    - Heart disease mortality
    - Acute and chronic coronary heart disease morbidity

- **Effects with suggestive evidence of a causal association with ETS exposure**
  - *Developmental effects*
    - Spontaneous abortion
    - Adverse impact on cognition and behaviour
  - *Respiratory effects*
    - Exacerbation of cystic fibrosis
    - Decreased pulmonary function
  - *Carcinogenic effects*

- Cervical cancer

The report went on to estimate annual morbidity and mortality in non-smokers associated with exposure to second-hand smoke in California. The estimates are given in Table 1.

Canada and California have about the same population. Assuming that exposure to second-hand smoke is similar in the two jurisdictions and that it was also similar in the past, the estimates given in Table 1 may well apply about as well to Canada as they do to California.

Table 1:
Estimated annual morbidity and mortality in California non-smokers associated with ETS exposure

Condition	Number of deaths or cases: California
Developmental effects	
Low birth-weight	1,200 - 2,200 cases
Sudden Infant Death Syndrome	120 deaths
Respiratory effects in children	
Middle ear disease	78,600 to 188,700 physician office visits
Asthma induction	960 - 3,120 new cases
Asthma exacerbation	48,000 - 120,000 children
Bronchitis or pneumonia	18,000 - 36,000 cases
Cancer	
Lung	360 deaths
Nasal sinus	Not available
Cardiovascular effects	
Ischaemic heart disease	4,200 - 7,440 deaths

1998: United Kingdom Scientific Committee on Tobacco and Health

This report reviewed the health effects of active smoking and exposure to second-hand smoke. Here are the conclusions reached on the health effects of second-hand smoke:

- Exposure to environmental tobacco smoke is a cause of lung cancer and, in those with long-term exposure, the increased risk is in the order of 20-30%.

- Exposure to environmental tobacco smoke is a cause of ischaemic heart disease and, if current published estimates of magnitude of relative risk are validated, such exposure represents a substantial public health hazard.
- Smoking in the presence of infants and children is a cause of serious respiratory illness and asthmatic attacks.
- Sudden infant death syndrome, the main cause of post-neonatal death in the first year of life, is associated with exposure to environmental tobacco smoke. The association is judged to be one of cause and effect.
- Middle ear disease in children is linked with parental smoking and this association is likely to be causal.

1999: International Consultation on Environmental Tobacco Smoke (ETS) and Child Health

This report was prepared by an international committee that met in Geneva in 1999 under the auspices of the World Health Organization. The committee reached the following conclusions with respect to the health effects of second-hand smoke on children.

> The Consultation concluded that ETS is a real and substantial threat to child health, causing death and suffering throughout the world. ETS exposure causes a wide variety of adverse health effects in children, including lower respiratory tract infections such as pneumonia and bronchitis, coughing and wheezing, worsening of asthma, and middle ear disease. Children's exposure to environmental tobacco smoke may also contribute to cardiovascular disease in adulthood and to neurobehavioural impairment.
>
> In addition, the Consultation noted that ETS exposure among non-smoking pregnant women can cause a decrease in birth weight and that infant exposure to ETS may contribute to the risk of SIDS.

2000: Ninth Report on Carcinogens of the National Toxicology Program

In 2000 the United States National Toxicology Program added environmental tobacco smoke to its official list of known human carcinogens. The report concluded:

> Environmental tobacco smoke (ETS) is known to be a human carcinogen based on sufficient evidence of carcinogenicity from studies in humans that indicate a causal relationship between passive exposure to tobacco smoke and human lung cancer (reviewed by IARC V. 38 1986; US EPA 1992, CEPA 1997). Studies also support an association of ETS with cancers of the nasal sinus (CEPA 1997).

It has classified environmental tobacco smoke as one of 41 known human carcinogens. Many of the 41 known human carcinogens are components of tobacco smoke. These include:

- 4-aminobiphenyl
- Arsenic
- Benzene
- 1,3-butadiene
- Cadmium
- Chromium VI
- 2-naphthylamine
- Vinyl chloride

Other known human carcinogens on the list include asbestos, coke oven emissions, radon and mustard gas.

Table 2:
Summary of Conclusions
of six major reviews concerning exposure to second-hand smoke as a cause or possible cause of various diseases and conditions

Disease or condition	1992: US EPA	1997: Australian NHMRC	1997: Cal EPA	1998: UK SCOTH	1999: WHO	2000: US National Toxicology Program
Developmental effects						
Foetal growth: low birth-weight or small for gestational age		✔?	✔		✔	
Sudden infant death syndrome (SIDS)		✔	✔	✔	✱	
Spontaneous abortion			✱			
Adverse impact on cognition and behaviour			✱		✱	
Respiratory effects						
Acute lower respiratory tract infections in children (e.g. bronchitis and pneumonia)	✔	✔	✔	✔	✔	
Asthma exacerbation in children	✔	✔	✔	✔	✔	
Asthma induction in children	✱	✔?	✔		✱?	
Respiratory symptoms	✔	✔	✔	✔	✔	
Middle ear disease in children	✔	✔	✔	✔	✔	
Decreased pulmonary function	✔	✔	✱		✱	
Exacerbation of cystic fibrosis			✱			
Carcinogenic Effects						
Lung cancer	✔	✔	✔	✔		✔
Nasal sinus cancer		✱	✔			✔?
Cervical cancer			✱			
Cardiovascular effects						
Coronary heart disease		✱	✔	✔		

A check mark (✔) indicates that the review concluded the relationship to the disease or condition was causal.
An asterisk (✱) indicates that the review concluded the relationship was possibly causal.
In both cases protective public health action is warranted.
A blank cell indicates that the relationship was reviewed only briefly or not at all.
A question mark (?) indicates some inconsistency or ambiguity in the report's conclusions as to whether the relationship is causal or not

Summary of Report Conclusions

The findings of all six reviews are summarized in Table 2. From Table 2 it is clear that there is a remarkable scientific consensus that exposure to second-hand smoke is a known or suspected cause of a wide variety of diseases and conditions. At least three of the reviews have concluded that exposure to second-hand smoke is a known or suspected cause of the following ten diseases or conditions:

Disease or Condition
Developmental effects
Foetal growth: low birth-weight or small for gestational age
Sudden Infant Death Syndrome
Respiratory effects in children
Acute lower respiratory tract infections in children (e.g. bronchitis and pneumonia)
Asthma exacerbation
Respiratory symptoms
Middle ear disease in children
Decreased pulmonary function
Carcinogenic Effects
Lung Cancer
Nasal sinus cancer
Cardiovascular effects
Coronary heart disease

One or two of the reviews have identified exposure to second-hand smoke as a known or suspected cause of the following additional five diseases or conditions:

Disease or Condition
Developmental effects
Spontaneous abortion
Adverse impact on cognition and behaviour
Respiratory effects in children
Asthma induction in children
Exacerbation of cystic fibrosis

Carcinogenic Effects
Cervical cancer

Recent research findings:

Since these major reviews have been published, research has continued. New studies have been published that reinforce the results of these reviews. No new studies have provided any reason to call into question the findings of any of the six reviews summarized in Table 2.

However, there has been significant new research pointing to previously unrecognized effects of exposure to second-hand smoke. These include risks for cerebrovascular disease and breast cancer.

Exposure to second-hand smoke and cerebrovascular disease (stroke)

The two major types of cerebrovascular disease (stroke) are infarctions and haemorrhage. In a cerebrovascular infarction, blood vessels in the brain are blocked by a thrombus or an embolism. A cerebrovascular haemorrhage involves a burst blood vessel in the brain. The pathophysiological mechanisms that underlie the development of both heart disease and cerebrovascular disease have many points in common. Atherosclerosis, platelet aggregation, the formation of thrombi and thromboses are among the pathophysiological effects that can lead to both heart disease and strokes.[9] The relationship between exposure to second-hand smoke and heart disease is now well established. Given the similarity in pathophysiology, it should not be surprising that evidence would emerge to demonstrate that like cardiovascular diseases, cerebrovascular diseases are also related to exposure to second-hand smoke.

[9] For further information on these subjects, see:

United States Department of Health and Human Services. *The Health Consequences of Smoking: Cardiovascular Disease: a Report of the Surgeon-General*: 1983. Washington, D.C., 1983 (DHHS Publication no. (PHS) 84-50204).

United States Department of Health and Human Services. *Reducing the Health Consequences of Smoking: 25 Years of Progress. A Report of the Surgeon-General*. U.S. Department of Health and human Services, Public Health Service, Centres for Disease Control, Centre for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health. DHHS Publication No. (CDC) 8908411, 1989.

Glantz SA, Parmley WW. Passive smoking and heart disease: epidemiology, physiology, and biochemistry. *Circulation* 1991; 83: 1-12.

Law MR, Morris JK, Wald NJ. Environmental tobacco smoke exposure and ischaemic heart disease: an evaluation of the evidence. *British Medical Journal* 1997; 315: 973-988.

You *et al.*[10] conducted a case-control study of stroke risk and exposure to second-hand smoke in the United States. They found that the risk of stroke was twice as high for subjects whose spouses smoked as for those whose spouses did not smoke (CI=1.3 to 3.1), after adjustment for subject's own smoking, heart disease, hypertension, diabetes and education level.

Bonita *et al.*[11] also conducted a case-control study of exposure to second-hand smoke and stroke in New Zealand. They found that there was a significant increase in risk in both men (OR = 2.10; 95% CI = 1.33 to 3.32) and women (OR = 1.66; 95% CI = 1.07 to 2.57). The study also confirmed the higher risk of stroke for active smoking, and found that the stroke risk from active smoking was higher when those exposed to second-hand smoke were excluded from the reference group. This led them to conclude that studies investigating the adverse health effects of active smoking will underestimate the active smoking risk if exposure to ETS is not taken into account.

Exposure to second-hand smoke and breast cancer

Johnson *et al.*[12] made a similar observation in their investigation of exposure to second-hand smoke and breast cancer. They noted that 19 published studies that have compared ever smokers to never smokers have found little or no increased risk of breast cancer due to smoking. However, a number of recently published studies, including their own, that have used a comparison group of women who have not smoked or had regular exposure to second-hand smoke have permitted better comparisons of exposed to unexposed populations. Such studies have found both active smoking and exposure to second-hand smoke to be related to breast cancer.[13] In the large Canadian study, among pre-menopausal

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[10] You RX, Thrift AG, McNeill JJ *et al.* Ischaemic stroke risk and passive exposure to spouses' cigarette smoking. *American Journal of Public Health* 1999; 89: 572-575.

[11] Bonita R *et al.* Passive smoking as well as active smoking increases the risk of acute stroke. *Tobacco Control* 1999; 8: 156-160.

[12] Johnson KC, Hu J, Mao Y and the Canadian Cancer Registries Epidemiology Research Group. Passive and active smoking and breast cancer risk in Canada, 1994-1997. *Cancer Causes and Control* 2000; 11: 211-221.

[13] The other published studies of breast cancer and passive smoking which include adult passive smoking exposure include:

Hirayama T. Cancer de mama. Avances en diagnostico y traitamiento. In Diaz-Faco J. (ed) *Epidemiologia y Factores de riesgo del Cancer de Mama.* Leon, Spain: Santiago Garcia, 1990, pp. 21-38.

Sandler DP, Wilcox AJ, Everson RB. Passive smoking in adulthood and cancer risk. *American Journal of Epidemiology* 1985; 121: 37-48.

Smith SJ, Deacon JM. Chilvers CE. Alcohol, smoking, passive smoking and caffeine in relation to breast cancer risk in young women. UK National Case-Control Study Group. *British Journal of Cancer* 1994; 70: 112-119.

women, both active smoking and exposure to second-hand smoke about doubled the risk of breast cancer, while among postmenopausal women risk increased by 20% for exposure to second-hand smoke and by 50% for active smoking. Dose-response relationships were also observed for both active smoking and exposure to second-hand smoke. When the nine published studies that have attempted to control properly for second-hand smoke exposure are considered together, the combined results suggest almost a doubling of breast cancer risk with long term active smoking or regular exposure to second-hand smoke, particularly among premenopausal women.[14]

Morabia A, Berstein M, Heritier S, Khatchatrian N. Relation of breast cancer with passive and active exposure to tobacco smoke. *American Journal of Epidemiology* 1996; 149: 5-12.

Lash TL and Aschengrau A. Active and passive cigarette smoking and the occurrence of breast cancer. Am J Epidemiol 1999; 149:5-12.

Jee SH, Ohr H, Kim IS. Effects of husbands' smoking on the incidence of lung cancer in Korean women. International Journal of Epidemiology 1999; 28: 824-828.

Wartenberg D, Calle EE, Thun MJ, Health Jr. CW, Lally C, Woodruff T. Passive smoking exposure and female breast cancer mortality. Journal of the National Cancer Institute 2000; 92(20): 1666-1673.

Zhao Y, Shi Z, Liu L. [Matched case-control study for detecting risk factors of breast cancer in women living in Chengdu]. *Chung Hua Hsing Ping Hsueh Tsa Chih* 1999; 20: 91-94.

[14] In addition to the reports cited above, the following publications provide supporting, adjunct or mechanism information that has also been considered in arriving at the conclusion that there is mounting evidence suggesting that both active and passive smoking may increase the risk of breast cancer:

Hirayama T. Lung cancer and other diseases related to passive smoking: a large-scale cohort study: In Gupta PC, Hamner, III JE, Murti PR, eds. *Control of Tobacco-related Cancers and Other Diseases.* International Symposium, 1990. Bombay: Oxford University Press; 1992: 129-137.

Hirayama T. Life style and mortality: a large-scale census-based cohort study from Japan. Volume 6, *Contributions to Epidemiology and Biostatistics.* Basel: Karger; 1990.

Millikan RC et al. Cigarette smoking, N-acetyltransferases 1 and 2, and breast cancer risk. *Cancer Epidemiology, Biomarkers & Prevention* 1998: 7:371-8.

Delfino RJ et al. Breast cancer, passive and active cigarette smoking and N-acetyltransferase 2 genotype. *Pharmacogenetics* 2000: 10:461-9.

Lee SH, Ohr H, Kim IS. Effects of husbands' smoking on the incidence of lung cancer in Korean women. *International Journal of Epidemiology* 1999; 28: 824-828.

Rookus MA, Verloop J., de Vries F, van der Kooy K, van Leeuwen FE. Passive smoking and the risk of breast cancer [abstract]. *American Journal of Epidemiology* 2000; 151 (Supplement): S28.

These studies point to exposure to second-hand smoke as a possible cause of cerebrovascular disease and breast cancer. Importantly, they have also highlighted a problem inherent in most epidemiological studies of active smoking. Most have failed to account for exposure to second-hand smoke in the control group. Relationships of active smoking to disease outcomes are generally underestimated if the control group is defined as non-smokers or never smokers. Risks from either active smoking or exposure to second-hand smoke are better estimated if the control group is truly unexposed – as close as possible to the ideal of a group that never had exposure to tobacco smoke from active smoking or exposure to second-hand smoke.[15]

Canadian estimates of mortality due to exposure to second-hand smoke

Many people are exposed to tobacco smoke at work. The 1994-5 Survey on Smoking in Canada estimated that 60% of employed Canadians, about seven million people, worked in workplaces that had no restrictions or partial restrictions on smoking in the workplace.

In Canada, lung cancer due to exposure to second-hand smoke is estimated to have caused 336 deaths in 1994 and 347 deaths in 1996.[16] In 1992, heart disease due to exposure to second-hand smoke was estimated to have caused 2,051 deaths per year between 1985 and 1990 (438 +/- 242 annual deaths among men and 1, 613 +/- 687 annual deaths among women).[17] In 2000, second-hand smoke is estimated to have caused 800 deaths a year due to residential exposure only.[18] The same study estimated that about two million

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Woo C, Davis D, Gravitt P, et al. A prospective study of passive cigarette smoking exposure and breast cancer [abstract]. *American Journal of Epidemiology* 2000; 151 (Supplement): S72.

Wartenberg D, Calle EE, Thun MJ, Health Jr. CW, Lally C, Woodruff T. Passive smoking exposure and female breast cancer mortality. *Journal of the National Cancer Institute* 2000; 92: 1666-1673.

Calle EE, Miracle-McMahill HL, Thun MJ, Health, Jr. CW. Cigarette smoking and risk of fatal breast cancer. *American Journal of Epidemiology* 1994;139: 1001-1007.

