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GUIDANCE DOCUMENT on CONTINUOUS IMPROVEMENT (CI) and KEEPING-CLEAN-AREAS-CLEAN (KCAC)

Canada-wide Standards for Particulate Matter and Ozone

PN 1389

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The Canadian Council of Ministers of the Environment (CCME) is the major intergovernmental forum in Canada for discussion and joint action on environmental issues of national, international and global concern. The 14 member governments work as partners in developing nationally consistent environmental standards, practices and legislation.

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TABLE OF CONTENTS

ACRONYMS AND ABBREVIATIONS

AQA	Air Quality Agreement (Canada-U.S.)
BACT	Best Available Control Technology
BAEFT	Best Available Economically Feasible Technology
BART	Best Available Retrofit Technology
BATEA	Best available technology economically achievable
CA	Census Agglomerate
CAA	Clean Air Act (U.S.)
CAG	Core Advisory Group (of non-government stakeholders)
CCME	Canadian Council of Ministers of the Environment
CI	Continuous Improvement
CMA	Census Metropolitan Area
CWS	Canada-wide Standard
EPA	Environmental Protection Agency (U.S.)
GDAD	Guidance Document on Achievement Determination
GIS	Geographic Information System
JAICC	Joint Actions Implementation Coordinating Committee
JIA	Joint Initial Action
KCAC	Keeping-Clean-Areas-Clean
LAER	Lowest Achievable Emission Reduction
LOEL	Lowest Observed Effects Level
MERS	Multi-Pollutant Emission Reduction Strategy
NAAQS	National Ambient Air Quality Standards (U.S.)
NH_3	Ammonia
NOx	Nitrogen Oxides
NO_3	Nitrate
NSR	New Source Review
P2	Pollution Prevention
PEMA	Pollutant Emissions Management Area
PM	Particulate Matter
$PM_{2.5}$	Particulate Matter less than 2.5 microns in diameter
$PM_{2.5-10}$	Particulate Matter with diameter in 2.5 to 10 micron range
PSD	Prevention of Significant Deterioration (of air quality)
RPO	Regional Planning Organization (U.S. Regional Haze Program)
RACT	Reasonably Achievable Control Technology
RSA	Reporting Sub-Area
SO_2	Sulphur Dioxide
SOMA	Sulphur Oxides Management Area
VOCs	Volatile Organic Compounds

CHAPTER 1: INTRODUCTION

1.1 Purpose of this Document

This Guidance Document is intended as a reference tool for jurisdictions to assist them in designing and implementing their Continuous Improvement/Keeping Clean Areas Clean (CI/KCAC) programs. It:

- follows direction on principles, commitments, roles and responsibilities in the *Canada-wide Accord on Environmental Harmonization* and its *Canada-wide Environmental Standards Sub-Agreement*
- builds on the general guidance provided in Annex A of the CWS Agreement
- provides concepts, definitions and methodologies to ensure reasonable consistency in CI/KCAC programs throughout Canada
- describes optional air management approaches and tools that allow flexibility for jurisdictions to tailor their CI/KCAC programs to their particular circumstances

1.2 Background

In June 2000, in accordance with the 1998 *Canada-wide Accord on Environmental Harmonization* and its *Canada-wide Environmental Standards Sub-Agreement*, the Canadian Council of Ministers of the Environment (CCME), except for Quebec, endorsed a Canada-wide Standards (CWSs) Agreement for Particulate Matter (PM) and Ozone in air. The Agreement established numerical ambient concentration targets for $PM_{2.5}$ - fine particulate matter - and ozone that are to be met by the year 2010. In setting these standards, the CWS Agreement acknowledged that:

- PM and ozone negatively affect human health and the environment
- there is no apparent lower threshold for the effects on human health, and
- there are additional benefits to reducing and maintaining ambient levels below the standards

In agreeing to the CWSs for PM and Ozone, federal, provincial, and territorial governments ("jurisdictions") across Canada have made strong commitments:

- to implement the CWSs
- to share information about implementation
- to be accountable to their respective publics

The CWS Agreement consists of several parts:

- Part 1 establishes numerical targets and timeframes
- Part 2 establishes steps for meeting the standards; *commits jurisdictions to implementation of CI/KCAC programs in areas with ambient concentrations below the CWS levels*; provides for subsequent reviews of the standards; and prescribes progress-reporting parameters
- Annex A promotes preventative action and provides basic guidance on CI/KCAC strategies
- Annex B provides direction on progress reporting

The CWS Agreement established the need for coordinated, long-term CI/KCAC management aimed at minimizing risk from particulate matter and ozone. The government of Quebec has committed to undertake actions to achieve comparable air quality.

Although Annex A of the CWS Agreement provides some general guidance, the CWS Joint Actions Implementation Coordinating Committee (JAICC) and its multi-stakeholder Core Advisory Group (CAG) felt that more detail was needed to establish common criteria and planning frameworks to assist jurisdictions in designing their CI/KCAC programs. The JAICC therefore established a CI/KCAC Working Group and charged it with seeking input from interested stakeholders and with developing a national Guidance Document.

This document was prepared through an open and transparent process by the CI/KCAC Working Group. The Working Group included representatives from federal, provincial and territorial governments as well as participants from health and environmental groups and industry. This Guidance Document will be reviewed periodically as directed by CCME and revised, if necessary, based on the experience gained by jurisdictions in implementing their CI/KCAC programs. The review could be coordinated with the required 5-year reviews of the CWSs for PM and ozone.

1.3 Relationship to the *Guidance Document on Achievement Determination*

This Guidance Document draws on some of the content of another guidance document recently endorsed by CCME - the *Guidance Document on Achievement Determination (GDAD) for the CWSs for PM and Ozone*. The GDAD contains criteria and methodologies for determining whether the numerical CWS targets have been achieved. Some of these criteria and methodologies are referenced for use in CI/KCAC implementation, either directly or in a modified form. The GDAD may be consulted for full details.

The GDAD provides jurisdictions with the rationale and recommendations for the methodologies, criteria and procedures they need to report on achievement of the CWSs for PM and ozone, including:

- concepts used to identify CWS reporting areas
- who should report on progress
- where PM and ozone monitoring sites should be located
- definition of PM and ozone data requirements
- calculation methodologies for determining achievement
- how to account for two significant regional circumstances related to treatment of areas highly affected by transboundary air pollution, and treatment of natural events

The GDAD includes a recommendation that the guidance it contains also be followed by jurisdictions in reporting on progress on CI/KCAC.

CHAPTER 2: POLLUTANTS

2.1 Pollutants of Primary Interest

CI/KCAC programs must address the following pollutants:

- *In the ambient environment:* ozone and $PM_{2.5}$
- *In emissions:* direct $PM_{2.5}$ emissions
  the $PM_{2.5}$ and ozone precursor pollutants NOx and VOCs
  the $PM_{2.5}$ precursor pollutants SO_2 and NH_3

Jurisdictions may wish to include other air pollutants in their ambient air measurements such as sulphur dioxide (SO_2), nitrogen oxide (NOx), volatile organic compounds (VOCs) and ammonia (NH_3). They may or may not have management targets for these pollutants. Jurisdictions may also wish to include specific components of fine particulate matter in ambient air such as sulphate (SO_4), nitrate (NO_3), elemental carbon, and organic carbon for the purpose of identifying emission sources. It is important to include the primary precursor pollutants to PM and ozone in emission inventories for CI/KCAC. Reducing precursor emissions is a primary means of lowering ambient levels of $PM_{2.5}$ and ozone. Tracking precursor emissions may be an important method for measuring progress on CI/KCAC.

2.2 Consideration of Coarse Particulate Matter ($PM_{2.5-10}$)

The preamble to the CWSs for PM and ozone acknowledges that there are health effects associated with the coarse fraction of PM ($PM_{2.5-10}$) and it indicates the need for actions to reduce concentrations of $PM_{2.5-10}$ in the atmosphere. However, the current CWSs do not include a target for $PM_{2.5-10}$. The JAICC undertook a review of the need for a CWS for $PM_{2.5-10}$ and concluded that, although there is evidence of health effects due to the coarse fraction, the available information is not sufficient to suggest a standard at this time. Therefore, in its report to Ministers in February 2005, the JAICC recommended that a plan to address the information gaps for this pollutant be developed and initiated by 2005 and CCME revisit the issue of a CWS for the coarse fraction as part of the 2010 review of the CWS for $PM_{2.5}$ and ozone.

The JAICC recognized that current $PM_{2.5}$ initiatives would reduce coarse fraction emissions. It also encouraged jurisdictions to pursue preventative activities for $PM_{2.5-10}$ until the 2010 review. In fact, at least one of the Joint Initial Actions (JIAs) agreed to by CCME - the JIA on Construction and Demolition - focused on the coarse fraction.

The JAICC's recommendation to Ministers was informed by a multi-stakeholder consultation workshop held in Calgary in November 2003 (see Appendix B). Participants agreed to postpone considering a recommendation on a CWS for $PM_{2.5-10}$. However, stakeholders agreed on the benefits of information gathering and other initial actions with respect to $PM_{2.5-10}$. Until the proposed plan for addressing $PM_{2.5-10}$ information gaps is available, jurisdictions can consider these suggested actions in their CI/KCAC management strategies (See Appendix B). Proactive measures will enhance understanding and curtail growth in ambient concentrations of $PM_{2.5-10}$ consistent with the objectives of CI/KCAC.

CHAPTER 3: VISION AND GUIDING PRINCIPLES

3.1 Vision

The broad vision for the CI/KCAC provisions of the CWSs for PM and ozone is:

> *To ensure that, in the vast areas of Canada with air quality better than the CWS numerical targets for PM and ozone, air quality is not significantly degraded and is maintained or improved to the extent practicable, to minimize risk to human health and the environment for the benefit of future generations.*

3.2 Guiding Principles

Principles are a general guide for decisions. They are applied in conjunction with site-specific contextual factors to arrive at decisions specific to a particular situation or area.

CI/KCAC plans should respect the principles in the *Canada-wide Accord on Environmental Harmonization* and its *Canada-wide Environmental Standards Sub-Agreement*, and the general principles in the PM and Ozone CWS Agreement. They should also take into account the following guiding principles:

Protection of Human Health and the Environment

The CWSs for PM and Ozone were established in recognition of the significant effects of these two pollutants on human health and the environment. The long-term management goal of the CI/KCAC provisions is to minimize the impact of PM and ozone. The CI/KCAC provisions of the CWSs recognize that:

- the current CWS numerical targets 'may not be fully protective' of human health and the environment
- these two pollutants have no apparent lower threshold for adverse health effects
- numerical targets are a 'balance between the desire to achieve the best health and environmental protection possible in the relative near-term and the feasibility and costs of reducing the pollutant emissions that contribute to elevated levels of PM and ozone in ambient air'

Polluting "Up to a Limit" is Not Acceptable

The overall objective of the CWSs is to *reduce* the adverse health and environmental effects of PM and ozone. Therefore, allowing PM and ozone ambient levels to increase up to the current numerical CWS targets is counter productive, and unacceptable in light of the absence of any apparent lower threshold for adverse effects and the knowledge that the numerical CWS targets may not be fully protective. Proponents of development should not regard the current CWS

numerical targets as a permissive maximum. The clear intent of CI/KCAC is to ensure air quality is not significantly degraded and to improve air quality whenever feasible.

Same Degree of Protection for All Canadians

All Canadians are entitled to the same level of protection from the adverse effects of PM and ozone, whether they live in large urban centers or small remote communities. The CI/KCAC provisions should apply to communities of all sizes. To the extent practicable, jurisdictions should strive through the application of a common set of principles to ensure that the same level of protection is afforded everywhere across Canada.

Consistency

Sufficient guidance should be provided at the national level to ensure consistency in CI/KCAC plans across jurisdictions through:

- adherence to accepted principles
- common interpretation of CI/KCAC
- similar program elements, and
- comparable reporting criteria

Flexibility

To accommodate the range of air quality and jurisdictional circumstances across the country, jurisdictions should have the flexibility to:

- tailor their programs to meet particular regional needs
- select their air management approaches
- establish their CI/KCAC targets and goals,
- harmonize with their current air quality management programs, and
- determine the most feasible and cost effective strategies appropriate to their circumstances

Achievability and Practicality

Current numerical CWS targets for PM and ozone were set to be achievable by all jurisdictions by 2010. Any new targets established for future dates as a result of periodic reviews should also be practical and achievable within the new timeframes. Similarly, guidance parameters for CI/KCAC implementation should reflect short and long-term achievability and practicality.

Open and Transparent

Jurisdictions are accountable to their publics for the protective mandate of CI/KCAC. Therefore the design, implementation and reporting should be as transparent as possible and should allow for meaningful participation of interested stakeholders.

Shared Responsibility

Implementation of CI/KCAC programs is a shared responsibility between the provinces, territories and the federal government as well as municipalities, regional air management groups, contributing emitters, interested stakeholders and the public.

Implications for Other Pollutants

CI/KCAC programs may have effects on other pollutants such as greenhouse gases and toxic air contaminants, either achieving co-benefit reductions in emissions or causing increases through greater energy use. Jurisdictions should consider these implications in designing their CI/KCAC programs and strive for integration of all their air issue programs to achieve across the board reductions in pollutants of concern.

Incorporating "Best Available Techniques" When Making Capital Improvements

In most cases, plans have to be made and budgets set for projects involving new equipment or changes to existing sources before entering jurisdictions' permitting/approvals processes. Once past this point, it is often difficult and costly to retrofit emission control technologies or make process changes to use pollution prevention techniques, especially for large emission sources. Jurisdictions should proactively promote, encourage or require the consideration and adoption of appropriate "best available techniques" (including pollution prevention measures, use of "best available technologies economically achievable," and best management practices) in the capital planning stage for new sources and replacement or modification of existing sources, even in areas where ambient air quality is below the Canada-wide Standards.

CHAPTER 4: DEFINITIONS, METRICS AND CONCEPTS

It is important to keep in mind that the CI/KCAC provisions of the CWS apply to all jurisdictions, and the principle that action is to be taken by the jurisdiction "best situated" to do so applies as an underlying assumption throughout this document. Measures taken by one jurisdiction can and will affect what needs to be undertaken by others, and there are likely to be situations where "who does what" will need to be discussed. This section builds upon the provisions of the CWS themselves and provides additional guidance for the development and implementation of CI/KCAC programs.

4.1 CI and KCAC Definitions

The definitions of CI and KCAC are fundamental to the intent of the program. The CWSs state clearly that CI and KCAC are concepts that apply where ambient levels are below the CWS numerical targets. Where ambient levels are above the CWS limits, CI and KCAC measures may still apply but additional achievement actions will need to be considered based on the sources contributing to levels in that area. Annex A to the CWS provides a general description of the CI and KCAC concepts (see Appendix A). Building on these reference points in Appendix A, additional guiding definitions for CI and KCAC, in the context of the CWSs for PM and ozone, are as follows:

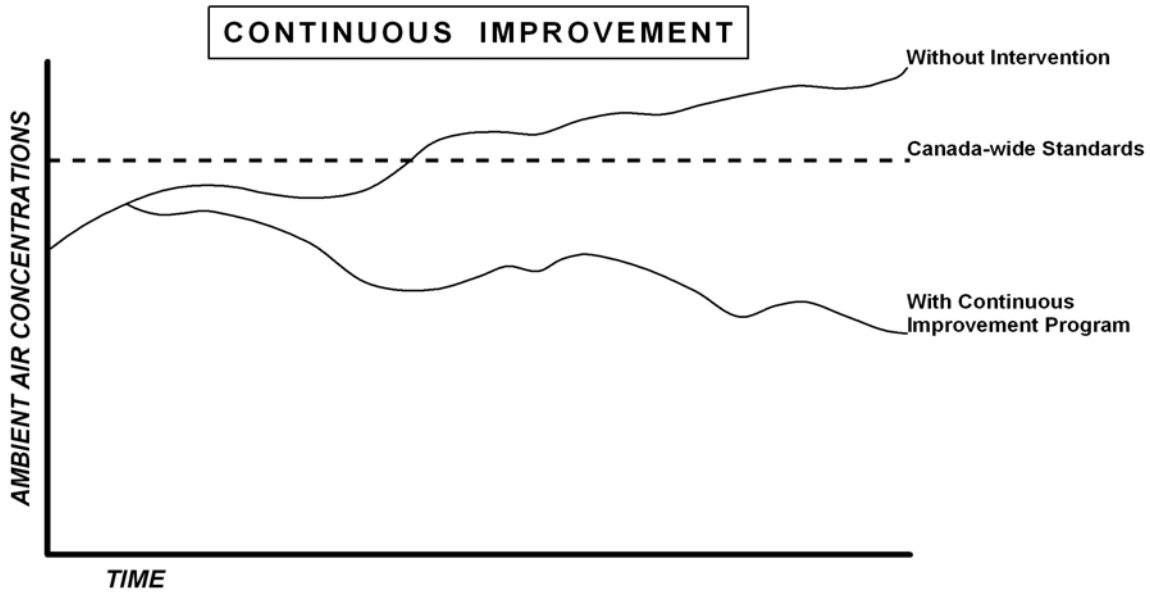
> ***Continuous Improvement (CI)*** *means taking remedial and preventative actions to reduce emissions from anthropogenic sources towards the long-term goal of reducing overall ambient concentrations of PM and ozone in areas below the CWS levels.*
>
> ***Keeping-Clean-Areas-Clean (KCAC)*** *refers to preventative measures applied either across a jurisdiction or within a specified area that are intended to avoid or minimize increases in overall ambient concentrations of PM and ozone in areas not significantly affected by local sources of emissions.*

The above definitions are represented schematically in Figures 1 and 2 below.

4.2 Intent of CI and KCAC

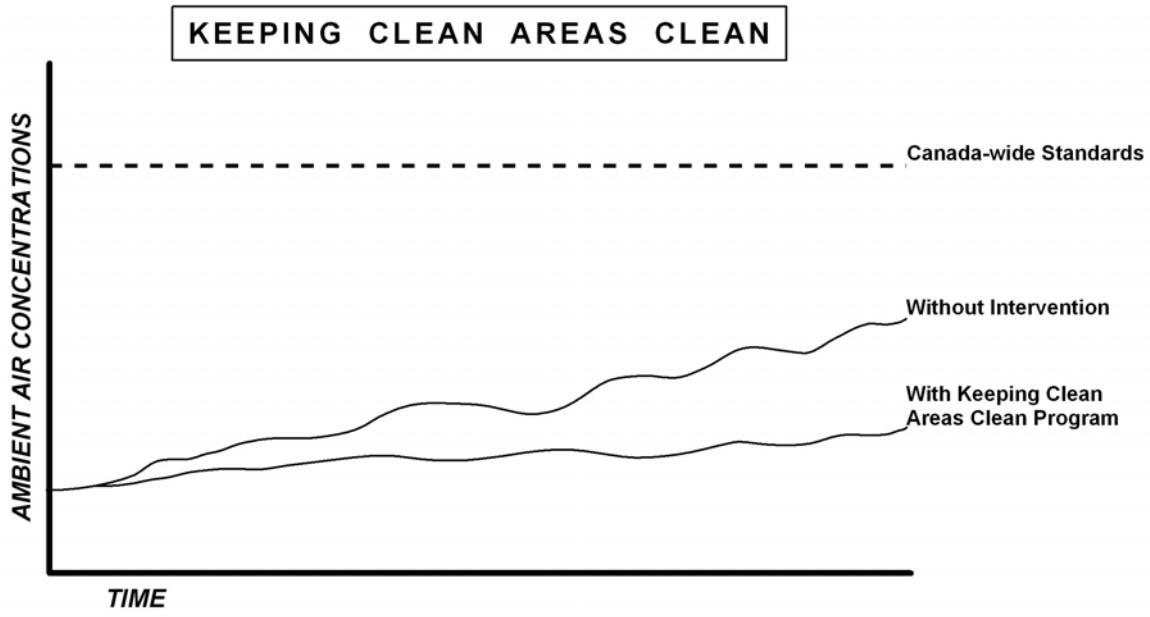
Both CI and KCAC apply across all areas in jurisdictions, however the focus of programs is expected to vary according to the air quality situation in a particular area. CI is likely to be the focus in areas where ambient PM and ozone levels are below the CWS primary targets but are significantly influenced by anthropogenic emissions, such as the Greater Vancouver Regional District (GVRD) where there is a desire to further reduce ambient levels even though the CWS has already been achieved, and a need to ensure that the CWS target levels are not treated as permissible maximums.

