WASTE MANAGEMENT ACT REVIEW
DISCUSSION PAPER

CLEAN AIR ISSUES IN BRITISH COLUMBIA

Prepared for:

Ministry of Water, Land and Air Protection
Victoria, BC

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PREFACE

As part of the provincial government's New Era commitment to ensuring sound environmental protection and economic prosperity, the Ministry of Water, Land and Air Protection has begun a comprehensive review of the *Waste Management Act*. Key commitments include:

- Establishing a scientifically based, principled approach to environmental management that ensures sustainability, accountability and responsibility.
- Implementing a streamlined, results-oriented regulatory framework to protect human health and the environment.
- Addressing the degree of unnecessary regulatory burden imposed by existing legislation.

Background information on the review process is published at:
http://wlapwww.gov.bc.ca/epd/waste_mgt_review/index.html.

A number of discussion papers have been or will be prepared for public review and comment as part of this process. These papers are not policy proposals, but rather are intended to stimulate discussion and solicit new ideas. The first of these papers have already been published:

- Authorization of Waste Discharge
- Compliance
- Appeals Under the Waste Management Act

This background paper is another in this series and is focused on air quality issues in relation to the *Waste Management Act*. It has been prepared by RWDI West Inc. for discussion purposes only, and is not intended as advice or recommendations. The views and comments in this paper do not necessarily reflect those of the Ministry.

Given the anticipated content of the other papers, this paper focuses on the air contaminant scientific and management issues, leaving the legal and regulatory setting to the other documents.

Interested persons and organisations are invited to review and provide comment on this discussion paper, including, but not limited to, the specific consultation questions presented here. Comments must be provided by May 2, 2003 and should be directed in one of the following ways:

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In the preparation of this discussion paper a number of stakeholders were asked to put forward areas of concern.

Suggestions were received from Tim Howard, Sierra Legal Defence Fund; Chris Rolfe, West Coast Environmental Law Association; Brian McCloy, on behalf of the Business Council of BC; Dan Potts, Council of Forest Industries; Hugh Kellas, Greater Vancouver Regional District;, and Athana Mentzelopoulos, Environment Canada Pacific and Yukon Region. Suggestions were also received from several Ministry of Water, Land and Air Protection staff.

Comments were submitted in confidence and are not attributed in the text. The time and effort required by each group to prepare their contributions is gratefully acknowledged and appreciated.

The opinions expressed here are solely the responsibility of the contractor and do not necessarily represent policy of the Government of British Columbia.

SUMMARY

This paper is intended to stimulate discussion of clean air issues by interested members of the public in BC.

The current review of the *Waste Management Act* (*WMA)* presents a timely opportunity for the residents of British Columbia to have their say about the management of air quality in their communities. As the current act has been largely unchanged for 20 years, a review of this magnitude may not occur again for some time. Many things have changed in 20 years: the mix of sources, approaches to managing emissions, awareness of cumulative impacts of multiple sources, for example – as well as the range of management tools available. Urbanisation has brought increased emissions from sources such as transportation and space heating, such that these sources may now dominate local or regional emissions.

The fundamental air quality issue is how to meet the expectation of clean air in each of the diverse regions of the province, in the context of ensuring sustainability. Currently over 80% of BC's airsheds experience poor air quality at least some of the time.

In the *WMA's* present form, air quality is managed by issuing permits with specific terms and conditions to large industrial operations, and by setting regulations under the *Act* to set conditions for other types of air pollution sources, such as for motor vehicles and fuels, woodstoves, and open burning. It is also important to recognize that the *WMA* is but one part of the air quality management system in BC.

Key roles and responsibilities exist for each of the provincial, federal, and local levels of government. These include some roles that are becoming increasingly important to air quality management, such as federal regulations for fuels and vehicles, by-laws set by local and regional authorities to restrict such activities as backyard burning and residential wood combustion, and the delegated *WMA* authority of the Greater Vancouver Regional District - which is unique in Canada and has been the basis for innovative airshed management.

Although the *WMA* has been an effective tool in many regards, the changing nature of air issues and sources of emissions now require a broader mix of tools and greater flexibility in order to fully address the range of challenges to having clean air in BC. Air quality management has to keep pace with initiatives such as shared stewardship for clean air between the public- and private-sectors, implementation of innovative, results-based approaches and reducing the regulatory burden.

To this end, assessing contributions of multiple sources and airshed planning – with stakeholder involvement in problem-solving – will be key components in responding to present and future priority air issues. Some of these are outlined below.

An air quality issue has two components:

- a concern caused by known or potential effects of air contaminants, and
- the province's capability to manage the emissions that lead to the concern.

Air quality concerns in BC

Key concerns for clean air are those for which our ability to manage them is inadequate at present. They include (in no particular order):

- Exposure to particulate matter and ozone at concentrations commonly found in BC is believed to lead to detrimental health and ecosystem effects, with the risk of experiencing an effect increasing as concentrations increase. Most of the common air contaminants are known to have human health and ecosystem impacts within the range of their current concentrations in typical urbanized and industrialized airsheds in BC. Management measures have produced emission reductions and improved air quality for PM and ozone in the Lower Mainland over the past 20 years, but in light of projected growth, additional measures will be required to counteract emission increases.
- Visibility impairment is a further result of emissions of air pollutants. In the Lower Fraser Valley, for example, it has been estimated that the lost tourism revenue due to reduced visibility may be equivalent to ozone damage to agricultural crops (i.e., potentially several million dollars per year, based on studies by Environment Canada and the University of British Columbia, respectively). Management measures for this issue have just begun to be developed, and supporting research is lacking. In addition to its impact on quality of life, visibility impairment is linked to the fine particles which are of greatest public health concern.
- Odorous substance emissions are an ongoing concern in BC. They produce many public complaints and may have health implications beyond their nuisance impact. Many odorous sources have been controlled effectively, but many complaints persist, and management approaches are limited.
- Greenhouse gases are of concern for their expected contribution to global climate change, and the range of impacts this may have on BC. Greenhouse gases and air contaminants are often emitted from the same source through combustion of fossil fuels. As such, some control actions may effectively address both global and local air issues. Management measures for greenhouse gases have just begun to be developed, and implications for BC of implementing the Kyoto Protocol are not known.

Challenges to addressing air quality concerns in BC

Impact thresholds no longer apply

Research findings on particulate matter and ozone firmly suggest that air quality objectives can no longer be defined as boundary lines between ‘safe’ and ‘unsafe’ conditions. This poses challenges in the creation of objectives for ambient air quality.

How these objectives and standards are then applied in guiding responses to airshed conditions or permitting individual sources is as important as the values of the objectives themselves. Additional consideration must also be given to the principles

of ‘keeping clean areas clean’ and ‘continual improvement’ in the Canada-Wide Standards for particulate matter and ozone.

Multiple sources & cumulative effects

Managing for clean air involves consideration of all sources in a region and assessing their cumulative effect on air quality – not just traditional point source management. Moreover, sources of emissions – point, area, and mobile – cannot be considered in isolation from each other.

Assessing the cumulative contribution to emissions of new developments or reviewing the overall air quality performance for an airshed depends on accurately estimating the full mix of emissions in a region. The mix of emissions may include a wide variety of sources, or it may include one dominant source which may also be a cornerstone of the local economy. Important sources can include, for example, emissions from factories, mills, power plants, cars, ships, aircraft, lawnmowers, agriculture, home space heating, and use of paints and solvents.

Managing for the mix of emissions may involve establishing effective and efficient management plans for permit holders, and adapting these when necessary. In other cases, it may involve emission reduction measures targeted to non-industrial sources.

Airshed management

Addressing air quality issues will also involve co-ordinated airshed management that is responsive to the issues at hand for each particular airshed. Airshed management has had successes in some parts of the Province, but has been implemented largely on a voluntary basis, with no legal requirements even if air quality can be considered degraded.

Choices & planning

Beyond these measures, it may involve addressing our choices and behaviour, such as assessing land-use and transportation planning options in terms of air quality impacts.

New ways of thinking

An air quality management system that is responsive to a range of situations is part of the challenge for BC. It requires new ways of thinking about clean air issues, beyond traditional point source management, and possible new legislation to fully support the development of these kinds of solutions.

A key part of almost all successful airshed management strategies has been to engage members of the community early in the process. Community members, business and industry, and non-governmental organizations representing multiple interests have guided airshed planning through steering committees, in setting priorities and targets, and in assessing the mix of tools and flexibility appropriate for airshed conditions. The most advanced processes have been developed for the Lower Fraser Valley and Prince George.

In addition to regional stakeholders, engaging local-level and federal governments is essential to air quality management. Both of these other levels of governments have important roles to play, through such actions as setting standards for vehicle emissions, international agreements, and setting local land-use by-laws.

New approaches

Although the *Waste Management Act* is the key tool used in BC to manage air quality, it is only one of several legislative tools used in air quality management and not all issues may necessarily be addressed through its application. Given the diversity of airsheds and communities in BC, a varying set of priorities and tools will probably be required across the Province.

Much may be done within existing frameworks, but changes and new tools are also required. Updating the air quality management system to be responsive to the issues in BC may involve modifying the *WMA*, developing new policies, adding new legislation or regulations, or improving management practices within the existing regulatory context.

In some cases, this could involve modifying the legislative basis for air quality management, ranging from establishing air quality objectives with legal standing for airshed planning to providing guidance for cumulative emissions assessment. In other cases, it may involve changing the management of low-risk point sources and implementing standards for other sources of emissions, engaging a variety of stakeholders in the airshed planning process, using economic measures, delegating responsibilities and resources to local authorities, or coordinating efforts between all levels of government.

Concluding comments

Air quality values might be summed up by the questions:

- *Is it healthy?*
- *Is it clear?*
- *Is it odour-free?*
- *Is it capable of sustaining our environment?*

Every citizen in British Columbia can rightfully expect to breathe clean air. To meet this expectation, the Ministry of Water, Land, and Air Protection hopes that all those who value clean air will play a part in shaping the path forward. Clearly discussion and debate are required, as choices and actions required to safeguard or improve air quality may directly affect many residents of BC.

In this report, key questions on air quality are raised for further discussion. The report is structured in five principal sections:

- an introduction to the discussion;
- an overview of air quality concerns in BC;

- a discussion of air quality management in BC;
- a discussion of options and issues in addressing air quality issues in BC, where consultation questions are posed along with supporting discussion;
- a brief conclusion, including a listing of the discussion questions.

The discussion questions are also presented below. Finally, it is hoped that the information contained in this report will provide valuable assistance for discussion, priority setting, and in helping to create the most effective air quality policy and legislation possible.

Discussion questions

General Priorities

1. What is needed beyond the direction provided by MWLAP's Service Plan to enable air quality management strategies to be developed in BC?
2. Have the most important clean air issues been listed? What priority should be placed on the principal issues?

Policy, Legislation and Regulations

3. Are there reasons for BC to consider legislating Ministerial requirements for clean air management?
4. Under what conditions should air quality objectives have Province-wide application, or alternately, under what conditions is it feasible to allow flexible, discretionary application on a regional or airshed basis, depending on local circumstances?
5. How should greenhouse gases be treated under the *WMA*? Should airshed management plans have objectives for reductions in greenhouse gases?
6. How should BC manage air quality in pristine or little-developed areas?
7. Under what conditions, if any, should there be a legislated requirement for airshed planning? Secondly, does the authority to make and implement plans need to be defined explicitly?
8. What roles should federal and municipal governments play in the development of regional air quality management plans?
9. Do you think that sanctions for not putting into action an airshed management plan or meeting airshed goals or timelines need to be in place? If so, what type and to what degree?
10. In what ways could air quality management plans be integrated with Regional Growth Strategies and Official Community Plans?

Management Practices

11. Do Provincial air quality objectives need to be formalized as standards (perhaps with enforceable sanctions), or should they remain as guidelines? If formalized as standards, how are they to be used?
12. Should objectives and standards be defined for other air quality impacts, such as odours, visibility, and acidic deposition?
13. Should BC adopt a risk-based approach to air quality impact assessment in place of, or to supplement, use of air quality objectives? Who should set the acceptable or threshold levels of risk? How should acceptable levels of risk be set in this context?
14. Under what conditions should use of flexible or facility-wide permits, BACT specifications, sector-wide approaches, emissions trading (for CACs or GHGs), or emission offsets be considered for air emissions in BC?
15. Should new sources be required to develop emission offsets in degraded airsheds? Elsewhere?
16. Should mandatory reporting of emissions be specified for BC?
17. Should review of cumulative regional emissions be required in permitting a new emission source? How should it be structured? Should existing sources be subject to review in the context of cumulative emissions?
18. Under what circumstances, if any, should economic instruments be considered for air quality management in BC?
19. With or without a regulatory requirement, what measures will facilitate airshed planning and implementation, and under what conditions (taking into consideration community size, severity of problem, level of support, etc.)?
20. Are there other new or innovative air quality management methods that BC should consider?
21. Should plans be required only if air quality does not, or is not expected to, meet specified objectives or standards?
22. Under what conditions would air quality management in airsheds be more effective and efficient if delegated to the local or regional level, or to regional airshed management authorities?
23. To meet the principles of 'keeping clean areas clean' and 'continuous improvement,' should there be required management actions associated with air quality targets below the Canada-Wide Standards? What kinds of actions and targets should be used?

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1. INTRODUCTION

How to read this report

For greater ease, most topics have been divided in the following way:

- "*Key points*" – a brief summary of essential points
- "*Discussion*" – further discussion concerning the key points
- "*Implications*" – synthesis of issues for possible changes to policy, legislation, regulations or management practices
- "*...For those who want to more*" – a follow-up section of supplemental information at the end of a section for those requiring more details (highlighted by a distinctive font and formatting).
- Footnotes and web site links are also provided for added reference

The main sections of the report are divided as follows:

- Chapter 1 "*Introduction*" – provides a concise overview of the report's goals: air quality concerns, current management systems, and guidelines for discussion of key issues.
- Chapter 2 "*Air Quality Concerns in BC"* – identifies key concerns such as air contaminants, health effects, and airshed degradation.
- Chapter 3 "*Air Quality Management in BC*" – outlines in brief the network of policies and related responsibilities for all levels of government.
- Chapter 4 "*Addressing Air Quality Issues in BC"* – includes a range of strategies that might be considered for air quality management and poses questions to aid the discussion process.
- Chapter 5 "*Conclusion*" – provides brief conclusions and re-iterates the implications and discussion questions grouped thematically
- "*Appendix A*" provides examples of approaches employed in California and the United Kingdom

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The fundamental air quality issue in BC is to meet the expectation of clean air in the diverse regions of the province – all with different issues and settings. Although air quality concerns and our understanding of health and environmental effects have changed greatly in recent years, provisions within the *Waste Management*

Act (*WMA)* for managing air emissions and resulting air quality have been essentially in place since 1982.

The Ministry of Water, Land, and Air Protection (MWLAP) is asking all interested parties for their views on, and concerns with, air quality management in BC. The purpose of this document is to provide supporting information and offer discussion questions to assist this process.

An "air contaminant" is defined under the *WMA* as any substance released into the air that

- injures or is capable of injuring the health or safety of a person,
- injures or is capable of injuring property or any life form,
- interferes or is capable of interfering with visibility,
- interferes or is capable of interfering with the normal conduct of business,
- causes or is capable of causing material physical discomfort to a person, or
- damages or is capable of damaging the environment.

In the *WMA*'s present form, air quality is managed primarily by issuing regulations and permits to large industrial operations[1]. In the past, this was an effective approach; however, a changing mix of emission sources and development patterns makes this no longer as effective as it once was. Many stakeholders – regulators, permittees, community members, public interest groups – have expressed dissatisfaction with the current application of the *WMA* and approaches to managing emissions. New approaches, including airshed management planning and non-regulatory initiatives, will be needed to address the issues fully.

