Central Okanagan
Air Quality Management Plan

REGIONAL DISTRICT of CENTRAL OKANAGAN

City of Kelowna

PEACHLAND ON THE LAKE

DISTRICT of LAKE COUNTRY

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EXECUTIVE SUMMARY

This Air Quality Management Plan (AQMP) provides a management framework to maintain and improve air quality within the Regional District of Central Okanagan (RDCO). With its adoption by the Regional Board and the Councils of Kelowna, Peachland and Lake Country the AQMP outlines future direction for policies and actions over the next five to ten years, taking into account the most recent trends, issues, priorities and community input. Implementation of strategies will remain flexible and responsive to financial partnerships, to new program opportunities, to changing public priorities, or to the results of research activities.

The AQMP was developed by the Regional Air Quality Committee through public dialogue and in consultation with representatives from provincial and federal agencies, public health, municipal managers and politicians. Key agencies involved in the process included the Ministry of Environment, Environment Canada, Interior Health Authority, Ministry of Agriculture, Ministry of Transportation, Health Canada and the BC Lung Association. This AQMP builds on the success of the 'Regional Growth Strategy Air Quality Discussion Paper, Planning for the Future' developed in 2001, which has guided regional efforts to improve air quality over the past six years.

To achieve air quality improvements will require continued efforts to reduce contaminant emissions. This goal presents an ongoing challenge to air quality managers, as the Central Okanagan region is projected to experience high population growth in future years.

To improve air quality in the Central Okanagan, emissions reductions will need to come from all sectors. The AQMP identifies actions that will result in improved air quality and significant societal benefits.

The key policies and actions for achieving the AQMP goals are broken down into the following strategies:

1. **Reduce emissions from major regional sources**
2. **Enhance air quality information and public awareness**
3. **Facilitate air quality research to achieve air quality goals**

The actions under each strategy will be prioritized based on their potential to reduce public exposure to pollutants that pose the highest risk to human health. Cost-effectiveness, technical feasibility, community and other concerns will be considered as actions are further refined and implemented.

Most of the strategies described in the AQMP have already been implemented to some degree; however, opportunities still exist to improve upon those strategies, which could reduce contaminant emissions further. Those strategies that have not been implemented are expected to be undertaken within the next 2 to 3 years. It is anticipated that annual costs to implement the AQMP will stay within current Air Quality Program budget levels. Strategies that could increase the Air Quality Program budget would not be implemented unless financial and staff support from senior levels of government could offset that cost. The AQMP will be implemented through an annual priority setting process and annual budgets as directed through the Regional Air Quality Committee and Regional District Board.

GLOSSARY OF ACRONYMS

Note: Glossary of Air Quality Terms is found in the Appendix

AQMP - Air Quality Management Plan
CWS - Canada Wide Standards
CH_4 - methane, a greenhouse gas
CO - carbon monoxide
CO_2 - carbon dioxide, a greenhouse gas
CACs - criteria air contaminants: CO, VOCs, NOx, SOx and PM
GHG - greenhouse gases: CO_2, CH_4 and N_2O
RDCO - Regional District of Central Okanagan
HAPs - hazardous air pollutants
N_2O - nitrous oxide, a greenhouse gas
NH_3 - ammonia
NO - nitric oxide
NO_2 - nitrogen dioxide
NOx - oxides of nitrogen: NO plus NO_2
PM - particulate matter
PM_{10} - inhalable particulate matter, particles less than 10 microns in diameter
$PM_{2.5}$ - fine particulate matter, particles less than 2.5 microns in diameter
PPB - parts per billion
SOx - oxides of sulphur, mostly sulphur dioxide (SO_2)
µg - microgram, a metric unit of mass
VOCs - volatile organic compounds
MoE - British Columbia's Ministry of Environment

1.0 INTRODUCTION

An Air Quality Management Plan (AQMP) sets strategic directions and formalizes policies and actions that will provide health, economic and environmental benefits for the region. This Air Quality Management Plan takes a long-term view to ensure that clean air will still be available for future generations within the Regional District of Central Okanagan (RDCO).

Development of the Plan

Air quality management planning in the Central Okanagan began with the formation of the Central Okanagan Regional Air Quality Committee in 1998. Consisting of a group of elected officials from municipalities and areas of the Central Okanagan Regional District, the Committee fulfills an air quality monitoring and education/public awareness and advocacy function. Through public input and with provincial and federal staff encouragement, the Committee has been "charged with the development and implementation of Air Quality Management Plans for the Regional District of Central Okanagan subject to Regional Board approval."

This AQMP was developed by the Regional Air Quality Committee through public dialogue and in consultation with representatives from provincial and federal agencies, public health, municipal managers and politicians. Key agencies involved in the process included the Ministry of Environment, Environment Canada, Interior Health Authority, Ministry of Agriculture, Ministry of Transportation, Health Canada and the BC Lung Association. This AQMP builds on the success of the 'Regional Growth Strategy Air Quality Discussion Paper, Planning for the Future' developed in 2001, which has guided regional efforts to improve air quality over the past six years.

With its adoption by the Regional Board and the Councils of Kelowna, Peachland and Lake Country the new AQMP outlines future direction for policies and actions over the next five to ten years, taking into account the most recent trends, issues, priorities and community input. The AQMP will be implemented through an annual priority setting process and annual budgets as directed through the Regional Air Quality Committee and Regional District Board.