Figure 1: Continuous Improvement



Continuous Improvement: Increasing concentration trends approaching the CWSs are reversed and levels are reduced over time

Figure 2: Keeping Clean Areas Clean



Keeping Clean Areas Clean: Increasing trends in concentrations in clean areas are avoided or minimized over time through pollution prevention and best management practices

Figures 1 and 2: Schematic of PM and Ozone CWS Ambient Air Quality Commitments

Figure 1 shows that Continuous Improvement means incremental reductions of ambient concentration levels over time. Without intervention, ambient levels might either slowly rise or remain at a plateau. Any short-term increases would be addressed to achieve a return to the downward trend as soon as possible. Plateaus and gradual increases would also be managed to achieve a downward trend over time.

With respect to Keeping Clean Areas Clean, Canada has vast sparsely populated territories where, inevitably, even minimal development such as a small increase in population or vehicles can cause ambient levels to rise. Such areas would still retain relatively clean air in comparison to highly populated or industrial areas. Nevertheless, KCAC as the focus of efforts for such areas means that ambient levels would be tracked directly or indirectly and action would be taken to avoid or minimize degradation whenever reasonable and possible. Over time, as a result of KCAC actions, increases in ambient levels would be less than those resulting from no action. The KCAC concept is expected to apply in the majority of Canada's less populated territory.

Since air pollution knows no boundaries, emissions in one jurisdiction can affect air quality in another. Ambient levels of $PM_{2.5}$ and ozone in a given area could be close to or even exceed the levels of the CWS despite the absence of local significant anthropogenic sources. Where emissions in one jurisdiction have been found to significantly contribute to the ambient PM or ozone concentrations in another jurisdiction, a combination of CI or KCAC actions may be necessary by both jurisdictions. When emissions from source regions have transboundary influences on receptor regions, jurisdictions are encouraged to co-operate on CI or KCAC actions.

4.3 Elements of the CWSs for PM and Ozone and Their Relevance to CI/KCAC

The numerical targets and timeframes for the CWSs are:

- For fine particulate matter ($PM_{2.5}$):

30 ug/m^3, 24-hour averaging time, achievement to be based on the 98th percentile annual ambient measurement, averaged over 3 consecutive years.

- For ozone:

65 ppb, 8-hour averaging time, achievement to be based on the 4th-highest annual ambient measurement, averaged over 3 consecutive years.

These numerical targets provide an important point of reference for design of CI/KCAC programs because, by definition, they will typically be used in determining areas where ambient air quality is better than the levels set out in the standards; supplementary information may be considered where appropriate.

4.4 Other Important Definitions

These definitions are for the purposes of this document.

Background *means the ambient air concentration resulting from anthropogenic and natural emissions outside North America and natural sources within North America (definition from GDAD).*

Transboundary Influence *means the effect on ambient levels of PM and/or ozone attributable to the transboundary flow of PM and/or ozone or their precursor pollutants from the United States or from another province/territory.*

Pollution Prevention *means the use of processes, practices, materials and energy that avoid or minimize the creation of pollutants and wastes at source (definition from CCME Pollution Prevention Policy).*

Receptor Region *means a region or area that receives air pollution from sources within its boundaries and/or from upwind sources or source regions.*

Source Region *means a region from which pollutants affecting a particular receptor region originate, and may include the receptor region, a source region(s) upwind of the receptor region, or a combination of the two.*

Reporting Region *means a region selected to provide specific information on progress in implementing the CI/KCAC provisions of the CWS for PM and ozone, and may include both a receptor region, where ambient air quality levels and trends are reported, and the contributing source region(s) affecting air quality in that receptor region, where emission levels and trends and emission reduction actions are reported*

4.5 The CWS Ambient Concentration Metrics

The Guidance Document on Achievement Determination (GDAD) provides methodologies and criteria for calculating the achievement statistics for $PM_{2.5}$ and ozone.

Management plan development, trend analysis, and achievement determination require data:

- of comparable quality
- determined by the same methodologies
- subject to the same criteria, and
- using the same statistical form

To ensure comparability, where monitoring facilities permit it the CWS metrics should be one of the indicators used in designing CI/KCAC management plans and for monitoring and reporting on progress. The methodologies and criteria outlined in the GDAD for calculating the CWS achievement statistic should be used for calculating $PM_{2.5}$ and ozone three-year averages for CI/KCAC.

Although there is no CWS and no statistical form for coarse particulate matter ($PM_{2.5-10}$), it is recommended that, where monitoring facilities are in place, ambient $PM_{2.5-10}$ data be reported in at least one of the statistical forms similar to that specified for $PM_{2.5}$, that is, 24-hour averaging time, 98th percentile annual average ambient measurement, averaged over 3 consecutive years.

4.6 Other Ambient Metrics

While the CWS ambient metrics determine CWS achievement, other ambient metrics may be considered for informing the management of progress on CI/KCAC. Several alternative metrics for $PM_{2.5}$ and ozone were considered in developing the CWSs for PM and ozone. The Context section of the CWSs notes that: "Forms of the PM and ozone CWSs other than the relatively short-term exposure forms established here, such as seasonal or annual average targets, may also be useful additions at a later date. Since the current CWSs are related primarily to protection of human health, their adequacy for the protection of vegetation, visibility impairment, material damage or other adverse effects may need to be assessed."

Optional metrics considered in developing the CWSs for PM and ozone included:

- Annual average for $PM_{2.5}$
- Seasonal (May to September) average of daily maximums for ozone
- Seasonal Cumulated Exposure Index (CEI) for ozone for vegetation protection (there are various forms of CEIs e.g. SUM60 which is calculated by summing hourly ozone concentrations when concentrations are equal to or greater than 60 ppb over a specified time period, usually during daylight hours)
- Alternative statistical cutoffs to the 4th highest for ozone and the 98th percentile for $PM_{2.5}$ (e.g. daily maximums, 10th highest, 90th percentile, etc)

Jurisdictions may wish to consider other ambient concentration metrics for $PM_{2.5}$ and ozone for establishing targets and tracking progress such as the following "everyday concentration" metrics:

- For $PM_{2.5}$: the 3-year average of the annual average of all daily 24-hour $PM_{2.5}$ measurements for the year
- For ozone: the 3-year average of the annual average of all daily maximum (D_{max}) 8-hour ozone measurements for the year

A rationale for consideration of these metrics is provided in Appendix C of this Guidance Document.

4.7 Emission Metrics

The CWS Agreement mentions the reductions in ambient levels of $PM_{2.5}$ and ozone as a benchmark for tracking progress in reducing the risk posed by $PM_{2.5}$ and ozone. However, on a year-to-year basis ambient concentrations can be highly influenced by prevailing meteorology. This is especially applicable for higher concentrations. This means that, although emissions may have been reduced, the prevailing meteorology may have caused concentrations to be higher than

would otherwise be the case. For this reason, in addition to the ambient metrics, it may be appropriate to track CI/KCAC based on some form of emission metric for $PM_{2.5}$ and ozone.

Pollutant emission metrics can be expressed in various ways:

- total annual emissions of specific pollutants (tonnes/year)
- total seasonal emissions of specific pollutants (tonnes/season) (e.g. NOx and VOCs typically contribute to ozone in summer while wood combustion typically creates pollutants in winter)
- maximum daily emissions of specific pollutants (tonnes/day), either regionally or for specific sources
- emission quantities above a threshold (e.g. National Pollutant Release Inventory (NPRI) thresholds for reporting)

Population density can be used as a surrogate to characterize area source emissions in a management area. Area source emissions such as those from agriculture, roads, and construction are often related to population. An area may be considered to have insignificant emissions if the Census Data for the number of inhabitants per km^2 is below some selected threshold number and it has no significant point emission sources.

4.8 Successive Building Blocks

KCAC actions, CI actions and CWS achievement actions can be viewed as successive building blocks in an integrated PM and ozone CWS implementation plan. These building blocks are represented schematically in Figure 1 below.

This successive building block model illustrates a continuum of incrementally stringent actions that relate to increasing levels of ambient air concentrations.

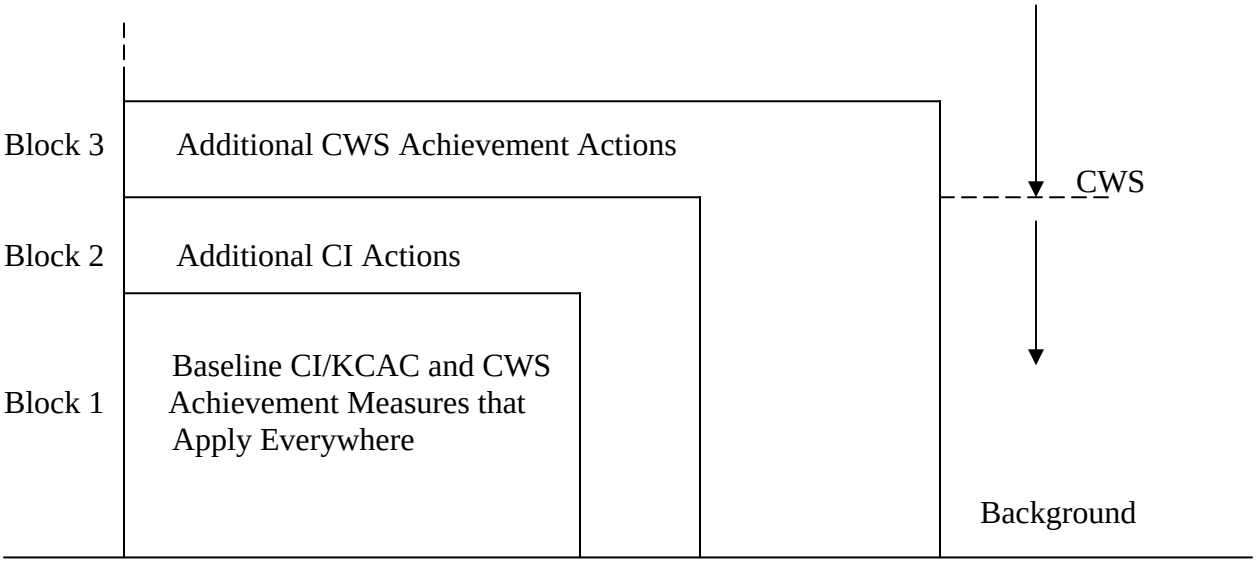


Figure 1: Schematic of Successive Building Blocks of KCAC, CI and CWS Achievement Actions

The First Block represents *the minimal level* of CI/KCAC and CWS achievement actions that should be considered *to apply everywhere* in a jurisdiction, such as:

- Pollution Prevention (P2) approaches
- Best Available Technology Economically Achievable (BATEA) requirements for selected sources of importance to a jurisdiction
- New Source Performance Limits
- Guidelines and Codes of Practice
- Economic Instruments such as emissions trading, tax incentives and subsidies
- Partnership Agreements such as Memoranda of Understanding (MOUs)
- National Vehicle and Fuel Standards
- Energy Conservation and Sustainable Transportation system measures
- Reduction in transboundary pollution contribution
- Other Initiatives: compliance assistance, environmental leaders programs

These actions may contribute:

- to KCAC by minimizing growth in ambient pollution levels in areas with clean air
- to CI by reductions in ambient pollution levels in areas with significant contributions from anthropogenic sources, or
- to CWS achievement where they bring ambient levels down to or below the CWS numerical target levels

These actions also may be taken in combination, e.g., BATEA requirements and/or New Source Performance Limits may form one element of a Guideline or Code of Practice, and MOUs or environmental leaders programs may serve as vehicles to promote broader use of pollution prevention measures in one or more sectors.

The Second Block includes additional actions applied to reduce ambient levels in selected areas *where the ambient levels are below but near the CWS numerical target levels*, such as:

- in-use vehicle emission reduction initiatives
- retrofit emission controls on selected emission sources or sectors, and
- local urban planning, transportation and energy conservation initiatives

The Third Block includes additional actions applied to reduce ambient levels to or below the CWS numerical target levels, *in areas where they currently exceed the CWS targets* such as:

- more stringent retrofit technologies on existing sources
- retrofit technologies on more sources or sectors, and
- more intense urban planning, transportation and energy conservation initiatives
- more vigorous negotiations with *out of area* sources to reduce their contribution (including transboundary contributions)

4.9 Decision-Making Process

The design of each jurisdiction's CI/KCAC Implementation Plan will be guided by a combination of factors that shape decisions, including:

- a shared vision and principles that provide top-down general guidance (see Chapter 3)
- non-case specific concepts and approaches that guide decisions in a generic way
- contextual factors specific to the particular community or geographic region, such as:
  - local air quality
  - the mix of contributing emission sources
  - the presence of transboundary influence, and
  - community interest

The combination of common and customized program parameters will help to provide both national consistency and regional flexibility.

4.10 Integration of CI/KCAC Actions with CWS Achievement Actions

As is evident from the building block model, there are linkages between CI/KCAC and CWS achievement plans and actions. The two action plans have many common elements, including:

- ambient monitoring methodologies
- selection of regional areas or airsheds for PM and ozone management
- assessment of the influence of transboundary flow
- assessment of background levels and natural events, and
- reporting to respective publics.

Jurisdictions should address the objective of achieving both CWS and CI/KCAC in an integrated manner, retaining sufficient distinction between the respective activities to be able to assess progress relevant to each.

4.11 Extension to Visibility Protection

Fine particulate matter is the primary pollutant contributing to visibility deterioration. Reduced visibility and the deterioration of natural vistas are a concern in some regions of Canada and in certain situations may be as significant a driver for reducing fine particulate matter in the air as ambient concentrations directly affecting human health. This Guidance Document has been identified as a primary mechanism for fulfilling Canada's commitment to the Canada-U.S. Air Quality Agreement (AQA) in which Canada has agreed to implement measures for prevention of air quality deterioration and visibility protection of comparable effectiveness to those in the United States. As well as reducing the direct adverse effects of PM and ozone on human health and the environment, the CI/KCAC programs adopted by jurisdictions can serve as a mechanism for protecting visibility and reducing regional haze in Canada.

4.12 Roles and Responsibilities

There are a number of parties that are integral to the successful implementation of the CI/KCAC provisions of the CWSs for PM and ozone. These include:

- the jurisdictions
- municipalities and regional air management groups

- contributing emitters
- interested stakeholders and the public

All jurisdictions have environmental protection legislation of some kind that gives them the legal authority to implement a range of emission management tools and programs. Among jurisdictions, certain kinds of emission reduction actions are typically undertaken by the federal government (e.g. vehicle, engine and fuel standards, international agreements). Other actions have typically been undertaken by provinces (e.g. stationary source emission regulations, operating permits). The territories and municipalities have also undertaken measures within their mandate and capacity (e.g., restrictions on open burning) and some actions have been undertaken cooperatively among various levels of government and with stakeholders (e.g. national codes and guidelines, sectoral multi-pollutant emission reduction strategies (MERS), airshed planning).

Municipalities and regional airshed management groups have an important role to play in CI/KCAC. They are instrumental in fostering grass roots support for local air quality programs. Some municipalities also have legislative authorities that may play an important part in implementing emission reduction actions within their boundaries. Regional airshed planning is often a multi-stakeholder community process. Because regional airshed management groups typically include a range of interested stakeholders including industry, these groups can play an important role in developing feasible, practical pollution-reduction measures and workable management plans.

The sharing of responsibilities between the federal government and the three territories may vary depending on the status of devolution of responsibilities in air quality management. The Governments of the Northwest Territories and Nunavut will undertake appropriate responsibilities to implement the CI/KCAC provisions of the CWS for PM and ozone after related environmental protection responsibilities are devolved to the Territorial Governments or through intergovernmental agreements, which include appropriate roles for institutions established pursuant to Aboriginal claims agreements.

Where air quality issues arise in areas that are the responsibility of one jurisdiction, but are primarily due to emission sources located in another jurisdiction, the governments responsible for both jurisdictions are expected to cooperate on actions to implement CI/KCAC. Three likely situations where areas under one jurisdiction could adversely affect or be affected by areas under another jurisdiction are:

- federal lands (e.g. most of the Northwest Territories and Nunavut, National Parks, ports, railway yards, military bases) adjacent to provincial, territorial, or international lands/waters
- provincial or territorial land adjacent to the border of another province or territory, and
- provincial or territorial land adjacent to an international border

It is recognized that there are also more complex situations where one jurisdiction may be impacted by emissions from a large number of other jurisdictions. In such cases the basic principles described above remain applicable for the Canadian jurisdictions involved. The ability to demonstrate that they are collectively demonstrating “best efforts” will be important to support any necessary discussions internationally.

Jurisdictions have agreed to act in accordance with the principle laid out in the *CCME Canada-wide Accord on Environmental Harmonization* which states that the jurisdiction "best situated" will act, and any jurisdiction can use any of the tools available through its respective legislative authorities.

CHAPTER 5: MANAGEMENT APPROACHES - STRATEGIES AND COMMON PLAN ELEMENTS

5.1 Optional Approaches

Jurisdictions vary in size, capacity, and the current state of development and implementation of their air quality management approaches. Some jurisdictions will have to take significant action to achieve the PM and ozone CWS numerical targets. These jurisdictions have an opportunity to develop their CI/KCAC programs in conjunction with their CWS achievement initiatives. Other jurisdictions may not require any action to achieve the CWSs, and can devise emission reduction programs focused solely on CI/KCAC. Jurisdictions may find it helpful to review management strategies currently being used in Canada and other countries as they design their CI/KCAC programs. Some of these strategies are summarized in Appendix D for reference. They include approaches used in Alberta, British Columbia, the United States, the United Kingdom, and New Zealand. In general, these examples include one or more of three basic approaches.

Regulatory

- e.g. U.S. Clean Air Act's Prevention of Significant Deterioration (PSD) and Regional Haze Programs
- are primarily top-down and driven at the national level
- uses legislative requirements to define processes and achieve action

Framework

- e.g. Alberta, New Zealand - both use a trigger level approach (See Appendix D)
- driven by both top down (jurisdiction) and bottom-up (airshed) levels
- uses frameworks or guidance documents to define processes and achieve action

Enabling or Capacity-building

- e.g. B.C., U.K.
- primarily driven from the bottom up by local communities or airshed groups
- assistance and support is provided at the jurisdiction level to encourage local action

5.2 Common Plan Elements

There is often some degree of overlap in the mix of approaches. However, experience suggests that there are common key elements to most air management strategies. Based upon current successful CI/KCAC strategies, and considering the principles and concepts detailed in the foregoing chapters, the following seven common elements are recommended as steps for the development of a CI/KCAC plan:

- Involve stakeholders
- Define management areas
- Establish baseline
- Develop goals/targets
- Develop strategies
- Implement strategies

- Evaluate effectiveness of strategies

A brief description and rationale for each of these common elements is provided below. Guidance for jurisdictions in applying these common elements is provided in Chapter 6.

Involve Stakeholders

Jurisdictions have committed to open and transparent processes to environmental management in the *Canada-wide Accord on Environmental Harmonization.* Involving stakeholders is a best practice for generating transparency. It helps ensure that interested parties understand the nature and extent of the air quality problem, the options available for improvement, the feasibility of various options, and the consequences of inaction. Stakeholders can make a valuable contribution to the design of plans to improve air quality. Their involvement also helps establish a sense of shared responsibility among all participants. It also helps ensure accountability of governments to their respective publics.

Define Management Areas

A *management area* is a geographic domain in which a jurisdiction applies a particular air quality management approach. The cause and solution of PM and ozone-related problems often varies among communities and regions. Defining a management area appropriate to the geography and scope of the air quality issue allows for focus on unique regional problems and solutions, and the identification and engagement of appropriate stakeholders. It enables management approaches to be tailored to the particular circumstances of a community or region. It also assists in tracking and reporting on progress in a way that is meaningful to the affected community or region. The size of a management area is a decision for each jurisdiction to make, and can range from a relatively small community to an entire jurisdiction as appropriate to the air quality situation.