[15] Repace J, Johnson KC. Turning over the wrong stone. Letter. *British Medical Journal* 2000; 321: 1221, November 11, 2000.

[16] Makomaski Illing EM, Kaiserman MJ. Mortality attributable to tobacco use in Canada and its regions, 1994 and 1996. *Chronic Disease in Canada* 1999; 20(3).

[17] Decou ML. Impact of passive smoking to coronary heart disease mortality. M.Sc. Thesis. Queen's University. Kingston, Ontario, Canada, 1992.

[18] de Groh M and Morrison HI. Environmental tobacco smoke and deaths from coronary heart disease in Canada. Health Canada. unpublished. 2000.

adult Canadians were regularly exposed to second-hand smoke at home. Results from the 1994-95 Survey on Smoking In Canada, cited above, suggest that up to seven million Canadians are exposed to tobacco smoke in the workplace to some degree. In round numbers, smoking is estimated to cause about 1100 to 2400 deaths per year among non-smokers from lung cancer (340 deaths per year) and heart disease (800 deaths per year due to residential exposure or 2050 +/- 930 deaths per year due to all exposure).

The only estimates available from Australia for lung cancer and heart disease deaths due to exposure to second-hand smoke are lower than estimates for Canada. However, the Australian estimates are for exposure to second-hand smoke at home only. No Australian estimates take into account exposure outside the home, nor effects of exposure to second-hand smoke on ex-smokers.

Meta-analyses have been performed on lung cancer and heart disease due to passive smoking at work. It has been concluded that workplace exposure to second-hand smoke results in relative risks of lung cancer[19] and heart disease[20] in the United States that are about the same as the relative risks already established for residential exposure.

California has about the same population as Canada, and estimates of mortality for both lung cancer and sudden infant death syndrome (SIDS) due to exposure to second-hand smoke are broadly similar in the two jurisdictions. However, estimates for heart disease deaths due to exposure to second-hand smoke in California (4,200 – 7,440 deaths) are higher than estimates for Canada. The California estimates are derived from US national estimates prepared by the United States Environmental Protection Agency and others. Both the US national and California estimates are more recent and based on a larger number of epidemiological studies than the older Canadian estimates. If the California estimates are applied to Canada, it suggests that 4,500 – 7,800 deaths per year are due to exposure to second-hand smoke in Canada, just as in California.

Summary of health effects of exposure to second-hand smoke

Six major scientific reviews carried out in the 1990s have identified 15 major disease groups or conditions as known or suspected to be caused by exposure to second-hand smoke (See Table 2). These include four developmental diseases or conditions, seven respiratory diseases or conditions, three cancers and coronary heart disease.

On the basis of recent research, breast cancer and cerebrovascular disease should be added to the list of diseases for which exposure to second-hand smoke is a suspected cause.
It is concluded that:

[19] Wells AJ. Lung cancer from passive smoking at work. *American Journal of Public Health* 1998; 88: 1025-1029.

[20] Wells AJ. Heart disease from passive smoking in the workplace. *Journal of the American College of Cardiology* 1998; 31: 1-9.

- **Exposure to second-hand smoke causes the following diseases and conditions:**
  - *In adults*
    - Heart disease
    - Lung cancer
    - Nasal sinus cancer
  - *In children*
    - Sudden infant death syndrome
    - Foetal growth impairment including low birth-weight and small for gestational age
    - Bronchitis, pneumonia and other lower respiratory tract infections
    - Asthma exacerbation
    - Middle ear disease
    - Respiratory symptoms

- **Exposure to second-hand smoke has also been linked to other adverse health effects. The relationships may be causal. These include:**
  - *In adults*
    - Stroke
    - Breast cancer
    - Cervical cancer
    - Miscarriages
  - *In children*
    - Adverse impact on cognition and behaviour
    - Decreased lung function
    - Asthma induction
    - Exacerbation of cystic fibrosis

- **It is estimated that exposure to second-hand smoke causes between 1100 and 7800 deaths per year in Canada.**

Recommendations of scientific reviews

Four of the six scientific review reports on the health effects of exposure to second-hand smoke in the 1990s also provided recommendations for action.

1993: Respiratory Health Effects of Passive Smoking: Lung Cancer and Other Disorders

In the preface to the 1993 NCI republication of the US EPA report, Dr Samuel Broder, Director of the US National Cancer Institute made the following policy recommendation:

> I strongly recommend the implementation of comprehensive policies that will protect innocent bystanders in all public places to the fullest extent possible. Such policies are medically justified and consistent with our responsibility to protect the public from a demonstrated health risk.

1998: United Kingdom Scientific Committee on Tobacco and Health

The United Kingdom Special Committee on Tobacco and Health made the following recommendations with respect to passive smoking:

> - Smoking in public places should be restricted on the grounds of public health. The level of restriction should vary according to the different categories of public place but smoking should not be allowed in public service buildings or on public transport, other than in designated and isolated areas. Wherever possible, smoking should not be allowed in the work place.
> - There is a need for public education about the risks of smoking in the home particularly in relation to respiratory diseases in children.
> - Health education programmes should focus on the dangers of ETS in foetal development and, post-natally, in the sudden infant death syndrome.

1999: Health Effects of Exposure to Environmental Tobacco Smoke

After reviewing this California Environmental Protection Agency report, Dr David Satcher, U.S. Surgeon-General and U.S. Assistant Secretary for Health made the following recommendation in the preface to the NCI republication of the report.

> I call on everyone committed to public health to join with me in a renewed effort to

complete the creation of a smoke-free society by:

- Encouraging communities to enact clean indoor air ordinances requiring 100 percent smoke-free environments in all public areas and workplaces, including all restaurants and bars.

- Encouraging smokers as well as non-smokers to make their homes smoke-free to protect children and families from ETS exposure.

1999: International Consultation on Environmental Tobacco Smoke (ETS) and Child Health

The international panel, meeting under the auspices of WHO, focussed their attention on the health effects of exposure to second-hand smoke on children. They concluded:

- Almost half of the world's children are involuntarily exposed to tobacco smoke.
- Exposure to environmental tobacco smoke causes increased risks of several illnesses in children and may increase the risk of death from sudden infant death syndrome (SIDS). Exposure of non-smoking women to environmental tobacco smoke during pregnancy also causes reductions in foetal growth.
- Children do not choose this exposure. Their right to grow up in an environment free from tobacco smoke must be safeguarded through actions by national and local governments, voluntary bodies, community leaders, health workers, educators and parents.
- Reducing children's exposure to tobacco smoke requires a two-pronged strategy: reducing smoking in spaces where children live, play, and learn, and reducing overall tobacco consumption.
- Effective public policy is important to protect this vulnerable group.
- To maximize impact, policies to protect children from tobacco smoke exposure should be implemented as part of comprehensive tobacco control programmes.
- Legislated restrictions on smoking in public places and the workplace will protect non-smokers in general and vulnerable groups such as children and pregnant women in particular.
- Young children's greatest exposure to tobacco smoke occurs at home. Increasing the percentage of tobacco-free homes is generally not amenable to legislation but can be achieved by a combination of mass media campaigns and smoking restrictions in public places and the workplace.
- Programmes to raise awareness and motivate behaviour change among pregnant women and their partners are needed to reduce the harmful effects of prenatal and postnatal exposure to tobacco smoke.

- Interventions through legislation and education need to be culturally specific.
- Surveys, using biomarkers where possible, will be necessary to plot changes in children's involuntary exposure and monitor the effectiveness of interventions.

Other recent developments

1999: Action Will Speak Louder Than Words: Getting Serious about Tobacco Control in Ontario

An Ontario Expert Panel on Tobacco, set up by the Minister of Health[21] recommended in 1999 that the Government of Ontario should:

- Require that indoor public places be 100% smoke-free, with immediate implementation in youth recreation facilities.
- Incrementally ban smoking in all indoor workplaces except where smoking areas are separately-enclosed and separately-ventilated to the exterior, beginning at once with offices and industrial worksites.
- Implement media-based public education programs on the dangers of second-hand smoke.

Recommendations made by the Ontario Expert Panel are very much in line with the scientific findings on second-hand and very much in keeping with the recommendations of other health authorities in other jurisdictions.

2000: Ninth Report on Carcinogens of the National Toxicology Program

In keeping with its usual practice, the National Toxicology Program does not make direct policy recommendations.

However, classifications of carcinogens by the US National Toxicology Program are taken very seriously by other agencies, like the American Conference of Governmental Industrial Hygienists (ACGIH) and the United States Environmental Protection Agency (US EPA). These and other agencies generally recognize that there is no safe level of exposure to known human carcinogens. The US National Toxicology Program has concluded that second-hand smoke is a known human carcinogen.

[21] Ashley MJ, Boadway T, Cameron R, d'Avernas J, Ferrence R, Pipe A, Schabas R, Thomsen P. Actions will speak louder than words: Getting serious about tobacco control in Ontario. A Report to the Minister of Health from her Expert Panel on the Renewal of the Ontario Tobacco Strategy. /Les actes sont plus éloquents que les mots: Un plan d'attaque au tabagisme en Ontario. Rapport présenté à la ministre de la Santé par son Comité d'experts sur la relance de la Stratégie antitabac de l'Ontario. Toronto, Canada: Expert Panel on the Renewal of the Ontario Tobacco Strategy; February 1999. ISBN 0-9686913-0-7 (http://www.camh.net/otru).

The ACGIH generally recommends no exposure to known human carcinogens. ACGIH recommendations are frequently incorporated into occupational health and safety regulations in many jurisdictions, including many Canadian provinces and Canadian federal jurisdiction.

The US EPA usually takes regulatory action to ensure that lifetime cancer risks are no higher than the range of one in ten thousand to one in a million. The risks of lung cancer from exposure to second-hand smoke are in the range of one in five hundred to one in a thousand, more than ten times greater than the cancer risks that would normally elicit regulatory control action by the US EPA.

Classification of environmental tobacco smoke as a known human carcinogen by the US National Toxicology Program should elicit concerted action in all countries to eliminate, in so far as possible, all involuntary exposure to tobacco smoke.

No solution through ventilation

Introduction

In 1981, the United States National Academy of Sciences assembled an expert panel to review a variety of indoor pollution and ventilation issues, including tobacco smoke in the workplace.[22] For its time, the report of their work, entitled *Indoor Pollutants,* was the most authoritative scientific statement on indoor air pollution extant. The report concluded that a ventilation system capable of completely removing tobacco smoke from the air did not exist.

The information on ventilation in the 1981 National Academy of Sciences report has been surpassed by many advances in ventilation science over the past two decades. Our knowledge of the health hazards of second-hand smoke, in its infancy in 1981, has also grown exponentially, as has our knowledge of the physics and chemistry of tobacco smoke in indoor air.

Twenty years ago, techniques of air cleaning and recycling were less sophisticated than they are today. Little knowledge of the behaviour of tobacco smoke in indoor air was available. Now, we have predictive models that can tell us with great reliability how much of several components of tobacco smoke will be present in indoor air under different conditions of smoking and ventilation. In 1981, the very first papers were being published pointing to a possible relationship between exposure to second-hand smoke and lung cancer. Now, scientific consensus has been established that exposure to second-hand smoke causes lung cancer and is a known or suspected cause of many other diseases or conditions (see Table 2).

With these advances in science on several fronts, the conclusion about ventilation and tobacco smoke nevertheless remains the same as it was twenty years ago – the ventilation system capable of removing tobacco smoke from the air does not exist.

The policy implications of this fact are more profound than they were twenty years ago. In 1981, there was still scientific debate about whether or not exposure to second-hand smoke was hazardous, and whether or not exposure should be reduced. Now, scientific consensus has been established – exposure to second-hand smoke causes lung cancer, heart disease and many other diseases. Moreover, scientists around the world agree – the only safe level of exposure to second-hand smoke is no exposure at all. If ventilation were to offer an effective public health solution to the problem of exposure to second-hand smoke in the workplace, it would have to ensure virtually no exposure to second-hand smoke.

[22] National Academy of Sciences. *Indoor Pollutants.* National Academy Press, Washington, D.C., 1981.

In the remainder of this section, documentation will be provided demonstrating that such a ventilation system does not exist. It will also be demonstrated that a preferred control method is to ban smoking in all public places and workplaces.

Ventilation standards

Heating, ventilation and air conditioning engineers around the world look to the American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE) for guidance and standard setting on determining ventilation rates for the buildings they design and manage. ASHRAE standards are frequently written into laws and regulations governing ventilation rates. Even when they are not written into law, they are widely followed by engineers and building managers as the preferred code of practice for ventilation rates. ASHRAE standards are the most widely observed code of ventilation practice in Canada.

The ASHRAE standard that governs indoor air quality is called *Ventilation for Acceptable Indoor Air Quality,* ASHRAE Standard 62-1999. This standard was revised in 1973, 1981, 1989 and 1999. The most recent revision is significant because it takes into account new knowledge on the health effects of second-hand tobacco smoke (See Table 2).

The revision removed a provision (present in the 1989 version of the standard) that recommended ventilation rates for the control of odours from second-hand tobacco smoke.[23] With the 1999 revision, ASHRAE, in essence, deferred to other authorities for standard setting on second-hand tobacco smoke, a known carcinogen. Now ventilation rates proposed by ASHRAE only apply to air free from tobacco smoke. For dealing with tobacco smoke, ASHRAE recommends the reduction of "the concentration of all known contaminants of concern to some specified acceptable level." To determine this level, one is referred to a list of health authorities that include the US Environmental Protection Agency, the World Health Organization, the American Medical Association, the American Lung Association, the National Institutes for Occupational Safety and Health, the National Academy of Sciences, the Occupational Safety and Health Administration and the Surgeon General. There is consensus among all these scientific agencies – there should be no exposure to second-hand tobacco smoke.

In revising its standard, ASHRAE adhered to a time-tested principle of sound public health and ventilation engineering practice. First, remove known sources of air pollution, and only then apply air cleaning and ventilation techniques. Revised standard 62-1999 adheres closely to this principle. ASHRAE no longer provides ventilation standards for air with tobacco smoke in it, only for air in smoke-free buildings.

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[23] American Society of Heating, Refrigeration and Air-Conditioning Engineers. *ASHRAE Publishes Updated IAQ Standard.* News release. September 17, 1999.

http://www.ashrae.com/about/upiaq.htm.

To sum up, ASHRAE, the premier ventilation rate standard-setting agency in the world has said, in essence, the only air for which it sets ventilation standards is air that is already smoke-free.

Searching for a ventilation solution

The revised ASHRAE standard was adopted only after considerable debate. Appeals were heard from many interests. Appellants included ventilation engineers, the tobacco industry and the Neighbourhood Pub Owners' Association of British Columbia. [24] All points of view were heard and considered before revisions to the standard were decided. Throughout the appeals procedure, the appeals panel indicated that ventilation standards could possibly be developed if cognizant health authorities were to define some safe non-zero level of exposure to second-hand smoke. That has not happened. In fact the appeals panel remarked, "The statements of cognizant health authorities have become more definitive and are unanimous with respect the health impacts of ETS." As described earlier, health authorities have been unanimous in recommending that we move as quickly as reasonably possible towards eliminating all exposure to second-hand tobacco smoke. No scientific basis has been found for recommending a non-zero limit for exposure to second-hand tobacco smoke.

Notwithstanding the scientific conclusion that all exposure to second-hand smoke should be avoided, the search for a ventilation solution continued. In 1998, US OSHA and ACGIH teamed up to sponsor a scientific review by a panel of fourteen ventilation experts to determine if there were technically and economically feasible engineering controls for environmental tobacco smoke in restaurants, bars and casinos. Their review was conducted in a scientific workshop held in Fort Mitchell, Kentucky in June 1998. The panel was instructed to conduct their work assuming that total elimination of second-hand tobacco smoke was not an option.[25]

Panellists concluded that well-mixed dilution ventilation, the overwhelming majority of current installations, was unsatisfactory for controlling worker exposure to ETS in hospitality venues. Local area exhaust ventilation, smokeless ashtrays, air cleaning, and displacement ventilation were identified as potentially more effective. Of these, displacement ventilation was thought to hold the most promise. Based on professional judgement, not measured data, panellists felt that a 90% reduction in levels of ambient tobacco smoke could be achieved under the most favourable conditions. Panellists noted, however, a number of practical problems. Most ventilation engineers are unfamiliar with

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[24] ASHRAE. *Appeals to Addendum e ANSI/ASHRAE Standard 62-1989,* Atlanta, Georgia, May 18, 1999. http://www.ash.org/june99/06-24-99-5.html.