Sustainability and the Air Quality Management Plan

The AQMP provides a management framework to maintain and improve air quality in the region. Predicted changes in our society, economy and environment have the potential to degrade the quality of the Central Okanagan's air. Although the Central Okanagan currently experiences good regional air quality relative to most other urban areas, emissions of some air contaminants – such as particulate matter and ozone forming gases – are forecast to increase as a result of predicted growth in population, trade and transportation. The AQMP will contribute to creating a more sustainable region by reducing emissions from human activities.

Actions that reduce emissions of criteria air contaminants and increase energy efficiency will be the most sustainable. Greater reliance on renewable energy sources and technologies with low or no emissions will directly benefit public health, the environment, tourism and agriculture. A shift towards a less energy intensive region will be necessary in the long-term. In the short-term, emission reductions and associated benefits such as greenhouse gas reduction can be achieved by adopting more efficient operating practices, and using cleaner fuels and emission control technologies to make combustion as clean and efficient as possible. The costs of implementing emission reduction strategies will be somewhat offset as a result of reduced energy consumption.

Links between the Air Quality Management Plan and other Regional Plans

The AQMP is linked to other plans to achieve success such as the Regional Growth Management Strategy, the Regional Transportation Plan, the Transportation Demand Management Strategy, the Smart Transit Plan, the Regional Environmental Protection Strategy, the Regional Solid Waste Management Plan, the Regional Parks Greenways Plan, the City of Kelowna Strategic Plan and the Official Community Plans of Kelowna, Peachland and Lake Country.

Economic Benefits

Review of data from the Ministry of Environment (MoE) monitoring site in Kelowna reveals that the Central Okanagan region is currently meeting the Canada Wide Standards (CWS) metric for particulate matter (PM) and ozone. However, as there is no safe level of exposure to these two air pollutants, and acceptable threshold levels have not been conclusively established, continuous efforts to improve air quality are desirable.

There are known health and other impacts associated with PM and ozone. Consequently, improvements in these two contaminant concentrations provide social benefits. A study of 'Health Effects and Benefits Estimates' completed by Environment Canada in 2006 demonstrates that even small improvements in air quality ($PM_{2.5}$ and ozone) will yield substantial economic benefits. For the Regional District of Central Okanagan the quantifiable annual benefits estimates associated with a 10% improvement in $PM_{2.5}$ and ozone are $16,646,630 for $PM_{2.5}$ and $1,833,540 for ozone. The monetary benefits were determined using the following health endpoints in the analysis: *mortality and morbidity (i.e.: adult chronic bronchitis, respiratory hospital admissions, cardiac hospital admissions, emergency room visits, child bronchitis, asthma symptom days, restricted activity days, minor restricted activity days, and acute respiratory symptom days).* Household materials soiling estimates were also included in the analysis.

Additional unquantifiable benefits also exist when air quality improves – including impacts on tourism and on local area residents associated with visibility improvements, adverse effects on important local agricultural crop yields (particularly tree fruits and grapes), impacts to forestry, impacts on wildlife health (implications for bio-diversity, hunting, and non-use values), eco-system impacts, deposition/soiling effects to commercial enterprises, and other effects that are difficult to quantify (including long-term cancer risk associated with toxic air pollutants) that may be substantial.

It is known that the costs of measures to improve air quality vary substantially. Although a comprehensive examination of the costs associated with various emissions reduction measures within the Central Okanagan region has not been evaluated, some measures are low cost and are easily implemented. Examples of relatively low cost measures include those associated with transportation demand management, smart growth/urban planning, burn control programs, and effective agricultural practices. Many of these programs are already in place within the region such as the Great Okanagan Wood Stove Change out Program, Wood Stove Nuisance Bylaw, Land Clearing and Backyard Burning Ban, Agricultural Chipping Program, Open Burning Education Program, Go Green Commuter Challenge, Bike to Work Week and the Walk and Roll Car Free Day. Examples of high cost measures include mandatory vehicle emissions testing or transit and road improvements (i.e.: transit exchanges/park and rides, bus rapid transit, intelligent transit exchanges, high occupancy vehicle lanes, walking and bike paths). The low cost, easily implemented emissions reduction cost measures should receive the highest priority.

Vision for a Sustainable Future

Social, economic and environmental sustainability is a fundamental objective of the RDCO, from the corporate level through to the service delivery mandates, and from the various management plans to partnerships with external agencies for actions beyond the RDCO mandates.

The AQMP will contribute to a sustainable region by providing:

Clean and healthy air for current and future generations.

Goals of the Air Quality Management Plan

Within the Central Okanagan Region, air quality management activities are directed at achieving the following goals.

- **Ensure that citizens in the Central Okanagan have healthy air to breathe, by meeting /exceeding Canada Wide Standards and Provincial air quality objectives.**
- **Ensure continuous improvement in air quality throughout the community/region.**
- **Educate and inform communities on air quality issues, especially the connection between air quality and health.**
- **Lead by example and bring about changes in behaviour as needed to protect air quality.**
- **Integrate regional air quality goals into all policies (i.e. land use planning, transportation planning, greenhouse gas management and energy management).**
- **Facilitate cooperation with all levels of government for continued comprehensive monitoring of air quality.**
- **Harmonize regional air quality initiatives with the objectives of other agencies and all levels of government.**

The key strategies and actions to achieve the goals of the AQMP are set out in Section 3.

2.0 AIR QUALITY IN THE CENTRAL OKANAGAN

The Central Okanagan's air quality compares favourably to that of other similar sized Canadian cities. However, we still do not meet our ambient air quality objectives all of the time. Air quality monitoring in the Central Okanagan reveals that of the six air pollutants measured; only particulate matter exceeded provincial air quality objectives.