Establish Baseline

Baseline air quality (measured or modeled) and emissions information is needed to:
- Determine the relationship between current air quality and emission levels
- Provide a scientific foundation for the choice of actions
- Provide a baseline against which to track changes

Develop Goals and Targets

Air quality goals are the desired outcomes for the management area. Targets are specific levels of achievement, attached to dates. Goals can be reached through various targets for the pollutants of concern, such as:

- ambient air concentration targets
- visibility improvement targets, and
- emission reduction targets

Goals are the driver for development of management strategies and targets are the incentive for specific actions. Targets provide a yardstick for measuring progress. The process of developing goals and targets will involve assessing the practicality and achievability of various potential actions. Such assessments can range from a simple prospective review to a sophisticated cost/benefit analysis. Goals and targets should reflect current baselines, jurisdictional priorities, and local concerns and aspirations. Targets should also be set to be consistent with the project management concept of "SMART" targets, that is, they should be Specific, Measurable, Achievable, Relevant and Timed.

The selection of appropriate goals and targets needs to be done with care, taking into consideration confounding variables, uncertainties, and information gaps.

Develop Strategies

A strategy for maintaining or improving air quality in a management area includes a set of agreed upon actions, timelines and responsibilities. It should contain sufficient actions to ensure that the general goals and specific targets for a management area will be met by the agreed date. The strategy may include a variety of actions including those to:

- directly reduce emissions
- fill information gaps
- improve scientific understanding
- improve public awareness

A strategy ensures that those responsible for implementation understand what is to be done and by whom. It also provides a mechanism for public accountability. The strategy may provide a basis for securing resources as well as developing partnerships. Developing an effective strategy will depend on an analysis of feasibility, and the costs and benefits associated with realistic goals and targets.

Implement Strategies

Implementing a CI/KCAC strategy for a management area involves carrying out each of the identified actions for reaching the determined overall goals and specific targets. Since actions may be required by several agencies or stakeholders, it will be essential to have:

- clearly understood and agreed-upon processes
- clearly defined roles, responsibilities and timelines
- coordination of efforts

Evaluate Effectiveness of Strategies

Evaluating the effectiveness of a strategy means tracking progress to determine whether:

- the actions are achieving what was expected in terms of emission reductions and air quality improvements (i.e. established goals and targets are being met), and
- there is need for interim adjustments to methods or revision to approaches

CHAPTER 6: MANAGEMENT APPROACHES -APPLICATION OF COMMON PLAN ELEMENTS

6.1 Introduction

The following sections outline considerations and describe optional approaches to applying each of the seven common elements of a management strategy described in Chapter 5. They provide examples of how plans are being applied in Canada and elsewhere, and identify sources of useful information that jurisdictions may wish to consult.

6.2 Involve Stakeholders

Factors that jurisdictions may wish to consider in determining the extent and type of stakeholder involvement include:

- the seriousness and complexity of the air quality problem
- the expected role for stakeholders in plan implementation
- the potential impact of the air quality management strategy on stakeholders
- the size of the management area

Stakeholder involvement may be achieved through mechanisms such as:

- multi-stakeholder steering committees, e.g.:
  - Alberta's Clean Air Strategic Alliance
  - Lower Fraser Valley Air Quality Coordinating Committee
  - Quesnel Air Quality Round Table
- technical working groups
- workshops and public meetings
- distribution of educational materials, e.g.:
  - news letters, bulletins
  - fact sheets, brochures
  - web-based information

Sources of information on approaches to involving stakeholders include:

- Consultation for Local Air Quality Management: the How to Guide, National Society for Clean Air and Environmental Protection: http://nscaorguk.site.securepod.com/assets/Consultation%20Guidance.pdf
- Alberta Clean Air Strategic Alliance: http://www.casahome.org
- http://www.casahome.org/?cat=18
- B.C. Bulkley Valley Lakes District Airshed Management Society: http://www.cleanairplan.ca/

6.3 Define Management Areas

Some air quality management areas have already been established in several jurisdictions such as Alberta and B.C. Other jurisdictions have yet to establish any such areas. For most jurisdictions it will be impossible to establish CI/KCAC programs in every community. In many instances, it

may be more efficient to define specific management areas that share common emission sources or air quality concerns. Some jurisdictions with limited resources may have to rely on local permit systems and national programs, such as vehicle and fuel standards, that apply throughout the province/territory, and consider the entire province/territory as a management area.

Considerations in deciding on the extent to which management areas will be defined within a jurisdiction may include:

- the extent of the air quality problem (geography and severity)
- available resources
- local support for action
- jurisdictional priorities

Examples of criteria that jurisdictions may consider in establishing management areas are:

- census boundaries that relate to emission sources
  (see GDAD for information on census boundary types)
- existing regional or municipal boundaries
- topographic features that delineate unique airsheds
- communities or groups of communities with common air quality concerns

Canada's protected areas (national and provincial/territorial parks and wilderness areas) should be considered candidates for treatment as management areas. Park or wilderness area management authorities should provide a focus for air quality planning within protected areas.

Jurisdictions will also want to be cognizant of pollutant management areas that have been formally established in international agreements. These include:

- the Pollutant Emission Management Area (PEMA) for Canada designated for managing NOx and VOC emissions in the Ozone Annex to the Canada-U.S. Air Quality Agreement, and
- the eastern Canada Sulphur Oxides Management Area (SOMA) designated in the 2nd Sulphur Protocol and the Protocol on Acidification, Euthrophication and Ground-Level Ozone (AEGLO) under the UN ECE LRTAP Convention, and included in the Canada-wide Acid Rain Strategy for Post-2000.

Sources of information on establishing management areas include:

- Appendix E: Examples of Management Areas
- Appendix F: Defining Clean Areas based on Pollutant Emissions and Population
- Alberta (9): http://www.casahome.org/?page_id=95
- http://www.casahome.org/?cat=18
- Canada-wide Acid Rain Strategy for Post-2000 (10): http://www.ec.gc.ca/acidrain/strat/strat_e.htm
- Canada/U.S.: http://www.ec.gc.ca/air/can_usa_e.html
- UN ECE LRTAP Convention Protocols: http://www.unece.org/env/lrtap/status/lrtap_s.htm

6.4 Establish Baselines

Jurisdictions may wish to consider various types of information in establishing a baseline for a management area, such as:

- air quality characterization
  - ambient concentrations of selected pollutants in one or more metric forms based on routine ambient monitoring (see Chapters 2 and 4 for metric forms and pollutants)
  - visibility indicators (e.g. light extinction coefficients, deciviews, inverse megameters)
  - use of air quality surrogates (e.g. population density, emission inventory information) in the absence of ambient monitoring data
  - identification of background and upwind region/transboundary influence (see GDAD for discussion/methodologies)
  - special studies to support modeling work

- source characterization
  - emission inventories of point sources (quantities and geographic distribution)
  - emission inventories of mobile and area sources
  - emissions profiling
  - stack information with spatial and temporal resolution for dispersion model studies the chemical profile of PM emissions from source areas for receptor model studies

- use of chemical tracers and/or models (e.g. dispersion or receptor) to link emission sources and air quality

More complex studies may be required depending on the magnitude of the air quality problem, the complexity of sources and other contributing factors, jurisdictional resources, and the degree of certainty required to support actions.

6.5 Develop Goals and Targets

Goals and targets articulate what is to be achieved in a management area within a particular timeframe. They may be in various forms such as:

- visibility improvement targets
- ambient air concentration targets for the pollutants of concern expressed in forms such as:
  - CWS metrics
  - Everyday Ambient Concentration metrics (see Appendix C)
  - Cumulative Exposure Index (CEI)
- emissions caps, maximum emission rates, or emission reduction targets for the air pollutants of concern in the management area or in upwind contributing source regions, expressed in forms such as:
  - total emissions per year for the air management region or for major emitting sources or source sectors
  - per cent reduction in emissions from a baseline for the air management region or for major emitting sources or source sectors

- maximum emission rates from stacks of major emitting facilities in selected source sectors

Historically, in some air management programs, ambient targets for receptor regions have often been established first, and then translated into emission targets for the source regions using source-receptor models and analyses. The 1985 eastern Canada acid rain program, for example, first established an ambient environment target of 20 kg/ha wet sulphate deposition for moderately sensitive receptor regions, then translated that into separate SO_2 emission caps for several source regions (7 provinces and the northeastern U.S.). The second round of acid rain goals/targets under the Canada-wide Acid Rain Strategy for Post-2000 focused on reduced ambient targets closer to critical loads for sulphate deposition for sensitive receptors. It translated those into reduced emission caps for a smaller contributing source region in Canada, the eastern Canada Sulphur Oxides Management Area (SOMA), and reductions needed in source regions in the U.S.

Meaningful, defensible goals and targets are key to managing air quality, and care needs to be taken in establishing these taking into consideration confounding variables, uncertainties, and information gaps.

6.6 Factors for Consideration

Factors that jurisdictions may wish to consider in setting goals and targets include:

- the feasibility of achieving the goal/target within the proposed timeframe (This may require a preliminary analysis of technical feasibility and a simple cost/benefit analysis of proposed actions.)
- the effectiveness of local emission reduction targets in light of transboundary contributions (It may be that emissions from within the management area are making a relatively small contribution and reductions will be ineffective or excessively costly compared to reductions in the upwind contributing source regions. See GDAD for some methodologies for assessing upwind source/transboundary flow influence.)

6.7 Develop Strategies

The purpose of a CI/KCAC management strategy is to articulate a set of agreed upon actions, timelines and responsibilities for achieving the goals/targets that have been developed for the management area.

The following steps may be included in the development of a strategy:

- identify baseline actions that can be applied everywhere in the jurisdiction
- identify information gaps that should be filled over time
- identify, evaluate and prioritize additional actions, with due consideration of:
  - likely effectiveness in achieving goals
  - technical feasibility
  - socio/economic impacts
  - impacts on other air issues such as climate change, acid rain, and air toxins
  - stakeholder and public input

Sources of information on experience that might assist jurisdictions in developing air management strategies include:

- Appendix D for examples of some different approaches that have been used to initiate, support and develop a strategy
- Appendix G for examples of tools and mechanisms that might be considered for baseline actions and/or additional actions beyond baseline
- The following web sites for specific regional strategies:
  - B.C. Air Quality management plans: http://www.env.gov.bc.ca/air/airquality/index.html#reports_plans
  - Greater Vancouver Regional District (GVRD): http://www.gvrd.bc.ca/
  - Bulkley Valley – Lakes District (BVLD): http://www.cleanairplan.ca

6.8 Implement Strategies

Implementing a strategy for a management area may involve:

- ownership of each of the actions in the strategy by a responsible agency or group
- coordination of actions among the participants
- carrying out the actions in the specified timeframes
- negotiating with identified upwind source regions to secure reductions in emissions affecting the management area
- progress reporting to stakeholders and the general public on:
  - air quality levels and trends
  - emission reduction actions implemented
  - emission reductions achieved and projected
  - studies completed
  - information gathering actions implemented

6.9 Evaluate and Adjust Strategies

Strategies should be monitored during implementation at specified time points. Evaluating the effectiveness of a strategy for a management area may involve assessing:

- whether the original assumptions of the plan are still valid
- whether the actions identified in the strategy are being implemented within the agreed timelines
- whether the actions have achieved the expected emission reductions (e.g. see Auditor General's report on Smog Program)
- trends in ambient data, including accounting for natural variability, to see if expected air quality improvements have occurred
- new scientific evidence on the roles of different precursor pollutants to confirm that the strategy contains the right mix of measures, or if it needs to be adjusted
- trends in surrogate indicators that can show progress in specific areas (e.g. vehicle km traveled, number of facilities with Pollution Prevention (P2) plans)
- the spin-off benefits (expected or otherwise) that may have occurred from other programs (e.g. acid rain, greenhouse gases)

- whether the level of resources available to implement the strategy is sufficient
- the proposal and implementation of revised strategies to ensure ongoing improvement

CHAPTER 7: MONITORING

7.1 Integration with CWS Achievement Monitoring

It is important that the ambient air monitoring network in each jurisdiction be designed to support both the CWS Achievement and CI/KCAC provisions of the CWSs for PM and ozone. Air quality in a community may alternate between achievement and non-achievement of the CWSs. Air parcels may be transported from a region of one classification to a region of another classification. As previously noted, there is a need to have ambient measurement data of comparable quality, determined by the same methodologies, subject to the same criteria, and using the same statistical form for ambient levels above and below the CWS numerical targets. Similarly, a common system for estimating emissions should be in place within each jurisdiction, and across jurisdictions.

7.2 Ambient Monitoring Strategies for CI/KCAC

The discussion on the use of Census Metropolitan Areas and Reporting Sub-Areas (RSAs) in Chapter 2 of the GDAD: Identifying Communities for Achievement Determination provides guidance on minimum monitoring densities for communities with populations greater than 100,000. This guidance applies to such communities regardless of whether the ambient levels are above or below the CWS numerical targets and hence is equally applicable for CI/KCAC management in these areas.

Ambient monitoring may be limited or non-existent in many smaller communities and rural areas where CI/KCAC applies. Where monitors exist, they have been established for a variety of reasons, such as community concerns over air quality, the presence of large industrial air pollution sources, or research and atmospheric transport modeling purposes. It is not intended that this Guidance Document imply a massive expansion in current monitoring to provide representative coverage of the many small communities that exist across Canada or for the vast expanses of sparsely populated territory. Rather, jurisdictions should endeavor to continue existing monitoring and, within their capabilities, expand monitoring to meet CI/KCAC program implementation goals. Other strategies could include passive monitoring and temporary monitoring using mobile equipment to help determine air quality levels and trends in areas where fixed monitoring is not in place.

Some jurisdictions may wish to include visibility monitoring within their ambient monitoring programs if appropriate for meeting their CI/KCAC program goals. For example, visibility monitoring has become an important part of the U.S. Regional Haze Program with a recent tripling of the available monitors.

Implementation plans can take advantage of all available monitoring data and opportunities, including those required for operating permits for large industrial emission sources. When major new sources are developed, and adequate ambient monitoring does not exist, jurisdictions or local authorities should ensure that ambient monitoring for relevant areas are put in place, as warranted.

Where there is reason to believe (based on modeling, intermittent monitoring or using methods which would not meet GDAD criteria, or anecdotal evidence) that deterioration of air quality or reduction in visibility is occurring or is likely to occur in national and provincial/territorial parks and wilderness areas, jurisdictions should ensure that some monitoring is in place, even if the protected area is believed to have relatively clean air.

7.3 Community-Oriented Ambient Monitoring

Although some of the ambient monitoring required for CI/KCAC will be rural or background monitoring, much of the monitoring will be community-oriented. Annex B to the PM and ozone CWS states that "CWS achievement will be based on community-oriented monitoring (i.e. sites where people live, work and play rather than at maximum impact points for specific emission sources)". Chapter 3 of the GDAD provides guidance on how to locate $PM_{2.5}$ and ozone monitors to ensure that the data collected is best suited to characterize area-wide exposure within a community. The guidance on siting monitors should also apply to the collection of ambient $PM_{2.5-10}$ data to help identify areas that may warrant remedial action and to assess the possible need for a $PM_{2.5-10}$ CWS in the future. The GDAD guidance for siting monitors is applicable to communities of any size and should be followed in siting or selecting monitors to provide representative data for communities or regions subject to CI/KCAC and should be used in determining the severity of the air quality situation within a community.

7.4 Monitoring Methods and Requirements

Jurisdictions should refer to the latest version of the CCME *Ambient Air Monitoring Protocol for $PM_{2.5}$ and Ozone* for guidance on ambient measurement methods and quality assurance (QA) methods.

7.5 Setting of CI/KCAC Ambient Targets and Tracking Progress

The GDAD provides criteria and methodologies for calculating the achievement statistics for $PM_{2.5}$ and ozone. To ensure a continuum of data of comparable quality, the statistical form, methodologies and criteria outlined in the GDAD for calculating CWS achievement should be used for setting and assessing achievement for ambient targets for CI/KCAC where the monitoring resources are in place to support this.

As noted in Section 4.5, there is no statistical form specified for $PM_{2.5-10}$. For purposes of comparability, it is therefore recommended that one of the statistical forms used be the same as that specified for $PM_{2.5}$.

7.6 Emissions Monitoring

Estimating emissions levels and trends of PM and ozone and their precursor pollutants is important in the CI/KCAC context. Emission levels are used for identifying sources and designing management plans. When used as inputs in predictive modeling, they are also a useful

surrogate for predicting probable trends in ambient levels where there is limited ambient data available.

Estimates of current and forecasted emissions from contributing source regions will be valuable in designing programs and actions for CI/KCAC management areas. Geographic Information Systems (GIS) and emission distribution methodologies for area source emissions are available to break down emissions by geographic region or management area. Using these tools, emission breakdowns have been provided by Environment Canada in the past for certain identified air management regions, such as the Sulphur Oxides Management Area (SOMA) and Pollutant Emissions Management Area (PEMA) in eastern Canada, the Windsor-Quebec Corridor (WQC) in Ontario and Quebec, and the Lower Fraser Valley (LFV) in B.C. As more management areas are created for implementing the CI/KCAC provisions of the PM and ozone CWSs, jurisdictions should expect to do more work on the geographic distribution of emissions.

CHAPTER 8: REPORTING

8.1 Integration with CWS Achievement Reporting

The CWSs for PM and ozone commit jurisdictions to report on progress toward meeting all provisions of the CWSs, including the CI/KCAC provisions, as follows:

(a) to respective publics of each jurisdiction on a regular basis, the timing and scope of reporting to be determined by each jurisdiction
(b) to Ministers and the public, with comprehensive reports at five year intervals beginning in 2006 and reports on achievement and maintenance of the CWSs annually beginning in 2011

Annex B (the Reporting Protocol for the CWSs) is intended to help jurisdictions ensure consistency and comparability in their reporting, and to help the public better understand how jurisdictions plan to monitor their progress. While much of Annex B is focused on reporting on achievement of the numerical CWS targets, it is also intended to provide guidance for reporting on all provisions of the CWSs for PM and ozone, including the CI/KCAC provisions.

Annex B elaborates on the nature and content of the annual and five-year reports to Ministers and the public. The GDAD, which expands upon the guidance in Annex B, recommends that jurisdictions begin some form of annual reporting to their respective jurisdictions on progress as soon as possible, in response to commitment (a) above and to gain experience for CWS achievement reporting beginning in 2011. The five-year reports are to be comprehensive and are to address all aspects of the CWS Agreement, including implementation actions for both the CWS achievement and CI/KCAC provisions of the CWSs.

As previously noted, jurisdictions should integrate their reporting on progress on CI/KCAC and CWS achievement, retaining sufficient distinction between the programs to be able to speak to progress on each. For further reference, the CWS Agreement is included as Appendix A of this document.

8.2 Jurisdictional Reports

In response to commitment (a) above, annual reports by jurisdictions should include information on ambient air quality average and peak levels and trends, whether air quality is expected to improve or deteriorate in the future. The reports should identify contributing causes to the improvement or deterioration in air quality. To simplify annual reporting on CI/KCAC, jurisdictions may choose to summarize this information in a brief report card format.

A jurisdiction may also wish to report on other aspects of CI/KCAC as the program evolves, such as:

- progress in designating CI/KCAC management and reporting regions
- progress in selecting ambient goals and targets
- initial actions taken on CI/KCAC, and

- other findings that are relevant to its particular management strategy
- emission levels

It is recommended that annual CI/KCAC reporting begin as soon as possible to:
- develop experience in reporting in the statistical forms recommended in the GDAD
- establish the selected regional air management process, and
- gain experience with its application

Jurisdictions' reports can include reporting on uncertainty.

8.3 Five-year Reports - CI/KCAC Actions

All actions taken to reduce ambient PM and ozone in communities or regions that are in achievement of the CWSs are by definition CI/KCAC actions. For each designated reporting region within a jurisdiction with ambient levels below the CWS numerical targets, CI/KCAC reporting should include all significant emission reduction actions on sources within the jurisdiction that contribute to decreases in elevated ambient levels in the reporting region. This should include baseline actions that are not specific to the contributing source region(s) but apply more broadly throughout the jurisdiction.