[25] United States Department of Labour, Occupational Safety and Health Administration. *Proceedings of the Workshop on Ventilation Engineering Controls for Environmental Tobacco Smoke in the Hospitality Industry,* 1998.

displacement technology, there would be difficulty in retrofitting existing installations and there could be aesthetic problems.

Why ventilation solutions do not work

The United States Occupational Safety and Health Administration has proposed (but not yet implemented) a rule on smoking in the workplace that would reduce exposure to tobacco smoke to zero for many workers in many workplaces. Banning smoking in the workplace is the preferred option under the proposed rule. However, smoking could be allowed under certain circumstances that were intended to greatly reduce exposure to tobacco smoke for non-smoking workers:

Tobacco smoke.

(i) In workplaces where the smoking of tobacco products is not prohibited, the employer shall establish designated smoking areas and permit smoking only in such areas;

(ii) The employer shall assure that designated smoking areas are enclosed and exhausted directly to the outside, and are maintained under negative pressure (with respect to surrounding spaces) sufficient to contain tobacco smoke within the designated area;

(iii) The employer shall assure that cleaning and maintenance work in designated smoking areas is conducted only when no smoking is taking place;

(iv) The employer shall assure that employees are not required to enter designated smoking areas in the performance of normal work activities;

(v) The employer shall post signs clearly indicating areas that are designated smoking areas;

(vi) The employer shall post signs that will clearly inform anyone entering the workplace that smoking is restricted to designated areas; and

(vii) The employer shall prohibit smoking within designated smoking areas during any period that the exhaust ventilation system servicing that area is not properly operating.

This proposed rule has not been implemented in the United States.

In further considering the limitations of their proposed rule, OSHA recognized that smoking areas could not easily be constructed in bars, restaurants and casinos, prompting OSHA to co-sponsor with ACGIH the 1998 scientific workshop referred to above. However, the workshop did not produce any ready answers to the question of how smoking could continue to be allowed in bars, restaurants and casinos and still ensure the health and safety of workers and patrons.

At the request of the California Department of Health Services, James Repace conducted such a further analysis. The analysis was completed in June 2000 and has been published electronically by

the California Department of Health Services.[26] Repace provided a synopsis of the Fort Mitchell workshop proceedings and then noted a number of shortcomings:

> Despite the wealth of ETS data in the literature compiled in more than ½ dozen reports, plus the fact that indoor air quality models have been under development for more than forty years, the panel did not use either models or data to characterize existing ETS exposures in hospitality venues. The panel did not apply the indoor air quality procedure in ASHRAE 62, section 6.2, which provides a direct solution to the problem by restricting concentration of ETS to some specified acceptable level. No data were presented to substantiate the panellists' belief that 90% reductions in ETS concentrations were obtainable under either controlled studies or in the field, especially in the view of the caveats raised about placement of supply air ducts, turbulent flows, and blowing smoke down or towards the workers (as often happens in casinos). Moreover, in view of OSHA's estimates of more than 13,000 workers' deaths per year from ETS exposure, the panel's attitude that only a 90% reduction is sufficient for ETS control seems cavalier. The panel's confidence in displacement ventilation is not well founded. In addition, the panel's conclusion on ETS-RSP being poorly correlated to more specific measures is not supported. Individual variability in cotinine levels does not compromise assessment of ETS dose.

In his comment, Repace noted that the ASHRAE standard does recommend application of the Indoor Air Quality Procedure when human carcinogens (such as tobacco smoke) are present. Repace then applies this procedure to the problem of tobacco smoke in hospitality venues.

In the first step, hazard assessment, Repace reviewed much of the same scientific literature reviewed in the "Health effects of involuntary exposure to tobacco smoke" section of this report, and noted essentially the same conclusion – scientific and health authorities are unanimous – all involuntary exposure to tobacco smoke should be avoided.

He noted that 103 chemicals in tobacco smoke have been identified as hazardous by various scientific and regulatory authorities in the United States and identified respirable small particles (RSP), together with nicotine and its metabolite, cotinine as markers for tobacco smoke in ambient air.

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[26] Repace J. *Can Ventilation Control Second-hand Smoke in the Hospitality Industry?*, June 2000. http://www.dhs.ca.gov/tobacco/documents/FedOHSHAets.pdf.

The Fort Mitchell workshop noted that general dilution ventilation accounted for about 99% of current heating, ventilation and air-conditioning installations. In the parlance of outdoor air pollution control, general dilution ventilation would be called reasonably achievable control technology (RACT). RACT is characterized by the US Environmental Protection Agency for outdoor air pollution control purposes as the lowest limit that a particular source is capable of meeting by the application of control technology that is reasonably available considering technological and economic feasibility.

The Fort Mitchell workshop also concluded, based on the professional judgement of the participants, that a 90% reduction in tobacco smoke in indoor air could be achieved through application of displacement ventilation, coupled with the use of ventilated, downdraft ashtrays. Dilution ventilation requires the air to be well mixed, while displacement ventilation uses the opposite strategy. Supply air is released at floor level and is 5-10 degrees cooler than room air. Convection currents cause the air to rise, along with warm tobacco smoke. The tobacco-smoke-laden air is then exhausted through exhaust grilles near the ceiling on the opposite side of the room from the supply vents. While workshop participants noted a number of problems with displacement ventilation, it can nevertheless be considered the best available control technology (BACT). In outdoor air pollution control, BACT is the maximum degree of air pollution reduction obtainable with available systems.

Repace then provided quantitative risk assessments of exposure to second-hand smoke under both RACT and BACT. Under the BACT model, he assumed that a 90% reduction in environmental tobacco smoke could actually be achieved with displacement ventilation, despite the reservations that Fort Mitchell workshop participants noted about this technology.
Based on the extensive scientific literature on the subject, Repace used a combination of field measurement data and risk modelling techniques to provide estimates of tobacco smoke concentrations (as measured by RSP-ETS) in smoking lounges, bars, restaurants, casinos and bowling alleys.

In the United States, there are no national regulatory standards for tobacco smoke in the workplace. However there are many other standards for regulating contaminants in both indoor and outdoor air. These standards are based on a considerable body of literature that provides the philosophical and scientific basis for standard setting for indoor and outdoor air contamination control. Travis *et al.* discuss the concepts of *de minimis* and *de manifestis* risks. [27] In general *de minimis* risks are so low that regulatory agencies almost never take action to reduce the risks to a lower level. *De manifestis* risks are so high that regulatory action is almost always imperative. Travis *et al.* reviewed 132 past regulatory decisions and concluded that de *manifestis* risk in practice corresponded to a lifetime risk of mortality of 3 per ten thousand (3×10^{-4}) while *de minimis* risk was one in a million ($1 \times$

[27] Travis CC *et al.* Cancer risk management. *Environmental Science and Technology* 1987; 21: 415-420

10^{-6}). However, these proposals have not been adopted. In Canada, greater levels of protection have been indicated. The Canadian Environmental Assessment Agency has observed that conventional levels of acceptable risk (*de minimis* risk) range from a low of one in 10 million (1×10^{-7}) to a high of one in ten thousand (1×10^{-4}).[28]

The United States Occupational Safety and Health Administration has also defined a 45-year working lifetime risk level of 1 death per 1000 workers at risk as corresponding to a "significant risk of material impairment of health."

Using data from observations of respirable suspended particulate from tobacco smoke (RSP-ETS), known risk-exposure relationships and risk modelling techniques, Repace estimated excess lifetime mortality risk in smoking lounges, bars, restaurants, casinos and bowling alleys. He compared these to *de manifestis* and *de minimis* risks as described by Travis *et al.*, and to the significant risk level defined by OSHA.

Excess mortality for workers due to exposure to tobacco smoke in these locations ranges from 15 to 26 times higher than the one-in-a-thousand significant risk level defined by OSHA. It is 1.5 to 2.6 million times higher than the lowest (one-in-ten million) level of acceptable risk discussed by the Canadian Environmental Assessment Agency. Regular patrons of these hospitality industry establishments fare little better. Even if they were present only about 10% of the time of employees, their level of risk would also exceed the OSHA significant risk level.

Repace then discusses how well various ventilation alternatives protect workers in the hospitality industry. Using ordinary dilution ventilation (reasonably available control technology – RACT), workers are still exposed to risks 20,000 times the *de minimis* level.

Despite doubts about the achievability of 90% reduction in tobacco smoke with displacement ventilation (best available control technology – BACT), Repace nevertheless assumed that 90% reduction was achievable. Even with optimum performance of this best available technology, hospitality workers would still be exposed to risks two thousand times greater than the *de minimis* risk level. There is no known way to make dilution ventilation twenty thousand times more effective at providing protection from tobacco smoke, nor any known way of making displacement ventilation two thousand times more effective.

Repace concluded by noting that there is an obvious solution to the problem of tobacco smoke in hospitality venues, and more generally all workplaces. Banning smoking in the workplace would

[28] Canadian Environmental Assessment Agency. *Reference Guide: Determining Whether a Project is Likely to Cause Significant Adverse Environmental Effects.* 1999

. http://www.ceaa.gc.ca/publications_e/ra_guide/guide3_e.htm.

remove the risk entirely at no cost, while providing significant health benefits to workers and the public.

Banning smoking in bars and restaurants is good for business

Most Californians are protected from tobacco smoke in public places and workplaces. Protection is guaranteed by local ordinances (bylaws) in hundreds of California municipalities. In addition, the 1995 California Clean Air Act provides statewide protection from second-hand smoke. In 1998, a provision of this law came into effect, adding all California bars and bar-restaurants to the list of establishments where smoking was banned.

With backing from the tobacco industry, some bar and restaurant owners had claimed that such a ban on smoking would be bad for business. However, analysis of revenues of licensed establishments before and after the ban was implemented showed that there was a small but significant increase in bar revenues following implementation of the ban.[29] This is clearly shown in Figure 1.[30]

[29] Glantz S. Effect of smokefree bar law on bar revenues in California. *Tobacco Control* 2000; 9: 111-112.

[30] Repace J. Can ventilation control secondhand smoke in the hospitality industry? http://www.dhs.ca.gov/tobacco/documents/FedOHSHAets.pdf. Prepared for the California Department of Health Services, June 2000.

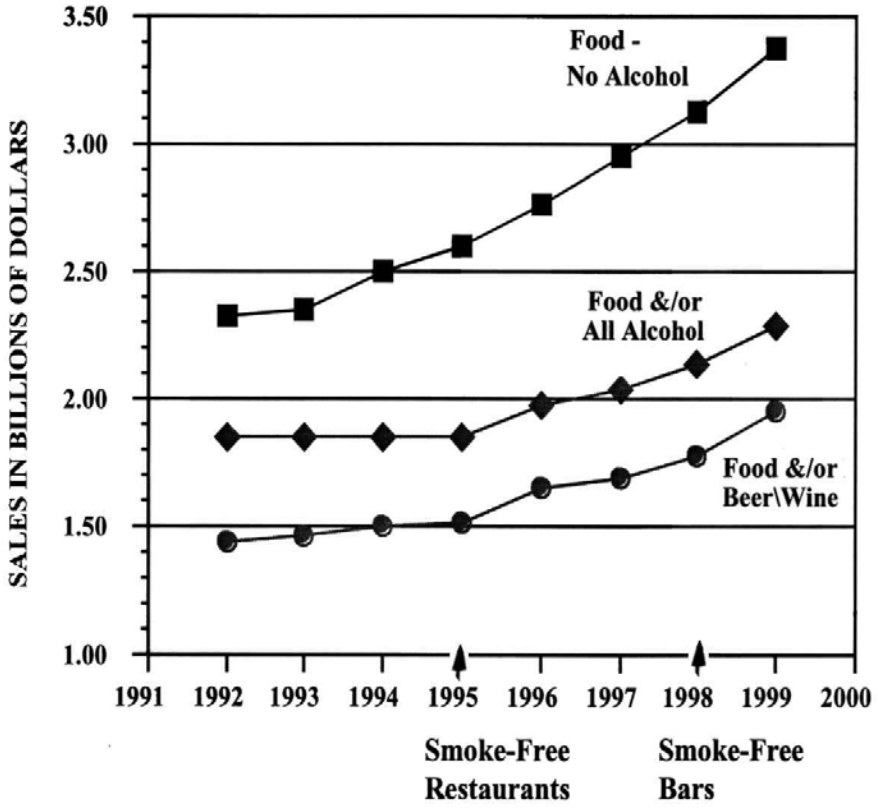

Figure 1: California restaurant and bar sales before and after smoke-free laws

First quarter taxable sales figures for restaurants and bars, State of California 1992 to 1999
Source: California Department of Health; California Board of Equalization

Smoke-free restaurants and bars in Canada

Restaurant and bar workers are among the occupational groups most exposed to second-hand smoke. Yet creating rules to protect them has proved to be contentious. They are the last group of workers to receive legal protection from second-hand smoke. However, the level of protection for them is growing across the country.

As of January 2002, bylaws to ban smoking in restaurants and bars or both were in place or coming into force at a later date in at least 51 Canadian municipalities. These included 30 municipalities in B.C., 5 in Alberta and 16 in Ontario.

Newfoundland has province-wide legislation that bans smoking in all restaurants that do not serve alcohol. Smoking is also banned between the hours of 8:30 A.M. and 9:00 P.M. in restaurants that serve alcohol. There are no restrictions on smoking in Newfoundland bars.

British Columbia has adopted revised regulations to further restrict, but not ban smoking in all bars and restaurants in British Columbia. The new regulations come into force in March 2002.

As there are far more non-smokers that avoid going to bars and restaurants because of the smoke than there are smokers who frequent such establishments, it stands to reason that a smoking ban would, on balance, be good for business. This reasoning has been borne out by a study in Massachusetts that found that 880,000 Massachusetts non-smokers avoided going to bars because of the smoke, 80,000 more than the total number of smokers in the whole state.[31]

Most Californians strongly support clean air policies in their state. More than 86% of California adults – including 71.4% of smokers feel that all workplaces should be smoke-free. Most Californians (87.7%) prefer to eat in smoke-free restaurants. Now, all restaurants in California are smoke-free and all 890,000 food service employees in the state are protected form second-hand smoke at work.[32]

Information available in Canada points to a similar situation. Smoking bans in bars and restaurants in Victoria, B.C. and Waterloo, Ontario were followed by some short-term decline in sales for a few months. However, business subsequently recovered to levels equal to or better than levels prevailing before smoking bans were implemented.[33]

Could there be a ventilation solution in the future?

Improvements in ventilation technology. It seems entirely unlikely that ventilation technology could become twenty thousand times more effective at removing tobacco smoke from the air, even with the most remarkable of technological advances. Systems have been imagined that are ten times more effective, but as Repace has demonstrated, even these systems would have to become a further two thousand times more effective to achieve the requisite level of protection.

Improvements in air cleaning technology. ASHRAE has examined air cleaning technology carefully and concluded that none exists to

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[31] Biener L, Fitzgerald G. Smoky bars and restaurants: who avoids tham and why? Journal of Public Health Management Practice 1999; 5: 74-78.

[32] California Tobacco Control Update. California Department of Health Services, Tobacco Control Section. Summary of presentations at the Eleventh World Conference on Tobacco or Health. Chicago, August 2000.

[33] Smoke-free by-laws for the City of Ottawa. Report to the Health, Recreation and Social Services Committee and Council. City of Ottawa, March 14, 2001

http://www.city.ottawa.on.ca/calendar/ottawa/citycouncil/hrssc/2001/04-06/ACS2001-PEO-HEA-0003.htm.

effectively reduce tobacco smoke in the air to levels that would provide adequate public health protection.[33] In response to a query on this matter, an ASHRAE appeal panel replied:

> Before air cleaning can be applied in a definitive manner, target concentrations of all ETS constituents that affect health or cause odour or irritation must be identified and the removal efficiency of the air cleaning device with respect to each of these constituents must be established by a repeatable rating procedure. The state-of-the-art is not yet at this level. In particular, no cognizant health authorities have established ETS concentrations that result in a reasonable health risk. Until these technical issues are addressed, the standard cannot provide definitive procedures for using air cleaners to control ETS.