Main Pollutants

What are the main pollutants? The two air pollutants of greatest concern in the Central Okanagan are Particulate Matter (PM) and Ozone (O3), because they are widespread and can have serious impacts on our health and environment. There are also several other pollutants to be concerned about, which are described in Table 1.

Table 1

	Description and Sources		Health Impact	Environment
Particulate Matter (PM) **Dust, soot, and tiny bits of solid and liquid material.**	**PM10 – Particles smaller than 10 micro-meters (µm) in diameter***	• Road dust; road construction • Mixing and applying fertilizers/ pesticides • Forest fires	• Coarse particles irritate the nose and throat, but do not normally penetrate deep into the lungs.	• PM is the main source of haze that reduces visibility. • It takes hours to days for PM10 to settle out of the air. • Because they are so small, PM2.5 stays in the air much longer than PM10, taking days to weeks to be removed.
	PM2.5 – Particles smaller than 2.5 micro-meters (µm) in diameter	• Combustion (motor vehicles, woodstoves and fireplaces) • Industrial activity • Garbage incineration • Agricultural burning	• Fine particles enter the lungs, making it difficult to breathe, and lead to diseases such as bronchitis. Depending on the source and chemical composition of the fine particles, effects can be severe enough to contribute to respiratory and cardiovascular disease and premature death in vulnerable individuals. • PM2.5 is the worst public health problem from air pollution in BC. (Research indicates the number of hospital visits increases on days with increased PM levels).	

Ground level Ozone (O3) **Bluish gas with a pungent odour**	• At ground level, ozone is formed by chemical reactions between Volatile Organic Compounds (VOCs) and Nitrogen Dioxide (NO2) in the presence of sunlight. • VOCs and NO2 are released by burning coal, gasoline, and other fuels; and naturally by plants and trees (e.g. the smell from evergreen sap/needles).	• Exposure for 6-7 hours, even at low concentrations, significantly reduces lung function and causes respiratory inflammation in healthy people during periods of moderate exercise. Can be accompanied by symptoms such as chest pain, coughing, nausea, and pulmonary congestion. Impacts on individuals with pre-existing heart or respiratory conditions can be very serious. • Ozone exposure can contribute to asthma, and reduced resistance to colds and other infections.	• Ozone can damage plants and trees, leading to reduced yields. • Leads to lung and respiratory damage in animals. • Ozone occurs naturally high above the Earth (in the stratosphere) where it protects us from harmful ultra-violet rays.
Other Pollutants	SO2 – Sulphur dioxide; CO – Carbon monoxide; NO2 – Nitrogen dioxide; VOCs – Volatile organic compounds; POPs – Persistent organic pollutants; Pb – Lead Most of these come from combustion and industrial processes or the evaporation of paints and common chemical products.	The health impacts of these pollutants are varied.	While some of these pollutants have local impact on the environment (e.g. Pb) or are relatively short lived (NO2) some are long lived (POPs) and can travel the world on wind currents in the upper atmosphere.

*Far too small to see—1/8th the width of a human hair.

(Source: MoE, 2005)

Ambient Air Quality Objectives

The Ambient Air Quality Objectives (AAQOs) in Table 2 are based on current knowledge about air quality and health science. The intent of the AQMP is that air quality throughout the Central Okanagan will meet these AAQOs, recognizing that they may not be achieved for brief periods during natural events such as forest fires. The AAQOs will be used to formulate an integrated management program comprised of, but not limited to, the following components:

- Long-term surveillance monitoring
- Reporting on the quality of the air
- One of several decision factors in permit evaluation and regulation development
- One of several decision factors in determining the need for and developing air quality management programs for area and mobile sources.

In accordance with the continuous improvement provision of the Canada-wide Standards, the AAQOs are medium-term, health-based objectives and a step towards the lowest observable effects levels.

Ambient Air Quality Objectives for British Columbia and Canada (micrograms/m^3)

Table 2

Air Contaminant	Averaging Time	Ambient Air Quality Objectives [micrograms/m^3 (µg/m^3)]
Fine particulate matter ($PM_{2.5}$)	*24 hour (Canada Wide Standards)	30
Inhalable particulate matter (PM_{10})	24 hour (B.C. Level A)	25
	24 hour (B.C. Level B)	50
	24 hour (B.C. Level C)	100
Ozone	**8 hour daily maximum (Canada Wide Standards)	130
Carbon monoxide	1 hour (B.C. Level B)	28000
	8 hour (B.C. Level B)	11000
Nitrogen dioxide	1 hour (Canada Maximum Acceptable)	400
	24 hour (Canada Maximum Acceptable)	200
Sulphur dioxide	1 hour (B.C. Level B)	900
	24 hour (B.C. Level B)	260

- based on annual 98th percentile value, averaged over 3 consecutive years;
- ** based on 4th highest annual value, averaged over 3 consecutive years

(Source: MoE, 2007)

Objectives for $PM_{2.5}$ and Ozone - Canada Wide Standards (CWS)

The Canada Wide Standards (CWS) for particulate matter ($PM_{2.5}$) and ground level ozone were endorsed by the Canadian Council of Ministers for the Environment (CCME) (including the BC Ministry of Environment, federal, provincial and territorial governments) in June 2000. The numeric targets and the established time-frames for attaining the standard for ground level ozone and particulate matter ($PM_{2.5}$) are summarized below.