8.4 Five-year Reports -Emissions and Trends

Reporting should include available data on current emission levels and emission trends for both past and forecast future for PM and PM and ozone precursor pollutants. As previously noted, emission distribution methodologies for area source emissions are available to break down emissions by region. For PM, direct emissions of both $PM_{2.5}$ and $PM_{2.5-10}$ should be included. In some cases, jurisdictions may want to break down emissions and emission trends seasonally to better characterize the contributing sources of greatest concern. It is recognized that emission trend analysis can be time and resource intensive and may not be feasible for all CI/KCAC management areas.

8.5 Five-year Reports -Ambient Levels and Trends

Where monitoring facilities are in place to support the use of ambient levels of $PM_{2.5}$, $PM_{2.5-10}$ and ozone as targets, they should be reported for the communities and management areas using, as a minimum, the CWS achievement statistical forms. In addition to this statistical form, jurisdictions may wish to report the data in other statistical forms such as:
- Annual averages
- Seasonal averages
- Annual or seasonal maximums
- Cumulative Exposure Index (CEI)

Trends in ambient levels from past to present should be reported for each identified reporting area. Estimates should be made of probable future trends in ambient $PM_{2.5}$, $PM_{2.5-10}$ and ozone based on the projected trends in emissions in the contributing source regions.

8.6 Summary and Recommendations

The report should conclude with a summary of the overall success in implementing the CI/KCAC provisions of the CWSs for PM and ozone, and recommendations on the future direction of the program.

REFERENCE DOCUMENTS CITED

1. Canada-wide Accord on Environmental Harmonization, Canadian Council of Ministers of the Environment, 1998

2. Canada-wide Environmental Standards Sub-agreement, Canadian Council of Ministers of the Environment, 1998

3. Canada-wide Standards for Particulate Matter (PM) and Ozone, Canadian Council of Ministers of the Environment, June, 2000

4. Guidance Document on Achievement Determination, Canada-wide Standards for Particulate Matter and Ozone, Canadian Council of Ministers of the Environment, 2001

5. Report of a National Consultation Workshop on Recommendations for a Canada-Wide Standard (CWS) for Coarse Particulate Matter ($PM_{2.5-10}$), May, 2004

6. Ozone Science Assessment Document, Working Group on Air Quality Objectives and Guidelines, July, 1999

7. Canada-United States Air Quality Agreement, 1991

8. 2002 Progress Report, Canada-United States Air Quality Agreement, 2002

9. Guidance Document for the Management of Fine Particulate Matter and Ozone in Alberta, Clean Air Strategic Alliance, Particulate Matter and Ozone Project Team, September, 2003

10. Canada-Wide Acid Rain Strategy for Post-2000, Canadian Council of Ministers of the Environment, 2001

APPENDIX A

CANADA-WIDE STANDARDS for PARTICULATE MATTER (PM) and OZONE

These Canada-Wide Standards (CWSs) for particulate matter (PM) and ozone are established pursuant to the 1998 Canada-wide Accord on Environmental Harmonization of the Canadian Council of Ministers of the Environment (CCME) and its Canada-wide Environmental Standards Sub-Agreement.

RATIONALE

Significant adverse effects have been demonstrated for the air pollutants PM and ozone on human health and the environment.

DEFINITIONS

PM_{10} refers to airborne particles that are 10 microns or less in diameter.
$PM_{2.5}$ refers to airborne particles that are 2.5 microns or less in diameter.
$PM_{10-2.5}$ refers to airborne particles in the size range 2.5 to 10 microns in diameter, known as the coarse fraction of PM10.
Ozone refers to an oxygen compound (O_3) occurring in the form of a gas in the atmosphere at ground level.

CONTEXT

The long-term air quality management goal for PM and ozone is to minimize the risks of these pollutants to human health and the environment. However, recent scientific evidence indicates that there is no safe level for exposure to smog.

These CWSs for PM and ozone are an important step towards the long-term goal of minimizing the risks they impose to human health and the environment. They represent a balance between the desire to achieve the best health and environmental protection possible in the relative near-term and the feasibility and costs of reducing the pollutant emissions that contribute to elevated levels of PM and ozone in ambient air. As such, while they will significantly reduce the effect of PM and ozone on human health and the environment, they may not be fully protective and may need to be re-visited at some future date. There are also additional benefits to reducing and maintaining ambient levels below the CWSs where possible.

Uncertainty and gaps exist and new data/information that becomes available will be acknowledged. However, Ministers are confident that taking action now to reduce PM and ozone levels will improve ambient air quality and result in benefits to the environment and to human health. Jurisdictions will have considerable flexibility in the detailed design of implementation

plans and sectoral emission reduction strategies over the next few years, and an opportunity to reduce information gaps and uncertainties.

In jurisdictions highly impacted by transboundary air pollution from the United States, achieving the CWSs will be strongly dependent on reductions of this transboundary contribution. Also, high background levels of PM and ozone that may occur through natural events (such as forest fires, natural formation and stratospheric intrusion) will need to be considered in assessing achievement of the CWSs.

The CWS for PM established here is for the fraction of PM recognized as having the greatest effect on human health, the fine fraction or $PM_{2.5}$. The $PM_{2.5}$ CWS has been established for the interim period prior to the planned review of the standard to be completed by 2005, which will incorporate advancements in scientific, technical and economic information and analysis. The $PM_{2.5}$ CWS will ensure that PM management efforts are focused on the sources of PM and PM precursor emissions that provide the greatest health benefit. It is acknowledged that health effects are also associated with the coarser fraction of PM, or $PM_{10-2.5}$, and that action to reduce the concentrations of these coarser fractions in the atmosphere are needed. Reductions in ambient PM_{10} levels will occur as ancillary benefits from reducing $PM_{2.5}$. In addition, some jurisdictions currently have ambient air quality objectives, guidelines or standards related to the coarser fraction of PM. These should continue to be used to design air quality management programs for PM_{10}. CWSs related to the coarser fraction may be a useful addition at a later date.

There are other aspects that should be considered in any future update of these PM and ozone CWSs. Forms of the PM and ozone CWSs other than the relatively short-term exposure forms established here, such as seasonal or annual average targets, might also be useful additions at a later date. Since the current CWSs are related primarily to protection of human health, their adequacy for the protection of vegetation, visibility impairment, material damage or other adverse effects may need to be assessed.

PART 1: NUMERICAL TARGETS and TIMEFRAMES

The CWS and related provisions for PM are:

A CWS for $PM_{2.5}$ of 30 $\mu g/m^3$, 24 hour averaging time, by year 2010

Achievement to be based on the 98^{th} percentile ambient measurement annually, averaged over 3 consecutive years

The CWS and related provisions for ozone are:

A CWS of 65 ppb, 8-hour averaging time, by 2010

Achievement to be based on the 4^{th} highest measurement annually, averaged over 3 consecutive years

Specific provisions related to transboundary flow of ozone are contained in Section B.3.5, Accounting for Transboundary Flow, of Annex B.

PART 2: IMPLEMENTATION

Jurisdictions will undertake the following implementation actions:

Development and implementation of jurisdictional implementation plans to achieve the CWSs.

Implementation of continuous improvement, pollution prevention, and keeping-clean-areas-clean programs in areas with ambient concentrations below the CWS levels, in accordance with the guidance provided in Annex A.

In areas where jurisdictional implementation plans need to be augmented by reductions in transboundary flow of pollution from the United States or from other countries to achieve the CWSs, the federal government, with support from the provinces and territories, will aggressively pursue further reductions in the transboundary flow into Canada of PM and ozone and their precursor pollutants.

Establishment and maintenance of the PM and ozone monitoring networks needed to characterize the PM and ozone air quality problems across Canada, design management programs, and track progress.

REVIEW

The CWSs will be reviewed as follows:

(a) by the end of year 2005, complete additional scientific, technical and economic analysis to reduce information gaps and uncertainties and revise or supplement the PM and ozone CWSs as appropriate for year 2015; and report to Ministers in 2003 on the findings of the PM and ozone environmental and health science, including a recommendation on a $PM_{10-2.5}$ CWS.
(b) by the end of year 2010, assess the need, and if appropriate, revise the CWSs for PM and ozone for target years beyond 2015.

REPORTING on PROGRESS

Progress towards meeting the above provisions will be reported as follows:

(a) to the respective publics of each jurisdiction on a regular basis, the timing and scope of reporting to be determined by each jurisdiction
(b) to Ministers and the public, with comprehensive reports at five year intervals beginning in year 2006 and reports on achievement and maintenance of the CWSs annually beginning in 2011, in accordance with guidance provided in Annex B

ADMINISTRATION

Jurisdictions will review and renew Part 2 and Annexes A and B five years from coming into effect. Any party may withdraw from these Canada-Wide Standards upon three month's notice.

These Canada-Wide Standards come into effect for each jurisdiction on the date of signature by the jurisdiction.

ANNEX A: GUIDANCE FOR CONTINUOUS IMPROVEMENT AND KEEPING-CLEAN-AREAS-CLEAN PROGRAMS FOR PM AND OZONE

In most areas of Canada, ambient levels are lower than the CWSs for PM and ozone established here. Ministers have agreed to include in the CWSs a provision on environmental management in areas where ambient air quality is "better" than the levels set out in the standards.

(a) Continuous Improvement

There are numerous locations across Canada that have ambient levels of PM and/or ozone below the CWS levels but still above the levels associated with observable health effects. There is a need to ensure that the public recognizes that the CWS levels are only a first step to subsequent reductions towards the lowest observable effects levels. It would be wrong to convey the impression that no action is required in these areas or that it would be acceptable to allow pollutant levels to rise to the CWS levels. Jurisdictions should take remedial and preventative actions to reduce emissions from anthropogenic sources in these areas to the extent practicable.

(b) Keeping Clean Areas Clean

Jurisdictions recognize that polluting "up to a limit" is not acceptable and that the best strategy to avoid future problems is keeping clean areas clean. Jurisdictions should work with their stakeholders and the public to establish programs that apply pollution prevention and best management practices, by, for example:

- developing and implementing strategies consistent with the CCME commitment to pollution prevention
- ensuring that new facilities and activities incorporate the best available economically feasible technologies to reduce PM and ozone levels
- requiring that upgrades carried out in the course of normal capital stock turnover incorporate the best available economically feasible technologies to reduce PM and ozone levels
- reviewing new activities that could contribute to an increase in PM and ozone levels with stakeholders and the public in terms of their social, economic and environmental merits

ANNEX B: REPORTING PROTOCOL FOR CANADA-WIDE STANDARDS FOR PARTICULATE MATTER AND OZONE

B.1 Introduction

It is intended under the Harmonization Accord and its Standards Sub-Agreement that all jurisdictions will report on a regular basis to their publics and to Ministers of the Canadian Council of Ministers of the Environment on their progress towards achieving the CWSs for particulate matter (PM) and ozone.

This reporting protocol is intended to provide guidance for reporting on all provisions of the CWSs for PM and ozone. Its provisions are designed to help ensure consistency and comparability in the reporting by jurisdictions, and better understanding by the public on how jurisdictions plan to track and report on progress.

B.2 Frequency, Timing and Scope of Reporting

There will be two types of reporting by jurisdictions:

1) Annual Reporting on Achievement of the CWSs

These reports will be completed by each jurisdiction in a standardized "report card" format, the format to be developed and agreed to by all jurisdictions, and provided to Ministers and the public by 30 September of each year, beginning in 2011. These annual reports will be limited in scope containing mainly summary information on levels and trends in ambient PM and ozone concentrations in communities within each jurisdiction, identifying communities where ambient levels are exceeding or approaching the CWS levels. They may also note the reason for any significant change in ambient levels or trends from previous years.

2) Five-Year Reports

These reports will be completed for the year 2005 and for every fifth year thereafter and provided to Ministers and the public by 30 September of the following year. The report for 2005 will be an interim report on progress towards meeting the CWSs, and subsequent reports will focus on achievement of the CWSs applicable at that time.

Five-year reports will be comprehensive, assessing progress on all provisions of the CWSs. The format and general content will be determined and agreed to by all jurisdictions 2 years in advance of the reporting year. They will include, assessment of ambient levels and trends in communities within each jurisdiction, identifying communities where ambient levels are exceeding or approaching the CWS levels, information on PM and ozone precursor emissions and trends, comprehensive descriptions of smog management efforts, progress with implementation of measures in implementation plans, actions to ensure continuous improvement in areas with ambient levels below the CWS levels but within the effects range, actions to ensure that clean areas are kept clean, actions on co-operation in monitoring and science, and any other provision of the CWSs. The federal government will include in its reports an assessment of

trends in U.S. emissions and ambient levels in border regions affecting ambient PM and ozone levels in Canada, and of the effectiveness of U.S. control programs in reducing those emissions and of Canadian efforts to secure such reductions.

The CCME will co-ordinate the collation of the information from the various jurisdictional reports in (1) and (2) above into a national overview report for the public, CCME Ministers and international audiences.

In addition to the reporting in (1) and (2) above, individual jurisdictions may report to their publics on a more frequent basis. The scope and timing of any such reporting would be determined by the jurisdiction.

B.3 Reporting on Achievement of the CWSs

B.3.1 Guidance Document on Achievement Determination

Jurisdictions will co-operate in the preparation and periodic update as required, of a Guidance Document on Achievement Determination for the PM and ozone CWSs. This document will elaborate on information, methodologies, criteria and procedures related to each of the basic elements of achievement reporting identified below.

B.3.2 Communities for CWS Achievement Determination

Jurisdictions will use a community-oriented approach for reporting on achievement of the PM and ozone CWSs. As a basic requirement, jurisdictions will report on CWS achievement for population centers over 100,000. As well, jurisdictions may also report on CWS achievement for communities with population less than 100,000 based on considerations such as regional population density, proximity to sources, local air quality, etc.

To provide consistency and comparability in reporting across jurisdictions, the geographic units for grouping of municipalities (Census Metropolitan Areas (CMAs)/Census Agglomerations (CAs)/Census Subdivisions) established by Statistics Canada will be used as guidance for community identification. Larger CMAs may be subdivided into smaller sub-areas to better capture geographic variation within the CMA. *[Refer to the **Guidance Document** for a listing of CMAs and CAs in Canada and suggested criteria for subdividing larger CMAs]*.]

B.3.3 Monitoring Sites for Determining Achievement

CWS achievement will be based on community-oriented monitoring sites i.e. sites located where people live, work and play rather than at the expected maximum impact point for specific emission sources. Rural (or background) and source specific sites will not be included for CWS achievement determination. *[See the **Guidance Document** for guidance on selection of community-oriented monitoring sites]*.

B.3.4 Calculation Methodologies for Determining Achievement

It is important that common statistical parameters be used by all jurisdictions in reporting on CWS achievement so that there will be consistency and comparability in assessing progress in achieving the CWSs. These parameters stem initially from the basic form and achievement statistics specified for the CWSs. That is:

For $PM_{2.5}$	24-hour averaging time, achievement to be based on 98th percentile annual value, averaged over three consecutive years
For Ozone	8-hour averaging time, achievement to be based on 4th highest annual measurement, averaged over three consecutive years

For PM CWS achievement determination, measurements from each multiple continuous (or daily) population-oriented monitoring station within a CMA/CA or CMA reporting sub-area will be spatially averaged for each year (up to three) for which measurements are available.

For ozone CWS achievement determination, the monitoring station with the highest average ozone concentration within a CMA/CA or CMA reporting sub-area will be used.

[See the Guidance Document for methodology for determination of 98th percentile annual levels for $PM_{2.5}$ and 4th highest annual levels for ozone from monitors that measure at various frequencies or for which there are less than 365 measurements per year, and methodologies for determining spatial averages]

B.3.5 Accounting for Transboundary Pollution

Communities for which jurisdictions demonstrate (i) that continued exceedance of the CWS levels is primarily due to transboundary flow of PM and ozone or their precursor pollutants from the U.S. or from another province/territory, and (ii) that "best efforts" have been made to reduce contributions to the excess levels from pollution sources within the jurisdiction, will be identified in reporting as "transboundary influenced communities" that are unable to reach attainment of the CWSs until further reduction in transboundary air pollution flow occurs. Demonstration of transboundary flow influence will be a shared responsibility of the federal government and the affected province/territory, and demonstration of best efforts will include measures in both provincial/territorial and federal implementation plans. *[See the **Guidance Document** for methodologies for demonstrating the influence of transboundary and criteria on what would constitute "best efforts"]*

For the province of Ontario, a 45% reduction in NOx and VOC emissions from 1990 levels by 2010 or earlier, subject to successful negotiations this fall with the U.S. for equivalent reductions, will be considered the province's appropriate level of effort towards achieving the ozone CWS. Any remaining ambient ozone levels above the CWS in Ontario will be considered attributable to the transboundary flow from the U.S. of ozone and its precursor pollutants.

B.3.6 Accounting for Background and Natural Events

Communities for which jurisdictions demonstrate (i) that continued exceedance of the CWS levels is primarily due to naturally occurring local or regional PM and/or ozone and (ii) that "best efforts" have been made to reduce contributions to the excess levels from pollution sources within the jurisdiction, will be identified in reporting as "communities influenced by background or natural events". Demonstration of background or natural influence is the responsibility of the affected jurisdiction, and demonstration of best efforts will include measures in both provincial/territorial and federal implementation plans. *[See the Guidance Document for methodologies for demonstrating background or natural influence and criteria on what would constitute "best efforts"]*

B.3.7 Maintenance and Provision of Monitoring Information

It is important to have up-to-date PM and ozone monitoring data. Jurisdictions will maintain their own data on ambient measurements of $PM_{2.5}$, PM_{10} and ozone and make it publicly accessible. Accessibility may be accomplished by posting on Internet Sites, which would be linked to the CCME Website.

Jurisdictions will also co-operate in establishing and maintaining a Monitoring Protocol, which will ensure the coordination of monitoring data. This will allow for better co-ordination of monitoring program design and operation, ambient air quality trends analyses, regional source-receptor assessments, transboundary air quality analyses and implementation plan design.

APPENDIX B

SUMMARY of MULTI-STAKEHOLDER WORKSHOP SUGGESTED ACTIONS for PM COARSE ($PM_{2.5-10}$)

Potential Interim or Complementary Actions

Please refer to the *Report on a National Consultation Workshop on Recommendations for a Canada-Wide Standard (CWS) for Coarse Fraction Particulate Matter ($PM_{2.5-10}$)* dated May, 2004, available at: http://www.ccme.ca/.

A multi-stakeholder consultation workshop was held on November 12, 2003 in Calgary on whether to recommend to Ministers that a Canada-Wide Standard (CWS) be developed for the coarse fraction of particulate matter ($PM_{2.5-10}$). The workshop participants made the following conclusions and recommendations:

"While there was general agreement that it would be premature to make a decision either in favour of, or against, pursuit of a CWS for coarse fraction at this time, this should not be taken as a signal that work should stop on the issue. To the contrary, workshop participants from all sectors volunteered suggestions for initiatives that might serve to either improve knowledge and understanding about the nature of coarse fraction PM, its sources, pathways and effects, or contribute to reductions of either emissions or human exposure. These suggestions follow in no implied order of priority:

- Link consideration of coarse fraction PM with the fine fraction PM CWS initiative, so that consideration is given to the nature, form and feasibility of a coarse fraction PM when the fine fraction CWS is reviewed in 2010. That will also enable consideration of insights from the United States at the same time.
- Explore pilot initiatives or other measures that might include voluntary measures, which could be evaluated to determine effectiveness. Consider pilot initiatives that focus on major urban population corridors where the populations at risk are greatest in terms of both exposure levels and absolute numbers at risk.
- Support and reinforce more in-depth study of source–receptor relationships, pathways of human exposure and human health effects. In doing so, ensure adequate consideration of regional and sectoral diversity, and of the relative contribution of anthropogenic versus biogenic sources, and domestic versus international sources.
- Consider broader-based interventions and measures that deal with some of the major controllable sources of PM, most notably urban sprawl and urban transportation.
- Support a more broad-scale monitoring program, and re-examine the appropriateness of location of monitors so that prime sources, pathways and populations at risk are adequately addressed. In doing so, leave the current network of fine PM monitors in place, and instead look to augmenting these with additional monitors that can improve knowledge about the coarse fraction.