The *WMA* does not explicitly address greenhouse gas (GHG) emissions. Most emission sources of GHGs, however, also emit common air contaminants – such as particulate matter or nitrogen oxides. Therefore, the management of the two categories of pollutants could involve co-management strategies.

New measures and programs within and outside the scope of the *WMA* are needed. The *WMA* is but one part of the air quality management system in BC, and ensuring clean air will require roles for all levels of government, communities, individuals, businesses, and industries in the Province.

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The Ministry of Water, Land & Air Protection's *Service Plan 2003/04 – 2005/06* sets out the Ministry's near-term strategic approach to environmental management[2]. The *Service Plan* identifies several strategic shifts that provide direction for air quality-related initiatives.

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[1] "Clean Air Provisions" of the *Act* (Part 6) addresses vehicle and fuel emissions by setting standards or requiring individual pieces of equipment and their fuels to meet applicable operating standards. Other regulations have been set to control air pollution impacts from, for example, open burning, woodstove use, and ozone-depleting substances. Otherwise, air contaminants are controlled under the *Act* by site-specific permits or authorizations.

2 The *Service Plan* may be found on the MWLAP web page:
http://www.bcbudget.gov.bc.ca/sp2003/wlap/wlap.pdf

In particular, the shift toward results-based management means more emphasis on setting appropriate environmental standards, and ensuring standards are met. With reference to air quality, the latter assurance will depend on enhanced air quality monitoring and reporting. This also implies enhanced understanding of the relationships between emissions and ambient air quality. *Results-based management depends on knowledge*.

In addition, MWLAP aims to discontinue permitting of low- to medium-risk pollution sources, which are to be addressed through codes of practice and other authorization tools.

The current comprehensive review of the *WMA* is being documented on the MWLAP web page[3]. General background information and discussion papers on other important aspects of the *WMA* review are posted on the website. The papers *Authorization of Waste Discharge, Compliance,* and *Appeals Under the Waste Management Act* are available, and others such as *Special Waste* are scheduled.

Other background documents and information sources that the reader may find useful in considering the air quality and climate change aspects of emission management in BC include –

- *State-of-Knowledge Report on Air Quality Management in British Columbia* (Draft), December 2002. [to be posted]
- *Updating BC Provincial Air Quality Objectives – An Options Discussion Paper*, May 2002. [http://wlapwww.gov.bc.ca/air/airquality/aqo_paper.pdf]
- *Greater Vancouver and Fraser Valley Air Quality Management Plan, Phase2: Harmonized Measures for Reducing Greenhouse Gases and Air Pollution in the LFV* (2001) and its companion report, *Phase 1: Options for Reducing Greenhouse Gases and Air Pollution in the GVRD* (2000). [Phase I Summary available at: http://www.gvrd.bc.ca/services/air/change/OPSum_pdf_gateway.html.]
- British Columbia Ministry of Water, Land and Air Protection climate change site (which also contains a link to the federal climate change information site): http://wlapwww.gov.bc.ca/air/climate/index.html .

3 See the *Waste Management Act Renewal* webpage: http://wlapwww.gov.bc.ca/epd/waste_mgt_review/index.html.

2. AIR QUALITY CONCERNS IN BC

Air quality is the measure of the cumulative contributions of all emissions into the atmosphere. Air quality issues are based on a combination of a concern about effects and our ability to manage the emissions that cause the concern, that is –

- the effect air contaminants have on the environment of the province and the health of its citizens (the source of concern), and
- the methods used to control air pollution and to reduce the effect of harmful emissions.

Key clean air concerns are those for which current or potential impacts have been identified and for which our ability to manage the emissions is inadequate. This section focuses on concerns about impacts of specific contaminants, primarily the scientific and technical aspects.

KEY POINTS

Priority concerns for BC include –

Common air contaminants

- Most of the common air contaminants (CACs) are known to affect human health and ecosystem impacts within the range of their current concentrations in typical urban and industrial airsheds in BC. The level of risk rises as concentrations of CACs in the air increase. CACs of principal concern are particulate matter and ozone.
- Based on concentrations of particulate matter (PM_{10})[4], over 80% of BC's airsheds experience poor air quality at least some of the time. The BC Objective for particulate matter (PM_{10}) is frequently exceeded in many areas of the province, especially outside of the Lower Fraser Valley.
- New evidence suggests that the composition of particulate matter influences health effects. For example, diesel particles are thought to be carcinogenic, whereas soil dust is less potent. Given the growing use of diesel engines (e.g. marine, railway, heavy duty trucks and construction equipment), addressing the specific origin of types of particulate matter may be important in responding to poor air quality.
- The sources of these emissions can be many and varied, ranging from home space heating to vehicle exhaust – not just industrial point sources.
- The Canada-Wide Standard (CWS)[5] for ozone is currently not exceeded in BC, but several communities are borderline. The Lower Fraser Valley is currently in compliance with the CWS for particulate matter ($PM_{2.5}$) by a significant margin.

[4] PM_{10} refers to the size fraction of particulate matter smaller than 10 micrometers in diameter; $PM_{2.5}$ refers to particulate matter smaller than 2.5 micrometers in diameter.
[5] See http://www.ccme.ca/initiatives/standards.html?category_id=5 for further details of the CWSs.

Based on limited data, it is expected that a number of interior communities may exceed the CWS.

Visibility impairment

- Visibility impairment is caused by many of the same common air pollutants which are of greatest public health concern. The factors that influence visibility impairment remain poorly understood and have not been studied in most parts of BC.

Odorous substances

- Some emissions are odorous and result in many public complaints. In some cases, these may have health implications beyond their bad smell.

Greenhouse gas emissions

- BC is committed to taking action on greenhouse gas (GHG) emissions. Human-produced greenhouse gases are thought to contribute to global climate change. Greenhouse gases and air contaminants are often emitted from the same source through combustion of fossil fuels. As such, some co-management opportunities exist to address both global and local air issues through the same measures.

The challenge with each of these concerns is our ability to prevent or reduce the emissions and their impacts. In some cases, it is not yet clear what the most effective management strategies are to address the range of these concerns. In other cases, significant lead time is required to implement strategies that have been identified.

Although weather and terrain will influence concentrations of contaminants in the air, our ability to reduce the effects of each of these concerns revolves around ways in which emissions to the air can be reduced.

Sources of emissions include the range of industrial facilities, but in many cases transportation and other combustion sources (e.g., lawnmowers, space heating, woodstoves) are significant contributors to elevated levels of particulate matter and ozone. The *WMA* has supported regulating emissions from industrial facilities, but is limited in its ability to deal with these other priority sources.

At the simplest level, mitigating concerns often involves making the activity that produces the emissions less polluting, or reducing the amount of the activity that occurs. Emission reductions might be achieved, for example, by adding pollution controls to manufacturing equipment or by designing transportation systems to reduce the use of road vehicles. However, in reality such actions often involve multiple trade-offs, difficult choices, and competing priorities. Cooperation among different stakeholders and multiple levels of government is needed in order to resolve these problems and clarify the path forward.

DISCUSSION

The *WMA* provisions for managing emissions and air quality should be viewed in the context of the complete regulatory framework. At present, all levels of

government have a role in air quality management. However, none have a means for addressing the full cumulative impact of emissions on air quality from a region's industrial ***point*** sources, dispersed ***area*** sources and ***mobile*** sources.

The relationship between emissions, which are controllable under the *WMA*, and air quality, which is the end result of the management system, is one of the principal issues to consider in reviewing the *WMA*.

Types of air contaminants

In principle, BC's air quality management system needs to accommodate all air contaminants. However, the stratospheric ozone-depleting substances (ODS)[6], persistent organic pollutants (POPs), and toxic air pollutants are not treated here as issues for this consultation, as these contaminants are addressed primarily through federal legislation under the *Canadian Environmental Protection Act (CEPA)* – with provincial cooperation (e.g., BC's *Ozone-Depleting Substances and Other Halocarbons Regulation*).

Air contaminants discussed here are common air contaminants, odorous substances, and greenhouse gases:

- *Common air contaminants* (CACs) – have acute or chronic effects on human health, or act as *precursors* to *secondary* substances that have human health effects; CACs include nitrogen oxides (NOx), sulphur dioxide (SO_2), carbon monoxide (CO), particulate matter (PM)[7], volatile organic compounds (VOCs) and ozone (O_3); in addition to direct health and environmental impacts, some CACs contribute to visibility impairment;
- *Odorous substances* – generally, organic compounds that cause nuisance responses in humans but which are not necessarily toxic; the effect is more acute near sources (examples: some hydrocarbons, reduced sulphur compounds such as hydrogen sulphide);
- *Greenhouse gases* (GHGs) – gases that are non-toxic to humans but whose emissions from manmade sources are thought to contribute to global atmospheric warming and eventual climate change with its consequent human and environmental impacts (principally, carbon dioxide – CO_2, methane – CH_4 and nitrous oxide – N_2O[8]);

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[6] *Ozone-depleting substances* are long-lived gases that diffuse upwards in the atmosphere where they react with and destroy the UV-protective stratospheric layer of ozone. *Stratospheric ozone* should not be confused with *ground-level ozone*, which has direct health and environmental impacts at the earth's surface.

[7] See supplemental information at the end of this section for details about various particle sizes.

[8] N_2O is not a component of NOx, which by definition includes only NO (nitric oxide) and NO_2 (nitrogen dioxide).

CACs

Health effects

The health and environmental effects that result from high levels of CACs are important concerns for air quality management in BC. Several CACs (e.g., PM, O_3) are known to affect human health within the range of their current concentrations in typical urban or industrial areas of BC.

Current air quality monitoring data for BC and recent scientific findings indicate the CACs of greatest concern are *particulate matter* (PM) and *ozone.* The higher their concentration, the greater the health impacts.

Moreover, key findings from the recent studies on air pollution state that certain types of particulate are more likely to cause respiratory and cardio-vascular disease. For example, particles from combustion sources appear to be more potent than particles from natural sources (e.g., soil dust).

There is also evidence that PM from traffic-related emissions is more potent than other combustion-related emissions. Within this latter general source, diesel exhaust particulate seems to be of particular concern given its potential to lead to cancer[9] (see Table 1 for more details).

There is also a substantial body of evidence that suggests wood smoke is a special concern for both respiratory and cardio-vascular effects[10].

Threshold levels do not exist

Detailed scientific studies have determined that even relatively low levels of PM and ozone cause respiratory and cardio-vascular damage in humans. In short, a safe level or threshold with no harmful effects does not exist. Higher concentrations result in greater numbers of people affected and more detrimental effects.

Both life shortening (increased *mortality* rate) and illness (increased *morbidity* rate) in humans are associated with ambient concentrations of PM and ozone. Relationships between ambient concentrations of other contaminants and such effects are not as clearly established. These observations are from studies in a wide variety of urban regions around the world, including those with populations, geographic settings and contaminant mixes similar to those in BC.

In this light, the current provincial objectives or the CWSs might be best viewed as indicators to identify priority airsheds for management plans, rather than as 'bright lines' between 'safe' and 'unsafe' levels. It must be recognized that health effects attributable to air contaminants are occurring in all monitored communities in BC. In brief, the level of risk[11] of health effects rises with increasing exposure to ele-

[9] See, for example, a recent update by US-EPA on impacts of diesel exhaust: http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=29060

[10] This has been demonstrated in Seattle and in other locations such as Christchurch, NZ.

[11] *Risk* is defined in terms of the combined probability and level of impact associated with a particular activity. *Risk assessment* is concerned with addressing risk in combined terms of what can happen, how likely this may be to happen, and what consequences would result. Risk increases in proportion

vated levels of PM and other pollutants but is not 'zero' if the objective is not exceeded.

Table 1 summarizes the effects of the common air contaminants. As indicated in the table, continued exposure to CACs can lead to a range of health effects including asthma, bronchitis and lung cancer[12].

Table 1. Summary of the health effects of common air contaminants found in ambient air*

POLLUTANT	DEFINITE EFFECTS	PROBABLE EFFECTS	POSSIBLE EFFECTS
Particulate Matter	Time-series association with daily respiratory and cardiac mortality Aggravation of asthma Increased hospital admissions for respiratory and cardiac conditions Depressed lung function in schoolchildren (acute & chronic) Increased prevalence of bronchitis Increased risk of lung cancer School absences increased	Aggravation of acute respiratory infections Increased risk of wheezy bronchitis in infants 4-12 months Decreased rate of lung growth in children	Decreased birth weight
Diesel emissions (in addition to particle effects)	Increased response to allergens Increased airway inflammation	Increased risk of lung cancer	
Wood smoke (in addition to particle effects)	Aggravation of asthma Increased hospital respiratory admissions Increased respiratory infections		Increased mortality
Ozone	Increased hospital admissions for acute respiratory diseases Aggravation of asthma Increased bronchial responsiveness Increased response to SO_2 Increase in reduced activity days Increased school absences for respiratory illness Reduced lung function Increased sensitivity to allergens	Effect on mortality	Aggravation of acute respiratory infections Chronic bronchiolitis with repetitive exposure Increased prevalence of asthma

to exposure to a contaminant. For example, the more often a person drives a car, the greater the chance of having an accident – likewise for driving faster. In air quality terms, the higher the concentration of an air contaminant to which one is exposed, and the more often one is exposed, the higher the risk of an effect.

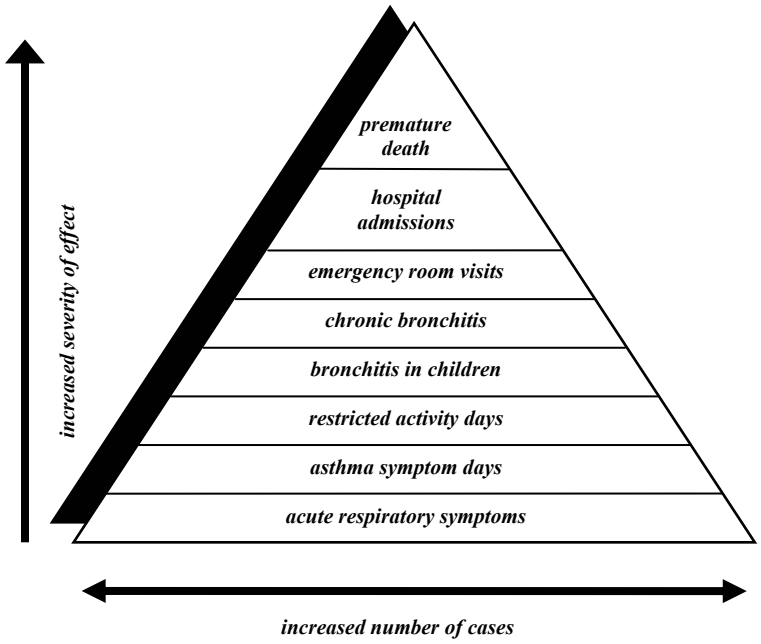
[12] Other information on the respiratory and cardio-vascular effects of air contaminants on humans may be found on a Health Canada website: http://www.hc-sc.gc.ca/hecs-sesc/air_quality/health_effects.htm. Environment Canada websites with additional information on impacts of impaired air quality are: http://www.ec.gc.ca/air/introduction_e.cfm ('Clean Air' and informative links) and http://www.pyr.ec.gc.ca/Air/air_eindex.htm (Pacific & Yukon Region, 'Clean Air').

POLLUTANT	DEFINITE EFFECTS	PROBABLE EFFECTS	POSSIBLE EFFECTS
Aerosol sulphates & nitrates	Reduced visibility Decreased lung function in adolescents with asthma	May be partly responsible for effects of $PM_{2.5}$	May increase all effects of concomitant ozone
Acid aerosols (combined gases & particles)	Increased prevalence of bronchitis Aggravation of asthma Effects on forests (contribution to acid rain)		May increase all effects of concomitant ozone
Sulphur dioxide	Acute bronchial constriction in asthmatics	Increased prevalence of lung cancer Increased nasal congestion (work of breathing)	Interaction with particles in relation to mortality and morbidity effects Increased prevalence of chronic bronchitis
Nitrogen dioxide	Increased respiratory morbidity & infections Aggravation of asthma in children Lowered lung function Increased response to ozone Reduced rate of lung growth Increased bronchial hyper responsiveness		
Carbon monoxide	Reduced heart blood supply	Increased hospital cardiac admissions Decreased birth weight	Increased cardiac mortality Increased birth defects
Hydrogen sulphide	Central nervous system and respiratory symptoms Eye irritation Mortality at very high concentrations	Chronic sinusitis	

* Adapted from, *A Citizen's Guide to Air Pollution*, second edition, The David Suzuki Foundation, 2002, D.V. Bates & R.B. Caton, eds.