Development of new technology capable of removing or reducing most of the more than 100 toxic agents from air polluted by tobacco smoke seems unlikely. Even if it were to happen, it would be a long time before the new technology found its way into an ASHRAE standard. ASHRAE takes a prudent, deliberate and cautious approach to changing its air quality standards.

Allowing some exposure to tobacco smoke. ASHRAE has indicated that a ventilation standard could be proposed for smoking areas if, in the future, recognized health authorities were to propose some non-zero standard for exposure to tobacco smoke. However, this seems unlikely. On the basis of current knowledge, health authorities agree that there is no safe level of exposure to second-hand smoke. Furthermore, as knowledge has advanced, we have found more, not fewer, diseases to be associated with second-hand tobacco smoke. Recent findings have pointed to second-hand smoke as a possible risk factor for breast cancer and strokes. With more knowledge of the health effects of second-hand smoke we will likely see development of reasonably accurate estimates of mortality attributable to exposure to second-hand smoke for these additional diseases. The continuing development of more accurate knowledge of more diseases associated with second-hand smoke makes it unlikely that any scenario could be foreseen where health authorities would recommend a non-zero level of exposure to second-hand smoke as safe. ASHRAE has indicated that it is developing guidance for restaurants where smoking is permitted. To date, however, no such guidance has been published.[34]

Separate smoking areas with separate ventilation. OSHA has proposed a system whereby smoking areas and their air exhaust could be kept entirely separate from other work areas.[35] Under this scheme, workers could not be required to enter the smoking areas. Smoking areas would be required to have separate exhaust to the outside and negative pressure ventilation.

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[34] ASHRAE. *Interpretation IC 62-1999-08 of ASHRAE Standard 62-1999, Ventilation for Acceptable Indoor Air Quality,* June 24, 2000. http://www.ashrae.org/standards/6208.htm.

Accommodating smokers and non-smokers. By the expedient of simply disagreeing with the scientific findings on the health hazards of second-hand tobacco smoke, the tobacco industry promotes the notion that smokers and non-smokers can accommodate each other in workplaces and, in particular, in the hospitality industry. Statements to this effect appear on the web sites of all major tobacco companies.[35] To this end the tobacco industry sponsors the Courtesy of Choice campaign for the hospitality industry. Many hotels, bars and restaurants endorse this principle of accommodation and participate in the Courtesy of Choice campaign. However, there are no scientific findings or public health protection principles underlying the notion of the safe accommodation of tobacco smoke in indoor air. The Hotel Association of Canada has so far received a total of $3.2 million at the rate of $800,000 per year from the Canadian Tobacco Manufacturers' Council to operate the Courtesy of Choice campaign.[36] The notion of accommodation of tobacco smoke in the workplace is not based on any principle of public health protection and flies in the face of the scientific findings that any exposure to second-hand smoke is hazardous. Finding some way of accommodating tobacco smoke in the workplace, as advocated by the tobacco industry and their financial partners in the hospitality industry, will not provide protection from second-hand smoke.

A ventilation solution is unlikely in the future. Sound science remains open to new possibilities in the future. However, given all knowledge accumulated to date in the health, risk assessment and ventilation sciences, it seems entirely unlikely that tobacco smoke in indoor workplaces could ever be reduced to safe levels through the application of ventilation technology.

Ventilation provides no solution to the problem of exposure to second-hand smoke.

[35] See the following web sites: Philip Morris (http://www.philipmorris.com), British-American Tobacco (http://www.bat.com) and RJ Reynolds (http://www.rjr.com).

[36] Heidemann D. *Who's funding the fight against the smoking ban in B.C.?* BCTV. June 15, 2000.

Legislative basis for effective protection from tobacco smoke in workplaces in federal and provincial jurisdictions

Federal Jurisdiction

Federal legislation directed towards occupational health and safety issues applies to a relatively small group of industries that fall under federal jurisdiction, such as interprovincial transportation (including ground, water and air transport), telecommunications, banks and crown corporations. The two major statutes governing occupational health and safety in the federal jurisdiction are the *Canada Labour Code* and the *Non-Smoker's Health Act*.

Canada Labour Code

A consolidation of various labour related legislation, the *Canada Labour Code* [37] is broad in scope, covering everything from hours of work to industrial regulations. Part II of the statute is devoted to Occupational Health and Safety. This section includes legislation on ventilation requirements, hazardous substance controls, and employer obligations.

As stated in section 125(1)(n) of the Code, levels of ventilation must be maintained in accordance with prescribed standards. These prescribed standards can be found in the *Canada Occupational Health and Safety Regulations* [38] at s. 10.17. According to this section, all ventilation systems "shall be designed, constructed, installed, operated and maintained that the concentration of the airborne hazardous substance does not exceed the values and levels prescribed."

Hazardous substances are defined in the Labour Code as "a controlled product and a chemical, biological or physical agent that, by reason of a property that the agent possesses, is hazardous to the safety or health of a person exposed to it." The prescribed values and levels of hazardous substances are those set out in the *Threshold Limit Values and Biological Exposure Indices* of 1994-1995, put out by the American Conference of Governmental Industrial Hygienists (ACGIH). That organization has defined threshold limit values (TLV) as "the conditions under which it is believed that nearly all workers may be repeatedly exposed day after day without adverse health effects." TLVs are based on animal and human exposure studies. They correspond to either an average exposure over an 8-hour shift, to a 15-minute exposure maximum, or to a ceiling value.

Many of the TLVs correspond to the list of poisonous chemicals found in tobacco smoke. While some of those chemicals have an

[37] R.S. 1985, c. L-2.

[38] SOR/86-304

allowable limit, both 4-aminobiphenyl and 2-naphthylamine, chemicals existing in tobacco smoke, have been classified by the ACGIH as A1 carcinogens with no threshold limit value and a recommendation of zero exposure.

To better understand the relationship between tobacco smoke and the *Canada Labour Code*, as well as all other similar statutes in several provinces, it is necessary to understand the nature of tobacco smoke and the toxic chemicals it contains. Tobacco smoke is a complex chemical mixture. It has most recently been estimated to contain over 4,000 chemicals. Quantitative determinations have been made for about 400 of these[39], and 103 have been identified as poisonous to humans (See Appendix A). The International Agency for Research on Cancer has determined that there is sufficient evidence of carcinogenicity in animals for 64 chemicals in tobacco smoke (See Appendix B).[40]

The British Columbia government requires 44 toxic chemicals in tobacco smoke to be reported in mainstream and sidestream smoke under two smoking conditions. These chemicals are all carcinogenic or otherwise toxic. Full reports were received for 33 popular brands of Canadian cigarettes in March 2000. Reports for all brands have been published on the British Columbia Department of Health website.[41] An example of the data sheet for one brand, Player's Light, is shown in Appendix C.

The 1998 revision of the Threshold Limit Values (TLVs) published by the American Conference of Governmental Industrial Hygienists[42] (ACGIH) publication classifies 4-aminobiphenyl and 2-naphthylamine as A1 carcinogens, known to cause cancer in both humans and animals, and gives no threshold limit values for them. ACGIH recommends no exposure by any route to A1 carcinogens. The International Chemical Safety Cards,[43] published by the International Labour Organization contain this notation about exposure to 4-aminobiphenyl:

> **AVOID ALL CONTACT!**

[39] National Institutes of Health. National Cancer Institute. *Health Effects of Exposure to Environmental Tobacco Smoke: The Report of the California Environmental Protection Agency.* Smoking and Tobacco Control Monograph Number 10. NIH Publication No. 99-4645, Washington, USA, August 1999.

[40] *Tobacco Smoking. Lyon*, International Agency for Research on Cancer, 1986 (IARC Monographs on the Evaluation of Carcinogenic Risk to Humans, Volume 38, Appendix 2.

[41] Full reports of all 44 chemicals obligatorily required by the British Columbia government became available for the first time in March 2000. Reports for 33 brands so far provided can be found at: http://www.hlth.gov.bc.ca/ttdr/pdf/sc.html.

[42] *1998 TLVs and BEIs: Threshold Limit Values for Chemical Substances and Physical Agents.* American Conference of Governmental Industrial Hygienists. Cincinnati, Ohio, USA. 1998.

[43] International Chemical Safety Cards. *4-aminobiphenyl.* International Labour Organization. March 2001. http://www.itcilo.it/english/actrav/telearn/osh/ic/92671.htm

Both 2-aminonaphthalene and 4-aminobiphenyl are present in mainstream and sidestream smoke of Player's Light and all 32 other brands of Canadian cigarettes listed on the British Columbia government website (See Appendix C).

While the C*anada Labour Code* and its regulations do not explicitly ban smoking in the workplace, they do prohibit exposure to two class A1 carcinogens, known to cause cancer in both humans and animals. They also require employers to prevent inhalation of "gas, vapour, dust or other impurity… so far as is reasonably practicable." Tobacco smoke is such an impurity and prevention of its inhalation by preventing tobacco use in the workplace is an eminently practical solution. It has been successfully implemented with few problems in many other jurisdictions. In locations including California, British Columbia, Toronto, Waterloo and Ottawa, it has been demonstrated that it is feasible and reasonable to ban smoking from all workplaces, including bars and restaurants.

The Occupational Safety and Health Administration (OSHA) regulates chemicals of a similar nature differently in the United States.[44] There, a particular regulation applies to 13 known human carcinogens. The list of thirteen chemicals includes four that are found in tobacco smoke (1-aminonaphthalene, 2-aminonaphthalene, 4-aminobiphenyl, and n-nitrosodimethylamine). Exposure is allowed to these chemicals in the United States, but only in closed-system operations and even then only under severely restricted conditions. The conditions are detailed in eleven pages of regulations. Some of the conditions under which exposure is permitted include:

- Employees shall be provided with, and required to wear, clean, full body protective clothing (smocks, coveralls, or long-sleeved shirt and pants), shoe covers and gloves prior to entering the regulated area.
- Entrances to regulated areas shall be posted with signs bearing the legend:
  CANCER – SUSPECT AGENT
  AUTHORIZED PERSONNEL ONLY

In federal jurisdiction and provinces that incorporate the ACGIH standards into their regulations (Newfoundland, Nova Scotia, New Brunswick Prince Edward Island, Manitoba) no exposure is allowed under any circumstances to two of these chemicals, classed as A1 carcinogens (2-aminonaphthalene and 4-aminobiphenyl), which are present in tobacco smoke.

The ACGIH sets out methods for calculating threshold limit values for mixtures of chemicals where the effects of chemicals are additive. However, if the mixture contains any substances with a

[44] Occupational Safety and Health Administration. OSHA Regulations (Standards – 29 CFR) 13 Carcinogens (4-Nitrobiphenyl, etc.). – 1910.1003.

http://www.osha-slc.gov/OshStd_data/1910_1003.html.

zero TLV, the formula for mixtures cannot be used because some of the terms in it would involve division by zero and therefore would be undefined. Tobacco smoke is a mixture of more than 4,000 chemicals, two of which have TLVs of zero. Therefore, the formula for mixtures shown in Appendix C of the ACGIH list of TLVs[54] cannot be used for regulatory decision-making with respect to tobacco. Elimination of tobacco smoke remains the only option for full regulatory compliance.

In order to assess the relative hazards of smoke from American and Canadian cigarettes, Rickert has applied a modified version of the ACGIH formula for mixtures, such as tobacco smoke from Canadian and American cigarettes.[45] To complete the calculations, Rickert omitted chemicals in tobacco smoke with zero exposure limits. While unacceptable as a regulatory procedure, this modification did permit construction of a Relative Exposure Index that allowed relative hazards of Canadian and American cigarette smoke to be compared, with hazard measures based on exposure limits proposed by ACGIH. By the measure of the Relative Exposure Index proposed by Rickert, smoke from Canadian cigarettes was more hazardous than smoke from an American blended cigarette. The Relative Exposure Index score for Canadian cigarette smoke was 24.3, while it was 14.6 for smoke from an American blended cigarette.

Employer responsibilities listed in section 124 of the *Canada Labour Code* are to "ensure that the health and safety at work of every person employed by the employer is protected." This duty includes ensuring that the workplace is properly ventilated according to the regulations described above to control the concentration of hazardous substances to which workers are exposed. Employers also have a duty to investigate any employee complaints regarding occupational health and safety.

The act also sets out a process whereby workers can refuse to work if the conditions are unsafe according to the regulations.

> 128.
> (1) Subject to this section, an employee may refuse to use or operate a machine or thing, to work in a place or to perform an activity, if the employee while at work has reasonable cause to believe that
>
> (a) the use or operation of the machine or thing constitutes a danger to the employee or to another employee;
>
> (b) a condition exists in the place that constitutes a danger to the employee; or
>
> (c) the performance of the activity constitutes a danger to the employee or to another employee.

[45] Rickert WS. Development of an Index for Mainstream Tobacco Smoke Based on Chemical Composition. Presented at the 52nd Tobacco Scientists' Research Conference, 1998.

Following an employee's refusal to work under this section, the complaint will be investigated by a health and safety officer "without delay." If it is determined that a danger does exist, the employer is under a duty to take immediate action to protect employees from that danger.

Non-Smoker's Health Act

Since 1988, the federal *Non-Smokers' Health Act* has partially protected workers under federal jurisdiction (about 8% of the workforce) from exposure to second-hand smoke in the workplace.[46] Smoking is allowed only in enclosed rooms specifically designated for that purpose. There have been nearly no implementation or enforcement problems with the law. It is widely respected, and provides a measure of protection from exposure to second-hand smoke, albeit one step below that which is recommended, based on current scientific knowledge.

The law does not provide complete protection from second-hand smoke. Non-smoking employees may be required to enter smoking rooms from time to time. Moreover, except in new federal buildings, there is no requirement that smoking rooms be separately ventilated. Thus, smoke can drift out of the smoking room or be circulated to the rest of the building by the ventilation system.

The *Non-Smoker's Health Act*[47] controls smoking in federally regulated workplaces. In accordance with the views of the time, the main focus of the legislation seems to be on physically separating smokers from non-smokers by creating separate locations for them to smoke in. The statute has some strongly worded provisions, most of which are followed by numerous exceptions that take the force out of the initial wording.

Under s. 3(1) of the act, federally regulated employers have a duty to ensure that persons refrain from smoking in the workspace, which includes any indoor or other enclosed space in which employees perform the duties of their employment, and extends to any adjacent corridor, lobby, stairwell, elevator, cafeteria, washroom or other common area frequented by such employees during the course of their employment. However, the act allows employers to designate enclosed spaces as "smoking rooms", and states in subsection 3 that, "nnotwithstanding subsection (1), an employer may require employees, by reason of the nature of their duties, to perform those duties in a room or area designated for smoking under subsection (2)." Cleaning staff will also be required to enter into these designated smoking areas.

Any place designated as a smoking room under this section must conform to the standards set out in the regulations accompanying the act. These standards require that the exhaust from the

[46] Non-Smokers' Health Act. *Revised Statutes of Canada.* Chapter N-23.6 (R.S., 1985, c. 15 (4th supp.)).

[47] R.S. 1985, c. 15 (4th Supp.).

enclosed smoking area must exhaust the air to the outside and not re-circulate it.

Section 4 of the act places employees under a duty to refrain from smoking in the workplace except in designated areas, then give employers the responsibility of informing employees and the general public of the non-smoking nature of the workplace and advising them of the location of designated smoking areas.

The act also regulates smoking in aircraft and on trains and buses, and requires employers to police the passengers' compliance with the law by asking anyone found smoking to stop, and if they do not comply, having them leave the vehicle at the next stop.

While some exposure to tobacco smoke is permitted under the *Non-Smokers' Health Act,* strict adherence to all provisions of the *Canada Labour Code* would require complete elimination of tobacco smoke from all federal workplaces.

Canada: Overview of second-hand smoke protection in provincial jurisdiction

All provinces control smoking under their jurisdiction to some extent, either as a matter of policy, law, or both.[48] Only Prince Edward Island and Nova Scotia have no laws restricting smoking. However, the former has administrative rules to restrict smoking in provincial government workplaces and the latter bans it by administrative fiat. Seven provinces (all except P.E.I., N.S. and Quebec) authorize municipalities to enact bylaws to control smoking in public places and workplaces. Smoking is prohibited in a large number of public places in British Columbia, Manitoba, Ontario, Quebec and Newfoundland. Smoking is prohibited in provincial government workplaces by policy directives in British Columbia, Saskatchewan, Ontario, New Brunswick, Nova Scotia and Newfoundland. Through specific smoking in the workplace provisions in law or in regulation, smoking is prohibited in at least some private sector workplaces under provincial jurisdiction in British Columbia, Quebec, Saskatchewan and Newfoundland. British Columbia regulation offers the most widespread protection from second-hand smoke in the workplace of any provincial jurisdiction All provinces have occupational health and safety legislation. In almost every case strict application of provincial health and safety legislation would require smoking to be banned in provincially regulated workplaces, covering about 92% of the Canadian workforce.