- Integrate knowledge from federal sources with those from provincial and municipal sources, such as customized regional studies conducted by the Greater Vancouver Regional District.
- Target analysis of health issues, emissions sources and pathways and potential intervention measures on known major sources of concern in areas of high urban concentration, such as dust from construction and demolition activities. Ensure that insights from any studies of major events such as the New York/Manhattan experience after 9/11 are taken into consideration.
- Pay attention to the agricultural sector, focusing in particular on the nature of emissions of concern and on potential interventions and agricultural practices that might be effective in reducing risks to human health.
- Increase emphasis in future science on metal speciation, free radicals and crystalline silica.
- Ensure that knowledge about PM coarse fraction is examined in the context of the full emissions inventory.
- Revisit the projections/forecasts for $PM_{2.5-10}$, to ensure they incorporate the most recent data, are based on valid and clear assumptions, provide a responsible indication of "margins of error" or "uncertainty," and take into account known or potential effects of other measures, including efforts related to the CWS for fine particulate matter, emissions reductions associated with Climate Change initiatives, and other air quality and pollution prevention measures, whether of a regulatory or voluntary nature.
- In preparation for consideration in 2010 of the need for, and potential form of, a CWS for coarse fraction PM, develop suitable tools and data that will allow a meaningful cost-benefit analysis of such a measure.
- Consider practical measures that can engage small- and medium-size enterprises in emissions reduction.
- Continue to extract useful insights from international and joint-venture studies, but increase focus on studies that address unique Canadian issues, sources and context.
- Examine the potential co-benefits and cross-impacts of various air quality initiatives, to ensure that PM coarse fraction is addressed in a broader air quality and human health protection context.
- Move forward with negotiation of a PM Annex to the Canada/U.S. Air Quality Agreement, addressing both coarse and fine fraction PM."
- Examine the potential co-benefits and cross-impacts of various air quality initiatives, to ensure that PM coarse fraction is addressed in a broader air quality and human health protection context.
- Move forward with negotiation of a PM Annex to the Canada/U.S. Air Quality Agreement, addressing both coarse and fine fraction PM."

APPENDIX C

RATIONALE for LONG-TERM AMBIENT METRIC

The Need To Track Everyday Concentrations

It is obvious that CI and KCAC programs should, at minimum, track the higher recorded concentrations of PM2.5 and ozone, since the intent is to keep concentrations declining in relation to the CWS targets. However, there is also merit in tracking long-term trends in everyday concentrations of ambient $PM_{2.5}$ and ozone. The findings of epidemiological studies have indicated that there is a linear relationship between the ambient concentrations of $PM_{2.5}$ and ozone and some health outcomes. This linearity means, for example, that an incremental reduction in $PM_{2.5}$ concentrations from a baseline level of 35 $\mu g/m^3$ produces the same health benefit as an identical reduction from a lower baseline level of 15 $\mu g/m^3$.

Typically, in any given year, high concentrations near or above the CWS targets for $PM_{2.5}$ and ozone occur infrequently. For example, in one region where there are some relatively high daily readings every year, the average number of such days over several years has been 7 for $PM_{2.5}$ and 19 for ozone. This means that even though this region experiences a number of days when readings exceed the CWS targets, on average, over 95% of the days throughout the year have readings below the targets. Tracking only the higher concentrations of $PM_{2.5}$ and ozone does not, therefore, provide an adequate representation of the ambient concentrations that the population is exposed to on most days. This observation is underscored in Figure 1, which shows that most typical daily 24-hour $PM_{2.5}$ concentrations are much less than the CWS target.

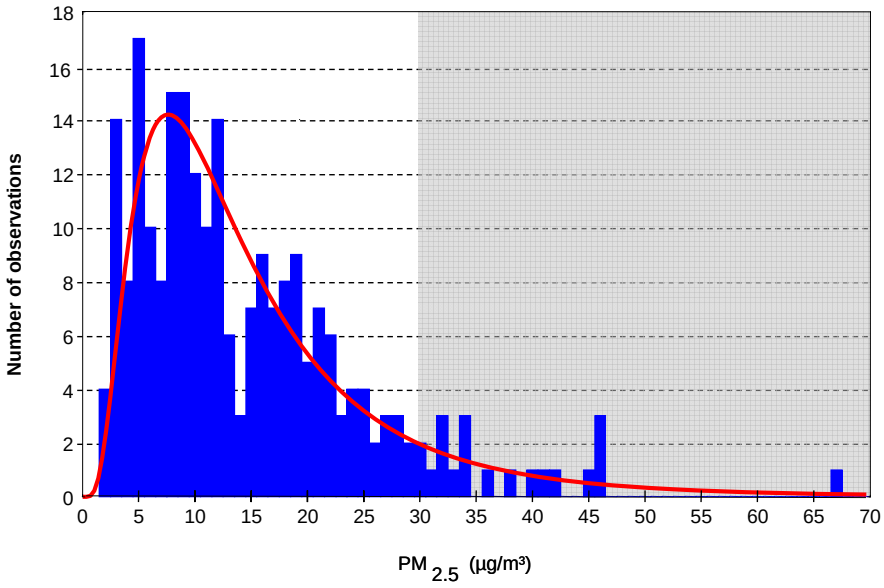


Figure C-1: Typical distribution of the daily 24-hour $PM_{2.5}$

Because of the linear relationship between improved air quality and health benefits, once the CWS targets are achieved there is significant value in reducing everyday concentrations simply because these everyday concentrations occur much more frequently than the higher concentrations. In effect, the average daily air quality trend over a longer period of time has as much or more relevance to health outcomes as a few relatively high spikes.

Another reason for capturing everyday readings is that trends in the higher concentrations cannot necessarily be assumed to reflect trends in the everyday concentrations. This is illustrated in Figure 2. The information in this Figure was compiled from a monitoring site in British Columbia. For this site, although the higher daily maximum (Dmax) 8-hour O_3 may have decreased over the years, the everyday concentrations (represented by the vertical bars) remained more or less unchanged. For this site, progress has been made in lowering the higher concentrations, but little progress has occurred in lowering the everyday concentrations.

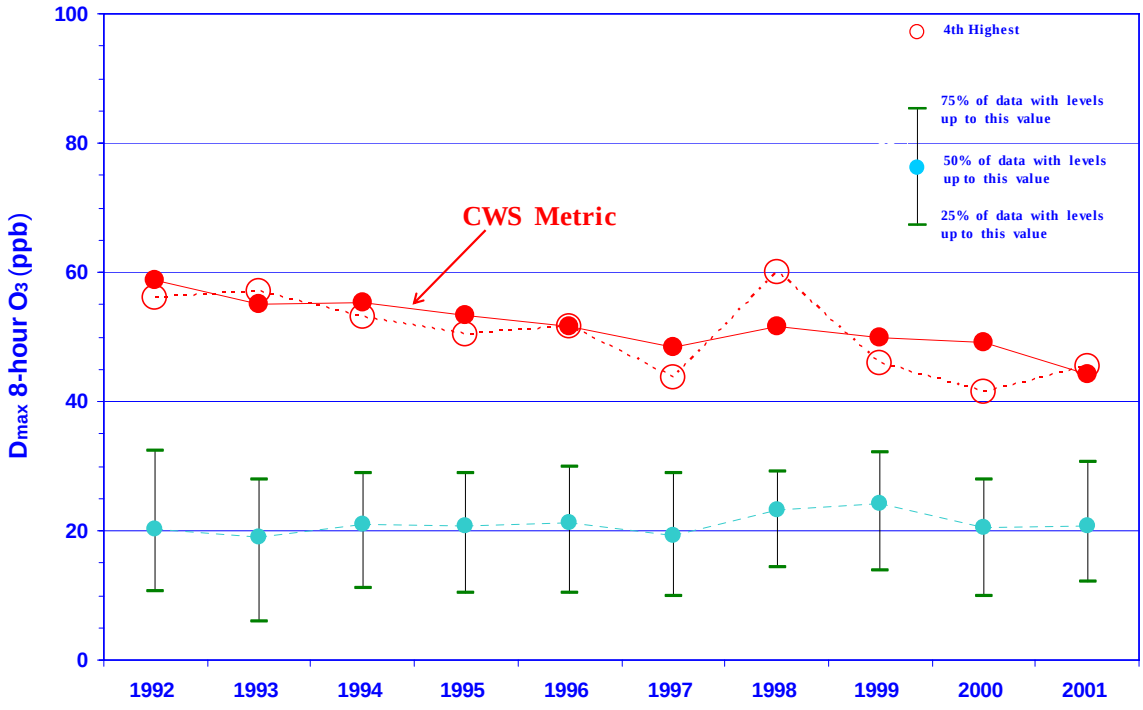


Figure C-2: Trends in Dmax 8-hour O_3 at a site in British Columbia.

Proposed CI/KCAC Ambient Metrics

Based on the rationale above, a comprehensive CI/KCAC program would track long-term trends in both the higher and everyday concentrations of ambient $PM_{2.5}$ and ozone.

For tracking progress in the higher concentrations, the CWS metrics are obvious candidates. The CWS metrics are:

$PM_{2.5}$ CWS Metric	The 3-year average of the annual 98th percentile of the daily 24-hour $PM_{2.5}$.
Ozone CWS Metric	The 3-year average of the annual 4th highest Dmax 8-hour O_3

For the everyday concentrations, various statistics (or estimators) could be used. An example is the annual average of the 365 measurements of the daily 24-hour $PM_{2.5}$ and the Dmax 8-hour O_3. These averages provide an unbiased estimate of the concentrations that are likely to occur, *on averag*e, on any given day of the year. Averaging these annual statistics over three consecutive years will reduce the year-to-year variability associated with weather conditions.

Based on this, the trends in the following metrics could be used, as an example, to track progress in reducing the everyday concentrations.

$PM_{2.5}$ Everyday Concentration (EdC) Metric	The 3-year average of the annual average of all daily 24-hour $PM_{2.5}$ in the year.
Ozone Everyday Concentration Metric	The 3-year average of the annual average of all Dmax 8-hour O_3 in the year.

Examples of Trends in Proposed Ambient CI/KCAC Metrics

Figure 3 below is based on Dmax 8-hour O_3 data measured at a monitoring site in British Columbia. It provides a visual indication of trends in the ozone CWS Metric and the Everyday Concentration (EdC) Metric discussed above as an example. Together the two metrics indicate that for this site progress has been made in reducing the higher concentrations while, on average, the everyday concentrations have remained unchanged or, at least have not deteriorated. This example demonstrates the need to track both the higher concentrations and the everyday concentrations since the trend in the higher concentrations is not necessarily representative of trends in the everyday concentrations.

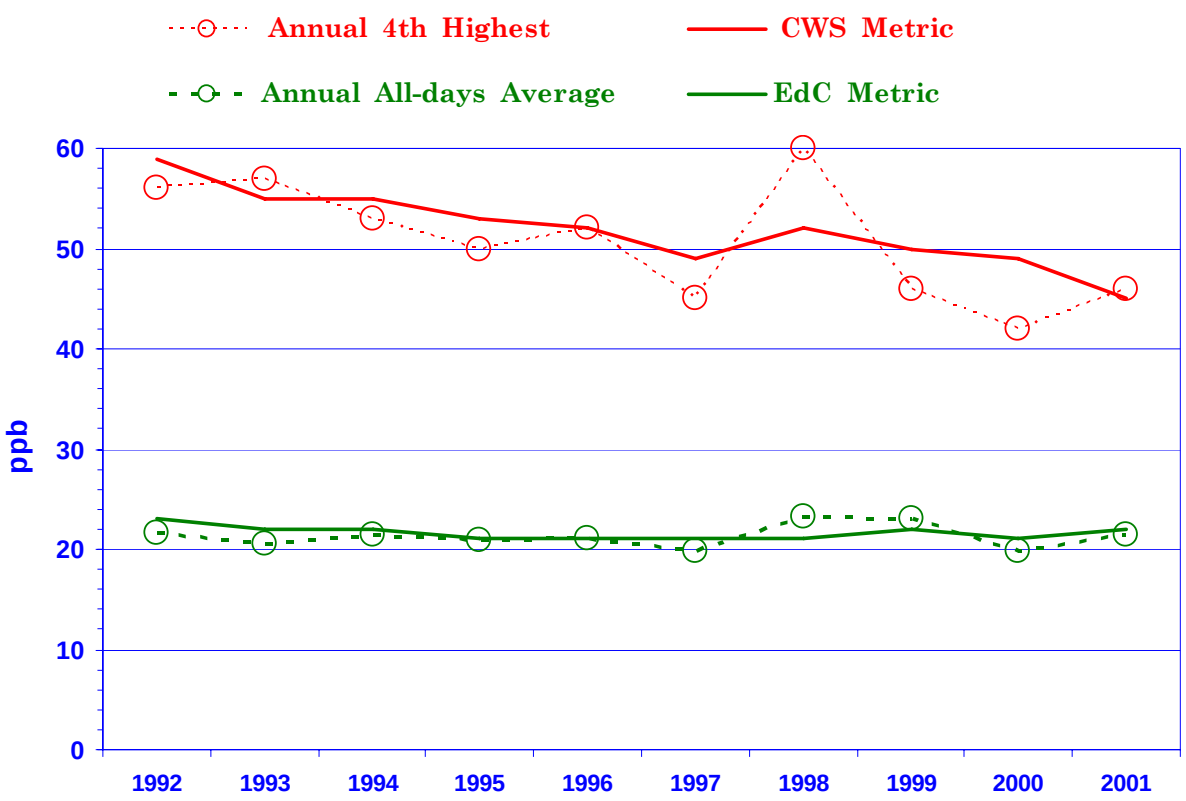


Figure C-3: Trends in CI/KCAC ambient metrics based on Dmax 8-hour O_3.

APPENDIX D

EXAMPLES of MANAGEMENT APPROACHES

1. **Alberta**
2. **British Columbia**
3. **Environment Canada**
4. **United States**
5. **United Kingdom**
6. **New Zealand**

1. ALBERTA'S TIERED APPROACH

Introduction

In 2003, the Alberta Clean Air Strategic Alliance (CASA) published a *Guidance Document for the Management of Fine Particulate Matter and Ozone* in Alberta. The Guidance Document describes a PM and ozone management framework for application in Alberta. Alberta's approach to both particulate matter (PM) and ozone CWS achievement and CI/KCAC for PM and ozone are incorporated within the Framework. The guidance document can be found at: http://www.casahome.org/wp-content/uploads/2006/10/PMO3_AB_Guidance_DocumentSEP-18-2003.pdf

Airshed Zones

Alberta's PM and Ozone Management Framework is applied in *airshed zones* established within the province. Airshed zones are managed by local organizations that involve stakeholders in a geographical area in identifying air quality concerns and implementing suitable solutions. Airshed zone organizations conduct air quality monitoring in their region. This data is a key input to the *PM and Ozone Management Framework.*

Current airshed zones in Alberta include:

- Fort Air Partnership Airshed
- Parkland Airshed Management Zone
- Peace Airshed Zone Association
- West Central Airshed Society
- Wood Buffalo Environmental Association Airshed

Alberta Environment supports a comprehensive network of airshed alliances to manage initiatives of joint concern and share best practices.

Tiered Approach Concept

The Alberta Framework consists of a tiered approach that uses pre-determined trigger levels to activate progressively more stringent response actions as ambient levels increase.

The Alberta tiered approach is represented schematically in Figure 1. The three action levels in the lower part of the diagram are CI/KCAC action levels. The action level above the CWS exceedance trigger (Mandatory Plan to Reduce Below the CWS) is a CWS achievement action level.

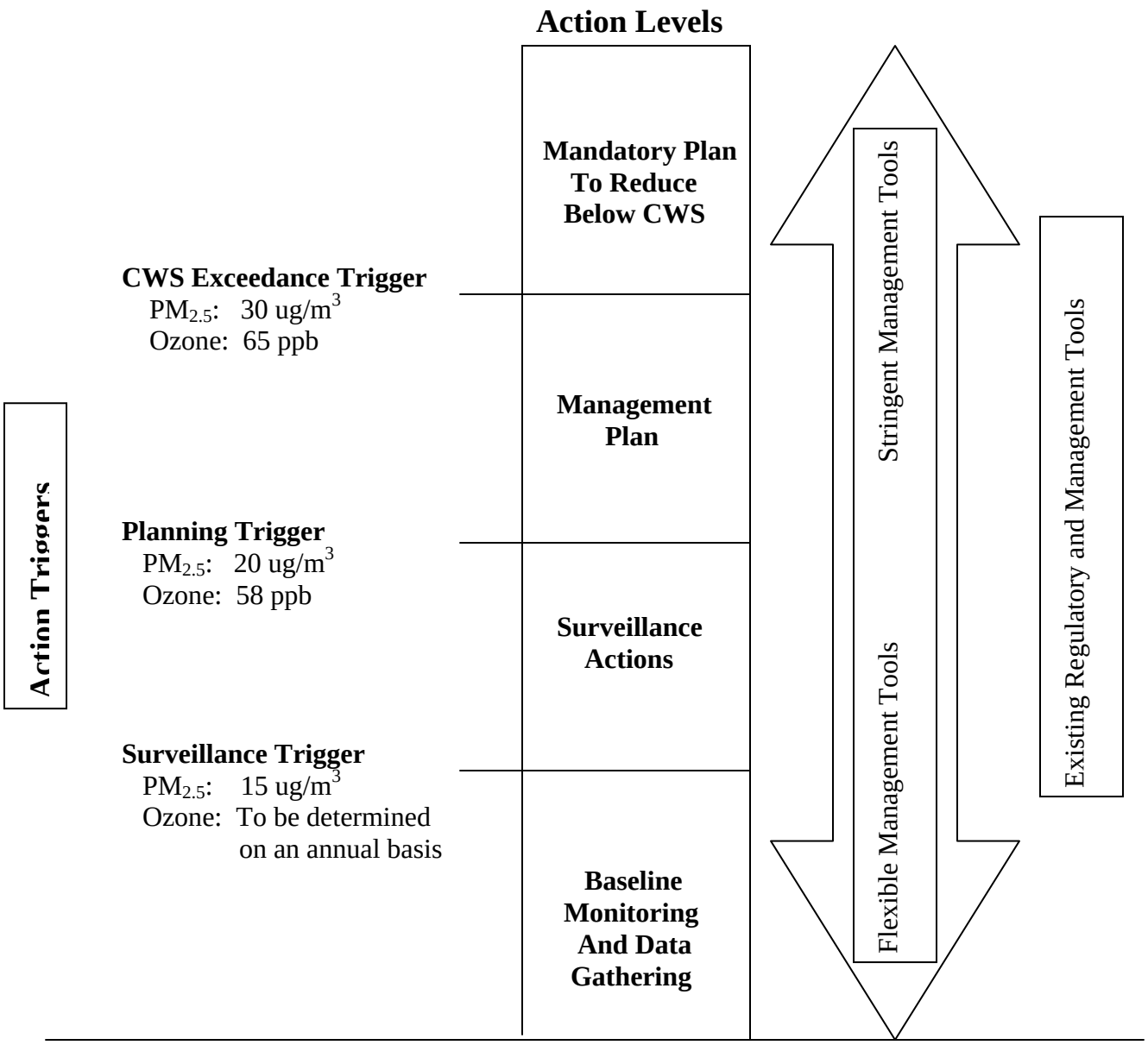


Figure D-1-1: Action Levels and Trigger Levels in Alberta's Fine PM and Ozone Management Framework (3)

Principles that Apply in the CI/KCAC Action Levels

The Alberta Framework identifies the following guiding principles and concepts that apply *below* the numerical CWS targets:

a) The action trigger concentrations are neither "pollute up to" levels, nor "not to exceed" levels

b) Activities should be prioritized according to available resources, contextual factors, and air quality needs

c) More stringent management tools should be used as ambient concentrations approach the CWS. More flexible management tools may be used when ambient concentrations are at baseline or surveillance levels

d) Action triggers should be used for airshed planning. They should not be applied as "point of impingement" concentrations in relation to approval limits and conditions. A point of impingement is the location – e.g. the factory fence – where pollutants descend and impact on persons breathing the air there.

e) Contextual factors include, but are not limited to:

- population growth and density
- trends in ambient levels
- the predicted impact of existing activities and initiatives
- economic growth forecasts
- age of facilities, and
- any factors related to the overall practicality of actions

f) The Management Framework will work towards the long-term goal of minimizing risks to human health and the environment, balancing the desire to achieve the best health and environmental protection possible in the relative near term and the feasibility and costs of reducing the pollutant emissions that contribute to elevated concentrations of PM and ozone in ambient air.