Ground Level Ozone Concentration
Based on an 8 hour averaging time – the fourth highest measurement annually, averaged over 3 consecutive years, is not to exceed 65 ppb (130 micrograms/$\mathbf{m^3}$), by the year 2010.

Particulate Matter ($PM_{2.5}$)
Based on 24 hour averaging time – the 98th percentile ambient measurement annually, averaged over 3 consecutive years is not to exceed 30 micrograms/$\mathbf{m^3}$ by the year 2010.

In recognition for the lack of threshold levels for PM and Ozone, the CWS also contained a stipulation for "keeping clean areas clean" and "continuous improvements" in areas that are already meeting the standards. Since the Central Okanagan meets the CWS standards for $PM_{2.5}$ and ozone, the goal of this AQMP is to strive for continuous air quality improvement.

Objectives for PM_{10} – BC Ministry of Environment

Recognizing the threat that PM_{10} poses to human health, the Ministry of Environment has established an air quality objective of 50 micrograms/m^3 (24-hour average). The selection of this number was based on the findings by Vedal (1993) on the effects of wood smoke in B.C. Vedal found that each 50 micrograms/m^3 increment in PM_{10} was associated with an increase in health effects ranging from respiratory symptoms to death. Exceedances of the air quality objective indicate reduced protection against associated health effects. Hence, one measure of PM_{10} air quality is the number or frequency of exceedances of the air quality objective.

Air quality objectives for PM_{10} and other common contaminants also form the basis of the Air Quality Index (AQI). The AQI is a scale used in parts of the province and elsewhere to determine if air quality is "good", "fair", "poor" or "very poor". At sites where numerous contaminants are monitored, the AQI reflects the concentration of the contaminant that is highest compared to its respective air quality objective. Where PM_{10} is the contaminant of concern, air quality can be described as shown in Table 3. Exceedances of the air quality objective for PM_{10} indicate that air quality may be poor or very poor.

Description of the air quality index, based on PM_{10} measurements:

Table 3

Air Quality Descriptor	Air Quality Index	PM_{10} Concentration (24-hour average) [micrograms/m^3 (µg/m^3)]
good	< or = 25	< or = 25
fair	26-50	26-50
poor	51-100	51-100
very poor	> 100	> 100

(Source: MoE, 2007)

Air Quality Trends

The following graphs show trends of PM_{10}, $PM_{2.5}$ and ozone compared to the provincial and Canada Wide Standards (CWS) for those contaminants.

PM_{10} - particles less than 10 microns in diameter

PM_{10} has been continuously measured by the Ministry of Environment (MoE) in the Central Okanagan since 1994. There is one MoE monitoring site located at the Okanagan College campus on KLO Road in Kelowna. Average data is recorded hourly in the same manner as $PM_{2.5}$.

Dust from road traction materials, wind blown soils and smoke from burning are major contributing sources that cause PM_{10} concentrations to increase. Figure 1 illustrates the history of hours per year that PM_{10} degraded air quality into the fair (>25 micrograms/m^3), poor (>50 micrograms/m^3), and very poor (>100 micrograms/m^3) range.

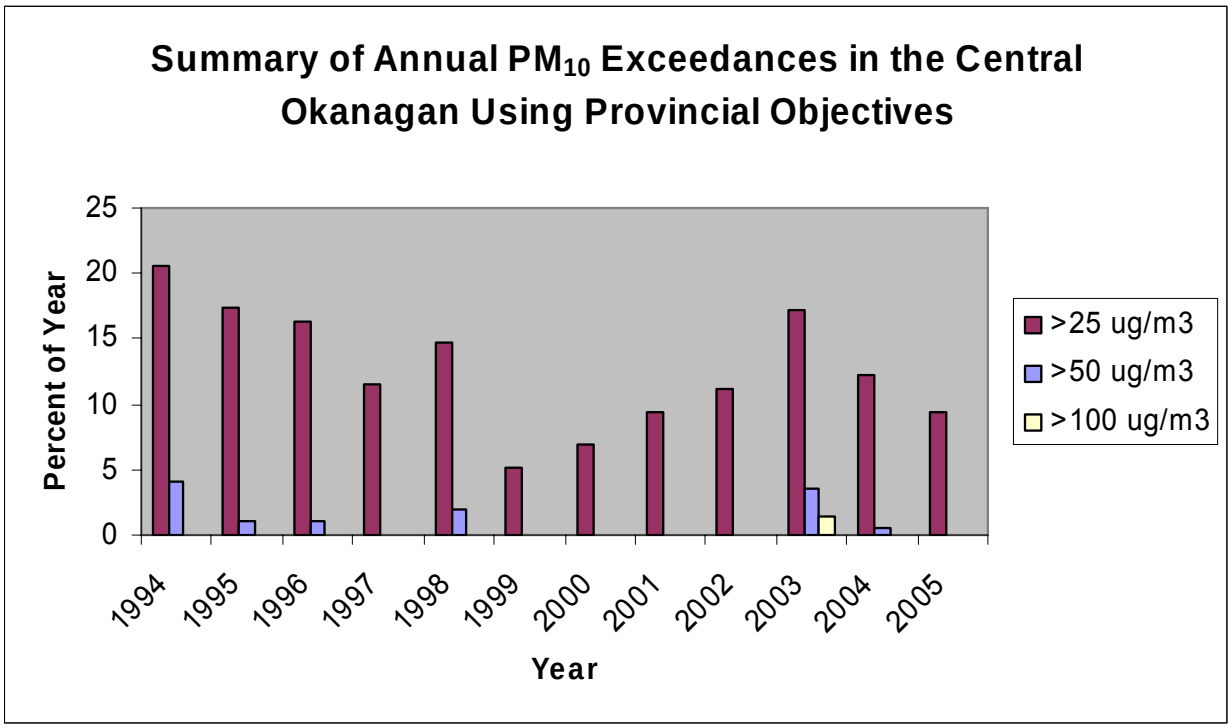

Figure 1 (Source: MoE, 2006)

Over short periods of time, (i.e. individual years) various events such as stagnant weather conditions and forest fires will significantly influence the ambient air quality of a particular year. This was particularly evident in 2003 when the Okanagan Mountain Park forest fire caused the only poor air quality of the year, as well as contributing to a 58% increase over the number of fair air quality hours recorded in 2002.