[48] Provincial statutes restricting smoking were summarized by the Canadian Council for Tobacco Control in 1999 and can be viewed at http://www.cctc.ca/ncth/docs/legislation/ncthproj/ros.html.

Newfoundland

Occupational Health and Safety Act

In Newfoundland the issue of smoking in the workplace is governed by the *Occupational Health and Safety Act.*[49] As with the other provinces, Newfoundland grants its workers the right to refuse to work in the face of danger. However, the wording of their legislation is somewhat different from that of other provinces, in that it does not limit the use of the section to occasions when the act to be undertaken is dangerous.

> 8.
> A worker shall not
> (a) carry out work where there exists an imminent danger to his or her or another worker's health or safety or the health or safety of another person; or
>
> 45.
> (1) A worker may refuse to do work that the worker has reasonable grounds to believe is dangerous to his or her health or safety, or the health and safety of another person at the workplace

The regulations [50] used in Newfoundland also delineate the TLVs for hazardous substances and, like the federal government and many provinces, use the ACGIH handbook as a guideline. According to the regulations, employers shall provide adequate ventilation for all employees. This ventilation shall "make impurities harmless and inoffensive." [51] "Impurities" doubtlessly includes the "hazardous chemical substances" which section 25 of the regulations requires employers to constantly monitor.

> 11.
> (1) An employer shall in accordance with health and safety codes and standards make effective and suitable provisions for securing and maintaining in a workplace
>
> (a) the circulation of clean and wholesome air;
>
> (b) adequate ventilation; and
>
> (c) making impurities harmless and inoffensive.
>
> 25.
> (1) An employer shall keep under constant review the use or presence of chemical substances at his or her workplace which may be hazardous to the health or safety of workers and shall wherever and so far as is

[49] R.S.N.L. 1990 c. O-3

[50] *Occupational Health and Safety Regulations* CNLR 1165/1996.

[51] *Ibid.* s. 11.

> reasonably practicable substitute a safe or less hazardous substance.
> …
>
> (3) Where a hazardous chemical substance is present at a workplace, the employer shall ensure that all practicable measures are taken to prevent the exposure of workers to the extent that may be injurious to their health.
> …
>
> (11) The employer shall ensure that
> (a) atmosphere contamination of the workplace by chemical substances is kept as low as is reasonably practicable and in the case of the substances for which a threshold limit value is currently established by the ACGIH that threshold value shall not be exceeded;
> (b) every worker is informed of the nature and degree of health effects of the chemical substances to which the worker is exposed by virtue of his or her work; and
> (c) the exposure of workers to harmful chemical substances is as little as is reasonably practicable.

The total effect of this legislation would seem to be that smoking, which releases chemicals into the air that the ACGIH has declared hazardous, should be banned in order to protect the workers from such hazardous (poisonous or carcinogenic) chemicals.

Smoke-Free Environments Act and Regulations

The *Newfoundland Smoke-Free Environments Act,* adopted in 1993, provides a measure of protection from tobacco smoke in the workplace. It bans smoking in most workplaces, but then, through exceptions, allows considerable latitude to employers for the establishment of smoking rooms and smoking areas in the workplace.

Legislative amendments, adopted in 2000, and new regulations that came into force in January, 2002, provide for better protection from tobacco smoke in restaurants. Smoking is prohibited in all restaurants that do not serve alcohol. Restaurants with a club, lounge or special events liquor licence can only allow smoking between the hours of 9 P.M and 8:30 A.M. when according to liquor licensing provisions, persons under 19 are not allowed in such establishments.[52] In these establishments, smoking is banned between the hours of 8:30 A.M. and 9 P.M.

Nova Scotia

While the control of second-hand smoke is not directly addressed in Nova Scotia provincial legislation, there are nevertheless two Nova Scotia statutes that have significance for tobacco control.

[52] Government of Newfoundland and Labrador Government moving forward to provide healthier environments for children. News release NLIS 3, July 31, 2001

.http://www.gov.nf.ca/releases/2001/health/0731N03.htm

While tobacco is not specifically mentioned in either the *Occupational Health and Safety Act*[53] or the *Health Act*,[54] both have great significance for protection from tobacco smoke because of their general approach to providing protection from health hazards. Exposure to tobacco smoke is clearly a health hazard.

Occupational Health and Safety Act

In effect, the *Occupational Health and Safety Act* bans smoking in all workplaces under provincial jurisdiction. However, most people are unaware that this is the case, and the provisions of the law that should ban smoking in the workplace are not applied. The Nova Scotia Occupational Health Regulations[55] state:

> 4
> (1) The occupational health standards relating to gases, vapours, mists, fumes, smoke, dust, and other chemical substances and physical agents shall be as listed in the Threshold Limit Values for chemical substances and physical agents for 1976, published by the American Conference of Governmental Industrial Hygienists and its subsequent amendments or revisions.
>
> (2) Where there is any conflict between any other regulation made under the Occupational Health and Safety Act and these regulations, the provisions of these regulations shall apply.

Nova Scotia Occupational Safety Regulations[56] place obligations on employers with respect to ventilation.

> 15 An employer shall
> (b) provide for a supply of fresh air into, and the removal of air from, a workplace or part thereof that is, so far as is reasonably practicable, sufficient to
>
> (i) keep the air reasonably pure, and
>
> (ii) render harmless all gases, vapours, dust or other impurities that are likely to

[53] Nova Scotia Statutes. *Occupational Health and Safety Act.* Chapter 7, 1996. http://www.gov.ns.ca/legi/legc/statutes/occph&s1.htm.

[54] Nova Scotia Revised Statutes. *Health Act. An Act To Amend And Consolidate The Acts Relating To Public Health*. Chapter 195. 1989.

http://www.gov.ns.ca/legi/legc/statutes/health1.htm.

[55] Regulations of Nova Scotia. *Occupational Safety General Regulations.* OIC 1999-195 , N.S. Reg. 44/99, March 29, 2000 http://www.gov.ns.ca/just/regulations/regs/ohsgensf.htm.

[56] Regulations of Nova Scotia. *Occupational Health Regulations.* OIC 76-1510 , N.S. Reg. 112/76, December 21, 1976. http://www.gov.ns.ca/just/regulations/regs/ohs11276.htm

> endanger the health or safety of any person therein;
>
> (b) where a process is carried on that produces a gas, vapour, dust or other impurity that is likely to be inhaled to an injurious extent by a person in the workplace, provide and use such mechanical means as are capable of
>
> (i) preventing such inhalation so far as is reasonably practicable,
>
> (ii) effectively carrying off and disposing of the impurity, and
>
> (iii) preventing the recirculation and re-entry into the workplace of air containing the impurity; and
>
> (c) ensure that all ventilation systems used for controlling the dissemination of gases, vapours, dust or other impurities, including their collection systems and emptying processes, are designed, installed, operated, maintained and repaired in an adequate manner by a competent person.

The Occupational Health and Safety Division of the Department of Labour has broad responsibility to ensure reasonable standards of health and safety in the workplace. Section 9 of the *Occupational Health and Safety Act* states:

> 9 The Division shall
> (a) be concerned with occupational health and safety and the maintenance of reasonable standards for the protection of the health and safety of employees and self-employed persons;

In some jurisdictions, health and safety legislation applies narrowly to substances or processes introduced into the workplace by the employer. However, this is not the case in Nova Scotia. Employers' duties are stated broadly.

> Employers' precautions and duties
> 13
> (1) Every employer shall take every precaution that is reasonable in the circumstances to
>
> (a) ensure the health and safety of persons at or near the workplace;

For greater certainty, the law also specifies that the generality of employers' duties is not limited.

> 23
> (1) A specific duty or requirement imposed by this Act or the regulations does not limit the generality of any other duty or requirement imposed by this Act or the regulations.

Under the Act, Nova Scotia has in place an elaborate and effective system of consultation, surveillance, monitoring and enforcement to ensure health and safety in the workplace. Only the controls on toxic substances with respect to tobacco smoke appear to have escaped the surveillance and enforcement systems that apply effectively to all other major potential workplace hazards.

Failure to eliminate tobacco smoke from Nova Scotia workplaces, as is required by Occupational Health Regulations, would leave the province vulnerable to large numbers of workers exercising their right to refuse dangerous work. Section 43 of the *Occupational Health and Safety Act* spells out the conditions under which a worker may exercise his or her right to refuse dangerous work.

> 43
> (1) Any employee may refuse to do any act at the employee's place of employment where the employee has reasonable grounds for believing that the act is likely to endanger the employee's health or safety or the health or safety of any other person until
>
> (a) the employer has taken remedial action to the satisfaction of the employee;
> (b) the committee, if any, has investigated the matter and unanimously advised the employee to return to work; or
>
> (c) an officer has investigated the matter and has advised the employee to return to work.

Despite the evidence that tobacco smoke in the workplace is in violation of the *Occupational Health and Safety Act*, it is also clear that there is plenty of tobacco smoke in Nova Scotia's workplaces. In fairness to the officials responsible for the Act, information has only recently come to light describing the presence in the smoke from all major brands of Canadian cigarettes of two toxic substances to which there should be no exposure. Armed with this new information, officials should now be able to take enforcement action to ensure full compliance with the Act by eliminating tobacco smoke from Nova Scotia workplaces.

There are many ways that action could be taken to move towards full compliance. One way that would be credible and effective would be for Minister of Labour to order a ban on smoking in Nova Scotia workplaces in order to ensure full compliance with the *Occupational Health and Safety Act* and its regulations.

The Minister of Labour need not worry about conflict between the *Occupational Health and Safety Act* and other acts or regulations. The *Occupational Health and Safety Act* has precedence.

> Conflict with other enactments
> 5 Notwithstanding any general or special Act, where there is a conflict between this Act and the regulations and any other enactment, this Act and the regulations prevail.

Health Act

The *Health Act* grants broad powers to the Minister of Health to ensure effective health protection for all Nova Scotians. Under the same law, public health nuisances are prohibited.

> 51
> Prohibited placement of nuisance
> (1) No person shall put or cause to be put in any place, on land or water, any offensive matter or thing likely to endanger the public health or likely to become or cause a nuisance.
>
> Removal by inspector
> (2) If any person suffers any such matter or thing to remain upon his premises after notice in writing from a board of health or an officer of a board requiring him to remove the same, an inspector may remove or cause to be removed the same under the direction of the board of health and at the charge of the owner of such place.
>
> Deemed nuisance
> (3) Anything which is injurious to the health or indecent, or offensive to the senses, or an obstruction to the free use of property, so as to interfere with the comfortable enjoyment of life or property, shall be deemed a nuisance under this Act.
>
> Order to abate nuisance
> (4) Any judge of the provincial court or medical health officer on the oath of one witness may make an order in writing for the removal, burial or destruction of any substance being or likely to become a nuisance in any place or in any boat or vessel, so far as the Legislature has jurisdiction, and may direct that the removal, burial or destruction be done by the owner or occupier of the place where the substance is, or the person who deposited the substance or by a person appointed by the board of health, and the expense of removal, burial or destruction shall be recovered as provided in the order.

Second-hand tobacco smoke is clearly a public health nuisance, as described by section 51 of the *Health Act*. While the preferred course of action to control tobacco smoke in the workplace would be for the Minister of Labour to ban workplace smoking under the *Occupational Health and Safety Act* and Regulations, or for the Minister of Health to ban workplace smoking by ordering compliance with section 51 of the *Health Act*, Medical Officers of Health could also do so. Citing section 51 of the *Health Act*, Medical Officers of Health could deem tobacco smoke in the workplace to be a public health nuisance and, "on the oath of one witness," order its removal.

Full compliance with the Nova Scotia *Occupational Health and Safety Act* and its regulations would require eliminating all tobacco smoke from Nova Scotia workplaces. The Minister of Labour, the Minister of Health or Medical Officers of Health could issue orders to this effect.

New Brunswick

The New Brunswick occupational health and safety legislation sets out employer duties, conditions for refusal to work, and terms for declaring hazardous substances. Section 9(1) of the *Occupational Health and Safety Act*[57] puts employers under a duty to "take every reasonable precaution to ensure the health and safety of his employees." Some of those reasonable precautions are listed later in that same section, while others can be found throughout the Act.

Section 19 of the Act gives employees a limited right to refuse to work. This option can be exercised only when the employee believes that an act required of him or her is "likely to endanger his health or safety or the health or safety of any other employee." The section gives no option related to unsafe working conditions and probably could not be used to avoid working in second-hand smoke.

The following section from the *Occupational Health and Safety Act* offers a possible means to prevent others from smoking in the workplace. Using the wording of this section, an employee could report a concern over second-hand smoke to his or her supervisor, and the concern would then be investigated. The immediate decision on whether or not the smoke endangered health would be left to the discretion of the supervisor.

> 20
> (1) Any employee who believes that an act is likely to endanger his or any other employee's health or safety shall immediately report his concern to his supervisor, who shall promptly investigate the situation in the presence of the employee.
>
> (2) Where a supervisor finds that the employee has reasonable grounds for believing that an act is likely to endanger his health or safety or the health or safety of any other employee, he shall take appropriate remedial action or recommend appropriate remedial action to the employer.
>
> (3) Where a supervisor finds the employee does not have reasonable grounds for believing that an act is likely to endanger his health or safety or the health or safety of any other employee, he shall advise the employee to do that act.

[57] R.S.N.B. c. O-0.2

Hazardous substances are covered in section 42 of the Act. However, this section only requires that employers create a list "of all biological, chemical or physical agents … present at the place of employment which may be hazardous to the health or safety of employees." Once prepared, this list must be kept current and provided to any employee upon request, but there is no requirement to limit or remove any of the substances found on the list.

The regulations under the act offer a greater possibility for protection from second-hand smoke through setting out ventilation requirements and threshold limit values for hazardous substances. The TLVs mentioned in the regulations refer to those values adopted by the ACGIH and set out in their 1997 publication. Taken in the context of s. 24(1) of the *Occupational Health and Safety Regulations* set out below, this means that any exposure to chemicals such as 4-aminobiphenyl and 2-naphthylamine, both of which are contained in tobacco smoke, would be prohibited under the regulations.

> 20
> (1) An employer shall ensure that a place of employment is adequately ventilated by
>
> (a) natural ventilation which introduces outside air provided by openings having a combined
>
> (b) mechanical ventilation conforming to ASHRAE standard 62-1989, "Ventilation for Acceptable Indoor Air Quality".
>
> (4) An employer shall ensure that exhausted air is replaced by air that
>
> (a) does not constitute a hazard to the health of employees,
>
> (b) does not contain air contaminants in concentrations that exceed 10% of the threshold limit values,
>
> 24
> (1) An employer shall ensure that an air contaminant is kept at a level of concentration that does not constitute a hazard to the health or safety of an employee exposed to it and, where a threshold limit value exists in respect of an air contaminant, that the exposure of the employee to the air contaminant at no time exceeds the threshold limit value.

Prince Edward Island

The Prince Edward Island legislation, both the statutes and regulations, is almost identical to that of New Brunswick.[58] Employers are given the same duties, and employees are given the

[58] See *Occupational Health and Safety Act*, R.S. P.E.I. c. O-1, *Occupational Health and Safety Regulations*

same rights as those of employees in New Brunswick. This means that the conclusions drawn and the options for achieving safe levels of second-hand smoke in the workplace will be the same in both provinces.

In both jurisdictions, employers could be found to have a statutory duty to ban smoking in the workplace as a "reasonable precaution" to ensure the health and safety of employees by protecting them from second-hand smoke. According to the regulations in both PEI and New Brunswick, exposure to toxic chemicals contained in second-hand smoke such as 4-aminobiphenyl and 2-naphthylamine is prohibited, meaning that banning smoking in the workplace is not only a reasonable precaution, but is required under the legislation.

Quebec

As in other provinces, Quebec workers have a right to a safe and healthy working environment.