Trigger Process and Annual Analysis

The trigger process consists of an annual analysis of ambient monitoring data from Alberta's monitoring network, performed by Alberta Environment with the assistance of Environment Canada. The analysis applies the CWS three-year metric to the monitoring data to determine the appropriate action level for an area. Episodes that are primarily caused by natural events, high background or transboundary transport are removed from the calculation of the three-year metric using the methodologies described in the Guidance Document on Achievement Determination (GDAD). Information gathered from passive and mobile monitoring can also be used to suggest the probable action level for a community or region. Visibility and regional haze concerns are also identified.

Use of Regulatory Tools

An important feature of Alberta's Framework is the inclusion of "existing regulatory and management tools" as an integral part of each Action Level. The existing tools include such initiatives as:

- Alberta Environment's Industrial Release Limits Policy which requires the use of Best Available Economically Feasible Technology (BAEFT) on new developments
- the Flaring and Venting initiative for the oil and gas industry, and
- the federal Ten Year Action Plan on Vehicles, Fuels and Engines

Goals and Actions in the CI/KCAC Action Levels

Building on existing initiatives that address PM and ozone, Alberta's Framework identifies additional goals and actions for each of the three CI/KCAC action zones. These additional goals and actions are summarized below:

Baseline Monitoring and Data Gathering Action Level

Goal	Actions
Ongoing monitoring of ambient air quality levels	• Continue ongoing ambient monitoring • Continue applying existing CI/KCAC activities (no additional analytical or management activities required)

Surveillance Action Level

Goal	Actions
Ensure that the source(s) of elevated ambient concentrations are determined and that trends in ambient concentrations are analyzed and monitored	• Review ambient air quality monitoring data annually and assess the adequacy of existing ambient air quality monitoring in the area and other available information relating to air quality • Share analysis and data with stakeholders; work with airshed zone or other multi-stakeholder group if one exists • Identify and encourage opportunities for CI/KCAC actions

Management Plan Action Level

Goal	Actions
Prevent exceedance of the CWS, and maintain and improve air quality wherever possible	• Develop and implement a management plan with actions appropriate to the ambient concentrations, trends, and contextual factors.

Steps in the Development of a Management Plan

- Either Alberta Environment or the local airshed organization, as appropriate, leads identification of key stakeholders, from both the emissions sources and receptor communities.
- Where there is an existing airshed zone organization or other multi-stakeholder group with similar interests, they may choose to lead the development of a plan.
- If there is no existing group, a zone formation analysis could occur.
- The group develops and implements a public communication and consultation strategy.
- A consensus model is recommended for plan development.
- Existing data and analysis is collected to inform the management planning process. Other data is gathered as required.
- The designated group has two years to develop a plan. If a plan is not developed, Alberta Environment may impose a plan.

Other Elements in the Guidance Document

There are other elements in Alberta's Guidance Document that provide an example of the components to consider when developing a CI/KCAC plan. They include:

- Roles and Responsibilities
- Potential Tools and Mechanisms
- Pollutants of Interest
- Monitoring Methods and Requirements
- Calculation Methodologies and Criteria for $PM_{2.5}$ and Ozone
- Transboundary Influence Considerations
- Background and Natural Influence
- Simplified Mechanisms
- Reporting Requirements

2. B.C.'S COMMUNITY-BASED AIRSHED PLANNING APPROACH

Jurisdictions may wish to consider a more flexible approach to CI/KCAC implementation, as reflected in the voluntary airshed management approach that has evolved in British Columbia over the last decade. BC has so far not used specific trigger levels like those used in Alberta's tiered approach, beyond their application in air quality advisories.

The focus of many air management activities in BC is at the airshed level. This is a reflection of:

- the complex topography typical of many BC communities
- the influence of local meteorological processes on the dispersion of air pollutants
- the relatively unique source mix in a number of such settings, and
- the challenges in managing sources within a finite airshed

BC airsheds have been largely defined on the basis of topography, local or regional political boundaries, and the location and types of sources that affect air quality. As a result, some airsheds are very large, such as the Bulkley Valley-Lakes District, and some are small, such as the Prince George airshed, which is limited to the boundaries of the City of Prince George.

Although a number of regulations were created during the 1990s to deal with the most significant sectors under provincial jurisdiction, the province has taken a largely non-regulatory approach to airshed management. Airshed planning is primarily done on a voluntary basis. It is usually initiated due to local concerns over air quality. It is carried out as a joint effort between provincial, federal and regional/municipal governments, health authorities, and local stakeholders, recognizing that a shared stewardship approach is needed to manage the broad range of sources typically affecting local air quality. Local airshed planning committees are responsible for guiding the planning process, and assisting with setting airshed goals. Recommendations from airshed plans will be considered by the Ministry in decisions on air approvals. Within the Greater Vancouver Regional District (GVRD), the regional government has delegated authority for air management, including airshed planning, within its boundaries. A framework to guide airshed planning has been developed (http://www.env.gov.bc.ca/air/airquality/pdfs/airshedplan_provframework.pdf). Additional work is being done to examine how airshed planning can be integrated with other local planning processes such as community energy plans and greenhouse gas management plans (http://www.env.gov.bc.ca/air/airquality/pdfs/int_aq_rep_may04.pdf).

Although most airshed management has thus far been voluntary, the new *Environmental Management Act* provides enabling legislation to require area-based planning where the Minister considers it advisable because of the cumulative impacts of discharges to the environment. This Act will provide a regulatory tool to require airshed management where there is little local support for action.

As part of its current initiative to improve air quality in BC airsheds, the province is focusing initial efforts on both impacted and relatively clean airsheds with community support and partnership opportunities. This strategy recognizes that even in cleaner airsheds, there should be efforts to reduce risks to human health wherever technically and economically feasible.

BC's efforts include:

- development of the best available tools to support decision-making
- assessment of ways to integrate airshed planning with opportunities to mitigate greenhouse gas emissions
- support of local airshed committees
- increasing partnerships with the business community and local governments, and
- encouragement of outreach to engage the public in actions to improve local air quality

There is a recognized need to build on, rather than duplicate, processes already in place, and to take actions at the most appropriate scale. BC supports multi-lateral agreements such as the CWS and the development of joint initial actions for sectors of national significance. The province also supports national standards for motor vehicle emissions and fuel quality, and has recently repealed older overlapping provincial regulations.

Additional provincial measures already in place include:

- a regulation that specifies emission limits, labeling, and testing requirements for new wood stoves, fireplace inserts and factory-built fireplaces,
- a regulation that limits where, when and how land-clearing fires can take place,
- transportation fuel standards regulations
- an alternate fuel tax exemption to encourage the use of natural gas, propane and high-level alcohol blends to reduce smog, PM formation and greenhouse gases, and
- a partial sales tax exemption on alternatively fuelled vehicles

Airshed planning work is currently underway in a number of BC communities, including the Bulkley Valley-Lakes District, Prince George, Quesnel, Williams Lake, Central Okanagan (including Kelowna), Southern Okanagan, Kamloops, Golden, Nelson, the Sea-to-Sky corridor (including Whistler), the Greater Vancouver Regional District (GVRD), the Fraser Valley Regional District (FVRD), and the Capital Regional District (including Victoria). Work is at various stages of development, ranging from preliminary information gathering to the implementation or revision of approved plans.

The most advanced and comprehensive planning has occurred in the Lower Fraser Valley, where work begun in the late 1980s led to plans in the GVRD and FVRD during the early to mid-90s. These plans were developed collaboratively by three orders of government, and have resulted in some 40% reduction in emissions in the region from 1990 levels. Some provincial regulatory programs were uniquely targeted to the Lower Fraser Valley, such as the AirCare and AirCare On-Road vehicle inspection and maintenance programs. The region also has some unique non-regulatory programs such as the "Go Green" public education campaign and voluntary vehicle scrappage.

To date, limited work has been done in BC on the characterization of background and transboundary contributions to local air quality. Transboundary airflow has been looked at most intensively in the Lower Fraser Valley as part of the Georgia Basin Ecosystem Initiative and the International Airshed Strategy. Under the Canada/US Border Initiative, the province will be

supporting Environment Canada’s efforts to characterize air quality along several areas of the southern BC/US border over the next 5 years.

3. ENVIRONMENT CANADA'S ACTION PLAN CONCEPT

The schematic of an action-plan based approach for moving forward with CI/KCAC is presented in Figure 1 below. The steps in this approach include:

- delineate areas for CI and KCAC
- evaluate internal anthropogenic sources (IAS) and external sources (ExS)
- establish ambient goals for these areas
- set a target year by which the goals should be achieved
- develop an emission reduction action-plan for achieving the goals by the target year
- phase in actions over an appropriate timeframe (5 -15 years)
- monitor progress
- as the target year approaches, begin the next planning phase

Tracking progress in CI/KCAC would be accomplished by the trends in the ambient CI/KCAC metrics and/or the trends in an emission metric. Air quality modeling could also be used to evaluate if the proposed actions will achieve the stated ambient goals. Any region-wide emission reduction actions for achieving the CWS targets would also benefit CI/KCAC.

The action-plan would focus in obtaining *long-term* reductions in the higher and everyday concentrations of ambient $PM_{2.5}$ and ozone for CI, and on *long-term* prevention or minimization of deterioration for KCAC. The result of this series of actions will be to continually reduce the risk to human health and the environment posed by $PM_{2.5}$ and ozone.

Ambient goals would be regionally flexible taking into account the various existing regulatory and voluntary frameworks and economical, geographical and topographical circumstances. However, the ambient metrics used to track progress in CI/KCAC should be nationally consistent to ensure comparability of data.

Emission reduction action plans would also be regionally flexible but, as noted in Annex A of the CWS Agreement, they should consider the establishment of programs that apply pollution prevention and best management practices by, for example:

- developing and implementing strategies consistent with the CCME commitment to pollution prevention
- ensuring that new facilities and activities incorporate the best available technologies economically achievable (BATEA),
- requiring that upgrades carried out in the course of capital stock turnover incorporate BATEA

Action plans should incorporate appropriate data collection and analyses. Ambient analyses could segregate ambient concentrations according to the contribution from either Internal Anthropogenic Sources (IAS) or External Sources (ExS). Air quality models, and other sound scientific methods, can be used to analyze internal and external contributions. Environment Canada can provide assistance with emission and ambient analyses. This will suggest where action is needed and which level of government is best situated to act.

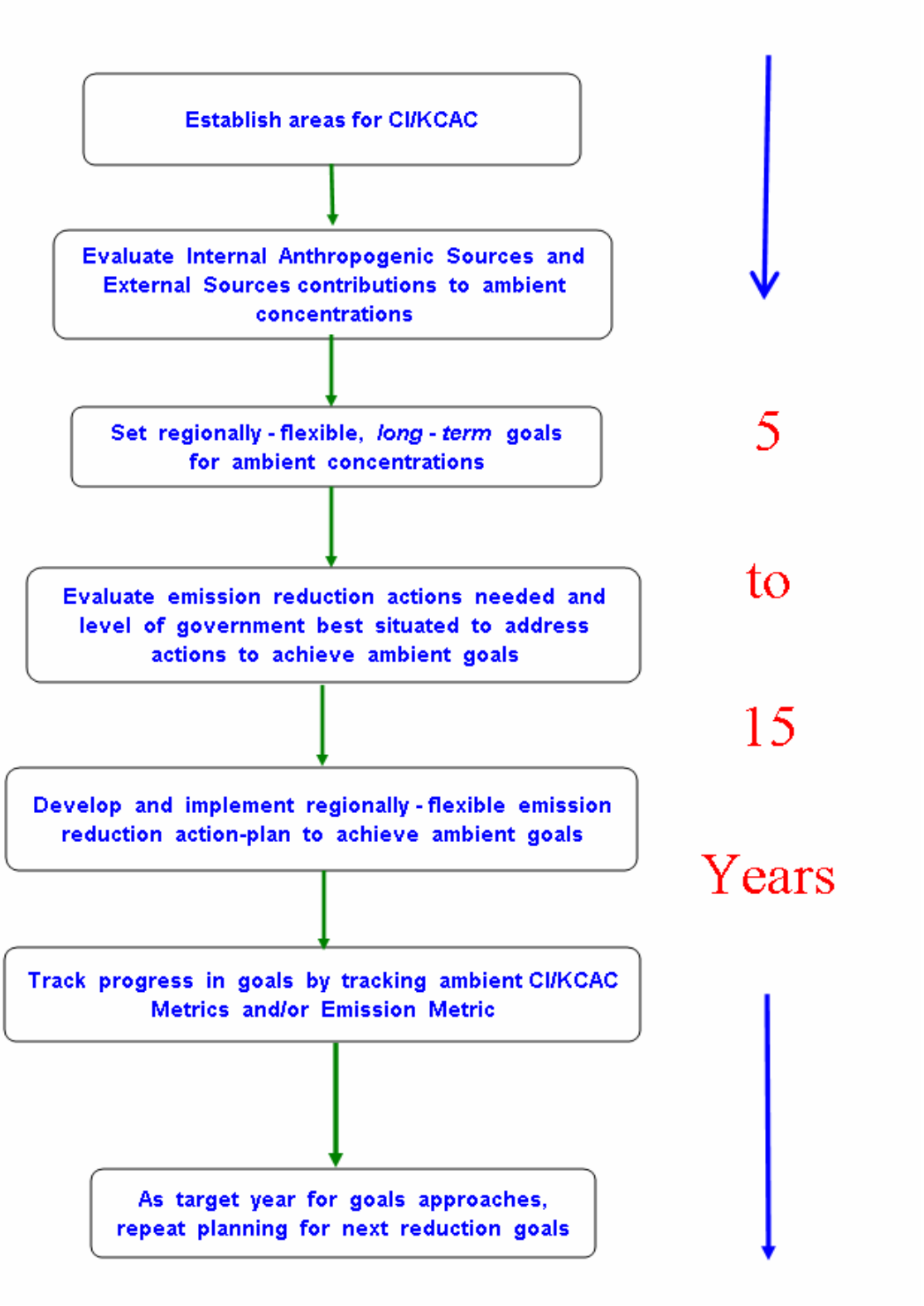


Figure D-3-1: Flow Chart of an Action Plan Based Approach for CI/KCAC

4. UNITED STATES' PREVENTION of SIGNIFICANT DETERIORATION, NEW SOURCE REVIEW and REGIONAL HAZE PROGRAMS

Overview

The U.S. has a rigorous, mechanized and complex Prevention of Significant Deterioration (PSD) program, aimed primarily at protection of its Class I areas, such as national parks. The program requires managing the gap between current air quality and the U.S. National Ambient Air Quality Standards (NAAQSs) for common air pollutants like PM and ozone. First established in 1975 and subsequently modified with various amendments to the U.S. Clean Air Act (CAA), the PSD legislation includes a New Source Review (NSR) program that requires use of best available control technology on new sources. The intent is to limit deterioration of air quality by any new source to a specified increment of the gap between current ambient air concentrations and the national standards. In recent years the U.S. has further enhanced this program by establishing new Regional Haze Rules to improve visibility in its Class I areas over the long term. In 2002, the U.S. made revisions to its New Source Review program providing greater flexibility in how some of its provisions are applied. The U.S. also usually acknowledges the contribution of other programs, such as those addressing vehicles and fuels, to the fulfillment of its deterioration prevention and visibility protection goals.

Prevention of Significant Deterioration Program (PSD)

The U.S. has three area classifications:

Class I Areas	• international parks • national wilderness areas >5,000 acres • national memorial parks >5,000 acres • national parks >6,000 acres
Class II Areas	• areas designated to be in attainment of the appropriate NAAQS • unclassified areas which are not established as Class I areas
Class III Areas	• other areas

The PSD legislation sets "maximum allowable increases" in ambient air concentrations by any new source over a baseline concentration. The baseline concentration is the ambient concentration level that exists in the area at the time of first application for a new source permit. Maximum allowable increases are defined in the U.S. Clean Air Act for various pollutants for which there are national air quality standards. The allowable increases are different for each of the area classifications. Allowable increases are also specified for different concentration metrics for a pollutant. For example, for SO_2, increments are specified for the annual mean, 24-hour maximum and 3-hour maximum concentrations. The ceiling in any area is the lower of the national primary and the national secondary ambient air quality standards for each pollutant.

New Source Review Program

The PSD legislation prohibits the construction of a major facility in subject areas unless:

- a permit has been issued setting forth emission limitations
- the permit has been subject to a New Source Review, including a public hearing
- the proponent demonstrates that the facility will not cause, or contribute to, air pollution in excess of the NAAQS or the PSD maximum allowable increase for any pollutant
- best available control technology (BACT) is applied
- air quality impact analysis has been conducted that accounts for growth associated with the facility, and
- the proponent agrees to such monitoring as may be necessary to determine the effect of emissions from the facility on air quality
- inter-Class area effects have been considered

A "major emitting facility" for most sectors means any source that emits, or has the potential to emit, 100 tons or more per year of any pollutant. The term "construction" includes the modification of any source or facility.

In addition to the New Source Review program associated with PSD, there is a parallel NSR program for non-attainment areas. The Non-attainment NSR program requires the application of state-of-the-art emission controls that meet the Lowest Achievable Emission Rate (LAER), and acquisition of offsets for emissions from other sources.

In November, 2002 the U.S. Environmental Protection Act revised its NSR rules to provide a regulatory definition of "routine maintenance, repair and replacement" which:

- offers greater flexibility to improve and modernize operations in ways that will reduce energy use and air pollution
- provides incentives to install state-of-the-art pollution controls, and
- provides for more accurate calculation of air pollution.

Regional Haze Program

In 1999, the United States Environmental Protection Agency (EPA) issued regional haze regulations to address visibility impairment. Haze obscures the clarity, color, texture, and form of what we see. Haze-causing pollutants (mostly fine particles) are directly emitted to the atmosphere by activities such as electric power generation, industrial and manufacturing processes, truck and auto emissions, forest and agricultural burning, and construction activities. Haze is also formed when gases emitted to the air form particles as they are carried downwind. Examples include sulphate, formed from sulphur dioxide, and nitrates, formed from nitrogen oxides. Haze-generating emissions generally originate from broad geographic areas and can be transported great distances, sometimes hundreds or even thousands of miles. Consequently, haze can occur anywhere in Canada.

Originally, the 1980 PSD regulations only addressed visibility problems that were "reasonably attributable" to a single source or small group of sources. With improved monitoring and modeling techniques that can better attribute haze to its sources, the U.S. introduced the latest haze regulations to address visibility impairment.

Key Elements of the Regional Haze Regulations

States/Areas Subject to the Rule

There are 156 areas of specific concern known as Class I areas. Because fine particles are frequently transported hundreds of miles, all 50 states – including those that do not have Class I areas – have to participate in planning, analysis, and in many cases, emission control programs under the regional haze regulations. This rule recognizes that emissions in one state can cause visibility impairment in another and encourages states to work together on prevention. The regulations allow a certain group of states forming the Grand Canyon Visibility Transport Commission to implement their specific recommendations according to different timelines, within the framework of the national program.

Reasonable Progress Goals

Regional haze regulations allow states flexibility in determining reasonable progress goals for Class I areas, taking into consideration the statutory requirements of the Clean Air Act. States are required to conduct certain analyses to ensure that they consider the possibility of setting an ambitious progress goal that is aimed at reaching natural background conditions in 60 years. The rule requires States to establish goals for each affected Class I area in the State to improve visibility on the 20% haziest days and ensure no degradation occurs on the 20% clearest days over the period of each implementation plan.

Long-Term Strategy

States are required to develop long-term strategies that include enforceable measures designed to meet reasonable progress goals. The first long-term strategy will cover 10 to 15 years, with reassessment and revision in 2018 and every 10 years thereafter. State strategies are expected to address their contribution to visibility problems in Class I areas both within and outside the State. States can take into account emission reductions due to ongoing air pollution control programs, such those intended to meet the national ambient air quality standards for particulate matter. EPA expects that some States may be able to demonstrate reasonable progress based on these emission reductions alone, particularly for the first period of the long-term strategy.