$PM_{2.5}$ - particles less than 2.5 microns in diameter

$PM_{2.5}$ has been continuously measured by the Ministry of Environment (MoE) in the Central Okanagan since 1997. There is one MoE monitoring site located at the Okanagan College campus on KLO Road in Kelowna. Average data is recorded hourly in the same manner as $PM_{10.}$

Smoke from burning, vehicle exhaust and smoke from industry are major contributing sources that cause $PM_{2.5}$ concentrations to increase. Figure 2 illustrates $PM_{2.5}$ measurements from the MoE monitoring site in Kelowna compared to the Canada Wide Standard (CWS) for $PM_{2.5}$. The CWS system uses the three-year running average based on annual 98th percentile values.

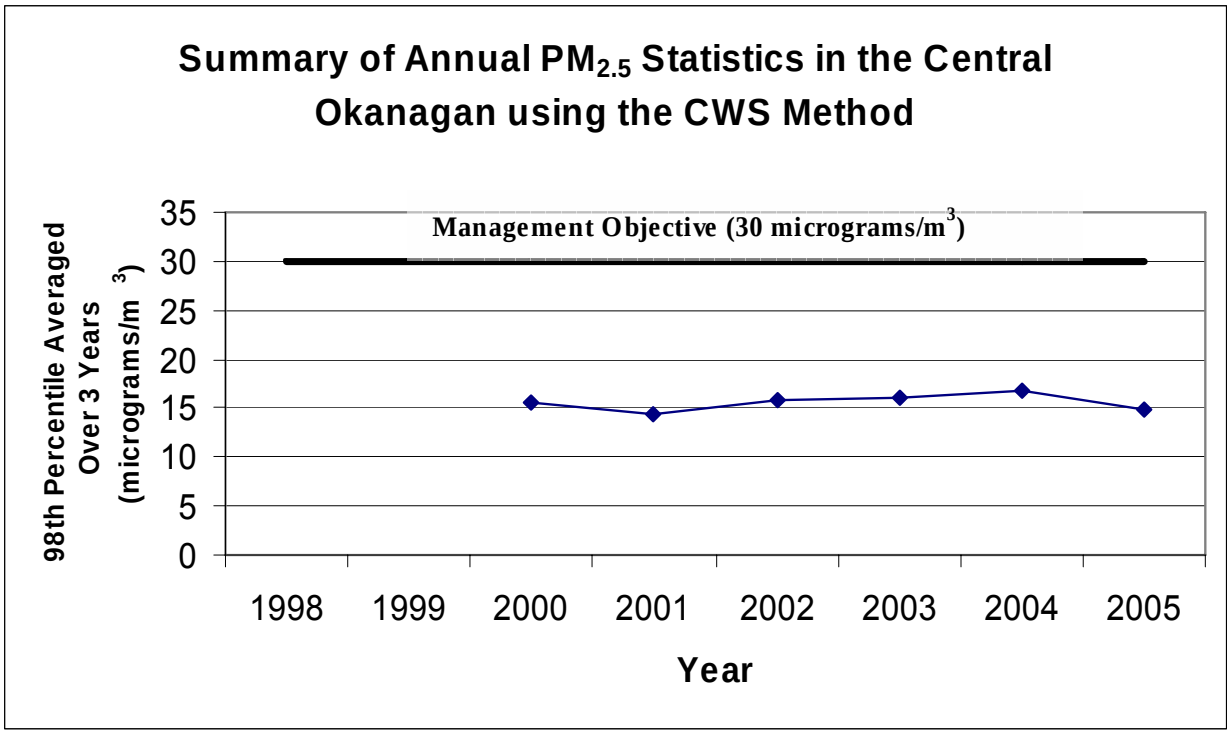

Figure 2 (Source: MoE, 2006)

Kelowna experienced very high $PM_{2.5}$ concentrations from nearby wildfires during the period July 15 to September 15, 2003. The CWS requires that smoke from nearby wildfires be considered in determining the CWS metric for $PM_{2.5}$. This was done by replacing the $PM_{2.5}$ hourly data in Kelowna from July 15 to September 15 2003 with that from the same time period in 2002 when calculating the 98th percentile and the CWS metric for $PM_{2.5}$.

PM_{10} and $PM_{2.5}$ Median Daily Concentrations

Figure 3 illustrates the trend in the median daily concentrations taken for PM_{10} and $PM_{2.5}$ at the Ministry of Environment monitoring site located at the Okanagan College campus on KLO Road in Kelowna.

For $PM_{2.5}$, median daily concentrations dropped most dramatically in the Central Okanagan from 1998 to 1999 but have stayed relatively unchanged since then, though the lowest median concentration for the period of record was in 2005. In 1998, the addition of the Smoke Control Bylaw and the Venting Index played a significant role in reducing the median daily concentrations of $PM_{2.5}$ in the Central Okanagan. Implementation of burning bans/regulations and public education also contributed to reducing $PM_{2.5}$ levels.