Occupational Health and Safety Act

These rights are set out in the *Occupational Health and Safety Act*, which gives workers the right to refuse work if they have a reasonable belief that continuing to do the task would expose them to health risk.[59] The wording of the section is broad enough that the health effects of second hand smoke could be included as an element of the work that causes danger to health.

Once a worker has refused to work under this section, as with most provincial occupational health and safety legislation, the employer is under a duty to investigate the worker's concern and to hold the worker's job for them until the investigation is complete.
Section 27 of the Quebec act provides for situations when multiple workers refuse to work due to a single safety concern. In such a case, their concerns would be investigated together, and the decision would be binding on all of those employees.
Under section 46, the Quebec government has provided specifically for pregnant workers, allowing them to request different work on the presentation of a medical certificate stating that their current work is affecting the health of the foetus.

Another option which the legislation makes available is for the worker to present his or her employer with a medical certificate proclaiming that their exposure to a hazardous substance has proven dangerous and detailing the effects that exposure has had on their health. (s. 32) Such a certificate allows the worker to request work within the company where they will not be exposed to the hazardous substance until their health has returned to a level where they can return to their previous job. The hazardous chemicals are listed in the regulations set out by the provincial occupational health and safety committee.

[59] *Loi sur la santé at la sécurité du travail*, section I s. 12.

The regulations cover the subject of ventilation, which includes the regulation of hazardous chemicals. Section 101 of the *Occupational Health and Safety Regulations* proclaims that a workplace must have adequate ventilation, either by natural or mechanical means. Later on in section 107 the purpose of the ventilation system is explained, that it must limit the presence of any gas, smoke, vapour or dust. The next section refers to the TLVs, which can be found in Appendix I of the regulations. According to section 108, the concentration of hazardous substances in the air must be less than the average values described in the appendix to the regulations.

Of the hazardous substances listed in the appendix, the following are also contained in tobacco smoke:

- 4-Aminobiphenyl
- Acrylonitrile
- Arsenic
- Benzene
- Benzo(a)pyrene
- Beta-naphthylamine
- Cadmium
- Formaldehyde
- Lead
- Mercury
- Nickel

Of these chemicals, 4-aminobiphenyl and beta-naphthylamine have no threshold limit value, according to the Quebec regulations. However, both are present in the tobacco smoke of major Canadian cigarette brands (See Appendix C).

Tobacco Act

Quebec's other legislation dealing with smoking in the work place is the *Tobacco Act*. Passed in 1998, the *Tobacco Act* was meant to be landmark legislation that would protect the health of Quebec residents. While the act may go farther than any previous legislation, its weak wording and numerous exceptions do little to protect health.

The act opens with a section restricting the use of tobacco in places from schools to health services facilities to community centres, tourist establishments and workplaces. However, the sections which follow the strong opening restrictions create exceptions that allow smoking for almost every one of those locations including workplaces. Those exceptions allow for closed smoking rooms to be set aside, which must ventilate smoke directly to the outside of the building. Operators of "game halls" may set aside smoking areas that do not need to be enclosed. Those smoking areas are limited to 40% of the total floor space in an establishment, and owners are to "maximize the protection provided to non-smokers."

Section 7 of the act seems to offer protection in tourist establishments, including restaurants, by requiring that the

smoking areas be separated from non-smoking areas by full walls and equipped with negative pressure ventilation systems. However, this provision is offset by the allowance for an open doorway between the two areas that does not need to be filled in by an actual door. The section is further weakened by section 69, which allows that the walled-in smoking areas are not required until December 2009 for existing businesses. New business built after December 2001 are required to build the separation wall.

If bingo halls or adult only establishments such as bars do not hold a restaurant licence, section 8 of the act does not require them to have a separate smoking area, instead allowing smoking throughout the establishment.

> 2.
> Subject to sections 3 to 12, smoking is prohibited in the following enclosed spaces:
>
> (1) facilities maintained by a health and social services institution governed by the Act respecting health services and social services (chapter S-4.2) or the Act respecting health services and social services for Cree Native persons (chapter S-5), and premises where services are provided by an intermediate resource referred to in the Act respecting health services and social services, except if the premises are situated in a dwelling;
>
> (2) premises used by a school providing instruction at the elementary or secondary level governed by the Education Act (chapter I-13.3) or the Education Act for Cree, Inuit and Naskapi Native Persons (chapter I-14), and premises used by a private educational institution referred to in the Act respecting private education (chapter E-9.1);
>
> (3) premises used by a general and vocational college or a university;
>
> (4) facilities operated by a childcare centre or other childcare service within the meaning of the Act respecting childcare centres and childcare services (chapter C-8.2), for the time during which childcare is provided if the facility is situated in a dwelling;
>
> (5) enclosed spaces where activities of a sports or recreational, judicial, cultural or artistic nature are presented, or where conferences, conventions or other similar events are held;
>
> (6) enclosed spaces where community or recreational activities intended for minors are held;
>
> (7) the common areas of residential buildings comprising more than 12 dwellings, except those that are temporarily placed at the

disposal of lessees or owners for their personal use;

(8) tourist establishments governed by the Tourist Establishments Act (chapter E-15.1), except a room used by a natural person to hold a private reception for personal purposes;

(9) workplaces, except workplaces situated in a dwelling;

(10) means of public transportation, and taxis and vehicles used exclusively for work-related purposes except where all the occupants agree otherwise, as well as bus shelters;

(11) premises used for detention within the meaning of the Act respecting correctional services (chapter S-4.01);

(12) all other enclosed spaces to which the public has admittance.

3.
Closed smoking rooms may be set aside by the operator of a place or business in any of the places referred to in section 2, except those referred to in paragraphs 2, 4 and 6.

A smoking room may be used only for smoking and must be equipped with a negative pressure ventilation system which allows smoke to be evacuated directly to the outside of the building.

For the purposes of this Act, the term “operator of a place or business” includes a mandatary of the operator who manages the place or business.

7.
The operator of a place or business of 35 seats or more who holds a permit for the operation of a restaurant establishment under the Tourist Establishments Act (chapter E-15.1) must, when setting aside areas where smoking is permitted, separate them from the areas where smoking is prohibited by means of partition walls that extend from floor to ceiling, and equip the smoking areas with a negative pressure ventilation system which allows smoke to be evacuated directly to the outside of the building. However, the opening that allows movement between the area where smoking is permitted and the area where smoking is prohibited need not be equipped with a door.

8.
The operator of a State-owned casino or a bingo hall and the operator of a place or business to which minors are not admitted pursuant to the Act respecting offences

> relating to alcoholic beverages (chapter I-8.1) may permit smoking throughout the establishment or bingo hall, except if the operator holds a permit for the operation of a restaurant establishment, in which case the provisions of section 7 apply to the part of the establishment or hall in which restaurant services are offered.

Overall, the Quebec Tobacco Act is of limited effectiveness at preventing exposure to smoke in the workplace. Notwithstanding the limitations of the Quebec Tobacco Act, strict application of the Quebec Occupational Health and Safety Act would require that smoking not be allowed in any Quebec workplace.

Ontario

Municipal bylaws

Protection from second-hand smoke exists at both the municipal and provincial level in Ontario. Over 100 Ontario municipalities have bylaws that ban or restrict smoking in at least some public places and workplaces.

The Waterloo Regional Municipality has a bylaw banning smoking in restaurants, bars, taverns and casinos. This bylaw survived a court challenge in 2000.[60] During the court proceedings, the judge showed that he was aware of the scientific consensus that exposure to second-hand smoke is hazardous.[61] Lawyer Paul Brooks, acting for the bar and restaurant owners who filed the formal complaint, claimed during the court proceedings that the regional council had not considered enough scientific evidence about the harm of second-hand smoke. There ensued this exchange between Mr. Justice Robert Reilly and lawyer Paul Brooks:

> **Mr. Justice Robert Reilly:** Are you suggesting that there is still an ongoing debate about the harmful effects of tobacco?
> **Mr. Paul Brooks:** Yes, I am.
> **Mr. Justice Robert Reilly:** Well, I guess there are still Holocaust deniers, too.

Ontario municipalities that have implemented bylaws banning smoking in bars and restaurants in 2000 or 2001 include:

- Guelph
- Ottawa
- Peterborough
- Regional Municipality of Waterloo (seven municipalities)
- Region of Hamilton-Wentworth (Ancaster, Dundas, Flamborough, Hamilton)
- Region of Peel (Brampton, Caledon, Mississauga)

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[60] Judge upholds Waterloo Region's anti-smoking bylaw. *Toronto Star*, July 26, 2000.

[61] Lawsuit hasn't shown smoking bylaw has caused any damage, judge says. *Kitchener Waterloo-Record*, June 9, 2000.

- South Easthope and Perth South
- Toronto
- Vaughan
- Windsor

Of these, the Ottawa by-law is most notable in that it allows no exceptions. Smoking is banned indoors in all bars, restaurants and most indoor locations under municipal jurisdiction. There have been a few problems with compliance, but by and large the by-law is working well and is effective. Definitive answers to questions about its effectiveness must await longer-term evaluation.

Ontario municipalities with bylaws banning smoking in bars and restaurants slated to come into force in 2002 or later include:

- Brantford
- London
- North Easthope
- Sudbury

Provincial statutes

In addition to municipal bylaws, there are two provincial statutes that deal specifically with smoke in workplaces. These are the Tobacco Control Act and the Smoking in Workplace Act.[62] The Tobacco Control Act was adopted in 1994 and prohibits or restricts smoking in indoor places frequented by members of the public. These include the public access parts of provincial government offices, schools, stores and other places where goods or services are sold to the general public. The Smoking in the Workplace Act restricts smoking in workplaces to 25% or less of the total floor area of a workplace. Although few enforcement difficulties have been reported, this law provides little public health protection. There is no requirement that smoking areas be limited in number, enclosed or separately ventilated. Full compliance with the Smoking in Workplace Act would not fulfil the recommendations of the Ontario Expert Panel on Tobacco for protection from second-hand smoke. Nor would it respond satisfactorily to the scientific findings of the six reviews that reported on the effects of second-hand smoke, reviewed earlier in this report.
The Smoking in the Workplace Act states:

> 9
> (1) No person shall smoke tobacco or hold lighted tobacco in any of the following places:
> …
>
> (8) An establishment where goods or services are sold or offered for sale to the public.

On its face, this provision would appear to ban smoking in bars and restaurants. They certainly qualify as places “where goods or services are sold or offered for sale to the public.” An

[62] Revised Statutes of Ontario, 1990. http://209.195.107.57.

administrative guideline indicates that this provision does not apply to the non-public areas of retail establishments. The same administrative guideline indicates that restaurants are not covered by Section 9 (1) (8), but the reasons why are restaurant should not be considered as an "establishment where goods or services are sold or offered for sale to the public" are unclear. The legal status of the guideline is ambiguous. In any case, the administrative guideline makes no exception for bars, meaning that rigorous application of the Ontario Tobacco Control Act would require the elimination of tobacco smoke in all Ontario bars, and possibly all restaurants as well.

There are two other Ontario laws that have significance for tobacco control. While tobacco in not specifically mentioned in either the Occupational Health and Safety Act or the Health Protection and Promotion Act,[35] both have great significance for protection from tobacco smoke, because of their general approach to providing protection from health hazards. Exposure to tobacco smoke is clearly a health hazard.

Occupational Health and Safety Act

The Occupational Health and Safety Act, in effect, bans smoking in most workplaces under provincial jurisdiction. However, most people are unaware that this is the case, and the provisions of the law that should ban smoking in the workplace are not applied.

The Ontario government regulates 587 chemicals in the workplace. Recently new or revised limits were proposed for 213 chemicals. These came into force on September 30, 2000.[63]

There are 14 toxic substances and one class of toxic substances (n-nitrosamines) that Ontario regulations identify as "known toxic agents for which exposure values have not been established, and to which any exposure should be avoided. Tobacco smoke contains twelve n-nitrosamines and five other substances on this zero-exposure list. British Columbia requires information on four n-nitrosamines and three other chemicals on the Ontario zero-exposure list (See Table 3).

[63] Ontario Ministry of Labour. Ontario adopts more protective occupational exposure limits. Backgrounder 00-34. June 27, 2000. http://www.gov.on.ca/lab/ann/00-34be.htm.

Table 3:
Known toxic agents for which exposure values have not been established, and to which any exposure should be avoided
(Part 10 of the Schedule to Control of Exposure to Biological or Chemical Agents Regulations under the Ontario Occupational Health and Safety Act)

Known Toxic Agent	Listed by IARC as present in tobacco smoke	Reported as present in at least 33 brands of Canadian cigarettes
Benzidine – skin		
Benzo(a)pyrene	✓	✓
(1,1'-biphenyl)-4-amine – skin	✓	✓
Chloromethyl methyl ether		
Chrysene	✓	
1,2-Dibromoethane – skin		
3,3'Dichlorobenzidine - skin		
3,3'-Dimethyl-(1,1'-biphenyl)-4,4'-diamine – skin		
Dimethylcarbamoyl chloride		
Hexamethylphosphoric triamide - skin		
Beta-Naphthylamine	✓	✓
4-Nitrobiphenyl		
N-nitrosamines – skin	✓ **12 chemicals**	✓ **(NNN, NNK, NAT, NAB)**
1,2 Oxathiolane 2,2-dioxide		
N-Phenyl-beta-naphthylamine	✓	

In summary, there are 17 chemical in tobacco smoke which according to Ontario regulation "any exposure should be avoided." Quantitative measurements are available in Canada demonstrating the presence and actual amounts of seven of these chemicals in mainstream and sidestream smoke from 33 leading brands of Canadian cigarettes (See Appendix C).

In addition, Ontario regulates eleven "designated chemicals" in the workplace to which special rules apply.[64] The designated chemicals are:

- Acrylonitrile*
- Arsenic*
- Asbestos
- Benzene*
- Coke oven emissions
- Ethylene oxide
- Isocyanates
- Lead*

[64] Revised Regulations of Ontario, 1990, Regulations 835 to 846. http://209.195.107.57

- Mercury*
- Silica
- Vinyl chloride*

Six of these eleven substances (the chemicals marked with an asterisk) are also present in tobacco smoke (see Appendix A).

The Ontario Government has recently revised and updated its occupational exposure limits (OELs), with the revised limits that came into effect on September 30, 2000. Revisions were made to about 200 of the nearly 600 OELs specified in Ontario regulations. The changes have all been made in the interests of providing greater levels of health protection. However, no changes have been made to Part 10 of the Schedule. Under the revised regulation, no exposure is still recommended for all the toxic substances shown in Table 3. The commitment of the government to enforcement of the updated regulations is strong. When the Minister of Labour announced the Government's intention in the Legislature on November 16, 1999, he stated:

> I emphasize, Mr. Speaker, that compliance with the new occupational exposure limits will be required – and enforced. When the new limits are in place, Ontario will not only be up to date – it will be ahead of the pack.[65]

When the consultation process was finalized, another announcement was made. The government committed an additional $2 million to enforcement of the updated OELs. On June 27, 2000, the Honourable Mr. Stockwell, Minister of Labour stated:

> - This action demonstrates once again this government's commitment to make Ontario workplaces among the safest in the world.
> - Today's announcement ensures that Ontario workers are protected by OELs that are current and up-to-date.[66]

This Ministerial commitment to renewed enforcement in the interest of the health and safety of the workers, together with the structure and provisions of the Occupational Health and Safety Act and its regulations, means that there should be no policy or technical barriers to eliminate tobacco smoke from Ontario workplaces in order to be in conformity with the Act. Normally, investigation for the presence of toxic substances would require air sampling and testing. However, from the information obtained on sidestream tobacco smoke pursuant to regulations in British Columbia in May 2000, it is clear that all major brands of

[65] Statement to the Legislature by the Honourable Chris Stockwell, Minister of Labour for Ontario regarding the updating of Occupational Exposure Limits for Hazardous Chemical Substances, Queen's Park, Toronto, November 16, 1999.

http://www.gov.on.ca/lab/99-55se.htm.

[66] Ontario Ministry of Labour. Ontario to invest $2 million to make workplaces safer News release 00-34. http://www.gov.on.ca/lab/ann00-34e.htm.

cigarettes consumed in Canada produce measurable amounts of at least seven toxic substances "to which any exposure should be avoided." In these circumstances, any presence of tobacco smoke in the air will indicate that the *Act* is being violated, and the corrective action to achieve conformity will be the elimination of tobacco smoke. No air sampling and testing will be needed.