Figure 1 compares the incidence of disease (number of cases) to the severity of the effect. Though clearly the most severe effect, shortened life, is the least frequent event, it is important to note, when reviewing the effect of air contaminants, the high number of cases with less severe symptoms.

Figure 1. Hierarchy of Air Pollution Health Effects



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Ecosystem effects

Although a great deal of concern over air quality is focussed in terms of human health impacts, there are also significant impacts on ecosystems. Poor air quality may directly affect animal and plant populations, either through respiration of degraded air, or from deposition of pollutants to soils and water.

Much of the known ecosystem effects have been assessed for plants. In addition to known acute responses due to specific chemical releases (i.e., HAPs) from particular sources, common air contaminants SO_2 and O_3 are of broad concern for their potential effects on plants.

Increased levels of SO_2 will lead to leaf discolouration and cell death, leading to loss of leaf function and potentially plant death. Increased levels of O_3 similarly lead to cell death and loss of leaf function, which inhibits plant growth. This may have significant impacts in terms of crop losses or reduced forest growth. Although the exposure response varies for different species, as with exposure in humans, there is no lower threshold for negative effects due to O_3 for plants[13].

[13] Further discussion of plant and ecosystem impacts may be found in Chapter 6 of *A Citizen's Guide to Air Pollution* (published by the David Suzuki Foundation, 2002).

Particulate matter levels and sources of emissions

The air quality in many airsheds in BC is under threat or has deteriorated in quality. An *airshed* is an area where geographic or meteorological conditions hinder the transport of air pollutants away from the community or region[14]. Airshed management has been identified as an important approach in the Ministry's *Service Plan*.

The Ministry of Water, Land, and Air Protection has developed a classification framework for identifying priority areas[15]. The Ministry suggests the use of the terminology *degraded*, *threatened* and *unthreatened* based on the percentage of the time that contaminant air quality levels exceed the Province's PM_{10} air quality objective[16].

Degraded airsheds are those in which the monitoring data show greater than 1% of days exceeding the objective annually (e.g., more than 3½ days each year). *Threatened* airsheds are those in which the objective was exceeded up to 1% of the time. About 80% of the monitored airsheds meet the *degraded* or *threatened* criterion at present. Only 6 of 52 airsheds were ranked as *unthreatened*[17].

Many regions in the interior of province have worse air quality than the more urbanized regions near the coast. Vernon, Golden and Grand Forks had the worst observed air quality, while Prince Rupert, Port Alberni, Campbell River, and the Sea-to-Sky Corridor had the best air quality, as indicated by local PM monitors[18].

The major urban areas – to which the Canada-Wide Standard for $PM_{2.5}$ applies – appear to be in compliance at present and on-track for the 2010 CWS compliance date. The currently operating monitoring stations for CWS PM compliance in the Lower Fraser Valley are at about 50% of the CWS limit, and PM levels in the region are forecast to rise slowly during the next 10 years. BC's performance target for PM is to have all monitored areas in compliance with the CWS limit by 2010 (most of which will fall below the 100,000 population threshold for the formal CWS compliance reporting requirement).

Prince George is presently in exceedance of the CWS for particulate matter. Other regions, such as Kamloops and Kelowna, have air quality levels that are currently below the CWS. In many of these communities, however, there is poor spatial and/ or temporal coverage in the data record.

In the urbanized areas, vehicle related emissions ('mobile sources') are more dominant than those from heavy industry. Residential, commercial and institutional space heating using fossil fuels (e.g., homes, offices, schools and hospitals) is also more important in the 'area source' category in urban as compared with more rural areas.

[14] It should be noted that airshed boundaries are not as spatially discrete as for watersheds.
[15] The application of such a classification system for priority setting in assigning resources to monitoring, assessment and remediation actions is currently evolving.
[16] Note that these are nominal classifications; unthreatened should not be interpreted to mean that there is no risk associated with ambient air quality levels.
[17] 19 of 52 airsheds could not be classified due to insufficient monitoring data.
[18] See *State-of-Knowledge Report on Air Quality Management in British Columbia* for further details.

In less urbanized areas, resource industry facilities often are major contributors to local emission inventories. Smoke from wood fires is also an important pollutant.

Ozone levels and sources of emissions

Ozone has been a pollutant of concern in the Lower Fraser Valley for many years. Systematic emission reductions of ozone precursors, many of which have been specified and implemented through GVRD's Air Quality Management Plan, have helped to control ozone production to the point that this region is now in compliance with the Canada-Wide Standard. Several areas of the Lower Fraser Valley are at 80-90% of the CWS limit, but barring surprises, the region will remain in compliance to meet the national CWS target by 2010. Emission inventory forecasts indicate that ozone precursor emissions will not increase materially over the next 10-15 years. However, health effects due to ozone concentrations may occur at levels below the CWS.

In other regions, such as Kelowna and Kamloops, ozone levels are presently at levels such that this is now a concern in this region.

Ozone is not emitted directly into the atmosphere, but forms from reactions of NOx and VOCs in the presence of sunlight. Sources of these emissions include fuel combustion, such as motor vehicles, ships, trains, industrial facilities, and fossil-fuel fired power generation, among others.

Determining which sources of emissions in an area are most important in terms of their impacts is not always easy, especially as the mix of emissions changes through time. Compiling accurate annual emission inventories[19] and projecting these into the future can provide a critical indication of the relative importance of specific sectors of emission sources in a region. But, particularly for smaller airsheds, emission inventories on their own will not provide a full indication of how the air is impacted by these sources. In addition, reactions of pollutants in the atmosphere that lead to secondary formation of particulate matter and ozone are complicated by a variety of factors that emission inventories on their own may not indicate.

Air quality knows no borders

Recent assessment proceedings for proposed projects on both sides of the Canada-US border, such as the Sumas Energy 2 and GSX pipeline projects, illustrate issues that arise with increasing urbanization and industrialization in both BC and Washington State. Differences between Canadian and US air quality standards and assessment procedures have caused confusion over whether emissions from these fa-

[19] *Emission inventories* provide region-wide (or finer scale) tabulations of emissions totals, typically on an annual basis, of pollutants of interest for key source activity sectors – for example industrial point sources (e.g., electricity generation, manufacturing, chemical processing), transportation sources (e.g., on-road vehicles, ships, rail, off-road equipment), and area sources (e.g., space heating, solvent and paint use, agricultural fertilizer use, biogenic emissions). They are very useful for air quality planning, but by themselves do not indicate how and where sources will impact the air.

cilities would meet acceptable impact criteria. Both facilities are approved by US agencies but are still pending in Canadian proceedings. More generally, differences in urbanisation and industrialisation in the two parts of the shared Lower Fraser Valley airshed produce different perspectives on new developments.

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Visibility Impairment

In addition to causing direct health risks, emissions in some airsheds are responsible for reduced visibility. Although visibility impairment is a complex physical phenomenon, judging its effects can be a simple matter. Objects viewed from a distance are either acceptably clear – or unacceptably dim or hazy. It has been estimated that the lost tourism revenue due to reduced visibility is about equivalent to the value of ozone damage to agricultural crops in the Lower Fraser Valley.

Poor visibility is caused by the same types of contaminants that affect our health. The very fine particles that are most effective in reducing visibility are in the size range that penetrates deepest into the lungs (i.e., particles smaller than one micrometer in diameter).

The persistence of visibility issues, such as in the eastern Lower Fraser Valley, illustrates the difficulty of addressing all concerns adequately within even a carefully-designed air quality management plan. Generally speaking, although measures to reduce emissions have shown an overall air quality improvement, less success has been achieved in improving visibility.

Because visibility degradation is the result of many contributing factors, it is not a simple issue to address and responding effectively will require research and careful thought. Contributing factors include particle composition, size, concentration, and relative humidity. In coastal communities, sea salt may also contribute to the problem.

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Odorous substances

Complaints to regulatory agencies about air quality are frequently about odours. Odorous substances may be either gases or particles which, in addition to smelling bad, may also be harmful to our health.

Odours are the most difficult type of air pollution to manage. This is partly because even at low levels of concentration these emissions can affect the health of individuals. It is also due to the subjective nature and transitory effects of these contaminants.

Odours may result from a mix of pollutants, and emission rates are often difficult to estimate, making it difficult to model and assess odour impacts. Sources of concern include, for example, kraft pulping processes, fibre-reinforced plastic manu-

facture, and landfills. The diverse nature of this listing provides an indication of the breadth of the challenge involved in addressing these concerns.

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Greenhouse gases

Greenhouse gases (GHGs) are of concern for their contribution to climate change. Current scientific consensus is that human-produced GHGs enhance the earth's greenhouse effect, and lead to global atmospheric warming and a range of regional impacts[20]. They are not of concern for their direct local impacts – since they are not directly toxic to humans or ecosystems at current or projected concentrations in the air. However, the indirect effects of GHG emissions and their potential effect on climate change are well established.

GHGs and several CACs (principally, NOx, SO_2, PM and CO) are emitted simultaneously during the combustion of fossil fuels. Thus, every fossil fuel-burning facility or vehicle is a source of both CACs and GHGs.

A critical difference between managing CACs and GHGs lies in the technical ability to remove emissions from exhaust gas streams. Because of the very large volumes of GHGs that would need to be removed from emission streams, technologies are expensive and on a much larger scale than their CAC control counterparts (and may produce large volumes of solid or liquid waste by-products). Alternately, strategies to reduce or displace activities that lead to GHG emissions in the first place are logical preventive measures, and often result in simultaneous reductions of CACs.

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IMPLICATIONS

Addressing CACs, odours, visibility and GHG concerns will involve making choices and taking action to change the activities that lead to emissions and air quality concerns in BC.

At issue is the relationship between emissions, the means used to control them, and resulting air quality. The nature and current status of these air quality concerns have a number of implications for policy development, regulatory authority and management practice:

- Managing these concerns requires the ability to address the human activities that lead to emissions. It involves consideration of all sources in a region – as it is the cumulative effect of all sources that produces observed air quality. It also involves understanding the science and the impacts involved, as well as the management framework and possible options for response.

[20]See the following BC-MWLAP publication, *Indicators of Climate Change for British Columbia, 2002*: http://wlapwww.gov.bc.ca/air/climate/indicat/pdf/indcc.pdf

- In some cases, responding to these concerns may include legislation, regulations and standards on specific activities, while in others it may relate more to integrated approaches, such as airshed planning.
- To move beyond emission reductions that have been achieved to date, consideration will have to be given to the co-benefits that can be achieved by addressing more than one type of pollutant at a time through multi-pollutant strategies (including CACs and GHGs together).
- The results of recent health effects research, for example, mean that we must rethink the way we set and apply air quality objectives. Similarly, emission inventories that reveal the relative importance of multiple sources of emissions in a region, plus how these may vary across regions in BC, mean that strategies that reflect local conditions are needed. The management system must have the means and the flexibility needed to enable these approaches.
- Air quality concerns are managed in BC in a variety of ways, including through legislation, with roles for all levels of government. The *WMA* has been the Province's principal, but not only, tool for managing emissions that lead to air quality concerns. However, many current and future sources of importance require multi-agency control.

The next chapter presents further analysis of the air quality management system and how it relates to addressing these concerns, and sets the stage for the consultation questions presented in Chapter 4.

… *FOR THOSE WHO WANT TO KNOW MORE*

Other acts controlling air quality

The expected result of BC's air quality management system is protection of human and environmental health. The process by which this result is achieved is based in part on the authority of the *WMA* but involves other processes and legislation as well, such as the Environmental Assessment Process under the BC *Environmental Assessment Act* (and by extension, joint proceedings under the *Canadian Environmental Assessment Act*) or the Environmental Appeal Board process under the *Environment Management Act*. The *Canadian Environmental Protection Act* (*CEPA*) is also important to air quality management, along with other roles for the federal government, plus roles for local governments across the province. The Provincial *Motor Vehicle Act* also plays a role, through its AirCare requirements.

How the *WMA* works

The *WMA* does not define air quality explicitly, nor does it address all emission sources; rather, it authorizes the control of emissions from individual sources. The management of impacts is implicit in the authorization to place conditions on a permit to emit to the air. However, with the exception of delegation of management responsibilities to GVRD, the potential need for area-wide air quality management is not formally recognized.

Examples of air quality concerns

The following examples outline various air quality concerns across the province, and indicate some of the types of management responses. The management approaches are discussed in more detail in Section 3.

- Lower Fraser Valley. Because they share the same airshed the GVRD and FVRD have developed a co-ordinated approach to air quality management. The combined efforts of three levels of government have improved air quality substantially over the past 20 years. For ongoing success in these regional districts, however, an even greater level of collaboration will be required among governments to address the complex urban-suburban-rural diversity of this airshed.

  Internationally, the recent assessment processes before both US and Canadian agencies for the proposed Sumas Energy 2 plant at Sumas, Washington (just across the international border from Abbotsford) exemplify the added complexity of managing an airshed with multiple Canadian and US jurisdictions.

- The Prince George airshed, in contrast, contains many large industrial point sources in an area with a smaller, but significant population. One of the issues in Prince George is how to balance the air quality implications of maintaining the productive industrial base and providing acceptable air quality to residents. To this end, planning activities have included siting a new industrial area outside the main airshed of concern (but still within regional boundaries).

  Prince George stakeholders have collaborated over the years to manage local air quality. Implementation of the region's air quality management plan began in 1998, with a focus on controlling particulate matter – for which provincial objectives are frequently exceeded. Specific actions have included a Clean Air by-law covering wood stove use and installation, open burning, and dust management.

- In less populated areas such as Bulkley Valley (Smithers/Houston), particulate matter is also a concern. Here the focus has been on industrial, permitted sources. Many regions have recognized the limits of managing for air quality solely through individual permits. In the Bulkley Valley recent activities have included initiating the development of a new airshed plan.

Air contaminants – more details

Common air contaminants (CACs) emitted directly from sources are categorized as *primary*, and those that form through chemical reactions in the atmosphere from *primary* emissions are called *secondary* contaminants. The names refer to their physical-chemical properties and not to their relative importance in a pollution sense. Primary CACs that form secondary contaminants are called the *precursors* of the secondary contaminants. The atmospheric reactions not only alter the chemical form of the precursors but also make products that may be more (or less) harmful to humans or ecosystems than the original contaminants.

Particulate matter

Particulate matter (generically abbreviated PM) is specified by the size distribution of its particles. PM_{10} defines the size fraction smaller than 10 micrometers (millionths of a meter) in diameter (sometimes called the 'inhalable' fraction because particles in this size range penetrate through the nasal passages and into the upper respiratory system of humans when inhaled).

$PM_{2.5}$ defines that fraction smaller than 2.5 micrometers in diameter (sometimes called the 'respirable' fraction because particles in this size range can penetrate deeper into the small airways of the human lung). The smaller particles not only penetrate deeper into the lungs when inhaled, but they also stay airborne for longer periods of time than the larger particles – and thus are of greater concern with respect to regional human health impacts.

Recent health research suggests that even smaller particles (smaller than 1 micrometer in diameter) are probably of greatest concern, since they can penetrate into the deepest parts of the lung and may cause damage at the cellular level in the lung. PM is a mixture of both *primary* particles (including those from combustion sources and windblown soil, for example) and *secondary* particles (including particles that form in the atmosphere from combustion sources and a large number of other chemical constituents). The composition may be important in the nature of its effects.