For PM_{10}, median daily concentrations have remained essentially unchanged since 1996. The number of "poor" PM_{10} air quality episodes (where daily concentrations were above 50 micrograms/m^3) has remained relatively unchanged since 1999 except for the extreme wildfire year of 2003.

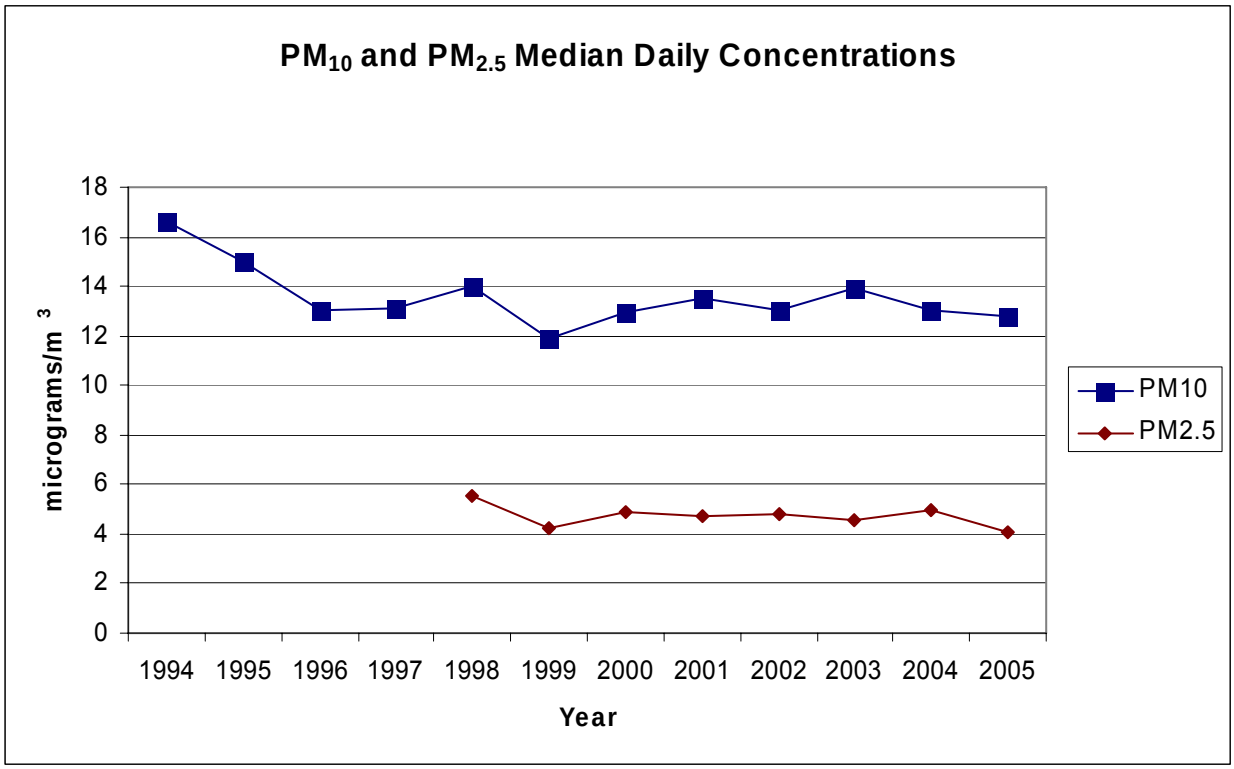

Figure 3 (Source: MoE, 2006)

Ozone

An abundance of intense sunlight hours and low wind speeds are common during the summer months in the Central Okanagan. These factors create ideal conditions for ground level ozone formation. Various emissions caused by human activity and natural sources such as coniferous forests can become trapped in the valley and contribute to elevated ozone levels during hot, sunny and stagnant weather conditions.

Figure 4 illustrates ozone measurements from the Ministry of Environment monitoring site located at the Okanagan College campus on KLO Road in Kelowna compared to the Canada Wide Standard (CWS) for ozone. The CWS system uses the three-year running average of the 4th highest annual daily maximum 8-hour average.