Under the Act, Ontario has in place an elaborate and effective system of consultation, surveillance, monitoring and enforcement to ensure health and safety in the workplace. Only the controls on toxic substances with respect to tobacco smoke appear to have escaped the surveillance and enforcement systems that apply effectively to all other major potential workplace hazards.

Failure to eliminate tobacco smoke from Ontario workplaces, as is required by Part 10 of the Schedule to the Regulation, would leave the Province vulnerable to large numbers of workers exercising their right to refuse dangerous work. Part V of the Act spells out the conditions under which a worker may exercise his or her right to refuse dangerous work. If the dangerous working condition is not "inherent in the worker's work or is a normal condition of the worker's employment," then the worker may exercise his or her right to refuse to work if "the physical condition of the workplace or the part in which he or she works or is to work is likely to endanger himself or herself or…[if it] is in contravention of this Act or the regulations and such contravention is likely to endanger himself, herself or another worker."

Despite the evidence that tobacco smoke in the workplace is in violation of the Occupational Health and Safety Act, it is also clear that there is plenty of tobacco smoke in Ontario's workplaces. In fairness to the officials responsible for the *Act*, information has only recently come to light describing the presence in the smoke from all major brands of Canadian cigarettes of seven toxic substances to which there should be no exposure. Armed with this new information, officials should now be able to take enforcement action to ensure full compliance with the Act by eliminating tobacco smoke from Ontario workplaces to which the Act applies.

There are many ways that action could be taken to move towards full compliance. One way that would be credible and effective would be for Medical Officers of Health to order compliance with the Occupational Health and Safety Act in respect of tobacco smoke in the workplace. The powers expressed in two statutes, the Health Protection and Promotion Act and the Occupational Health and Safety Act, could both be invoked to ensure effective compliance and enforcement of orders from Medical Officers of Health to ban smoking in workplaces.

An argument may be raised that there appears to be a conflict between the Occupational Health and Safety Act, which bans smoking in nearly all workplaces, and the Smoking in the Workplace Act, which restricts smoking to 25% or less of the total area of the workplace. It might be thought that since, the latter Act deals specifically with smoking, it would take precedence over the

former, which regulates toxic substances in the tobacco smoke mixture, but does not specifically regulate tobacco smoke *per se.* However, this interpretation is erroneous. The two Acts both have clauses making it clear that, in the matter of worker protection, the Act that is most protective takes precedence. In this case, the Occupational Health and Safety Act is the most protective. The Smoking in the Workplace Act states:

> In the event of a conflict between this Act and another Act or a regulation or a municipal by-law respecting smoking in the workplace, the provision that is most restrictive of smoking prevails.

The Tobacco Control Act has a similar provision:

> If there is a conflict between sections 9 and 10 of this Act and a provision of another Act, a regulation or a municipal by-law that deals with smoking, the provision that is more restrictive of smoking prevails...

The Occupational Health and Safety Act states:

> Despite anything in any general or special Act, the provisions of this Act and regulations shall prevail.

Summary: Regulations under the Occupational Health and Safety Act ban any workplace exposure to seventeen chemicals known to be in tobacco smoke. Current data exist documenting the presence of seven of these chemicals in the sidestream smoke emitted by all major brands of Canadian cigarettes. Ontario law therefore, in effect, bans smoking in all workplaces under provincial health and safety jurisdiction. The Ontario government may wish to move quickly to ensure that the law is soon respected and enforced and that tobacco smoke is eliminated from Ontario workplaces. Failure to do so could result in a great many workers exercising their right to refuse work on the grounds that they are being exposed to a known danger – second-hand tobacco smoke – from which they should expect to be protected by toxic substance regulations.

Health Protection and Promotion Act

The Health Protection and Promotion Act places obligations on Medical Officers of Health in every region (health unit) to take action to investigate complaints of occupational and environmental health hazards. If, for example, a complaint were made to a Medical Officer of Health about smoking in the workplace, he or she would then be obliged to report the matter to the Ministry of Labour and in consultation with Ministry of Labour officials determine whether or not a health hazard exists. Given that the mere presence of tobacco smoke in the workplace places employers in the position of non-compliance with the Control of Exposure to Biological or Chemical Agents Regulations, it seems very likely that Medical Officers of Health would find that tobacco smoke in the workplace was a health hazard.

Whether a complaint is received or not, the Health Protection and Promotion Act affords the Medical Officers of Health broad discretionary power to protect community health. If, for example, a Medical Officer of Health was of the opinion, on reasonable and probable grounds, that there was no safe level of exposure to tobacco smoke in any workplace, the Act grants the Medical Officers of Health discretionary power to order the elimination of tobacco smoke from all workplaces in their health unit.

Full compliance with the Ontario Occupational Health and Safety Act and its regulations would require eliminating all tobacco smoke from Ontario workplaces. Medical Officers of Health could issue orders to this effect.

Manitoba

Manitoba Labour regulates chemicals in the workplace.[67] The regulations contain the following provision:

> 19
> (2) In the case of a designated material, or any mixture containing a designated material, the occupational exposure limit shall be as close to zero as is reasonably practicable for the material but shall not exceed a TLV identified for the material in Schedule C or an OEL set in accordance with subsection (5).

Of the over 4,000 chemicals contained in tobacco smoke, twenty-five are hazardous chemicals also listed in the above-noted Schedule C, the list of designated materials in Manitoba for which the "occupational exposure limit shall be as close to zero as reasonably practicable." These twenty-five designated materials are:

- Acrylonitrile
- 4-aminobiphenyl
- Arsenic
- Benzene
- Benzo(b)fluoranthene
- Benzo(a)pyrene
- Cadmium
- Chromium (elemental)
- Chrysene
- Dibenz(a,j)acridine
- Dibenzo(a,i)pyrene
- Formaldehyde
- Hydrazine
- 2.naphthylamine
- 2-nitropropane
- N-nitrosodiethanolamine
- N-nitrosodiethylamine

[67] Manitoba Workplace Health Hazard Regulation MR53/88, Manitoba Labour.

http://www.gov.mb.ca/labour/safety/publicat/wshlegis/mr53.html

- N-nitrosodimethylamine
- N-nitrosomorpholine
- N-nitrosonornicotine
- N-nitrosopyrrolidine
- Nickel
- O-toluidine
- P-toluidine
- Vinyl chloride

Of these twenty-five materials, the following ten are present in Canadian cigarettes and reported to the British Columbia government (See Appendix C).

- Acrylonitrile
- 4-aminobiphenyl
- Benzene
- Benzo(a)pyrene
- Cadmium
- Chromium (elemental)
- Formaldehyde
- 2-naphthylamine (2-aminonaphthalene)
- n-nitrosonornicotine
- Nickel

In Schedule C of the Manitoba *Workplace Health Hazard Regulation*, one is referred to the TLVs and Biological Exposure Indices for 1987-88 published by the ACGIH. This publication classifies 4-aminnobiphenyl and 2-naphthylamine amine as known human carcinogens and gives no threshold limit values for them.

The Manitoba regulation declares:

> In the case of a designated material, or any mixture containing a designated material, the occupational exposure limit shall be as close to zero as is reasonably practicable.

It is certainly "reasonably practicable" to reduce exposure to all of the toxic substances found both in tobacco smoke and in Schedule B of the regulations to zero by the simple expedient of banning smoking in all workplaces. Smoking bans have long been demonstrated to be "reasonably practicable" in many workplaces. In the interests of public health protection, it would be reasonable and feasible to extend them to all workplaces.

Even if banning workplace smoking were not found to "reasonably practicable" the regulation goes on to state that the occupational exposure limit for any designated material shall not exceed a TLV identified for the material in Schedule C. In the ACGIH technical document referred to in Schedule C, 4-aminobiphenyl and 2-napthylamine, both present in tobacco smoke are classified as known human carcinogens for which no TLVs are given. It is further recommended that all contact with these chemicals be avoided. Here is the summary of information on 4-aminondiphenyl given by the ACGIH:

> Available data associate 4-aminobiphenyl with a high incidence of bladder cancer in humans and bladder and liver tumours in experimental animals. The compound appears to be one of the most potent known bladder carcinogens. An A1 designation without an assigned value is recommended. Workers exposed to the chemical should be properly equipped to eliminate to the fullest extent possible all exposures to the carcinogen.

In considering the matter from several points of view, one arrives at the same conclusion:

Full compliance with the Manitoba Workplace Health Hazard Regulation would require eliminating all tobacco smoke from Manitoba workplaces.

Saskatchewan

The Saskatchewan provincial legislation is structured differently from that of other provinces. Instead of using a TLV approach specifically listing the hazardous substances being regulated, Saskatchewan uses an industry specific approach in their occupational health and safety regulations controlling "dangerous atmospheres" and "hazardous substances", but never defining what those terms are referring to. While this method of regulation may seem to ignore the issue of second hand smoke, it is simply dealt with in another, more direct fashion.

Section 44(1)(s) of the Occ*upational Health and Safety Act* gives the Lieutenant-governor the power to make regulations "respecting smoking or the prohibition of smoking in any place of employment including the designation of the areas in which smoking will be permitted at a place of employment." In accordance with this statutory power, regulations have been passed that limit smoking in the work place.

These regulations apply to all workplaces except residential institutions and places where self-employed people work alone. Becoming law on July 1, 1997, the regulation requires that no worker smoke in an enclosed place of employment except in a designated area. In order for an enclosed area to be designated as 'smoking', it must minimize the passage of smoke into non-smoking areas. Other non-enclosed areas can only be designated as 'smoking' if they are designed to ensure that "no worker will be exposed to second-hand tobacco smoke; and second-hand tobacco smoke from the area to be designated will not contaminate other areas of the place of employment."

> 77
> (2) This section does not apply to a self-employed person at a place of employment where no other self-employed person and no employer, contractor, owner or worker is present.
>
> (3) An employer, contractor or owner shall ensure that:

> (a) on and after July 1, 1997, no worker smokes in an enclosed place of employment, worksite or work-related area except in an area designated for smoking pursuant to subsection (5); and
>
> (b) worker exposure to second-hand tobacco smoke is restricted until smoking areas are designated at the place of employment pursuant to subsection (5).
>
> (4) On and after July 1, 1997, no worker shall smoke in an enclosed place of employment, worksite or work-related area except in an area designated for smoking pursuant to subsection (5).
>
> (5) An employer or contractor, in consultation with the committee, may:
>
> (a) designate one or more enclosed areas at a place of employment as areas where smoking is allowed if the passage of smoke into non-smoking areas is minimized;
>
> (b) designate one or more worksites or parts of a place of employment as areas where smoking is allowed if the design of the worksite or part of the place of employment or of the mechanical ventilation of the area to be designated will ensure that:
>
> (i) no worker will be exposed to second-hand tobacco smoke; and
>
> (ii) second-hand tobacco smoke from the area to be designated will not contaminate other areas of the place of employment; or
>
> (c) designate a vehicle supplied by the employer or contractor as an area where smoking is allowed.

In 2001 the Saskatchewan legislature adopted Bill 56, the *Tobacco Control Act*. In many ways this proposed legislation is similar to the Quebec *Tobacco Act*, in that it proposes to prohibit smoking in most public places subject to a wide variety of exceptions. Restaurants and bars would need to designate at least 30% of their establishment as non-smoking, with that number increasing to 40% then 60% over two years. While owners would be required to post signs indicating the non-smoking area, there are no proposed requirements regarding ventilation or separation between the smoking and non-smoking areas.

The draft regulations that go with the legislation require special care or personal care homes to have an enclosed, ventilated room for smoking. Draft guidelines suggest, "the designated non-smoking area must be separated as much as possible from the smoking area in an establishment."

The highlight of the legislation is found in section 15, which states "if there is a conflict between section 11, 12, 13, or 14 (the sections dealing with protection from second-hand smoke) of this Act and a provision of any other act, any regulation or any bylaw of a municipality, the provision that is more restrictive prevails." The bill was given Royal Assent July 9, 2001 and is expected to enter into force during the first quarter of 2002.

Alberta

The Alberta government regulates chemicals in the workplace through the *Occupational Health and Safety Act*.[68] The regulations under that act contain the following provision of general application:

> Exposure to substances by inhalation
> 2 (1) An employer shall ensure that each worker's exposure by inhalation to any substance listed in Schedule 1
>
> (a) is kept as low as is reasonably practicable, and
>
> (b) does not exceed its Occupational Exposure Limit.
>
> (2) If no Occupational Exposure Limit has been established for a harmful substance present at a work site, an employer shall ensure that all steps are taken to keep each worker's exposure to that harmful substance as low as is reasonably practicable.
> AR 393/88 s2

There are four hazardous chemicals present in tobacco smoke and listed in Appendix A that are also listed in Table 1 of Schedule 1 of the *Chemical Hazards Regulations* for which no occupational exposure limits are given. They are:

- 4-aminobiphenyl
- Chrysene
- N-Nitrosodimethylamine
- Beta-Naphthlyamine

Of these, 4-aminobiphenyl, also known as 4-aminobiphenyl, and beta-naphthylamine, also called 2-amino-naphthalene are known to present in Canadian cigarettes and reported to the British Columbia government (See Appendix C).

The Alberta regulations also have special rules that apply to substances and processes listed in Schedule 2 of the regulations:

[68] See the following:

Alberta Occupational Health and Safety Act: http://www.gov.ab.ca/qp/ascii/acts/O02.TXT

Alberta Chemical Hazards Regulation: http://www.gov.ab.ca/qp/ascii/regs/1988_393.TXT

> Codes of practice for Schedule 2 substances and processes
> 9 (2) Where there is a possibility that a substance listed in Schedule 2 could be present at a work site in an uncontrolled release, the employer shall establish a code of practice setting out the procedures to be used to prevent the uncontrolled release of the substance and the procedures to be followed in the event of such a release.
> AR 393/88 s9

Subsection 9 (2), shown above, is relevant to tobacco smoke. Tobacco smoke contains a number of hazardous chemicals, and their release into workplace air is uncontrolled. A number of tobacco smoke components are listed in Schedule 2. In particular, the following twelve chemicals shown in Appendix A are also listed in Schedule 2.

- Acrylonitrile
- 4-Aminobiphenyl
- Benzene
- Benzo(a)pyrene
- Chrysene
- 1,1' – Dimethyl hydrazine
- Hydrazine
- Hydrogen sulfide
- Beta-Naphthylamine
- 2-Nitropropane
- N-Nitrosodimethylamine
- Vinyl chloride

Of these twelve chemicals, five are known to be present in Canadian cigarettes and are reported to the British Columbia government, in accordance with regulations under the British Columbia *Tobacco Sales Amendment Act* (Appendix C). The chemicals in question are:

- Acrylonitrile
- 4-Aminobiphenyl (4-Aminobiphenyl)
- Benzene
- Benzo(a)pyrene
- Beta-Naphthylamine (2-Aminonaphthalene)

Strict adherence to Alberta health and safety legislation would require banning smoking in all workplaces.

British Columbia

The British Columbia government has a comprehensive tobacco control policy, covering all aspects of the tobacco problem. Under the policy, responsibility for protecting workers has been assigned to the Workers' Compensation Board (WCB). The WCB has taken this responsibility seriously. In 1998, it adopted new regulations providing protection from second-hand smoke to 85% of British Columbia workers, by banning smoking in most workplaces.

These rules were implemented with little problem and continue to be respected throughout the British Columbia workplaces to which they apply. The remaining 15% of the workers (those working in restaurants, bars, games rooms, sporting arenas, long term care facilities and correctional facilities) became smoke-free on January 1, 2000. However, there were objections, and in March 2000, a B.C. judge ruled the ban on smoking in these facilities void, pending more public consultations. Those public consultations were concluded, and the WCB had re-introduced regulations to extend full protection from second-hand smoke to the remaining 15% of British Columbia workplaces, beginning in September, 2001.[69] However, the new British Columbia government has overruled the WCB and put in place a weaker set of controls on smoking in the bars and restaurants.[70]

Notwithstanding the weakening of province-wide controls on smoking in restaurants, bars, games rooms, sporting arenas, long term care facilities and correctional facilities, the most populous British Columbia municipalities in the Lower Mainland and the Capital Regional District (see marginal note: Smoke-free restaurants and bars in Canada) have bylaws that ban smoking in bars and restaurants. Other B.C. municipalities have partial bans on smoking in bars and restaurants. Usually, B.C. municipal smoking bylaws also restrict (but do not ban) smoking in games rooms (bingo halls, pool halls, bowling alleys and casinos).[71]

The Workers' Compensation Board (WCB) of British Columbia the Workers' Compensation Act[72] has, in part, as its purpose:

> 107
> (1) The purpose of this Part is to benefit all citizens of British Columbia by promoting occupational health and safety and protecting workers and other persons present at workplaces from work related risks to their health and safety.
>
> (2) Without limiting subsection (1), the specific purposes of this Part are
>
> (a) to promote a culture of commitment on the part of employers and workers to a high standard of occupational health and safety,

[69] WCB Regulation Background. Clean Air Coalition of British Columbia, 2000. http://www.cleanaircoalitonbc.com/cacontentwcbregdesc.htm.