Quantitatively, the health effects literature indicates that day-to-day changes in ambient PM_{10} or $PM_{2.5}$ concentrations are associated with a 0.2 to 1% change in total (non-accidental) mortality for each 10 microgram/cubic meter change in concentration. Longer-term effects studies indicate that total mortality changes by about 4% for each 10 microgram/cubic meter difference in long-term average $PM_{2.5}$ concentrations across monitored communities.

In the Lower Fraser Valley, the overall effect on mortality of exposure to air pollution is estimated to be of the same magnitude as deaths from motor vehicle accidents or drug overdoses (from a study done for the Vancouver-Richmond Regional Health Board).

Ozone studies

The new Ozone Annex to the *Canada-US Air Quality Agreement* does not currently specify actions for BC, but could do so in the future. The scheduled re-opening of the *Agreement* in 2004 and the trans-boundary nature of air pollution issues means that BC (in collaboration with Environment Canada's Pacific & Yukon Region) must devote resources to studying ozone formation and transport along BC's borders with neighbouring US states.

The Georgia Basin Ecosystem Initiative and the recently initiated International Air Quality Modelling Project are suggestive of the types of collaborative studies that BC will need to be involved with in the future. These international activities are coordinated (and, generally, funded) by Environment Canada.

These cases suggest the growing complexity of managing development and environmental impacts in an overall social and economic context. Efficient management of air quality impacts may involve some tradeoffs among environmental values and social and economic values.

Airsheds

An airshed can be defined as an area where geographic or meteorological conditions hinder the transport of air pollutants away from the community or region. Airsheds do not exist as physical entities in the same defined way as watersheds. Airsheds that have various sources of

emissions present a special problem as it is often difficult to determine the effect of contaminants released from each source. Moreover, the relative emitted quantities of contaminants from various sources (some of which may be limited by permit specifications) are not necessarily directly related to their contribution to air quality.

The characteristics of the sources themselves, the day-to-day meteorological conditions, and the physical terrain of an airshed are factors that combine to determine where the contaminants travel and how rapidly or thoroughly they are dispersed. In addition, some airsheds are more sensitive than others to a given quantity of emissions depending on the dispersion characteristics at the time of emission. This means that strategies and goals appropriate for one airshed may not be effective for others.

The management system needs to address these complex relationships between individual emission sources and their eventual effect on regional air quality. Other tools and approaches in addition to permits are necessary. In reviewing new strategies for air quality management in BC, it is important to recognize that the mix of sources and their relative contribution of emissions will change with time.

Management practices and measures will need to be relevant to the pattern of tomorrow's emission sources. Reliable emission forecasts, which will be important in deciding what practices and measures may be effective in the future, can also play a role in developing appropriate management strategies and tools.

Odour sources

Many harmful odours fall into two categories:

- *hydrocarbon vapours* such as styrene from fibre-reinforced plastics manufacturing operations or aromatic compounds from petroleum processing and
- *sulphur-containing gases* such as hydrogen sulphide and sulphur compounds used in Kraft pulping processes, sour natural gas processing, or the odorant in our natural gas supply.

Ontario uses an informal quantitative standard and protocol for enforcement, which in some cases have been written into permits. BC has no such standards, and complaints are dealt with on a case by case basis.

Greenhouse gases

The Lower Fraser Valley emission inventory for 2000 shows that 98% of the NOx and SO_2 emissions come from fossil fuel, energy-related sources, as well as 89% of the CO_2. This means that there is a close connection between the common air contaminants (CACs) found at a regional level and greenhouse gases (GHGs). Recently, attempts have been made by GVRD to address these close connections and develop measures that would reduce both categories of contaminants. Like the GVRD, the Province has also identified the need for the joint management of CACs and GHGs.

The Ministry's *Service Plan* includes an objective to meet global atmospheric targets, with a further goal of developing a climate change strategy. The new BC energy plan confirms the commitment to GHG management[21].

[21] *Energy for Our Future: A Plan for BC*, BC Ministry of Energy and Mines, November 25, 2002; http://www.gov.bc.ca/em/popt/energyplan.htm

3. AIR QUALITY MANAGEMENT IN BC

A key element in any air issue is our ability to manage the emissions that impair air quality and cause concern. This section describes some of the important components of BC's air quality management system and the problem aspects for managing the concerns identified earlier.

KEY POINTS

Multiple sources

- Since all sources of emissions in a region contribute cumulatively to air quality, and emissions in a region may originate from a variety of sources, or in some cases from one dominant source, managing for clean air requires addressing the mix of emissions accordingly.
- Determining which emission sources in a region or airshed are most important when many and varied sources are present is not often easy. Having information required to resolve this kind of issue is a key part of the management and decision-making framework, but in many cases uncertainty is a factor.
- New sources of emissions – whether industrial or related to commercial and residential development or transportation – have to share with existing sources the capacity of the airshed to maintain acceptable air quality.

Factors to consider

- Research findings on particulate matter and ozone suggest firmly that air quality objectives can no longer be defined as boundary lines between 'safe' and 'unsafe' conditions, thus complicating management decisions about acceptable impacts.
- The principal source(s) of emissions in a community may also be the cornerstone(s) of the local economy, thus, social and economic factors complicate decisions about acceptable and appropriate environmental protection approaches.
- New emission reduction measures may target non-point sources or involve land-use and transportation planning options in terms of air quality impacts, so that factors outside of the purview of traditional emission management practices become important. An effective system of air management requires ways of thinking about clean air issues beyond traditional point source management.
- The provincial government or delegated regional authorities do not necessarily have jurisdiction over emissions from all of the sources of concern. This is particularly true for transportation-related emissions (including rail, air and marine sources), or numerous, widely distributed sources such as residential and commercial space heating.

- Lack of regulatory jurisdiction over important types of emission sources means that participation by the owners of many emission sources in regional airshed planning and management is currently voluntary. This underscores the importance of engaging stakeholders and of the possible need to authorise additional regulatory authority to achieve policy goals.
- There have been some positive experiences in BC with managing airshed-wide emissions, and lessons learned from this experience provide useful information for regional authorities in areas that are early in their development of management plans.

Management requirements

- The participation of all levels of government is critical if air quality is to be managed effectively. Managing the cumulative effects on air quality of the complex mix of emission sources in communities in BC *may* require – and in larger communities, *will* require – involvement of more than one level of regulatory jurisdiction.
- To be successful, airshed management must include all stakeholders early in the process of changing management strategy and tactics. Involvement of local political bodies is important.
- Discretionary authority of regional regulators or provincial assessment officers may not be adequate to assure continual air quality improvement.

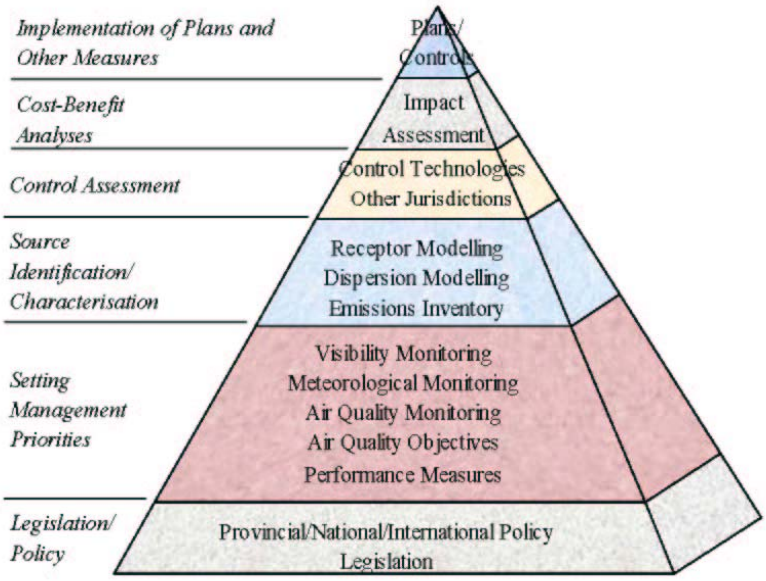
DISCUSSION

Air quality in BC is managed through a range of legislation and regulations. The supporting components include policy statements, information tools, data records, impact assessment frameworks, and airshed plans (Figure 2).

All of the elements in Figure 2 have to function together to produce the desired management result – acceptably clean air in all regions of BC. The top-level functions (impact assessment and plans and controls) are carried out with a certain amount of discretion by regional regulators and environmental assessment officers. The information generated by the lower-level activities in Figure 2 can be (and has been) interpreted and applied to management decisions in creative ways under the existing legislation and regulations to manage both individual source emissions and regional or airshed overall air quality.

Establishing performance measures (under 'Setting Management Priorities' in Figure 2) is an important activity under the Ministry's *Service Plan*.

Figure 2. BC's Air Quality Management System



*From *Air Quality Management in British Columbia: State-of-Knowledge Report* (Draft), Water, Air & Climate Change Branch, December 2002.

The management organisation that has been set up to deliver the components of the management system depicted in Figure 2 involves interaction between MWLAP's offices in Victoria and seven regional offices throughout BC[22]. One of the challenges is to assure that each is playing an appropriate role in the system and has the appropriate authority to act.

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Roles and Responsibilities

As noted in the previous section, air quality in BC is managed by the combination of several laws and levels of government. The *Waste Management Act,* however, remains the principal piece of legislation for air quality in BC, as it specifies the fundamental condition that air should not be polluted.

At a provincial level, controlling point source emissions with the *WMA* has been BC's traditional air quality responsibility and management tool. The *WMA* also contains provisions that have allowed the Province to set some standards for vehicles and fuels, and introduce regulations for some other sources of emissions, such as open burning and wood stoves. Most of the latter regulations were developed during the 1990s.

[22] The Ministry's Environmental Protection regional offices are Vancouver Island (Nanaimo), Lower Mainland (Surrey), Southern Interior (Kamloops), Kootenay (Nelson), Cariboo (Williams Lake), Omineca-Peace (Prince George) and Skeena (Smithers).

The federal government's role in addressing air quality issues is largely, though not entirely, defined through the *Canadian Environmental Protection Act* (*CEPA*)[23]. Many emission sources that lie beyond provincial authority are subject to federal regulation. These include motor vehicles and fuels[24], marine vessels, railways, and off-road engines, among others. The federal government also has authority for international aspects of air quality issues.

Local and regional governments throughout the province have the authority to pass by-laws which may restrict emission-causing activities in their regions. These include many non-point sources, such as backyard burning and residential wood combustion. Some indirect activities that affect the quantity of emissions are also subject to local authority, such as land-use zoning. Beyond legislative authority directly related to air pollution, provincial and municipal agencies have authority over activities that may give rise to emissions, such as transportation and land-use planning and regional growth strategies and sustainability plans.

Given the size of the population affected by its policies and permitting decisions, the GVRD plays a critical part in the overall management system in BC. In addition to administering the *WMA*, the GVRD has added key pieces to the management system. These include the development of a formal air quality management plan, with specific goals, timelines, and emission reduction measures to meet the goals. The Fraser Valley Regional District (FVRD) is collaborating with GVRD to develop an airshed-wide plan.

The somewhat different roles of GVRD and FVRD in managing the Lower Fraser Valley airshed are useful to consider in the context of models for elsewhere in the province. GVRD has full delegation of planning and permitting/enforcement under the *WMA*. FVRD has planning authority, but permitting and enforcement in the region are carried out by the Ministry's Lower Mainland office in Surrey. FVRD has expressed its desire to assume full authority in the future. GVRD has used its authority under the *WMA* and regional bylaws to translate regional policy from the political level into concrete emission reduction requirements and standards for a number of industrial, commercial and institutional types of emission sources.

FVRD still relies on cooperation from both the Ministry and GVRD to implement regionally developed policies and to gather the monitoring data necessary to characterise air quality and the effectiveness of emission reduction measures. The resources necessary for FVRD, for example, to carry out the administrative and technical functions that are necessary to support implementation of its air quality management plan on its own are significant.

Many of the participants, including permittees, in developing and implementing the GVRD Air Quality Management Plan did so voluntarily. Measures to improve current air quality will require a greater level of voluntary participation, since under

[23] Other federal jurisdiction, for example, extends to transportation sources such as railways, plus aircraft and shipping that are regulated under international frameworks.

[24] Motor vehicles and fuels have been subject to regulation under the *Act*, although the current federal agenda on vehicles and fuels, which will harmonize Canadian measures with those of the US-EPA, will supersede some or all of the provincial regulations.

the current regulatory structure, many of the emission sources from which reductions are feasible are not regulated.

Similar considerations will arise as more regions and airsheds grapple with the challenges of establishing appropriate air quality goals and implementing measures to meet them.

In summary, the development of effective air quality management plans and their implementation require the active involvement of all levels of government and citizens throughout BC. The next chapter deals with roles and responsibilities in management approaches to addressing air quality issues in more detail.

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Managing Priority Concerns

As identified in Chapter 2, managing the elevated levels of particulate matter and ozone that occur in many parts of BC is difficult because it requires assessing multiple types of sources, plus the many ways the emissions can combine, react, and disperse in the atmosphere. The various roles and responsibilities identified above further complicate the challenge for managing these air quality concerns.

For example, in many urban communities, significant PM emissions result from such activities as motor vehicles, ships, rail, non-road equipment, plus space heating and a wide range of industrial and utility point sources. At present, managing PM occurs primarily through the permitting process and through regulations set under the *WMA*.

In many airsheds in BC, woodsmoke is believed to be the principal cause of PM impacts. One of the key challenges here is that woodsmoke particulates result from residential wood burning, industry waste burning, and manufacturing processes. The latter two of these sources could be effectively moderated under the *WMA*, but often problems persist (e.g., beehive burner phase-out delays). Residential emissions can be significant in many regions, but must currently be reduced through other actions, such as voluntary management plans, local by-laws, and regulations for new woodstoves under the *WMA*. Road dust can also contribute to problems in these airsheds.

At the same time, many of these same sources are also of concern in the context of ozone. Emissions of ozone precursors (NOx and VOCs) come from industrial combustion sources, but also other sources such as space heating and motor vehicles. Significant amounts of VOCs in BC come from natural sources such as forests and wetlands, which cannot be controlled. Some of the anthropogenic sources can be controlled through the permit system, but others must be regulated through emissions standards specified by the provincial and federal governments. The management of ozone is further complicated in port cities, for example, by emissions from ships, which are regulated internationally and which require many years for regulations and other controls to be implemented (e.g., State of Alaska's voluntary MOU with the cruise ship industry).

Information Requirements

Performance-based air quality management requires accurate information. Management priorities are based on assessing the current (and future) state of air quality. Effective assessment requires a complete and detailed data record for emissions and air quality, as well as coverage of regions (e.g., having enough monitoring stations to assess air quality in a region).

Thus, regional authorities, whether provincial or municipal, need to have access to monitoring data and research that will enable them to assess the current state of air quality with respect to the issues in their region. Information from monitoring and research that enables regional authorities to estimate and forecast the effect of specific policies and measures on air quality is often limited (because of cost).

The Ministry plans that in future more monitoring and research activities will be carried through partnerships with permittees, owners of non-regulated emission sources and other agencies. The feasibility of providing the necessary resources to accomplish such partnerships will vary from region to region (airshed to airshed), so that providing appropriate information in support of achieving air quality goals is an important factor in provincial air quality management.

Timely and accessible reporting to stakeholders and the public of air quality and relevant research data is important in gaining support for management policies and measures. The Ministry is developing a province-wide air quality (and water quality) monitoring and reporting strategy to ensure that the required information is produced and disseminated appropriately.

An example of the type of research information that is often essential but that is also often lacking is the quantitative attribution of ambient air quality impacts to specific sources or groups of sources in a region or airshed. This is one of the challenging problems in assessing the cumulative impacts of multiple sources to overall regional and airshed air quality. When many different types of sources are present in an airshed, or when several sources of the same type are present, airshed conditions make it difficult to apportion accurately individual source impacts on observed air quality.