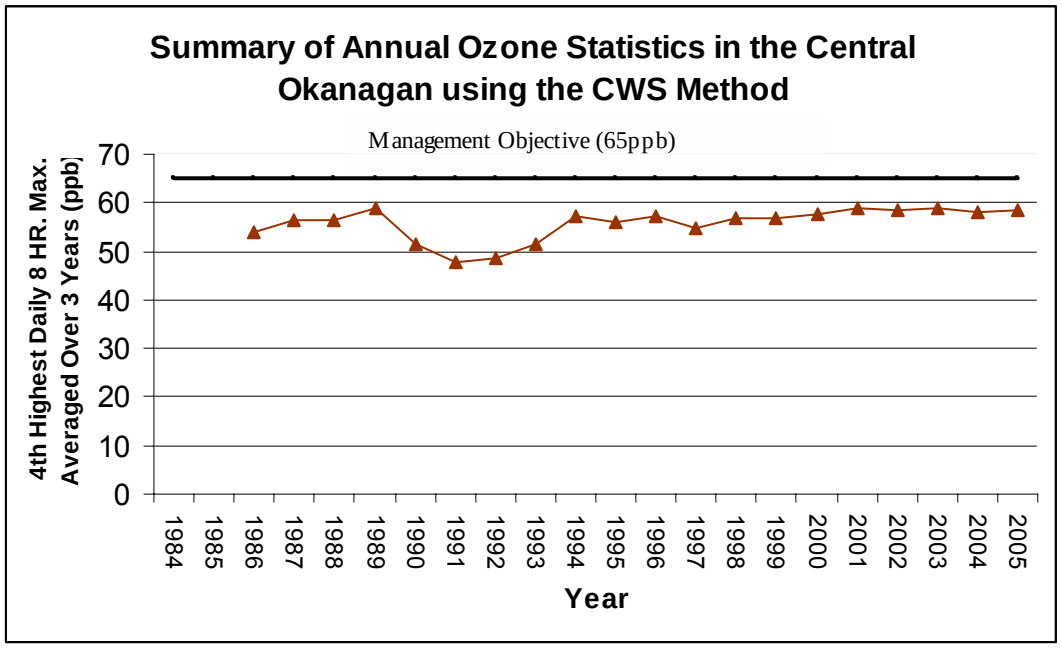

Figure 4 (Source: MoE, 2006)

20 years of continuous monitoring of ozone in the Central Okanagan has shown that concentrations are not increasing. This suggests that a large majority of the ozone formation in the valley is likely natural in origin.

Although there have been no exceedances of the Canada Wide Standards (CWS) for ozone and $PM_{2.5}$ at the Central Okanagan monitoring site over the historical record, due to the nature of the standard it is difficult to determine whether the trend will increase or decrease within the next few years. Local climate, geographical features and anthropogenic influences such as vehicle emissions and outdoor burning are key factors influencing regional air quality levels. Given the significant population growth; and expansion that is anticipated over the next decade, achievement and maintenance of the CWS by the year 2010 and beyond will require continued and sustained efforts to improve air quality.

3.0 CURRENT STRATEGIES AND ACTIONS

Central Okanagan residents are breathing cleaner air thanks to their support of the many initiatives of the Regional District Air Quality program.

According to data from the Ministry of Environment, air contaminant emissions in the region were reduced by 1,359 tonnes in 2005 due to the various programs and bylaws initiated by the RDCO Air Quality Committee. In fact, the Central Okanagan recorded the lowest concentration of $PM_{2.5}$ (combustion sources, smoke from burning, emissions from vehicles) since monitoring of this pollutant started in 1997. In all, the air quality programs are credited with the following air contaminant reductions in 2005:

- Smoke particulate was reduced by 193 tonnes
- Carbon Monoxide was reduced by 1,047 tonnes
- Nitrogen Oxides were reduced by 19 tonnes
- Volatile Organic Compounds were reduced by 99 tonnes
- Sulfur Oxides were reduced by 1 tonne

During 2005 the Ministry of Environment monitoring site located at the Okanagan College campus on KLO Road in Kelowna didn't record any hours when the air quality was within the 'fair' or 'poor' range for smoke particulate from combustion sources. While this is good news from the air quality perspective, there are however still many instances of degraded air quality in individual neighbourhoods, especially those that have numerous wood stoves or nearby outdoor burning.

In 1998 open burning was identified as one of the major causes of degraded air quality in the Central Okanagan. Since then, provincial and municipal regulations and programs have been introduced to reduce the impact of smoke in the area. Most of the burning permits issued in the Central Okanagan are for agricultural burning, which is allowed under the Provincial Right to Farm legislation. While this means that municipalities cannot ban agricultural burning, over the past eight years they have enacted programs and regulations designed to reduce the smoke impact in the Central Okanagan. For example the Agricultural Chipping program is credited with clearing the air by reducing smoke particulates.

Open burning is not the only major source of air pollution in the region. Since 1998 several regulations and programs have been implemented to reduce the impact of smoke coming from wood stoves and fireplaces. It's now illegal to burn unseasoned wood and any new wood burning appliance that is installed must meet strict emission standards.

The Great Okanagan Wood Stove Change Out Program was developed in 2001 to encourage homeowners to remove or replace old wood burning appliances. The goal is to encourage homeowners, by providing incentives, to trade in their uncertified, dirty-burning wood stoves and fireplaces and replace them with new certified, clean burning appliances.

Other programs offered by the Regional Air Quality Program include Cash for Clunkers, which provides incentives to get older polluting vehicles off the road. Also, an Anti-Idling program has been introduced encouraging parents to shut off their vehicles when dropping off or picking up students at local schools.

Another municipal initiative that compliments the Air Quality Program is Transportation Demand Management (TDM); staff is responsible for the planning and implementation of programs that seek to reduce road space demand by influencing travel choices and the amount and timing of travel. TDM aims to encourage more walking, cycling, public transit use, car-pooling, and tele-commuting. Subsequently

local governments of the Central Okanagan have worked collectively to prepare a long-range transit vision called the Central Okanagan Smart Transit Plan (2005). A capital investment strategy was prepared (2006) in support of implementing a higher order bus-rapid transit service between Westbank and the UBC Okanagan campus. These plans should position the region to take advantage of federal funding that has come available. The UBC-O students recently (Dec/07) voted in favour of a Universal Transit Pass (U-pass) which should in turn have a significant impact on trips by transit to the UBC campus.

The Regional Air Quality Program is currently working on an inventory to estimate air pollution emissions within the Central Okanagan over the next 20 years. The forecast inventory will be used extensively for planning, and for guiding discussions about future emission reduction priorities with the public, other agencies and stakeholders.