[70] British Columbia Ministry of Labour. Environmental Tobacco Smoke Regulation. January 2002. http://www.labour.gov.bc.ca/news/2002/ets-regulation.htm.

[71] WCB Regulation Background. Clean Air Coalition of British Columbia, 2000.

http://www.cleanaircoalitonbc.com/cacontentlmbylaws.htm.

[72] British Columbia Workers' Compensation Act.

http://www.worksafebc.com/policy/regs/excerpts.asp.

> (b) to prevent work related accidents, injuries and illnesses.

Occupational Health and Safety Regulation

The WCB also regulates chemicals in the workplace under the *Occupational Health and Safety Regulation*.[73] The regulation contains the following provisions:

> General duty
> 2.2 Despite the absence of a specific requirement, all work must be carried out without undue risk of injury or occupational disease to any person.
>
> CONTROLLING EXPOSURE
> Exposure limits
> 5.48 The employer must ensure that a worker's exposure to a substance does not exceed the exposure limits listed in Table 5-4.

For eleven carcinogens found in cigarette smoke, British Columbia regulations list no safe or tolerated exposure limit. For one of them, 4-aminobiphenyl, the Regulation specifies that it is a "carcinogen with no permitted exposure or contact by any route (respiratory, skin or oral)." These eleven cancer-causing substances are among the chemicals listed in Table 5-4: "Exposure Limits and Designations" of the *Occupational Health and Safety Regulations*. The eleven carcinogens are:

- 4-aminobiphenyl
- Benz(a)anthracene
- Benzo(b)fluoranthene
- Benzo(a)pyrene
- Beta-naphthylamine
- N-nitrosodiethanolamine
- N-nitrosodiethylamine
- N-nitrosodimethylamine
- N-nitrosodimethylethylamine
- N-nitrosodimorpholine
- N-nitrosopyrrolidine

Of these eleven cancer-causing substances, the following three are present in the sidestream smoke of Canadian cigarettes and are reported to the British Columbia government by the tobacco industry, as required by regulation (See Appendix B).

- 4-aminobiphenyl
- Benzo(a)pyrene
- Beta-naphthylamine (2-aminonaphthalene)

[73] Workers' Compensation Board of British Columbia. Occupational Health and Safety Regulation. http://www.worksafebc.com/policy/regs/contents.asp

In Table 5-4, "Exposure Limits and Designation," of the British Columbia *Occupational Health and Safety Regulation*, seven of the eleven carcinogens with no safe level of exposure are also designated as "ALARA substances," those "to which the exposure of workers must be kept as low as reasonably achievable." These are:

- 4-aminobiphenyl
- Benz(a)anthracene
- Benzo(b)fluoranthene
- Benzo(a)pyrene
- Beta-naphthylamine
- N-nitrosodiethylamine
- N-nitrosodimethylamine

It is certainly "reasonably achievable" to reduce exposure to all of these chemicals to zero by the simple expedient of banning smoking in all workplaces. Smoking bans have long been demonstrated to be "reasonably achievable" in many workplaces. Indeed, it is already the case in most British Columbia workplaces, including many workplaces in the hospitality industry. In the interests of public health protection, it would be reasonable and feasible to extend smoking bans to all workplaces.

The Workers' Compensation Board proposed revisions to Part 4, General Conditions, Articles 4.82 and 4.83, of the *Occupational Health and Safety Regulations* that would extend existing explicit controls on environmental tobacco smoke to all workplaces in British Columbia including long term care facilities, prisons, restaurants, bars and games rooms.[74] The regulations were withdrawn and replaced by another regulation that allows some exposure to tobacco smoke in the workplace.[75] The presence of tobacco smoke in the workplace contravenes Part 5, Chemical and Biological Substances of the same regulation.

Full compliance with Part 5, Chemical and Biological Substances, of the British Columbia Occupational Health and Safety Regulation would require eliminating all tobacco smoke from British Columbia workplaces.

[74] Workers' Compensation Board of British Columbia, Public Hearing, Environmental Tobacco Smoke, http://www.worksafebc.com/policy/hearings/ets/proposed.asp.

[75] British Columbia Ministry of Labour. Environmental Tobacco Smoke Regulation. January 2002. http://www.labour.gov.bc.ca/news/2002/ets-regulation.htm.

Conclusions

Health effects of involuntary exposure to tobacco smoke

Six major scientific reviews carried out in the 1990s have identified 15 major disease groups or conditions as known or suspected to be caused by exposure to second-hand smoke (See Table 2). These include four developmental diseases or conditions, seven respiratory diseases or conditions, three cancers and coronary heart disease.

On the basis of recent research, breast cancer and cerebrovascular disease should be added to the list of diseases for which exposure to second-hand smoke is a suspected cause.
It is concluded that:

- **Exposure to second-hand smoke causes the following diseases and conditions:**
  - *In adults*
    - Heart disease
    - Lung cancer
    - Nasal sinus cancer
  - *In children*
    - Sudden infant death syndrome
    - Foetal growth impairment including low birth-weight and small for gestational age
    - Bronchitis, pneumonia and other lower respiratory tract infections
    - Asthma exacerbation
    - Middle ear disease
    - Respiratory symptoms

- **Exposure to second-hand smoke has also been linked to other adverse health effects. The relationships may be causal. These include:**
  - *In adults*
    - Stroke
    - Breast cancer
    - Cervical cancer
    - Miscarriages
  - *In children*
    - Adverse impact on cognition and behaviour
    - Decreased lung function
    - Asthma induction
    - Exacerbation of cystic fibrosis.

It is estimated that exposure to second-hand smoke causes between 1100 and 7800 deaths per year in Canada.

Recommendations of scientific reviews

Not all of the reports of the six scientific reviews contain policy recommendations. However, of the four that do, they are unanimous in the view that all exposure to second-hand smoke should be avoided. Dr. David Satcher, the United States Surgeon-General was most specific in his recommendation, contained in the preface to the California Environmental Protection Agency Report.

> I call on everyone committed to public health to join with me in a renewed effort to complete the creation of a smoke-free society by:
> - Encouraging communities to enact clean indoor air ordinances requiring 100 percent smoke-free environments in all public areas and workplaces, including all restaurants and bars.
> - Encourage smokers as well as non-smokers to make their homes smoke-free to protect children and families from ETS exposure.

Dr Satcher's recommendations and those of other scientific reviews, are consistent with the recommendations of an Ontario Expert Panel that reported in 1999:

> - Require that indoor public places be 100% smoke-free, with immediate implementation in youth recreation facilities.
> - Incrementally ban smoking in all indoor workplaces except where smoking areas are separately-enclosed and separately-ventilated to the exterior, beginning at once with offices and industrial worksites.
> - Implement media-based public education programs on the dangers of second-hand smoke.

Recommendations have been stated in many different words. However, the message is clear, consistent and unanimous – **all involuntary exposure is harmful and should be eliminated.**

No solution through ventilation

ASHRAE, the world's leading ventilation standard-setting organization, no longer provides standards for air with tobacco smoke in it, only for smoke-free air. Searches for ventilation solutions have proven fruitless. A panel of 14 experts in ventilation technology concluded that existing dilution ventilation technology could not effectively remove much tobacco smoke from indoor air. However, they speculated that displacement ventilation might be able to remove up to 90% of tobacco smoke from air.

Repace analyzed these finding using risk assessment procedures and concluded that dilution ventilation would have to improve by a

factor of 20,000 and displacement ventilation by a factor of 2000 in order to meet the level of public health protection normally expected for environmental contaminants.
Accommodation of tobacco smoke in the workplace, the solution proposed by the tobacco industry, was found to have no basis in science or public health protection. Its advocacy by members of the hospitality industry is similarly lacking in public health motivation. The tobacco industry has made payments to the hospitality industry to implement its Courtesy of Choice campaign.

Given all knowledge accumulated to date in the health, risk assessment and ventilation sciences, it seems most unlikely that tobacco smoke in indoor workplaces could ever be reduced to safe levels through the application of ventilation technology.

Ventilation provides no solution to the problem of exposure to second-hand smoke.

Legislation to control second-hand smoke

California: Smoking is banned in all workplaces in California. The ban is widely respected and strongly supported by Californians.

Canada - federal jurisdiction: The Non-Smokers' Health Act limits smoking to separate smoking rooms for the 8% of workers under federal jurisdiction. The law is widely respected, but guarantees less than complete protection from second-hand smoke. Strict application of health and safety legislations would require elimination of tobacco smoke from all federally regulated workplaces.

Newfoundland: New regulations of the Smoke-Free Environments Act would ban smoking in restaurants when children under could be present. However, strict application of health and safety legislation would require smoking to be banned in all workplaces all the time.

Nova Scotia: Smoking is banned by administrative rules in provincial government workplaces. The Cape Breton Regional Municipality recently passed a by-law that would convert bars, ice rinks, malls, restaurants, hotels, bowling lanes, bingo halls and casinos into smoke-free spaces within three years. There is strong public support for action to control second-hand smoke across the province. Three out of four Nova Scotians would support province-wide legislation similar to the Cape Breton by-law.

New Brunswick: Strict application of New Brunswick health and safety legislation would require smoking to be banned in all workplaces.

Prince Edward Island: Strict application of Prince Edward Island health and safety legislation would require smoking to be banned in all workplaces.

Quebec: Quebec's Tobacco Act ostensibly controls smoking in many places. However, there are many exceptions, meaning that the law if

far from complete in protecting people from exposure to second-hand smoke. However, strict application of Quebec health and safety legislation would require smoking to be banned in all workplaces.

Ontario: Rigorous application of the Ontario Tobacco Control Act would require the elimination of tobacco smoke in all Ontario bars, and possibly all restaurants as well.

Regulations under the Occupational Health and Safety Act ban any workplace exposure to seventeen chemicals known to be in tobacco smoke. Current data exist documenting the presence of seven of these chemicals in the sidestream smoke emitted by all major brands of Canadian cigarettes. Ontario law therefore, in effect, bans smoking in all workplaces under provincial health and safety jurisdiction. The Ontario government may wish to move quickly to ensure that the law is soon respected and enforced and that tobacco smoke is eliminated from Ontario workplaces. Failure to do enforce the law would leave the door open to a great many workers exercising their right to refuse work on the grounds that they are being exposed to a known danger – second-hand tobacco smoke – from which they should expect to be protected by toxic substance regulations.

The Ontario Health Protection and Promotion Act affords the Medical Officers of Health broad discretionary power to protect community health. If, for example, a Medical Officer of Health was of the opinion, on reasonable and probable grounds, that there was no safe level of exposure to tobacco smoke in any workplace, the Act grants the Medical Officers of Health discretionary power to order the elimination of tobacco smoke from all workplaces in their health unit.

Full compliance with the Ontario Occupational Health and Safety Act and its regulations would require eliminating all tobacco smoke from Ontario workplaces. Medical Officers of Health could issue orders to this effect.

Manitoba: Full compliance with the Manitoba Workplace Health Hazard Regulation would require eliminating all tobacco smoke from Manitoba workplaces.

Saskatchewan: Unlike the other provinces, Saskatchewan's health and safety legislation does not have lists of potentially dangerous chemical and their threshold limit values.

The effect of the two Saskatchewan laws that deal with tobacco smoke in the workplace, the Saskatchewan Occupational Health and Safety Act and the Saskatchewan Tobacco Control Act is to restrict smoking to enclosed smoking rooms, or in certain circumstances to permit smoking in smoking areas that are not enclosed.

Alberta: Full compliance with Alberta health and safety legislation would require eliminating all tobacco smoke from Alberta workplaces.

British Columbia: Smoking is banned in 85% of workplaces in British Columbia. The ban is a widely respected and an effective

public health protection measure. While the Workers' Compensation Board had proposed that the ban be extended to bars and restaurants, new regulations of the Ministry of Labour allow some exposure to second-hand smoke in bars and restaurants.

Canada – all jurisdictions: The federal government and the provinces of Newfoundland, Quebec, Ontario, Saskatchewan and British Columbia have adopted laws that in whole or in part seek to restrict exposure to second-hand smoke in the workplace.

In addition occupational health and safety legislation in federal legislation and all provinces except Saskatchewan indicate that there should be no exposure at all in workplaces to two or more chemicals present in tobacco smoke.

The effect of the health and safety legislation in federal jurisdiction and nine provinces (Saskatchewan is the exception) would require tobacco smoke to be eliminated from the workplace, were the legislation strictly applied. This is because all these jurisdictions list as dangerous regulated chemicals a number of chemicals with no safe level of exposure that are nonetheless present in tobacco smoke. The number of chemicals present in tobacco smoke to which no exposure is permitted varies according to province from 2 (federal government, Newfoundland, Nova Scotia, New Brunswick, Quebec, Manitoba, Alberta) to 17 in Ontario.

It is therefore concluded that strict application of federal and provincial health and safety legislation would result in tobacco smoke being eliminated from nearly all workplaces in Canada.

Appendix A

Appendix B

Appendix B:

Sixty-four chemicals in tobacco smoke for which IARC has determined there to be sufficient evidence of carcinogenicity in animals

Polycyclic Aromatic Hydrocarbons

1 Benz[a]anthracene
2 Benzo[b]fluoranthene
3 Benzo[j]fluoranthene
4 Benzo[k]fluoranthene
5 Benzo[a]pyrene
6 Dibenz[a,h]anthracene
7 Dibenzo[a,e]pyrene
8 Dibenzo[a,l]pyrene
9 Indeno[1,2,3,-cd]pyrene
10 5-Methyl chrysene

Heterocyclic compounds

11 Dibenz[a,h]acridine
12 Dibenz[a,j]acridine
13 Dibenzo[c,g]carbazole
14 Benzo(b)furan
15 Furan

N-nitrosamines

4-(Methylnitrosamino-1-(3-pyridyl)-1-butanone
N-Nitrosodimethylamine
N-Nitrosodiethylamine
N-Nitrosoethylmethylamine
N-Nitrosonornicotine
N-Nitrosodiethanolamine
N-Nitrosopyrrolidine
N-Nitrosopiperidine
N-Nitroso-n-butylamine
N-Nnitroso-n-propylamine

Aromatic amines

2-Toluidine
2,6-Dimethylaniline
2-Naphthylamine
4-Aminobiphenyl

N-heterocyclic amines

Aac
IQ
Trp-P-1
Trp-P-2
Glu-P-1
Glu-P-2
PhlP

Aldehydes

Acetaldehyde
Formaldehyde

Volatile hydrocarbons

39 1-3-Butadiene
40 Isoprene
41 Benzene

Miscellaneous organic compounds

42 Acetamide
43 Acrylmide
44 Acrylonitrile
45 Vinyl chloride
46 DDT
47 DDE
48 Catechol
49 Caffeic acid
50 1,1,-Dimethylhydrazine
51 Nitromethane
52 2-Nitropropane
53 Nitrobenzene
54 Ethyl carbamate
55 Ethylene oxide
56 Propylene oxide

Inorganic compounds

57 Hydrazine
58 Beryllium
59 Nickel
60 Chromium VI
61 Cadmium
62 Cobalt
63 Lead
64 Polonium-210

Source: National Cancer Institute. Risks Associated with Smoking Cigarettes with Low Machine-Measured Yields of Tar and Nicotine. Smoking and Tobacco Control Monograph No. 13. Bethesda, MD: US Department of Health and Human Services, National Institutes of Health, National Cancer Institute, NIH Pub.No. 02-5074, November, 2001.Table 5-4, pages 163-165.

Appendix C