Detailed and expensive scientific studies are sometimes required to assist in determining which sources contribute to air quality impacts. Apportionment studies have been carried out in the Lower Fraser Valley, Cranbrook and Prince George, for example, and have been valuable in addressing PM issues in these airsheds by allowing key sources to be identified.

While the difficulty and cost of such studies may preclude definitive source attribution to be made, this does not necessarily preclude appropriate management actions. Making management decisions may thus involve balancing the uncertainties (and potential controversies) regarding source-specific contributions with the resources necessary to obtain more definitive assessments.

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Air quality objectives and standards

Although air quality objectives and standards serve as benchmarks to determine the acceptability of contaminant levels in ambient air, BC currently does not have standards with explicit legal sanctions. Moreover, BC's current ambient air quality and emission objectives have not been updated for many years and are in need of review.[25]

In addition to the Provincial objectives, BC is also bound by the Canada-Wide Standards (CWSs) for PM and ozone[26]. These standards set target levels for ambient concentrations of both $PM_{2.5}$ and ozone to be met in all covered regions by 2010[27]. The available information suggests that the occurrence of health effects at levels below the CWSs must be an issue in determining BC's plan for implementation.

In summary, as discussed above, there are no detectable thresholds of response for any of the CACs at current ambient levels, so existing standards should not be seen as a boundary between 'safe' and 'unsafe' concentrations. Nor should they necessarily be seen as the ultimate target levels for air quality performance. They may be interpreted as interim air quality management targets – subject to revisions over time – but in the absence of an effects threshold, objectives or standards are best viewed as markers for management purposes.

The Ministry also prepares emission objectives for categories of industrial emission sources (e.g., coal-fired power plants) and guidelines for emission testing, air quality monitoring and reporting functions.

* * *

IMPLICATIONS

The current status of air quality management in BC and the challenges to effective progress have a number of implications for policy development, regulatory authority and management practice:

- Some of the concerns identified in Chapter 2 may be addressed by simple changes in management practices. For example, more assertive administrative promotion of airshed planning or collaborative management approaches with stakeholders may lead to creative solutions to some of the

[25] Current BC Air Quality Objectives may be found at http://wlapwww.gov.bc.ca/air/airquality/#airqual. Discussion of BC's objectives may also be found in the paper referenced in the Introduction (see page 2).

[26] More background information about the Canada-Wide Standards for PM ($PM_{2.5}$) and ozone may be found on a Canadian Council of Ministers of the Environment (CCME) website: http://www.ccme.ca/initiatives/standards.html?category_id=5.

[27] Compliance with the CWSs will be determined by monitored performance in communities of 100,000 population or greater.

emission concerns. Chapter 4 provides more details on how this might be framed.

- Other concerns might be addressed adequately with a significant change in provincial policy. For example, emerging regional ozone concerns might be appropriately addressed by establishing a provincial policy that enables and expedites the formation of airshed-based management authorities.
- An element of enabling properly informed measures in a region might be mandatory reporting of actual emissions and placing reporting requirements on regional authorities to compile complete emission inventories based on locally-acquired data.
- Concerns that require collaboration among levels of government might require implementation of specific agreements between the province and federal governments or between the province and a municipal government that define certain roles and responsibilities.

… *FOR THOSE WHO WANT TO KNOW MORE*

Federal involvement

The *Canadian Environmental Protection Act (CEPA)* provides the federal government with enforcement tools and powers to reduce pollution and regulate emissions of toxic substances. Although traditionally treated as a CAC, PM_{10} has recently been declared a toxic substance under *CEPA*. Similarly, PM_{10} precursors, ozone, and ozone precursors are to be added to the list of *CEPA* toxic substances.

The federal government's traditional role in BC with respect to air quality has been to provide research support and advice to provincial and municipal agencies in the development of strategies and plans. Environment Canada is active in coordinating and funding international research initiatives such as the Georgia Basin Ecosystem Initiative and the International Air Quality Modelling Project. The federal vehicles and fuels agenda will provide a valuable contribution to meeting air quality goals, especially in urban areas.

The establishment of the Canada-Wide Standards for PM and ozone and the declaration of PM_{10} and ozone and their precursors as toxic under CEPA are expected to bring more active federal involvement in air quality issues at the provincial level.

Assessment – how it is done

Information tools are used to identify key sources of emissions and causes of degraded air quality, and to characterize the nature of specific problems. To provide this information, both receptor and dispersion modelling can be performed, and detailed emission inventories completed.

These can be carried out at the scale of new point sources to be added to a region, or at a larger regional scale and can include more complex treatment of terrain and meteorological conditions, as well as more complex chemistry in the atmosphere that is important in the formation of secondary pollutants.

Professional judgement by Ministry staff with input from interested parties is used to evaluate the information and use this information as the basis for management decisions.

New projects that meet the specifications for review under the *Environmental Assessment Act* are reviewed and evaluated according to that act's requirements with input from MWLAP and other stakeholder ministries. Thus, the environmental assessment process also contributes to air quality management decision making.

The Ministry is developing guidelines for carrying out and interpreting dispersion modelling for application to assessment activities.

Current airshed management

In concept and in practice, airshed management is not new to BC; however, the implementation of airshed management varies widely across regions of the province. By itself, this is not necessarily an issue, as air quality and management issues are bound to vary across BC.

GVRD and FVRD – details on airshed planning

Airshed planning for the Lower Fraser Valley has included

- stakeholder involvement to guide the process,
- development of emission inventories and forecasts,
- assessment of cost-effectiveness and cost-benefit of emissions reductions and greenhouse gas co-management options,
- implementation of emission reduction measures involving by-laws and provincial and federal policies

Airshed planning is currently moving forward toward integration with regional sustainability planning (through the GVRD's Sustainable Region Initiative).

Air quality management in the Lower Fraser Valley has involved setting and meeting specific reduction goals in terms of emissions levels, and progress in annual ambient levels has been evaluated. In recent years, ambient air quality has been tracking reductions in the regional emission inventory reasonably closely.

Other regions – airshed planning

Prince George, where the population, economic diversity, and airshed characteristics are quite different from the Lower Fraser Valley, has also developed a management plan which involves community members, municipal government, and provincial authorities. Implementation is in progress. In the Bulkley Valley, a management plan is progressing. Its focus is on episode management evaluated against ambient concentrations. Plans are also in various stages of development and implementation for other regions, such as Williams Lake and Quesnel, Central Okanagan, and the Capital Regional District.

Air quality management plans may involve monitoring ambient air quality and reporting results, developing an emission inventory, conducting air quality modelling, setting reduction goals, and/or specifying emission reduction measures.

Lessons learned

One of the key elements in the successes that these various airshed management activities have achieved is collaborative action of stakeholders, regulators and the public in determining priorities and developing plans built around coordinated sets of emission reduction measures.

GVRD's Air Quality Management Plan included emission reduction measures that were seen to be necessary, including some that were not under GVRD's direct control. Specific actions by other levels of government were identified. Some actions were included that were clearly for the long term and possibly not feasible within the original target timeframe. Nevertheless, GVRD's target of 38% reduction in total emissions of common air contaminants to be achieved relative to 1985 levels by 2000 was achieved by 1999. Reductions at permittee sources and reductions in non-industrial sources influenced by provincial and federal standards and regulations all contributed to achieving this goal.

Engagement at the political level within GVRD, staff research and technical analysis, supplementary research and analysis support from both provincial and federal staff all expedited the launch and implementation of GVRD's Plan. The involvement of the Lower Fraser Valley Air Quality Advisory Committee (LFVAQAC) made up of representatives of stakeholder constituencies in oversight of development and implementation of the GVRD Plan is credited by many as a key factor in its acceptance and success.

In Prince George, collaborative identification of emission reduction measures, especially for particulate matter, led to significant reductions in industrial emissions. Lack of detailed source apportionment information to identify the effects of the reductions on air quality has hampered progress in recent years. The recent activation of the Prince George Air Quality Steering and Implementation Committees indicates stakeholder commitment to moving forward to address the problems of where future emission reductions need to be made to reduce the persistently high levels of PM in the region.

A goal of continuous improvement

Critical aspects of the Canada Wide Standards are provisions for 'continuous improvement' and for 'keeping clean areas clean' for regions that are already in compliance with the requirements. That is, the standards should not act as a plateau for air quality performance, but rather air quality improvements should continue beyond the requirements of the standards.

As a signatory to the CWS, BC must address how both compliance and continuous improvement are to be achieved for both PM and ozone. 'Keeping clean areas clean' and continuous improvement are additionally important given that health effects findings indicate a range of impacts at any ambient concentration for PM and ozone.

BC's performance target for PM – to meet the CWS requirements **for all monitored communities** – will be a significant challenge in some smaller communities that would otherwise not be captured in the formal CWS reporting and compliance requirement (see footnote 27).

4. ADDRESSING AIR QUALITY ISSUES IN BC

Although the *WMA* is the key tool used in BC to manage air quality, it is but one component of the air quality management system and not all issues may necessarily be addressed through its application. Given the diversity of airsheds and communities in BC, both the priorities and the strategies relevant to one airshed may be different from those for the next.

In some cases, these could involve modifying regulatory mechanisms to enhance efficiencies and improve the distribution of administrative resources, while in others it may relate to more effectively addressing cumulative effects, human health impacts, airshed management plans and continual improvement goals.

Some aspects of these issues with the air quality management system are presented below, preceded by suggested consultation questions that these issues raise. The discussion following the questions is intended to assist in formulating answers.

KEY POINTS

- Provincial policy is a major driving force for achieving clean air, thus, goals and objectives for air quality throughout BC must be expressed clearly and explicitly.
- Meeting air quality goals in all regions of BC under current regulatory requirements will necessitate action beyond the controls of the WMA permit and regulation system and municipal bylaws. Thus, effective means must be found to mobilize participation in air quality improvement programs.
- If voluntary, collaborative stakeholder actions within the current framework are not successful in achieving emission reductions toward air quality goals in airsheds, either more formal or more flexible requirements, or some combination thereof, may need to be implemented.
- A policy framework that goes beyond meeting air quality objectives is necessary for implementing the 'keeping clean areas clean' and 'continuous improvement' requirements of the Canada-Wide Standards for PM and ozone.
- If a risk-based approach to screening and regulating emission sources is to be implemented in BC, effort will need to be invested in determining possible thresholds of risk significance or levels of acceptable risk.
- The fact that many different types of sources in an airshed contribute to observed air quality means that accurate information about their emissions is essential for developing management programs. This may require mandatory reporting of emissions where other estimation methods are inadequate.
- Various options for modifying the point source permitting process exist and need to be considered in light of the relative importance of these emissions and in light of the Ministry's aim to eliminate low- to medium-risk sources from the permitting system.

- The advantages and disadvantages of delegating more regulatory authority to the local level in an airshed as an approach to achieving air quality goals need to be considered .
- Canada's ratification and implementation of the Kyoto Protocol for greenhouse gas reductions may have implications for management of related air quality issues, especially for sources that emit both greenhouse gases and common air contaminants.

DISCUSSION

Fundamentals

Directions and priorities

Consultation questions:

- *What is needed beyond the direction provided by MWLAP's Service Plan to enable air quality management strategies to be developed in BC?*
- *Have the most important clean air issues been identified? What priority should be placed on the principal issues?*

Having a clear definition of Provincial policy and issue priorities with regard to air quality and ensuring that they reflect the interests and expectations of the residents of BC is essential to the practical application of air quality objectives, permitting point source releases, and airshed management.

The MWLAP *Service Plan* provides current direction in this regard. In terms of air quality, strategies include developing an airshed planning framework, policy and advocacy, adopting Canadian Environmental Protection Act/ US-EPA vehicle and fuel standards, and developing a climate change strategy. The Ministry's only air quality performance measure is for particulate matter. The plan's goal for 2005/06 is a 100% compliance rate with the Canada-Wide Standard for $PM_{2.5}$ in all monitored communities. This is well in advance of the nationally required compliance date of 2010 for larger communities >100,000 population). The *Service Plan* also includes performance measures related to total greenhouse gas emissions.

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Clean air responsibilities

Consultation question:

- *Are there reasons for BC to consider legislating Ministerial requirements for clean air management?*

The current focus of air quality management under the *WMA* is source regulation. As already pointed out, there may be a disconnect between source regulation and management goals for air quality. Ultimately it is the end result of the management system (clean air) that is the real target. The best methods of management are those that effectively and efficiently provide for clean air, whatever their legislative or administrative basis may be.

Taking action to ensure clean air, through the *WMA* or by other means, remains discretionary on the part of the provincial Minister. The explicit requirements for the minister to ensure clean air are relatively narrowly defined within current legislation. The provincial *Environment Management Act* defines how the Minister *may* take actions, but does not expressly *require* that they be taken. Under these terms, there are no assurances that actions will be taken to ensure clean air in BC, even if air quality remains degraded for extended times.

In contrast, the *Canadian Environmental Protection Act* (*CEPA*) provides discretionary duties for the federal minister, but also has requirements where the federal Minister *shall* take action in carrying out the duties of environmental protection (e.g., environmental monitoring).

An alternative to the current BC framework would be to establish clear responsibilities for the minister in this regard. This approach has been taken in many jurisdictions, typically with multi-media legislation (e.g., provincial *Environment Management Act* or *Canadian Environmental Protection Act*) or with explicit clean air (or clean water) legislation (e.g., at the federal and state level in the US). Establishing clear requirements and duties on the part of the Minister, whether they have to do with ensuring that air quality objectives are met or that airshed management plans exist, can be a means of providing consistency in actions for air quality management in BC.

Without additional legislated obligations placed on the Minister, it may be difficult to assemble information needed to manage air quality and to control the sources that are currently unregulated or to hold the Minister publicly accountable for clean air. The downside of placing more binding obligations on the Minister for achieving clean air may be that creative, flexible, effective voluntary approaches that are possible under the current framework may be discouraged.

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Assessing the threat to human health and setting air quality standards

Consultation questions:

- *Do provincial air quality objectives need to be formalized as standards (perhaps with enforceable sanctions), or should they remain as guidelines? If formalized as standards, how are they to be used?*
- *Under what conditions should air quality objectives have province-wide application, or alternately, under what conditions is it feasible to allow flexible, discretionary application on a regional or airshed basis, depending on local circumstances?*
- *Should objectives and standards be defined for other air quality impacts, such as odours, visibility, and acidic deposition?*

The Province is currently in the process of assessing how provincial air quality objectives may be reviewed and updated based on new research and understanding of the risk posed to individuals and populations by exposure to degraded air. This is not a small task. It involves difficult choices with respect to the magnitude of risk and affected populations (i.e., determining what constitutes an acceptable level of protection). Ensuring that each individual in BC has the same level of risk from air contaminants is very different from ensuring an overall or average level of risk protection for the province or a community. Risk assessment often considers sensitive members of the population but seldom does it consider the health status of individual people.

At present, the air quality management system for BC does not formally incorporate risk-derived objectives as a means for evaluating air quality performance. In practice, when new development applications are evaluated, provincial air quality objectives are used as reference points for assessing resulting effects on ambient air quality. With this approach, considerable variation of impacts on human health in the province will occur.

For the future, updated objectives could be used as standards to evaluate performance outcomes of both regulated sources and for entire regions. In these terms, they would not serve as just guidelines, but rather be considered requirements. Potential sanctions could be specified for regions that do not meet the objectives or standards. For example, this could involve conditions such as that no new air emission permits be issued for a region in which objectives were not being met unless equivalent (or greater) emission offsets could be specified.

There are many examples of sanctions that are in place currently. Emission permit conditions are enforced through a system of fees and fines under the *WMA*. Similarly, occupational health standards are enforced by fines levied against employers if workplace air quality standards are exceeded. It is difficult to envision, however, how analogous sanctions might be applied to airshed managers in BC. The US *Clean Air Act* authorises penalties for states that do not deliver compliance with the national air quality standards, but US legal tradition differs significantly from the Canadian in this regard.