Smoke Management

States' long-term strategies are expected to address all types of manmade emissions, including those from mobile sources, stationary sources, and prescribed fires. Fires of all kinds – both naturally-caused fires and human-caused fires – contribute to regional haze. However, the strategic use of intentionally prescribed fires in an area may achieve particulate emission levels lower than those that would be expected from a catastrophic wildfire. Because prescribed fires

are intended to restore the natural fire cycle to forest ecosystems and thus avoid catastrophic wildfires, EPA will work with States and Federal Land Managers to support development of smoke management plans that reduce the risk of huge particulate emissions from extensive natural fires that would have a significant effect on public health and welfare.

Best Available Retrofit Technology (BART)

One of the principle elements of the visibility protection provisions of the Clean Air Act addresses installation of best available retrofit technology – BART – for certain existing sources that came into operation between 1962 and 1977. The regional haze rule requires three BART plan elements:

- a list of sources that came online between 1962 and 1977, including those that are reasonably anticipated to contribute to visibility impairment in a Class I area
- the BART emission limits for each subject source, or an alternative measure such as an emission-trading program for achieving greater progress in visibility protection than implementation of source-by-source BART controls
- a regional analysis of the cumulative emission reductions and changes in visibility that would result from best retrofit control levels being applied to these sources

In 2001, EPA issued draft guidance for implementation of BART requirements, tracking progress, and estimating "natural conditions". In determining the best retrofit, the State can take into account several factors, including:

- the existing control technology in place at the source
- the cost of compliance
- energy and non-air environmental impacts of compliance
- remaining useful life of the source, and
- the degree of anticipated visibility improvement

Expanded Monitoring

The EPA expanded the existing Class I area visibility monitoring network from 30 to 110 sites in 2001. The EPA works closely with the expanded network to provide regionally representative data for all 156 Class I areas.

Optional Approach for Regional Planning

Regional haze is caused by many sources, often located throughout a broad region of adjacent states. The regional haze regulations incorporate an optional set of requirements for States to submit coordinated strategies. States are allowed additional time to develop their strategies if they commit to participate in regional planning.

There are several requirements for proposed regional strategies. Each participating State must submit a plan demonstrating its commitment to the regional planning process. This plan must demonstrate the cross-state impact of sources affecting regional haze. The proposed plan must also include details about the regional planning process and a commitment to develop a coordinated control strategy.

As of this writing, there are five regional planning organizations (RPOs) developing strategies to address haze. They are currently conducting impact analyses for their sources on national park and wilderness areas (Class I areas) across the country. They will then develop regional strategies to reduce the emissions that produce regional haze. Participant states will each develop implementation plans to achieve "reasonable progress" toward the national visibility goal of no human-caused impairment in the 156 mandatory Class I federal areas.

RPO projects are managed nationally by the EPA to ensure consistency. Lead EPA regions manage the specific grants for their individual RPOs. National meetings of the RPOs with EPA, State, tribal representatives, and Federal land Managers have been held since spring 2000.

Timing

Revisions to visibility protection requirements are matched to the area's EPA-designated timing for the national ambient air quality standard for $PM_{2.5}$. For "attainment" and "unclassified" areas, States have one year following the designation to submit their implementation plans (generally 2004 to 2006). For "non-attainment" areas, States have three years from the date of designation to submit their plans (about 2006 to 2008).

For a State proposing to participate in regional planning, its first commitment plan is due one year after EPA first designates an area within that State as attainment or non-attainment for $PM_{2.5}$. Complete control strategy plans for regional haze would be due to EPA at the same time as $PM_{2.5}$ state plans are due, that is, three years after EPA designates an area non-attainment for $PM_{2.5}$, but no later than 2008.

Subsequent revisions to the State implementation plans are required in 2018, and every 10 years thereafter. With each revision, the State is required to set new progress goals and achievement strategies. States must also submit progress reports to EPA every five years. These reports are to document actual changes in visibility and emission reductions, comparing current visibility conditions to baseline conditions. Baseline is the average condition for 2000 to 2004. The report, which will be subject to public review and comment, must also include any needed mid-course corrections to emission management strategies.

Jurisdictions, Agencies and Sectors Affected

State and local air quality agencies are expected to implement the regional haze program through revisions to their state implementation plans. However, the EPA encourages States to participate in coordinated multi-state strategies for meeting progress goals. While the Clean Air Act specifically identifies certain source types as potential contributors to visibility impairment, ultimately States will make decisions about specific emission management strategies. In some areas, existing strategies for other air quality programs (such as the $PM_{2.5}$ national air quality standards) may provide steady visibility improvements in the near-term. Both the regional haze programs and Clean Air Act require consultation and collaboration between the States and Federal Land Managers responsible for managing Class I areas.

Information on the U.S. regional haze program can be found at the following sources:
Web site: http://www.epa.gov/oar/visibility/program.html
Canada-U.S. Air Quality Agreement Progress Reports

Other U.S. Programs Contributing to PSD and Visibility Improvement

In the joint biannual reports on implementation of the Canada-U.S. Air Quality Agreement, the U.S. usually cites additional non-legislated programs that contribute to PSD and visibility improvement by reducing fine particulate matter formation. These include:

- the U.S. acid rain program to reduce SO_2 emissions
- the NOx State Implementation Plan (SIP) Call in the northeastern U.S.
- mobile source emissions and fuel standards programs
- certain air toxics standards
- smoke management and woodstove programs

5. THE UNITED KINGDOM

Overview

The U.K. approach to air quality management is structured to meet national objectives. Only areas that exceed or are anticipated to exceed objectives are required to designate Air Quality Management Areas (AQMAs) and develop action plans. Local authorities are under no legal obligation to achieve objectives, but must demonstrate they are doing all they reasonably can to work towards them. Local authorities have no statutory duty or obligation to prepare a local air quality strategy, but this is encouraged as a means to ensure air quality is considered across various sector-planning activities. No prescriptive guidance is provided. If areas are below the national standard, they are still encouraged to develop air quality improvement strategies.

Regulatory Requirements

The 1995 Environment Act requires local authorities to designate air quality management areas (AQMAs) where objectives are not being achieved or unlikely to be achieved within a specified time. Local authorities are then required to draw up action plans demonstrating how they intend to meet these objectives. They are also required to monitor local air quality from time to time. The level of assessment is to be commensurate with the risk of the objective being exceeded. Modeling is used to obtain confidence in results.

Scope of Management Areas

An AQMA could vary in scale from a single road to an entire county. To date, more than one hundred AQMAs have been declared (about one third of local authorities in England, Wales and Scotland), largely on the basis of NO_2 exceedances due to transportation.

Plan Requirements

All source sectors are responsible for achieving local air quality targets. Plans are expected to complement those of neighbouring jurisdictions to the extent possible but are to identify any concerns beyond the local jurisdiction's authority that cannot be resolved locally. Plans should encourage integration with other planning mechanisms. Solutions are not based solely on regulation. Consultation and a multi-stakeholder process are encouraged. There are no specific timelines for plan development, but 12-18 months is encouraged. There are annual reporting expectations. An initial round of review and assessments highlighted the need to consider public exposure and hotspots as a first step.

Local Government Tools

Local governments have a variety of tools that can be employed to achieve improved air quality. These include:

- Land use planning
- Local Bylaws, such as those for smoke
- Traffic planning
- Low emission zones
- Corporate actions, such as green purchasing and green fleets
- Guidelines that have already been produced, to use as examples
- Estimated mean background maps for criteria pollutants
- Screening tools to estimate contributions from specific sources such as on-road transportation, industry, and domestic solid fuel

For further details about air quality management in the UK see:

- http://www.airquality.co.uk/archive/laqm/laqm.php
- http://www.nsca.org.uk/pages/topics_and_issues/local_air_quality_management.cfm

6. NEW ZEALAND

Overview

A 1991 Resource Management Act (RMA) defines how air quality is to be managed in New Zealand. The RMA includes national ambient air quality benchmark guideline values. These are intended to promote sustainable management of the air resources in New Zealand. Achievement and improvement on the benchmarks is encouraged. Regional councils and local authorities are responsible for managing air emissions and outdoor air quality. They are expected to monitor air quality and develop regional policy statements and plans to address any issues of concern. The benchmark guideline values and advice on how to apply them are not legislative requirements. Instead, local councils are encouraged to incorporate them into planning documents and monitoring programs as soon as practical.

Air Quality Management Plans

Developing and implementing an air quality management plan is defined by five main steps:

- define the current state of the air, impacts on it, and any historic data on changes
- use national benchmarks to develop regional criteria and reduction targets
- devise management or reduction strategies and assess their costs and benefits
- refine strategies through consultation and implement them
- evaluate the effectiveness of reduction strategies

Action Categories

Environmental Performance Indicators (EPI) air quality categories are often used as a framework for air quality management. The categories are outlined below.

Category	Measured Value	Comment
Action	Exceeds the benchmark	Exceedances are a cause for concern and warrant action, particularly if they occur on a regular basis
Alert	Between 66% and 100% of the benchmark	This is a warning level, which can lead to exceedances if trends are not curbed
Acceptable	Between 33% and 66% of the benchmark	Maximum values might be of concern in some sensitive locations, but are generally at a level that does not warrant urgent action
Good	Between 10% and 33% of the benchmark	Peak measurements in this range are unlikely to affect air quality
Excellent*	Less than 10% of the benchmark	If maximum values are less than a 10^{th} of the guideline, average values are likely to be much less

* This category should not be applied to PM_{10} as the level of detection of most monitoring methods is not accurate enough.

No guideline values have been set for $PM_{2.5}$ yet, although assessments use a monitoring value of 25 ug/m^3. Guideline values for ozone are 150 ug/m^3 (1-hour) and 100 ug/m^3 (8-hour).

For small to medium-sized urban areas without too many problems, being near the top end of the "acceptable" category range is generally considered an appropriate air quality to maintain in most areas of the country. For areas that are pristine or of special sensitivity, good or excellent categories are encouraged. In addition, further consideration is encouraged for:

- criteria for visibility degradation
- criteria for specific ecosystems based on critical levels or biological monitoring
- broad site limitations for certain activities in sensitive areas

For further details on RMA and its requirements, see:
http://www.mfe.govt.nz/publications/rma/
http://www.mfe.govt.nz/publications/air/ambient-air-quality-may02/ambient-guide-may02.pdf

For guidance documents developed to support local airshed planning, see:

Good Practice Guide for Assessing and Managing the Environmental Effects of Dust Emissions
http://www.mfe.govt.nz/publications/air/dust-guide-sep01.pdf

Good Practice Guide for Atmospheric Dispersion Modeling
http://www.mfe.govt.nz/publications/air/atmospheric-dispersion-modelling-jun04/html/index.html

Good Practice Guide for Monitoring and Management of Visibility in New Zealand:
http://www.mfe.govt.nz/publications/air/visibility-guide-aug01.pdf

Reducing Emissions from Domestic Home Heating:
http://www.mfe.govt.nz/publications/air/reducing-emissions-domestic-fires-may02.pdf

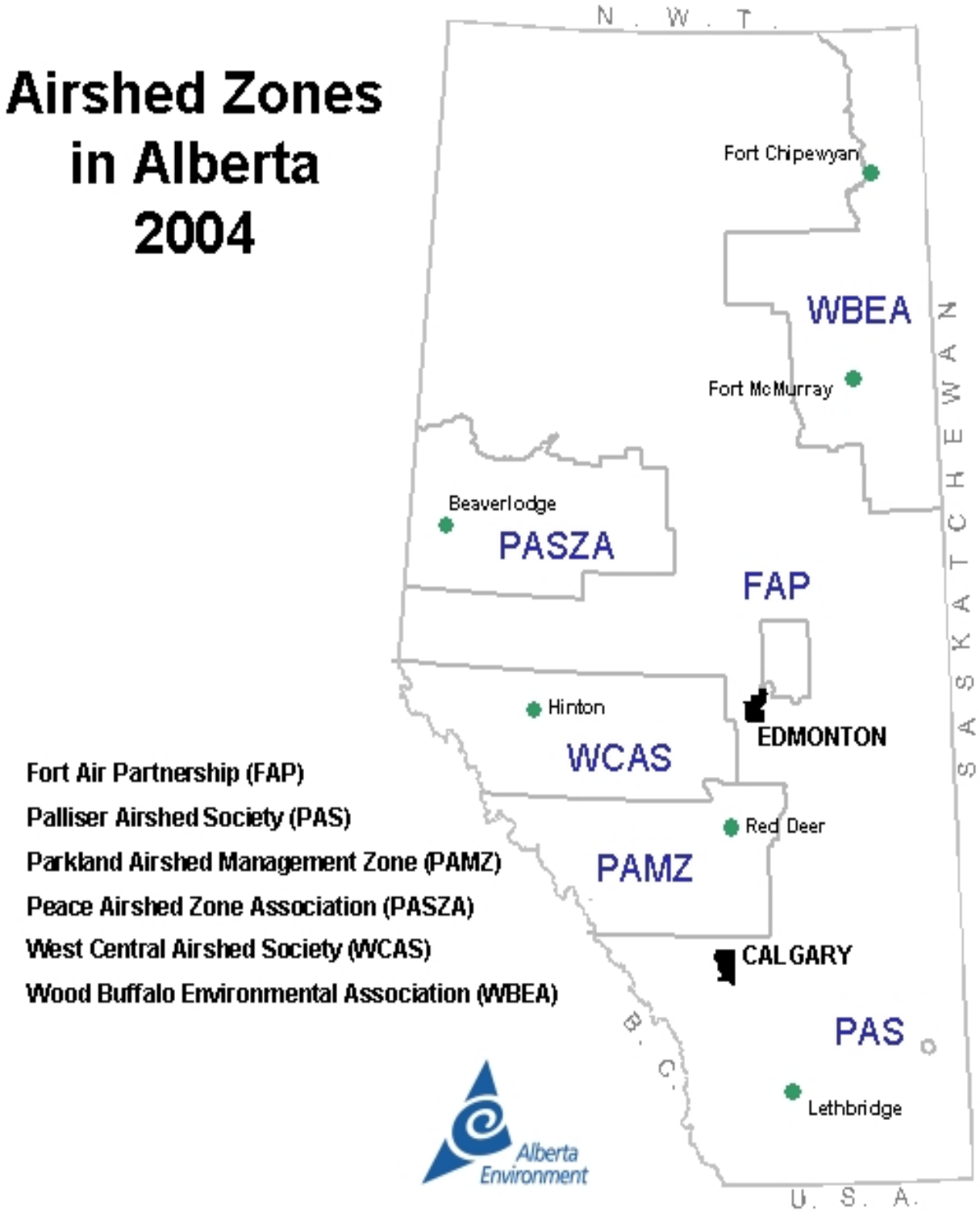
APPENDIX E

EXAMPLES of MANAGEMENT AREAS

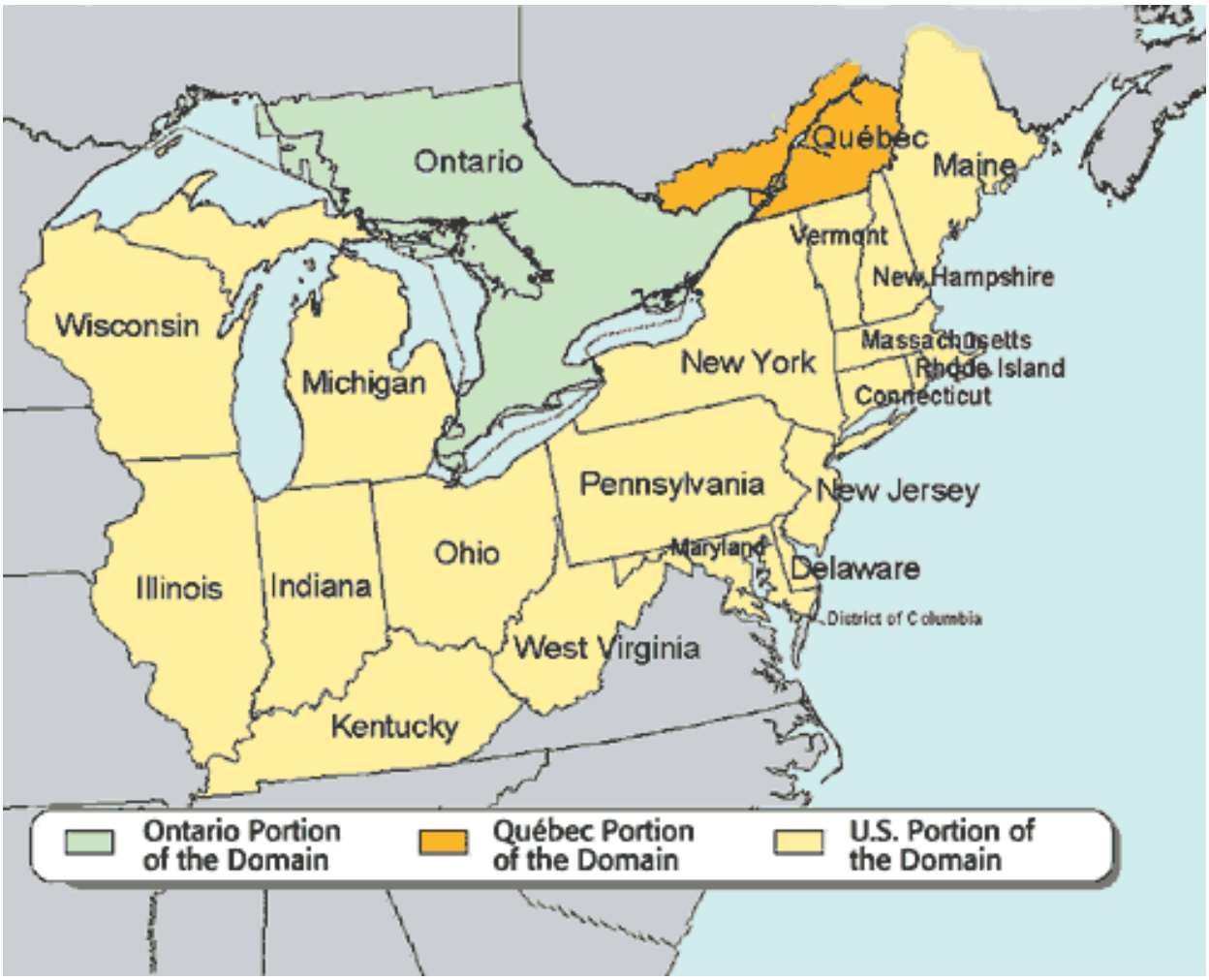
1. **Alberta**

2. **Canada-U.S. Air Quality Agreement**

1. MANAGEMENT AREAS IN ALBERTA



2. MANAGEMENT AREAS IN THE CANADA-U.S. AIR QUALITY AGREEMENT



APPENDIX F

USE of EMISSION-BASED CRITERIA IN SELECTING CI/KCAC MANAGEMENT AREAS

Parameters for defining CI/KCAC management areas could include the quality of the prevailing air, the amount of anthropogenic emissions in the area, or both. In many cases, there may be advantages in characterizing areas using emission-based criteria rather than using ambient air quality.

Limitations in Characterizing CI/KCAC Management Areas Using Ambient Air Quality

Most of the land area in Canada is not monitored for $PM_{2.5,}$ ozone, and their precursors. Since the focus has been on human health, air quality monitors are typically located in urban areas. For vast areas of Canada's landmass there is little or no monitoring information, and obtaining sufficient data to provide a representative picture of air quality across the entire country would require an increase of an order of magnitude in terms of resources. Without other criteria to supplement the use of air quality monitoring information, most of the land area in Canada would have to remain unclassified.

Also, defining areas based on ambient air quality can often lead to counterintuitive results. Many Canadians would consider sparsely populated areas with few anthropogenic sources to be automatically "clean," although some such areas may also be significantly influenced by the long-range transport of pollutants from other sources and regions. For the many areas in this category which are less affected by long-range transport, defining "clean" areas in terms of the prevailing ambient air quality alone may not be appropriate or practical. Another approach may be more useful.