Alternatively, their current discretionary status could be maintained, with enabling changes to policy or management practices in their application.

Air quality objectives could also be applied differently for different regions or airsheds in the province. The implications for management if air quality objectives were not met could be allowed to vary between regions, or the objectives themselves could be set differently, potentially as a function of current air quality for an area. Discretionary approaches could provide for setting targets that could be realistically met in the short term, but could be criticized for not providing consistent application of risk considerations across the Province.

In addition to the effect of air pollution on health, there are other ways in which emissions can lead to pollution. These include visibility degradation, deposition of gases and particles to soils or water bodies, odour impacts, and ecosystem effects. Ozone, for example, affects crops and forests detrimentally at about the same concentrations as for human health effects.

Managing Point Source Emissions

Managing point source emissions will remain an integral part of an overall approach to air quality management in BC. Concerns about the effectiveness of an air permit system have been raised with regard to point sources,[28] because their importance as well as the administration of permits can vary from airshed to airshed. At the same time, MWLAP has specified in its *Service Plan* its strategy to reduce or eliminate the permitting of low- to medium-risk pollution sources, and shift towards use of codes of practice or other authorizations. In this light, it is important to ensure that that the system is efficient and able to provide for the desired air quality.

Risk assessment and point source emissions

Consultation question:

- *Should BC adopt a risk-based approach to air quality impact assessment in place of, or to supplement, use of air quality objectives? Who should set the acceptable levels of risk? How should acceptable levels of risk be determined in this context?*

A risk assessment method provides a mechanism to match levels of regulatory effort, scrutiny, and fees with the level of risk associated with the air emissions. By doing so, this approach has the potential to reduce the burden associated with regulation for both business and government by improving flexibility and performance, and to improve consistency in application.

A risk-assessment method has been employed in Alberta (see the *Authorizations* paper for further discussion). In this system, pollution up to a specified level is allowed with only a notification required. Beyond this threshold or trigger level, a further system of tiered responses exists with additional scrutiny and requirements for

[28] Many of these issues have been discussed in the *Authorizations* paper.

sources of emissions. The levels at which triggers occur are set based on risk criteria. A similar risk assessment system is currently in development in the United Kingdom within the framework of local air pollution management, and has progressed to the stage of completion of an administrative trial project[29].

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Flexibility and point source emissions

Consultation questions:

- *Under what conditions should use of flexible or facility-wide permits, best available control technology specifications, sector-wide approaches, emissions trading (for CACs or GHGs), or emission offsets be considered for air emissions in BC?*
- *Should new sources be required to develop emission offsets in degraded airsheds? Elsewhere?*

The permitting approach traditionally used in British Columbia, as in most jurisdictions, has been criticized for being overly prescriptive and inflexible in its operating requirements. Although strictly specified operating conditions provide a great deal of performance certainty, some industries find these terms hamper their ability to adapt to changing business conditions and to make production improvements, including those that may lead to efficiencies and reduced emissions.

Facility-wide/ 'bubble' permits

To provide flexibility for this kind of situation, facility-wide permits may be implemented, including pre-approved flexibility for process changes. The equivalent of this approach has been used in BC when permit amendments have been required for plant modifications, or when stakeholders in an airshed have voluntarily agreed to reduce emissions. Examples may be cited in the GVRD and Prince George in this regard. In some cases where flexibility has been introduced into air permitting systems, the granting of flexible terms is allowed only if operators satisfy performance criteria in terms of their environmental track record.

A 'bubble' permit system defines all emissions from the variety of emission sources within a facility as occurring as if the facility had an imaginary 'bubble' enclosure over the site. This approach allows modifications to be made to individual sources within the 'bubble' without triggering a permit amendment, as long as total emissions of specified contaminants do not increase. Such a permit has been implemented for a facility in Trail. However, this method may not be universally appropri-

[29] Program documents can be accessed at http://www.defra.gov.uk/environment/airquality/riskam/index.htm and http://www.defra.gov.uk/environment/consult/lapcrisk/index.htm. This did not constitute a full pilot project, but rather an assessment of the feasibility of applying the method and of participant comments on risk categorizations. In the UK, air pollution management is the responsibility of the Dept. of Environment, Food and Rural Affairs (policy), the Environment Agency (regulations and standards) and local air pollution authorities (administration). See also Appendix A

ate for BC. The influence of terrain and meteorology on what happens to emissions from a given source, especially considered in relation to the source's location and the location of receptors (e.g., residences, hospitals, schools, parks), can be very important in many airsheds in the interior of the province.

De-permitting

Another option to improve the efficiency of the system is to remove certain emission sources from the permitting process altogether, while still specifying and requiring that they meet particular performance standards. As noted above, the *Service Plan* indicates that low- to medium-risk sources will be removed from the permitting process, and codes of practice or other authorizations will be used instead. To some extent, this is the kind of approach that has been taken by the GVRD, which has targeted to reduce its air emissions permit list from its current level of over 200 to approximately 50 at some point in the future. With this approach, only the very largest emitters would be included in the permitting process. For all other sources, performance standards would be set. Responsibility is then placed in the hands of facility operators to screen and assess their own levels of emissions and if necessary adjust their operations accordingly. The main enforcement tool in this approach would be management system auditing (by government or qualified third-parties).

The flexible approach has been taken with some *WMA* regulations and by GVRD by-laws and regulations to address emissions from numerous small sources that would otherwise not receive scrutiny under the *WMA*. This is especially relevant in terms of managing air emissions for cumulative effects, where numerous small sources distributed throughout an airshed may make a comparatively significant contribution to the regional emissions total.

These sources typically include small industry, commercial operations, and institutions. For example, printing, dry cleaning, and photofinishing are operations that can contribute significant levels of some CACs to an airshed but are not subject to review or conditions of operation under permit approval systems. Under the current terms of the *WMA*, these operations when considered individually are seldom judged as a significant source of air pollution and are thus not subject to any terms (e.g., control devices, monitoring and reporting) for their emissions.

Emissions offsets

Negotiated emission trading between individual sources, however, may be effective in the right circumstances, where one facility directly trades for 'offsets' within an airshed probably as a condition to initial project approval or to expansion. Offset programs allow for an increase in emissions from a particular source by requiring that these be compensated by reduction of an equivalent (or greater) quantity of emissions elsewhere in the airshed. Offset programs can provide some further degree of flexibility within a company itself. For example, a company might be able to increase manufacturing emissions if reductions from non-manufacturing sources such as employee trip management programs were put in place.

Technology specification

Flexible options are in contrast to another approach taken in some jurisdictions where 'best available control technology' ('BACT', or variations thereof) is strictly specified for new or modified equipment. BACT was tried in BC for a short time during the 1990s, but with insufficient resources to properly implement.

Equipment costs as installed in Canada and differing industry market conditions often make it difficult to determine cost-effectiveness of process or control technology accurately. The technology specification approach is more characteristic of traditional 'command and control' regulation that may not be appropriate for managing non-industrial sources. In the latter category, however, new car tailpipe emission standards are BACT. Consumer product standards (e.g., home heating furnaces, woodstoves or energy efficient appliances) are also amenable to a BACT approach.

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Mandatory monitoring and reporting

Consultation question:

- *Should mandatory reporting of emissions be specified for BC?*

Accurate and timely information on emissions and ambient air quality concentrations is a key component of the air quality management system.

Mandatory reporting for an extensive list of pollutant releases to water, land and air is required already for many industries as part of the National Pollutant Release Inventory (NPRI)[30]. Common air contaminants were added to NPRI in 2002 and greenhouse gases will be added soon. Information from this inventory is available in a publicly-accessible database.

Ontario has recently emulated the NPRI approach and, with Regulation 127, is requiring monitoring and reporting of additional CACs and GHGs for individual facilities[31]. Information is to be made public as with NPRI.

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Air quality modelling and interpretation

To estimate the effect that emissions will have on air quality in an airshed, BC frequently relies on computer generated models. These findings are then compared to air quality objectives. BC has generally adopted and adapted the US-EPA's suite of air dispersion models to estimate source impacts for permitting and environmental assessment purposes.

[30] http://www.ec.gc.ca/pdb/npri/npri_home_e.cfm
[31] http://www.ene.gov.on.ca/envision/monitoring/monitoring.htm

At present, BC has no explicit guidelines for the application of the preferred dispersion models in the context of BC's or Canada's air quality objectives, other than by reference to the US-EPA's *Guideline on Air Quality Models*. Such guidelines are essential, since the application of US-EPA models is carried out in the context of the US National Ambient Air Quality Standards which differ in definition and intent from Canada's or BC's objectives.

Due to this situation, difficulties continually arise in interpreting the results of dispersion modelling studies. Problem areas include:

- permitting exercised under the *WMA*
- environmental assessments under the BC *Environmental Assessment Act* and
- non-regulatory regional or airshed-level modelling for the purpose of developing air quality management plans (e.g., GVRD/ LFV and Prince George).

Alberta has explicit modelling execution and interpretation guidelines, and Ontario is currently developing such guidelines. The absence of such guidance in BC has been an issue, since terms of reference for application of computer models is currently negotiated on a case-by-case basis. A project is currently being initiated by MWLAP to produce province-wide modelling guidelines.

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Point sources and cumulative effects

Consultation questions:

- *Should a review of the cumulative regional emissions on air quality be required in permitting a new emission source? How should it be structured? Should existing sources be subject to review in the context of cumulative effects?*
- *How should BC manage air quality in pristine or little-developed areas?*

Within the current management framework, no specific direction exists to address the cumulative environmental effects of air emissions. In practice, cumulative effects are addressed to some degree by regional managers in the permitting process for new development applications under the *WMA*, following from the example of the environmental impact assessment process. A specifically defined framework would ensure that cumulative effects on air quality are more consistently assessed.

New developments

When looking at present and future air quality, it is necessary to consider how the incremental effect of new sources of emissions would affect air quality within a region. Currently, new developments are assessed on how they may affect existing ambient air quality ('background') in combination with other sources in the region. Much of the assessment of cumulative effects on air quality is done with regional discretion. Given the diversity of regions and airsheds in the province, allowing for flexibility this way may be effective.

Without formal guidance, however, with regard to relevant air quality objectives and methods for assessment (e.g., air quality modelling), cumulative effects assessment has the potential to vary widely in application and leave much open to interpretation and legal appeal.

Adding to the emissions source mix

The assessment process includes no explicit provision for addressing other pre-existing sources in a region as part of the review of cumulative effects. If one facility pre-dates another, no specific provisions exist to determine if the older facility is exempt from the same level of scrutiny as air quality degrades in an area. For example, a relatively low emitting new source may be prevented from operating in a region where air quality is degraded. Individual regional managers do, however, have the authority to re-open existing permits at their discretion. This re-assessment could dealt with in one of three ways: be left to discretion; be periodically required by legislation; or be specified to be done within a time-frame stated in each permit (potentially based on size of source and present or expected air quality in a region).

Pristine areas

Although the process of individual permitting as currently followed in the *Waste Management Act* has some weaknesses, it may be a worthwhile approach for cases at the other end of the pollution spectrum, where an airshed can be essentially considered to be pristine. This method is followed in the US and has been effectively used to assess the cumulative effects of emissions from adjacent developed areas near pristine areas.

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Economic Instruments

Consultation question:

- *Under what circumstances, if any, should economic instruments be considered for air quality management in BC?*

In many jurisdictions, various non-regulatory approaches to managing environmental problems have been sought in recent years, including economic instruments. These have been used to influence emission causing activities for both point and non-point sources with marketplace incentives or disincentives as alternates to strict legislation and regulation.

The *Authorizations* discussion paper presents an overview of economic instruments from a report to the Ontario Ministry of Environment:

> [T]hough often created through legislation and regulation, these are methods of using the market-type incentives and charges that will motivate compliance and exemplary environmental performance. Such instruments are said to "internalize" the environmental costs into a process, service, product or activity. In theory, high-polluting products should cost more to make than low-polluting products. Examples: tradeable emission permits,

emission charges, and "feebates", financial assurance, subsidies and deposit-refund systems.[32]

Emission trading is perhaps the most widely known economic instrument for pollution management. Emissions trading programs aim to achieve lowest cost emission reductions and allow flexibility for operating conditions using market mechanisms and price incentives. Various emissions trading schemes have now been instituted in many jurisdictions, both for common air contaminants and greenhouse gases[33]. In almost all successful cases, participation for at least some sources is regulated, and emissions are subject to an overall cap in total. Participation is almost always by large point sources.

Emissions within the trading scheme must also exist within a geographic area that is relevant to the performance objectives to be met. These are different for CACs and GHGs. Any trading in CAC emissions must occur within the same airshed, otherwise air quality degradation would occur. Trading for GHG emissions, however, can occur without reference to airsheds, since the atmospheric impact of GHG emissions occurs at a global scale, regardless of where the emissions originate.

Market-based emission trading, however, is not appropriate in all cases. The viability of emission trading in the Lower Fraser Valley has been previously analyzed, and results indicated that there is not an appropriate market for this strategy to be effective in the region.[34] Given the need for market size and airshed-specific location concerns, it is unlikely whether market-based trading would be effective in other areas of BC for CACs.

There are examples of other economic measures being used in BC. These have included providing incentives for low-emissions choices, such as:

- Alternative fuel tax exemptions have been provided to encourage the use of natural gas, propane, high-level alcohol blends, and diesel alternative fuels to reduce smog, fine particulate formation, and GHG emissions;

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[32] *Managing the Environment: A Review of Best Practices*, January 2001, prepared by Executive Resource Group, available at http://www.ene.gov.on.ca/envision/ergreport/index.htm

[33] Various examples of emissions trading schemes exist. Arguably the most successful of these has been the US-EPA Acid Rain program (Clean Air Act Title IV), which includes a framework for SO_2 and NOx trading (http://www.epa.gov/AIRMARKET/arp/index.html. Other programs include the RECLAIM trading scheme for NOx and SOx in the greater Los Angeles region (http://www.aqmd.gov/reclaim/reclaim.html), and the UK domestic GHG trading program http://www.defra.gov.uk/environment/climatechange/trading/). These major US programs have both been criticised recently for failing to produce significant emission reductions. In addition, two voluntary trading programs have been implemented in Canada – the Pilot Emission Reduction Trading Project (now Clean Air Canada; http://www.cleanaircanada.org/home.html), and the Greenhouse Gas Emission Trading Pilot (GERT) headquartered in BC (http://www.gert.org). More recently, Ontario has begun implementing a trading program for NO and SOx for its electricity sector, with incentives for other businesses and industries to opt-in (http://www.ene.gov.on.ca/envision/air/etr/).

[34] *Potential Economic Instrument Approaches to Air Quality Management in the GVRD*, prepared for Greater Vancouver Regional District, BC Ministry of Environment Lands and Parks, Environment Canada by The ARA Consortium and Sholtz & Associates, and *Air Quality Management in the Year 2020: Airshed Emission Limits for the Lower Fraser Valley*, prepared by Levelton Engineering, Margaree Consultants and Cantor-Fitzgerald, 1996.

- Partial PST exemptions have been provided to encourage the purchase of alternative fuel vehicles and hybrid vehicles;
- Beehive burner operators are subject to escalating fees per tonne of PM emissions to encourage early phase out. They are also eligible to receive proportional rebates of their *WMA* permit fees if they make contributions towards the development or commercialization of value added uses for wood residues.

Disincentive fees ("feebates") may also be used in a complementary way with incentive mechanisms to reinforce the "polluter pays" principle and fund rebates, such as specifying an additional purchase fee for low fuel efficiency vehicles, such as SUVs, whose revenue could then fund incentives, such as the above-mentioned PST exemption.

Further reinforcement for this approach could come from including explicit provisions for these measures in legislations. For example, Alberta *Environmental Protection and Enhancement Act* contains a general enabling power in Section 13 which states that the Minister may use such economic instruments as emission trading, incentives, subsidies, emission, effluent and waste disposal fees, and differential levies.

Managing Airsheds

Management approaches

An effective air management system in BC must involve more than consideration of point source releases and move towards area-based management that addresses the effect of area and mobile emission sources. An area-based approach to planning and pollution management provides a framework to address cumulative effects and consider the full spectrum of emissions-causing activities – including point and non-point sources.

As presented in the *Authorizations* discussion paper, airshed plans could include the following:

- partnerships, collaborations, and consultations with the community
- specifications and limits to control present or future emissions that could range from non-binding to formally binding under the *WMA* with objectives
- an allocation guide for provincial funding
- specific implementation plans to comply with air quality objectives and/ or standards
- the designation of areas (airsheds, smaller areas within airsheds, or multiple adjoining airsheds) to particular status levels (e.g. threatened, degraded),

with specific corresponding management terms and conditions, including regulatory conditions and funding allocation.

Although formal airshed management strategies have not been implemented widely in Canada, the Greater Vancouver Regional District and Prince George have been leaders in airshed management in Canada. Airshed management has occurred to varying degrees in many other BC areas, including FVRD, Bulkley Valley, Quesnel, Williams Lake, and Kelowna. To date, airshed planning has occurred essentially on a voluntary basis involving regulators, permittees and public interest representatives. Alberta's Clean Air Strategic Alliance (CASA) is a particularly relevant example for consideration[35]. CASA has established several independent, stakeholder-managed airshed management areas for monitoring and planning purposes.

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Responding to status of airsheds in BC

Consultation questions:

- *Under what conditions, if any, should there be a legislated requirement for airshed planning? Secondly, does the authority to make and implement plans need to be defined explicitly?*
- *With or without a regulatory requirement, what measures will facilitate airshed planning and implementation, and under what conditions (taking into consideration community size, severity of problem, level of support, etc.)?*
- *Are there other new or innovative air quality management methods that BC should consider?*
- *Should plans be required only if air quality does not, or is not expected to, meet specified objectives or standards?*

Strategies addressing *degraded* or *threatened* airsheds are currently under development in BC. Under consideration is an approach which allows for tiered responses and for follow-up actions if cumulative effects show airshed degradation.

Airshed management has progressed to different levels across the province. The GVRD and the FVRD are a good example of progress. Their co-ordinated planning for the Lower Fraser Valley is among the most developed airshed management in North America.

The right mix of tools for planning varies from region to region. Policies that allow flexibility to respond to local circumstances are essential, and in this light, a universal formula for the province may not be appropriate, but it may be that while the choice and implementation of different strategies and regulations could be left to local authorities, a system of action triggers, requirements and provision of resources could be specified for BC. Such a system is currently in development in Alberta, and could involve specifying progressive actions to be completed for areas where air quality concerns exist, or in cases where air quality degrades past criteria levels, or based

[35] The CASA website provides more information (http://www.casahome.org/).

on other terms such as population growth, number of permits in a region and other factors[36]. These actions and responses may include, for example, increased monitoring, completing an emission inventory, air quality modelling, or developing an airshed management plan.

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Delegation of authority

Consultation question:

- *Under what conditions would air quality management in airsheds be more effective and efficient if delegated to the local or regional level, or to regional airshed management authorities?*

Given the range of airshed situations in BC, an airshed management plan which provides for local response and flexibility is important. This may be accomplished by delegating degrees of authority to regions. At present, the development of an airshed plan is typically co-ordinated by regional representatives of the provincial MWLAP. Regional representatives do not have control over all relevant sources or emissions (e.g., rail, ships) nor do they have the full authority to change regulations under the *WMA*.

This may change, however, as a recent decision by the Environmental Appeal Board has supported regional managers' discretionary ability to set more stringent local terms and objectives. These changes may be possible under the Community Charter (pending legislation). The Charter could provide the necessary latitude for municipalities to develop by-laws for more stringent local air quality management as the Province has already done in the Lower Fraser Valley (e.g., AirCare, gasoline regulations) and elsewhere in BC (e.g., Open Burning Smoke Control Regulation).

The GVRD – effective use of local authority

The current delegation of responsibilities under the *WMA* to the GVRD provides a further option to consider for airshed management. GVRD is currently responsible for administering the *WMA* within its regional boundaries (encompassing 21 municipalities and one electoral area). At the same time, it has authority to develop regional bylaws and has done so in the context of air quality management. While the GVRD has developed an airshed management plan and has been successful in achieving its targets through implementing various emission reduction measures, its authority to do so is under a by-law, with strong local political support. The latter factor is essential to locally-based actions.

Options for delegation of authority and requirements for local plans may be limited by local expertise and resources, and in some cases, community recognition of air quality issues. The elements of air quality administration include committees at the political level, dedicated professional and support staff, integrated air manage-

[36] See Appendix A for other examples of approaches used in the UK and California

ment with regional planning, locally managed monitoring and enforcement, and an active stakeholder advisor body.

Authority for air quality planning has been delegated to FVRD, and it has asked for the same level of delegation as GVRD. FVRD may undertake air quality planning activities, but it does not have authority for issuing permits or collecting fees.

Although successful in its own area, the GVRD model is not a universal approach. Other possibilities will have to be examined in other airsheds in BC. Factors that might influence delegation of airshed planning responsibilities include levels of community engagement and willingness to participate, and size of local government and technical resources. The current state of air quality is also a factor.

For example, delegating airshed management to larger cities in the province may consist of establishing air quality planning departments, full delegation of *WMA* authority (or other new legislation related to emissions source management), and use of region-wide flexible measures (e.g., emissions trading or offsets).

In medium-sized cities (e.g., up to 100,000 population), delegating some responsibilities and resources could involve authority for smaller sources, or setting region-specific codes of practice or other sector-type requirements.

In small centres (e.g., up to 25,000 population), some delegation could be considered. More feasible options include local air quality committees working with MWLAP staff who could provide the technical expertise that would otherwise be difficult to provide in small centres.

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Intergovernmental involvement

Consultation question:

- *What roles should federal and municipal governments play in the development of regional air quality management plans?*

The success of air quality management requires the appropriate participation of all levels of government. Furthermore, a means to harmonize federally regulated activities with local objectives would ensure greater effectiveness of air quality management. Often, in inter-governmental matters senior levels of government serve as a regulatory backstop that ensures minimum conditions are met or as a supplier of research information. Such a system may hamper options for addressing local air quality issues that involve federally-regulated emission sources. With this in mind, coordinated approaches that are regionally responsive are appropriate. In the case of the Lower Fraser Valley, the situation is further complicated by the shared airshed with US authorities (Whatcom County/ North West Air Pollution Authority/ EPA Region 10).

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Goal setting and meeting air quality objectives

Consultation question:

- *To meet the principles of 'keeping clean areas clean' and 'continuous improvement,' should there be required management actions associated with air quality targets more stringent than the Canada-Wide Standards? What kinds of actions and targets should be used?*

Airshed planning could play a key role in meeting performance-based standards and goals for ambient air quality, such as the Canada Wide Standards (CWSs). One approach would be the creation of emission reduction targets set in relation to the region's emission inventory. Success would be based on the plan's progress towards meeting its emission reduction goals.

An alternative approach would see airshed management goals set in terms of ambient air quality objectives. The set objectives could be directly related to CWSs or to provincial objectives. This may be appropriate for smaller interior communities where terrain, weather conditions, location of sources, and the location of the affected population may prove to be comparatively more important in setting priorities and strategies. It is important, however, to recognize that, in practice, emission reduction targets are likely to remain an important part of airshed management, as planning in these terms is practical. Accurate emission inventories are essential information.

The preservation of clean air

One of the key requirements in the CWS is the preservation of clean air and the continual improvement of air quality in regions where ambient levels already meet the CWS. As the CWS are set for 'peak' pollution episodes, and since the health risk from emissions is not limited to the peak events targeted by the CWS, it may be worth considering including additional requirements beyond current standards and objectives in evaluating regional air quality performance – such as for annual average levels for common air contaminants.

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Implementation

Consultation question:

- *Do you think that sanctions for not putting into action an airshed management plan or meeting airshed goals or timelines need to be in place? If so, what type and to what degree?*

Once an airshed management plan has been developed, especially where responsibility has been delegated from the Province, a review process may be required. Among other steps, a review process would ensure that a plan is being correctly fol-

lowed and estimate the plan's likelihood of meeting air quality objectives. For example, there are various emission reduction measures specified in GVRD's air quality management plan that remain to be implemented, even as the next phase of the plan is in development. At this point, enough of the context has changed that it is questionable whether they will be implemented. Nonetheless, the GVRD plan met its targets (for emission reductions).

Along these lines, establishing clear sanctions or penalties for not implementing an airshed plan could be used as a tool to ensure that airshed plans are implemented. Airshed planning is currently a voluntary activity, and there is little in the way of implications or legal leverage if some stakeholders resist implementation.

For example, in the US, states are required to prepare, implement and achieve specific plans for meeting the national air quality standards. If plan targets are not met, sanctions such as withholding federal highway construction funds may be imposed.

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Time horizons

To be effective, airshed management needs specific timelines for targets or objectives to be met. For some sources of emissions, specific time horizons are required to set emission reduction goals accurately and evaluate their success. In other areas, such as point source emissions management, knowledge of equipment replacement cycles (5 years, 10 years or longer) is a key step towards the creation of cost-effective plans of actions.

Results in the UK show that clear time guidelines are as important and effective in air quality management as adapting priorities and measures to the changing nature of issues. See Appendix A.

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Integration with regional and local planning

Consultation question:

- *In what ways could air quality management plans be integrated with Regional Growth Strategies and Official Community Plans?*

Future air quality management is directly tied to the successful management of regional growth - social and economic - and careful attention to transportation and land-use planning. To be effective, local air quality management will generally require the authority to deal with a range of emission sources of air pollutants, not just point sources.

A success story

For example, the development of Greater Vancouver Regional District's 1994 Air Quality Management Plan was directly linked to its regional growth vision and 25 year transportation plan. Similarly, the development of its next air management plan has been ongoing in tandem with the development of the next regional growth plan. In this regional district the focus for continuing improvements in air quality is on planning for regional growth, transportation systems, land use, and urban development.

It is important to note that Regional Growth Strategies and Official Community Plans are existing planning practices. These approaches could be co-ordinated with local air quality planning. There may also be scope to strengthen the relationship between the municipal planning process and air quality management, perhaps initially by co-ordinating the timing of measures being implemented.

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Managing Greenhouse Gases

Consultation question:

- *How should greenhouse gases be treated under the Waste Management Act? Is it important for airshed management plans to have objectives for reductions in greenhouse gases?*

The management of greenhouse gases is an ongoing concern in British Columbia. Although there is uncertainty about how the Kyoto Protocol will be implemented, it appears that some form of greenhouse gas management will result in Canada.

One option would be to formally recognize the link between GHG emission management and common air contaminants. Attempts to reduce GHGs almost always result in reductions to CACs, since most processes which give rise to GHGs result in CACs as well. CAC and GHG co-management approaches have recently been explored by GVRD as part of the development of the next phase of their regional air quality management plan.

At present, GHGs are not currently addressed by legislation or regulation in BC. As discussed in the *Authorizations* paper, it must be determined whether the *WMA* can require monitoring and limiting of GHG emissions, but given that the existing definition of an air contaminant is anything that is emitted into the air and "damages or is capable of damaging the environment," it seems reasonable to postulate that greenhouse gas emissions could be regulated within existing provisions. Ozone-depleting substances are currently regulated on this basis.

In California, CO_2 has been formally recognized as a pollutant, and a timeframe has been set for establishing vehicle tailpipe performance standards for CO_2 emissions.

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IMPLICATIONS

The following points highlight some of the possible implications of the approaches to addressing air quality issues in BC that have been discussed in this chapter.

- Careful consideration needs to be given to whether or not the Minister should be given more specific obligations under legislation (the *WMA* or other). More specific obligations for meeting air quality management goals might enable effective actions to improve air quality to be taken that are currently negotiated voluntarily. Specific obligations might also make the Minister more accountable for delivering acceptable air quality everywhere in the province. On the other hand, obligatory powers assigned to the Minister may create an inflexible framework that would stifle creative, voluntary actions that would produce the desired results.
- The desired air quality improvements may be achieved by broadening regulatory coverage of certain sources, such as large space heating facilities (institutions, etc.), under the existing *WMA*. That is, new legislation may not be necessary. Similarly, policy changes may bring about desired actions without new legislation.
- Airshed management options are many and varied. The following table indicates some of the possibilities that are already under consideration by the Ministry.

Activity	**Range of Actions/ Considerations**		
Delegation of authority	No formal planning or enforcement delegation	Partial delegation: planning	Full delegation: planning & enforcement
Criteria for delegation	Degree of air quality degradation	Availability of local resources	Local interest or willingness
Air quality management plans	Voluntary/discretionary	Required in areas where air quality is degraded and voluntary planning not taking place	Required of all areas in which air quality is degraded
Air quality objectives	Maintain current discretionary application	Targeted to certain regions/formal regulation (still discretionary)	Applied throughout BC/formal regulation with enforcement sanctions
Ministry's role	No change	Selective regulation of high-risk sources/local management of other sources	Advisory to airshed management authorities

- Air quality management may be complicated by requirements that fall to the province under federal-provincial implementation of the Kyoto Protocol. Implementation of the Kyoto Protocol may present opportunities for co-management of greenhouse gases and common air contaminants.

… *FOR THOSE WHO WANT TO KNOW MORE*

Flexibility and point source emissions

Greater flexibility

With flexible conditions, overall emission levels can be specified, but the means of achieving them is left to the permit holder. As a further extension of this, a 'bubble' permit may be issued, specifying overall performance for the entire facility, rather than allowances for each stack on site. In this case, how the permit holder meets its specified performance level is left to its discretion, with the argument that with this flexibility, individual operators may find innovative solutions within their own plant boundaries where they are most feasible and likely to be most cost-effective. This kind of flexibility is typically augmented with requirements for environmental management systems and auditing, either by government or accredited third parties.

In the US, the Environmental Protection Agency in combination with states such as Oklahoma, Minnesota, Wisconsin, and Oregon, among others, has tried numerous methods to facilitate these kinds of approaches, with varying degrees of success. For example, the state of Oregon has a tiered 'Green Permits' program[37] that provides for expeditious processing of permit applications and allows for additional flexibility beyond the basic regulatory framework. To be considered, facilities must satisfy several requirements, including having a track record of 'superior environmental performance,' a public performance report, and a communication and outreach program to include interested stakeholders in the facility's environmental planning process.

A further variation on the basic program that allows for flexibility includes a requirement for a formal environmental management system. In this case, the program does not so much replace the basic air emissions allowance system, as supplement it, and provides incentive for improvement in emissions performance.

Agreements

Variations on codes of practice, memoranda of understanding, and industry agreements have also been tried for air emissions management. For the most part, these have been negotiated for particular industries (e.g., power plants, pulp and paper industry), but in some cases have been negotiated on a case specific basis. For example, Dofasco in Ontario has entered into an agreement with the provincial and federal government that provides it with an overall emissions allowance for its operations[38]. The Railway Association of Canada is another example. It has entered into a Memorandum of Understanding with the Canadian government that specifies an overall cap on NO_x emissions[39].

Alternately, through the CCME, Canada Wide Standards have been prepared on a sector-by-sector basis for dioxins and furans, and other pollutants. This work essentially amounts to a code-of-practice for each industrial sector involved, e.g., incineration, coastal pulp and paper, iron sintering, and electric arc steel making. Under the *Canadian Environmental Protection Act*, several multi-pollutant, sector-wide emission reduction strategies have been initiated under various CCME or Environment Canada-led processes[40].

Examples of agreements at a larger scale include the BC-Washington Memorandum of Understanding and the Canada-US Air Quality Agreement.

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[37] http://www.deq.state.or.us/programs/greenpermits/gpupdate.htm

[38] http://www.dofasco.ca/ENVIRONMENT_AND_ENERGY/body_environ_frameset.html).