Emissions-based Characterization for CI/KCAC Management Areas

Emission levels provide a generally available, useable metric for use in CI/KCAC planning in areas with no air quality monitors and may also be used in conjunction with ambient data in areas with monitoring. Areas could be classified based on a threshold amount of the total anthropogenic emissions for $PM_{2.5}$ and its precursors, and ozone precursors. If the total emissions were less than the threshold amount, the area would be defined as "clean" for the purpose of establishing management measures.

There are three major types of anthropogenic sources - point sources, mobile sources and area sources. To classify the area, the collective total emissions from these three source types would have to be estimated.

It is possible to estimate emissions information on a grid or census area (e.g., Census Subdivisions (CSD)) basis. For the purpose of defining clean areas, a CSD with an emissions density of less than some selected value could be regarded as contributing practically

insignificant anthropogenic emissions of smog precursors (where "smog" includes $PM_{2.5}$ and ozone).

To provide an idea of the likely magnitude of an appropriate emissions density, Figure 1 below was developed based on 1995 data to show several key levels of emissions density for total smog precursor (NOx, SO2, VOC & PM2.5) emissions. Starting at annual emissions of 2.5 tonnes per square kilometer (km^2), approximately 93% of the land area in Canada would be classified as "clean" (the green area in Figure 1), at least for the first level of screening before considering point sources. Alternatively, setting the threshold at 5 tonnes per square kilometer would mean approximately 97% of Canada's land area would be considered clean.

Using these concepts, a sample definition of a Management Area where KCAC would be the dominant strategy based on emissions considerations could be:

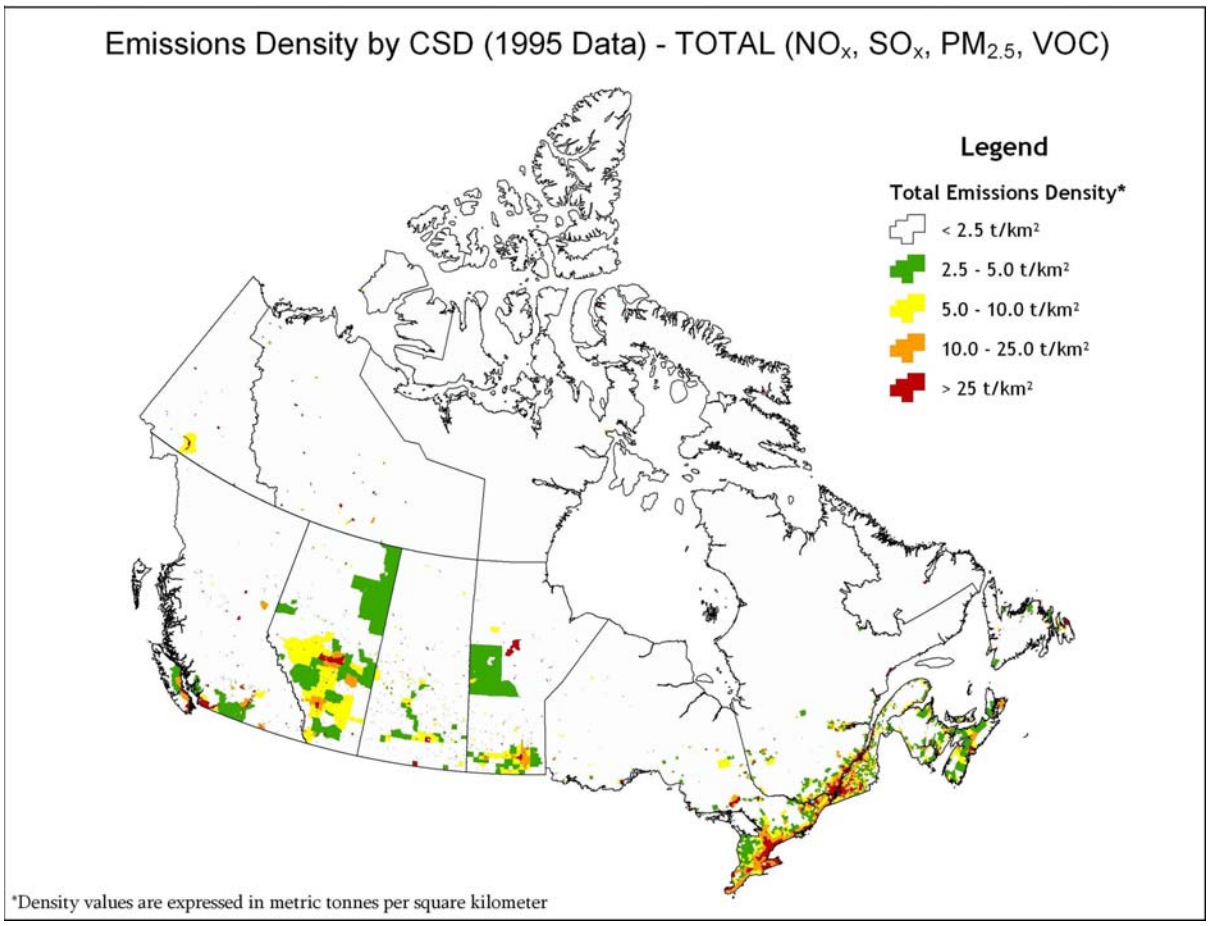
> A management area where KCAC is the primary air management strategy is any Census Subdivision (CSD) with an emissions density of less than 2.5 tonnes per square kilometer.
>
> Such areas **exclude** any CSD that is wholly or partly located within the boundaries of a Census Metropolitan Area or a Census Agglomeration.
>
> Such areas **include** those national parks, provincial parks, wildlife reserves and other areas which are identified as having significance due to their pristine nature.

The suggested exclusion of CSDs whose boundaries are within Census Metropolitan Areas (CMAs) or Census Agglomerations (CAs) follows from the fact that emissions from the remainder of the neighbouring areas in those CMAs or CAs are likely to impact on the local air quality of any included CSDs even if those CSDs have population densities less than 2.5 inhabitants per km^2. National parks and any other areas that would be considered to have significance due to their pristine nature are suggested for inclusion because of their special status.

Consideration of Available Air Quality Data

In cases where emissions-based information indicates that an area is "clean" but available air quality information suggests otherwise, management strategies for such areas will need to stress identification of out-of-area sources impacting air quality in the management area and the need for negotiations aimed at reducing those contributions in addition to best efforts to limit emissions locally. Relevant air quality information may include monitoring data, including results of intermittent monitoring which might not satisfy the criteria for CWS achievement determination, or modelling results.

Figure F-1: Emissions Density of Smog Precursors by CSD (1995 Data).



APPENDIX G

TOOLS and MECHANISMS for IMPLEMENTING CI/KCAC PROGRAMS

Examples of Types of Tools and Mechanisms

There are a wide variety of management tools and regulatory mechanisms that can be used to manage emissions to achieve the CI/KCAC goals. These tools can be either compulsory or voluntary in nature. A range of tools applicable to CI/KCAC is provided in the table below.

Tools or Mechanisms	Examples
Regulatory Tools	Approvals, regulations, bylaws, prohibitions, regulated requirements
Standards, Codes & Guidelines	Industry codes of practice, ambient air quality guidelines, new source performance standards
Economic Instruments	User charges, green taxes, tradable permits, deposit refund schemes, liability and insurance schemes, tax incentives, subsidies
Programs	Pollution prevention planning, education & outreach
Agreements	Covenants, memorandum of understanding, letters of agreement, inter-jurisdictional agreements, international agreements
Targets and Objectives	Provincial/territorial emission targets, national or regional targets in international agreements, source region or pollutant management area emission targets, sectoral targets
Incentives/ Disincentives	Recognition/award programs, enhanced performance programs
Municipal or Regional Planning Approaches	Zoning, urban and transportation planning
Other Initiatives	Voluntary reduction programs, environmental management systems, employee education & awareness programs, commuter programs

Certain kinds of emission sources are typically dealt with through regulation (e.g. federal regulations for vehicles, engines and fuels). Emissions from large stationary sources are typically dealt with by use of provincial/territorial operating permits, but may also be dealt with by federal or provincial/territorial regulation, or by memorandum of understanding or letter of agreement between one or more levels of government and industry.

Specific Tools and Mechanisms

NATIONAL LEVEL

CCME Codes and Guidelines for Reducing VOC Emissions

Environmental Codes of Practice for:
- Vapor Recovery in Gasoline Distribution Networks
- Measurement and Control of Fugitive VOC Emissions from Equipment Leaks
- Reduction of Solvent Emissions from Dry Cleaning Facilities
- Reduction of Solvent Emissions from Industrial Degreasing Facilities
- Reduction of VOC Emissions from the Commercial/Industrial Printing Industry
- Light Duty Motor Vehicle Emission Inspection and Maintenance Programs - 2nd edition
- On-Road Heavy-Duty Vehicle Emission Inspection and Maintenance Programs

Environmental Guidelines for:
- Control of VOC Emissions from New Organic Chemical Plant Operations
- Controlling Emissions of VOCs from Aboveground Storage Tanks
- Reduction of VOC Emissions from the Plastics Processing Industry

National Standards for:
- VOC Content of Canadian Commercial/Industrial Surface Coating Products – Automotive Refinishing
- Reduction of VOC Emissions from Canadian Commercial/Industrial Surface Coating Operations

Standards and Guidelines for Reduction of VOC Emissions from:
- Canadian Industrial Maintenance Coatings (IMC)
- Canadian Wood Coating Operations
- Canadian Automotive Parts Coatings Operations

MOU between CCME, Environment Canada and the Canadian Paint and Coatings Association (CPCA) Respecting the Annual Reporting of the Volume of VOCs Contained in Consumer Paint Sold in Canada

New Source Performance Standards (NSPS) and Guidelines for the Reduction of VOC Emissions from Canadian Automotive Original Equipment Manufacturing (OEM) Coating Facilities

CCME Codes and Guidelines for Reducing NOx Emissions

National Emission Guidelines for:
- Commercial/Industrial Boilers and Heaters
- Cement Kilns

- Stationary Combustion Turbines

Other CCME Initiatives
- National Inventories and Forecasts for Criteria Air Contaminants
- Canada-wide Standard for Benzene
- Canada-wide Standard for Mercury
- Canada-wide Acid Rain Strategy for Post-2000
- National Framework for Petroleum Refinery Emissions Reductions

Multi-Pollutant Emission Reduction Analysis Foundation (MERAF) Reports for Selected Industrial Sectors
- Iron and Steel
- Pulp and Paper
- Lumber and Allied Wood Products
- Base Metal Smelters
- Concrete Plants
- Asphalt Plants

FEDERAL LEVEL

Federal Agenda for Vehicles, Fuels and Engines:

- Regulations for On-Road Vehicles and Engines, aligned with the United States
- Code of Practice for Heavy Duty Vehicle Inspection and Maintenance Programs
- Regulations for Off-Road Vehicles and Engines, aligned with the United States
- Policy to align Canadian fuel requirements with those of the United States, taken into consideration those of the European Union
- Regulation for Sulphur in Diesel Fuel, aligned with the United States
- Future Standards for Fuel Oils to align with the European Union
- Analysis and possible action on additional controls for gasoline quality, specifically emissions of toxic substances from vehicles and use of deposit control additives

Other Federal Measures/Instruments for Vehicles, Fuels and Engines

- Gasoline and Gasoline Blend Dispensing Flow Rate Regulations
- Sulphur in Gasoline regulations
- Benzene in Gasoline Regulations

Federal Agenda for Reducing Emissions of Volatile Organic Compounds (VOCs) from Consumer and Commercial Products:

- CEPA Regulations limiting the VOC content of:
  - Consumer Products
  - Architectural and Industrial Maintenance Coatings

- Environmental Performance Agreements (EPAs) for selected solvent use sectors
- 2002 Canadian Environmental Protection Act (CEPA) Guideline for Consumer Products
- Proposed CEPA Regulation to Control the Quantities of Trichloroethylene (TCE) and Tetrachloroethylene (also known as perchloroethylene and commonly referred to as PERC) Used in Solvent Degreasing Operations
- Proposed CEPA Regulation to Control the Quantities of Tetrachloroethylene (PERC) Used in Dry Cleaning Operations

Other Federal Measures/Instruments and Programs

- National Pollutant Release Inventory (NPRI)
- CEPA Guidelines for Fossil-Fueled Electric Power
- Environmental Performance Agreements (EPAs) and economic instruments
- NRC's Burn-it-Smart public education campaign on better woodstove
- Commitments to emission reduction, transboundary notification and assessment, and visibility protection programs in the Canada-U.S. Air Quality Agreement and its Ozone Annex
- Transboundary PM Assessment initiatives to support a possible PM Annex to the Canada-U.S. Air Quality Agreement

PROVINCIAL/TERRITORIAL LEVEL

There are many examples of provincial and territorial initiatives that could be useful to other jurisdictions as they design and implement their CI/KCAC programs. Examples include:

- SO_2 emission caps or limits under the Canada-wide Acid Rain Strategy for Post-2000
- best available technology requirements for new sources, modifications to existing sources, and permits renewals
- airshed-specific emission controls (e.g. New Brunswick's Air Quality Regulation which imposes a stricter ambient standard for sulphur dioxide in three counties in southern New Brunswick)
- episode response plans where industry is required to take actions (e.g. fuel switching) to control emissions to prevent air quality deterioration (e.g. industry in east Saint John)
- limits on prescribed open burning to coincide with times when pollutants are forecast to be effectively dispersed
- source emission testing, facility emissions profiling, and dispersion modeling prediction in support of operating approvals and renewals
- operating permits containing emission limits for stationary emission sources

Some jurisdictions have specific emission management initiatives underway that contribute to CI/KCAC, including:

Quebec and the Atlantic Provinces

- New England Governors/Eastern Canadian Premiers forum: emission reduction commitments

Quebec

- Air Quality Regulation (Projet de règlement modifiant le règlement sur la qualité de l'atmosphère (PRMRQA)) : Standards for degreasing foams, adhesives, cleaners, pharmaceuticals, aircraft cleaning, dry cleaning, and other solvent use activities

New Brunswick

- *NB Reg. 97-133*: Regulated sulphur content in fuels
- *NB Reg. 97-133*: Regulated air quality standards
- *NB Reg. 97-133*: Regulated vapor pressure of gasoline
- *NB Reg. 97-133*: Maximum 5 year renewal cycle for approvals
- *NB Reg. 97-133*: Smoke density standards
- Policy on Open Burning: Prohibited materials in open burning

Ontario

- *O. Reg. 397/01*: SO_2 and NOx emissions trading regulation
- *(O. Reg. 346/90)*General Air Pollution Regulation, Point of Impingement Standards, Point of Impingement Guidelines, and Ambient Air Quality Criteria (AAQC): emission standards and management
- (*O. Reg. 361/98*) Drive Clean: vehicle inspection and maintenance program to reduce NOx, SO_2, VOC and $PM_{2.5}$ emissions
- (*O. Reg. 397/01*): NOx and SO2 emissions caps from Ontario Power Generation's (OPG) fossil plants and electricity sector
- (*O. Reg. 271/91*): limit and reduce VOC emissions from gasoline
- (*O. Reg. 212/02*) Sulphur Levels in Gasoline Reporting Regulation: manufacturers, blenders and importers must report the average sulphur content in gasoline
- (*O. Reg. 345/94)*: recovery of Gasoline Vapors in Bulk Terminals
- *Smog Alert: A Municipal Response Guide*: provides municipalities and the public with a list of best municipal practices on how to take actions during a smog alert
- Guideline A-9: NOx emission limit on new or modified large boilers and heaters in industrial installations
- *Atmospheric Emissions from Stationary Combustion Turbines*: requires NOx emission limits for new combustion turbines

Alberta

- Report and Recommendations for the Upstream Petroleum Industry by the Flaring / Venting Project Team, Clean Air Strategic Alliance, June 2002: Use of decision trees to reduce gas flaring and venting
- Alberta Energy and Utilities Board Guide 60: Upstream Petroleum Industry Flaring Guide
- Alberta Energy and Utilities Board Sulphur Recovery Guidelines
- Alberta Environment: Alberta Ambient Air Quality Objectives
- Guidance Document for the Management of Fine Particulate Matter and Ozone in Alberta, Clean Air Strategic Alliance, Particulate Matter and Ozone Project Team, September, 2003: Provincial Emission and Sectoral Targets and Objectives
- Alberta Environment Codes of Practice: for Compressor and Pumping Stations, Sweet Gas Processing Plants, Foundries, Concrete Producing Plants, and Asphalt Paving Plants

British Columbia

- 1997 Asphalt Plant Regulation under B.C.'s Waste Management Act: provision inhibiting summertime use of cutback asphalt
- AirCare On Road Program: heavy-duty vehicle testing to reduce emissions from diesel buses and trucks
- Solid Fuel Domestic Appliance Regulation: particulate emission limits, and labeling and testing requirements for new solid fuel (wood) stoves, fireplace inserts and factory-built fireplaces (http://www.qp.gov.bc.ca/statreg/reg/e/envmgmt/302%5F94.htm)
- Open Burning Smoke Control Regulation: to control open burning of land-clearing debris (http://www.qp.gov.bc.ca/statreg/reg/e/envmgmt/145%5F93.htm)
- Tax exemptions to encourage use of alternative fuels or alternative-fuelled vehicles (http://www.sbr.gov.bc.ca/CTB/publications/bulletins/sst_085.pdf)
- Rebates to encourage voluntary scrapping of older vehicles (www.scrapit.ca)

REGIONAL/MUNICIPAL

There are many examples of initiatives at the regional/municipal level that are aimed at reducing emission of pollutants that contribute to PM and ozone, such as:

- Montreal Metro Community (MMC) emission reduction requirements under its Bylaw 90
- Greater Vancouver Regional District (GVRD) permits for numerous sectors, e.g.:
  - cabinet manufacturing plants
  - furniture manufacturing plants
  - polyurethane foam manufacturing
  - metal container manufacturing plants
  - aerospace component manufacturing facilities
  - auto dewaxing/body shops
  - web press printing
  - emulsion/special asphalt products
  - boat manufacturing plants

  - custom refinishing and restoration plants
  - industrial rubber rebuilding plants
  - wood preservation facilities
  - industrial laundry facilities
- GVRD emission regulations for some sectors, e.g.
  - automotive refinishing
  - reinforced plastics
  - composites industries
- AirCare light-duty vehicle inspection and maintenance program initiated by the province of BC and GVRD (http://www.aircare.ca)
- City of Prince George 2001 Clean Air Bylaw prohibits residential woodstove use during air quality advisories, except where no other heating options exist http://www.city.pg.bc.ca/city_services/cpd/building_permit/circular_woodstove_policy_new_installations.pdf
- British Columbia model municipal bylaw for regulating residential backyard burning http://www.env.gov.bc.ca/air/particulates/pdfs/bylaw.pdf
- Regional District of Central Okanagan Bylaw No. 773 (http://www.regionaldistrict.com/departments/inspections/inspections_smokectrl.aspx) : regulates open burning to control uncontrolled fires and smoke
- Woodstove exchange programs in BC communities to provide users of old woodstoves with rebates to purchase new U.S. EPA emissions certified woodstoves that produce fewer emissions. http://www.cleanairplan.ca/html/stoveexchange2007.htm; http://stoveexchange.com/; http://www.woodheat.org/changeout/BCchangeout.htm

OTHER SOURCES OF INFORMATION

Other information sources that may be useful to jurisdictions in implementing their CI/KCAC programs include:

- Technology clearing houses (e.g. U.S. EPA's RACT/BACT/LAER Clearing House at http://www.epa.gov/ttn/catc/)
- Technology costing data bases and methodologies (e.g. U.S. EPA Air Pollution Control Cost manual at http://www.epa.gov/ttn/catc/dir1/cost_toc.pdf)
- Technologies recently installed on new facilities (e.g. technologies installed as a result of New Source Review (NSR) in the U.S. at http://www.epa.gov/air/nsr/)
- Appendices K & J of Alberta Multi-Stakeholder Group for PM & Ozone, Report to Alberta Environment, 1999 available at http://www.casahome.org/wp-content/uploads/2006/10/MSG_final_report.pdf.