[39] http://www.ec.gc.ca/transport/publications/railwaymou/railwaymou.htm

[40] See CCME overview of the MERS process for the PM and ozone CWSs at http://www.ccme.ca/assets/odf/rvsd_mers_update_e.pdf

International example

In the Netherlands, a series of performance agreements or covenants have been negotiated between the national government and various industries. These have received widespread attention. Covenants are written, voluntary agreements between the government and individual facilities or industry associations. They are used to set performance terms, until regulations are in place, and to set implementation plans for particular sectors. These do not, however, replace the regulatory and permit context, but co-exist with it. This has resulted in some confusion as to their legal status and enforceability. Future certainty is a concern for some parties. They point out that since covenants are negotiated agreements, they can be terminated by either party at any time.

Offset programs

Offset programs have been included in various jurisdictions. The US-Environmental Protection Agency's State Implementation Plan requires that any emission increases for existing sources be offset by equal reductions elsewhere within the region. Closer to home, Prince George has included conditions for offset requirements for changes to existing facilities or adding new facilities to the already degraded airshed.

Finding acceptable offsets can be a problem. Offsets must be pollutant specific. This is becoming increasingly difficult as research shows that not all particulate matter has the same effect on human health. Suggested offsets may need to be supported by modelling to indicate that the change in source location does not lead to detrimental impacts to air quality.

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Responding to status of airsheds in BC

Airshed management has been identified as an important issue in the Ministry's Service Plan and is a key component in moving to a performance-outcome system for air quality. While examining releases to the air on a case by case basis allows for consideration of specific local impacts, current practice may fail to provide for evaluation of the cumulative impact of the emissions on the airshed as a whole and their contribution to overall regional air quality levels and degradation.

The *Environment Management Act* defines the current air quality management authority of the Ministry thusly: "The duties, powers and functions of the minister with extend to preparation and publication of environmental management plans for specific areas of British Columbia which may include ... measures with respect to ... air management." To-date, this authority has not been exercised.

Most municipal governments (regional districts) have not been delegated authority under the *WMA*. The full delegation of *WMA* authority to GVRD is unique. FVRD has been authorised to carry out planning responsibilities, but full permitting and enforcement authority has not been delegated. All other regional district municipal governments rely on the Ministry for all air quality management planning and regulatory functions.

Regional Growth Strategies are providing a formal framework under which some communities are developing general plans to prevent pollution (air, land and water). GVRD, FVRD, the Central Okanagan and east coast of Vancouver Island are such communities. The planning activities that have been cited for Prince George, Quesnel/Williams Lake, the Bulkley Valley and Kelowna are taking place voluntarily without formal powers.

A range of airshed management plans have been tried and implemented in numerous jurisdictions. In some cases, the permitting of sources has been completely delegated to regional

air quality authorities. In others, local authorities are required by law to assess air quality in their region. If air quality is found to be degraded, a hierarchy of responses, including air quality modelling and the designation of 'Air Quality Management Areas,' is stipulated. In some instances, additional resources are made available and guidance related to linkages between air quality degradation and land use and transportation planning is made available. Many of these approaches have already been incorporated into the airshed plans developed or under development in BC that are noted above.

In the US, the national *Clean Air Act* requires states that contain areas that do not comply with the National Ambient Air Quality Standards to file State Implementation Plans (SIPs) to define a path to compliance. If a state fails to make significant progress toward the compliance conditions in its SIP, in principle, the federal government can cut off funding for transportation systems (primarily highway construction). This sanction is a big stick.

Details on airshed management systems in California and the UK are provided in Appendix A.

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Intergovernmental involvement

Implementing local air quality plans and measures is further complicated by the intergovernmental structure in Canada. To successfully cover the spectrum of regulatory authority for various emission sources all levels of government must be involved.

As the make up of the emissions inventory shifts and mobile and other area sources comprise a larger share of total emissions, strategies to reduce emissions face the challenge that a greater proportion of the sources of local problems may fall under national level authority. In some cases, they fall beyond the scope of Environment Canada and extend to other departments such as Transport Canada for marine or railway emissions. Similarly, many avenues for addressing activities that give rise to emissions are the responsibility of municipal authorities (e.g., land use planning, etc., as discussed above).

There is some history of success on this front. Many of the CCME activities, such as the National NO_x/VOC action plan, are the result of co-ordinated federal, provincial, and municipal efforts and include some regionally-specific measures.

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Goal setting and meeting air quality objectives

It is open to discussion as to whether airshed goals should be set to levels different from province-wide objectives. The basis for this approach is the creation of specific objectives which would provide regional managers with the ability to set goals appropriate for local conditions. For degraded airsheds, a realistic first goal may be appropriate, while for airsheds whose performance betters the provincial objective, more stringent terms could be used to ensure that clean air is maintained. However, some concerns may arise over the introduction of continual improvement and how populations or businesses in one region are treated compared with those in another.

The GVRD, the Puget Sound Clean Air Authority (Seattle region) and the State of California are examples of jurisdictions that have set tougher goals than more senior levels of government have required.

The need for continual improvement will influence social and economic factors and affect how decisions are made. In communities where there is a range of emissions sources, set-

ting priorities may involve trade-offs among competing priorities. Communities may also decide that attracting particular kinds of development to a region is not viable within the current range of air quality levels, or community insistence on continual improvement may provide the stimulus to make emission reductions.

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5. CONCLUSION

The discussion presented here and the consultation questions posed cover a wide range of issues. In a short paper of this nature it has been necessary to touch on some of these issues rather briefly. Reference to additional material at the weblinks provided will help to fill in some of the gaps. Discussions during the consultation period will also develop many of these ideas further.

A summary listing of the 'implications' from Chapters 2, 3 and 4 and all of consultation discussion questions is provided below. The questions have been grouped in general themes based on the implications of the answers. In some cases, these will have direct relevance to the need to set new legislation. In others, these may reflect issues that can be resolved by adjusting management practices.

IMPLICATIONS

Air quality concerns

- Managing these concerns requires the ability to address the human activities that lead to emissions. It involves consideration of all sources in a region – as it is the cumulative effect of all sources that produces observed air quality. It also involves understanding the science and the impacts involved, as well as the management framework and possible options for response.
- In some cases, responding to these concerns may include legislation, regulations and standards on specific activities, while in others it may relate more to integrated approaches, such as airshed planning.
- To move beyond emission reductions that have been achieved to date, consideration will have to be given to the co-benefits that can be achieved by addressing more than one type of pollutant at a time through multi-pollutant strategies (including CACs and GHGs together).
- The results of recent health effects research, for example, mean that we must rethink the way we set and apply air quality objectives. Similarly, emission inventories that reveal the relative importance of multiple sources of emissions in a region, plus how these may vary across regions in BC, mean that strategies that reflect local conditions are needed. The management system must have the means and the flexibility needed to enable these approaches.
- Air quality concerns are managed in BC in a variety of ways, including through legislation, with roles for all levels of government. The *WMA* has been the Province's principal, but not only, tool for managing emissions that lead to air quality concerns. However, many current and future sources of importance require multi-agency control.

Managing air quality concerns

- Some of the concerns identified in Chapter 2 may be addressed by simple changes in management practices. For example, more assertive administrative promotion of airshed planning or collaborative management approaches with stakeholders may lead to creative solutions to some of the emission concerns. Chapter 4 provides more details on how this might be framed.
- Other concerns might be addressed adequately with a significant change in provincial policy. For example, emerging regional ozone concerns might be appropriately addressed by establishing a provincial policy that enables and expedites the formation of airshed-based management authorities.
- An element of enabling properly informed measures in a region might be mandatory reporting of actual emissions and placing reporting requirements on regional authorities to compile complete emission inventories based on locally-acquired data.
- Concerns that require collaboration among levels of government might require implementation of specific agreements between the province and federal governments or between the province and a municipal government that define certain roles and responsibilities.

Addressing air quality issues

- Careful consideration needs to be given to whether or not the Minister should be given more specific obligations under legislation (the *WMA* or other). More specific obligations for meeting air quality management goals might enable effective actions to improve air quality to be taken that are currently negotiated voluntarily. Specific obligations might also enhance accountability for delivering acceptable air quality everywhere in the province. On the other hand, obligatory powers assigned to the Minister may create an inflexible framework that would stifle creative, voluntary actions that would produce the desired results.
- The desired air quality improvements may be achieved by broadening regulatory coverage of certain sources, such as large space heating facilities (institutions, etc.), under the existing *WMA*. That is, new legislation may not be necessary. Similarly, policy changes may bring about desired actions without new legislation.

- Airshed management options are many and varied. The following table indicates some of the possibilities that are already under consideration by the Ministry.

Activity	Range of Actions/ Considerations		
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Ministry's role	No change	Selective regulation of high-risk sources/local management of other sources	Advisory to airshed management authorities

- Air quality management may be complicated by requirements that fall to the province under federal-provincial implementation of the Kyoto Protocol. Implementation of the Kyoto Protocol may present opportunities for co-management of greenhouse gases and common air contaminants.

CONSULTATION DISCUSSION QUESTIONS

General Priorities

1. What is needed beyond the direction provided by MWLAP's Service Plan to enable air quality management strategies to be developed in BC?
2. Have the most important clean air issues been listed? What priority should be placed on the principal issues?

Policy, Legislation and Regulations

3. Are there reasons for BC to consider legislating Ministerial requirements for clean air management?
4. Under what conditions should air quality objectives have Province-wide application, or alternately, under what conditions is it feasible to allow flexible, discretionary application on a regional or airshed basis, depending on local circumstances?

5. How should greenhouse gases be treated under the *WMA*? Should airshed management plans have objectives for reductions in greenhouse gases?
6. How should BC manage air quality in pristine or little-developed areas?
7. Under what conditions, if any, should there be a legislated requirement for airshed planning? Secondly, does the authority to make and implement plans need to be defined explicitly?
8. What roles should federal and municipal governments play in the development of regional air quality management plans?
9. Do you think that sanctions for not putting into action an airshed management plan or meeting airshed goals or timelines need to be in place? If so, what type and to what degree?
10. In what ways could air quality management plans be integrated with Regional Growth Strategies and Official Community Plans?

Management Practices

11. Do Provincial air quality objectives need to be formalized as standards (perhaps with enforceable sanctions), or should they remain as guidelines? If formalized as standards, how are they to be used?
12. Should objectives and standards be defined for other air quality impacts, such as odours, visibility, and acidic deposition?
13. Should BC adopt a risk-based approach to air quality impact assessment in place of, or to supplement, use of air quality objectives? Who should set the acceptable or threshold levels of risk? How should acceptable levels of risk be set in this context?
14. Under what conditions should use of flexible or facility-wide permits, BACT specifications, sector-wide approaches, emissions trading (for CACs or GHGs), or emission offsets be considered for air emissions in BC?
15. Should new sources be required to develop emission offsets in degraded airsheds? Elsewhere?
16. Should mandatory reporting of emissions be specified for BC?
17. Should review of cumulative regional emissions be required in permitting a new emission source? How should it be structured? Should existing sources be subject to review in the context of cumulative emissions?
18. Under what circumstances, if any, should economic instruments be considered for air quality management in BC?
19. With or without a regulatory requirement, what measures will facilitate airshed planning and implementation, and under what conditions (taking into consideration community size, severity of problem, level of support, etc.)?

20. Are there other new or innovative air quality management methods that BC should consider?
21. Should plans be required only if air quality does not, or is not expected to, meet specified objectives or standards?
22. Under what conditions would air quality management in airsheds be more effective and efficient if delegated to the local or regional level, or to regional airshed management authorities?
23. To meet the principles of 'keeping clean areas clean' and 'continuous improvement,' should there be required management actions associated with air quality targets below the Canada-Wide Standards? What kinds of actions and targets should be used?

APPENDIX A – EXAMPLES FROM OTHER JURISDICTIONS

Local air quality management planning examples – *California and the United Kingdom*

California

The state of California has a long history of aggressive air quality management. State regulatory requirements use the US-Environmental Protecton Agency and the federal Clean Air Act to provide for a hierarchy of area-based air quality management. Each state in which non-compliance areas exist is required to submit State Implementation Plans (SIPs) detailing the steps and measures to be taken in order to meet National Ambient Air Quality Standards. Once approved, SIPs have legal status.

Within California, the California Air Resources Board (CARB) oversees regional Air Quality Management Districts (AQMDs). Each of these districts is responsible for preparing regional portions of the SIP, permit administration, and implementation of indirect source and transportation control measures to satisfy the requirements of the California Clean Air Act. Although standards and the regulatory context are set by all three levels of government, the AQMDs are the units of administration and compliance assurance.

Various other states have now followed California's lead in this approach to local level air quality management. A wide variety of innovative and flexible regulatory and non-regulatory approaches have been implemented within this framework to enable locally-responsive airshed management. The South Coast AQMD (SCAQMD), for example, encompasses three airsheds[41]. In addition to preparation of an air quality management plan, it administers all permits in the region, including a program to certify professionals to assist in permit preparation.

The permit context includes federal Title V permits for 'large' sources – which are defined by a floating emission rate, set specific to each airshed. Extensive information is made available to assist the regulated community, which is required to use BACT. A program exists to certify control technology so that when used by a facility, its permit application is expedited and subject to lower fees.

As well, an emission trading program also exists in the region (RECLAIM). Programs targeted at transportation patterns exist, as do measures targeted to sectors otherwise not included in traditional definitions of point sources (e.g. targeted to dry cleaning, auto-body refinishing, etc.).

Delegation of authority has occurred to a wide extent in the US, along the lines of the model described for California. As a further example, the State of Washington created the Puget Sound Clean Air Agency to administer all federal (which were initially delegated to the state), state and local air quality laws.

[41] http://www.aqmd.gov/

The United Kingdom

The UK Local Air Pollution Control mechanism for Air Quality Management Areas may also provide an example instructive to this discussion[42]. In the UK, a newly created framework for local air quality management (LAQM) complements traditional point source management and provides for delegation of responsibilities to the local level. The system is performance-based and allows for local flexibility while including a tumbling system of mechanisms to ensure that focused emissions management occurs in relation to specified performance objectives.

The *Environment Act* requires that local authorities assess current and future air quality in their region and designate Air Quality Management Areas (AQMAs). These are areas that will not meet air quality standards by the specified timeframe. In these instances, an action plan is then required by law for any designated areas. Funds are earmarked for local authorities for this process, and guidance is provided to local authorities to direct them in identifying major emission sources, developing an emission inventory, and conducting air quality modelling where necessary. This includes a tiered review process of increasing levels of scrutiny to reveal risk. Air Quality Management Areas may consist of any area from a single building to the entire local area. Multiple AQMAs may also be designated within a local area.

Various degrees of flexibility are included within the requirements. For example, multiple local authorities may act jointly and co-ordinate their air quality management activities. Emission reduction measures must be included in the action plan:

> *Local authorities should ensure that the measures to be included in the plan should be cost-effective and proportionate taking into account the contribution of pollution from the different sources. They should also make sure they strike the right balance between the use of regulatory powers and other non-regulatory measures…*

The tools and techniques at the disposal of local managers include land-use planning, regulation of industrial emissions, traffic management, vehicle emission testing, designation of 'low emission zones,' and travel planning. Local authorities in the UK have authority for controlling emissions from numerous industrial processes and are responsible for reviewing permit applications and issuing authorizations. Where AQMAs are not designated, local authorities are not formally required to prepare action plans, but are encouraged to prepare a local air quality strategy nonetheless.

Local managers, however, are not provided with additional tools for modifying or implementing regulations and these functions continue to reside in a central agency. Rather than allowing for a full devolution of responsibilities on an airshed basis, the UK system assesses cumulative effects principally by identifying areas of concern as related to performance objectives,. The UK system is based on traditional jurisdictional boundaries rather than on discrete airsheds.

[42] http://www.defra.gov.uk/environment/airquality/laqm.htm