The Regional Air Quality Program is guided by an Air Quality Committee comprised of political representatives from the Regional District Electoral Areas, the City of Kelowna, the District of Peachland and the District of Lake Country. The goal is to ensure our air does not degrade as the region grows.

The following are some of the strategies and actions employed in the Central Okanagan, since 1998:

Chronology of Open Burning Smoke Reduction Initiatives

1998:

- Backyard burning was prohibited throughout the Regional District (The City of Kelowna banned backyard burning in 1988).
- The Venting Index (VI) was introduced. The VI determines if weather is forecast to disperse smoke out of the valley.
- All wood waste over 8 inches diameter must be dried for two years before burning it.
- Outdoor burning permit holders must phone the Outdoor Burning Hotline to determine if weather conditions are favourable enough to disperse smoke out of the valley.
- Forest industry slash burning may only occur when weather is forecast to disperse smoke out of the valley.

2002:

- No burning is allowed during “fair” or “poor” air quality conditions. The Venting Index must also be good before burning is allowed.
- Open burning on development sites was prohibited.

2004:

- The Agricultural Chipping Program was introduced. This is a free program for orchardists who are removing whole trees. Each year there is an average of 234 acres of trees removed in the Central Okanagan.

2005:

- Proactive bylaw enforcement of open burning regulations within the City of Kelowna began (all burn piles are inspected and permit holders are consulted).

2006:

- Outdoor burning permits are now required in some of the more rural areas of the Regional District such as North Westside, Ellison, Joe Rich and Wilson’s Landing.
- Venting Index requirements for open burning were increased to 65 (previously 55), which ensures better venting of smoke out of the valley.

Wood Stove and Fireplace Smoke Reduction Initiatives since 1998

- New wood burning appliance installations must meet strict emission standards (i.e. CSA B415.1 or US EPA Code of Federal Regulation standards).
- Non emission approved wood burning boilers and furnaces are not allowed to be installed.
- Burning unseasoned wood is illegal.
- Creating nuisance amounts of smoke is illegal.
- Burning garbage is illegal.

4.0 STRATEGIES AND ACTIONS

Although the ground level ozone and $PM_{2.5}$ concentration levels at the Central Okanagan Ministry of Environment monitoring site do not exceed the Canada Wide Standards (CWS) metric, there is still health and other effects associated with the current air quality levels. As can be seen in the "Health Effects and Benefits Estimates" study completed by Environment Canada in 2006, there are substantial human health and monetary benefits to be realized by achieving marginal improvements (or avoiding future increases) in ground level ozone and particulate matter (PM) concentration within the region.

The CWS's also committed the jurisdictions to develop jurisdictional implementation plans. These plans are the primary vehicle for CWS implementation. Jurisdictional implementation plans will outline more comprehensive actions being taken within each jurisdiction to achieve the Standards for PM and Ozone by the 2010 target date. A different "level of effort" is required in each jurisdiction given that air quality varies significantly from region to region. These implementation plans will be developed in consultations with stakeholders. The concepts of continuous improvement, pollution prevention and keeping-clean-areas-clean are elements of the Standards which will help to guide the implementation plans.

To achieve air quality improvements will require continued efforts to reduce emissions. This goal presents an ongoing challenge to air quality managers, as the Central Okanagan region is projected to experience high population growth in future years. In the immediate future air quality managers are also challenged with the requirement to meet the Canada Wide Standards (CWS) for particulate matter (PM) and ground level ozone by the year 2010. Air quality improvements will be aided by the federal agenda on clean air that will result in the gradual turn-over of the vehicle fleet to cleaner vehicles. Also, local governments of the Central Okanagan have collectively recognized the regionally significant role of public transit thus made this mode of transportation a high priority for funding that comes available from the federal gas tax transfer.

To improve air quality in the Central Okanagan, emissions reductions will need to come from all sectors. The AQMP identifies actions that will result in improved air quality and significant societal benefits based on the following principles:

Pollution Prevention: Using processes, practices, materials and energy in ways that avoid or minimize the creation of pollutants and wastes at the source.
Continuous Improvement: Taking remedial and preventative actions to reduce emissions from human activities towards the long-term goal of reducing overall ambient concentrations and health risks.
Achieving Co-benefits: Favouring actions that reduce both common air contaminants and greenhouse gas emissions.
Shared Responsibility: Partnering with other jurisdictions to address common priority issues, and building awareness and motivating action in all sectors of society.
Innovative Approaches: Using market-based and community-based approaches to complement conventional air quality management.

Strategies for achieving the AQMP goals include:

1. **Reduce emissions from major regional sources**
2. **Enhance air quality information and public awareness**
3. **Facilitate air quality research to achieve air quality goals**

The actions under each strategy will be prioritized based on their potential to reduce public exposure to pollutants that pose the highest risk to human health. Cost-effectiveness, technical feasibility, community and other concerns will be considered as actions are further refined and implemented.

A study of "Health Effects and Benefits Estimates for the Central Okanagan" completed by Environment Canada in 2006 shows that policies to reduce Particulate Matter will have the greatest impact as they provide the highest social value.

Most of the strategies described in the following sections have already been implemented to some degree; however, opportunities still exist to improve upon those strategies, which could reduce contaminant emissions further. Those strategies that have not been implemented are expected to be undertaken within the next 2 to 3 years. It is anticipated that annual costs to implement the AQMP will stay within current Air Quality Program budget levels. Strategies that could increase the Air Quality Program budget would not be implemented unless financial and staff support from senior levels of government could offset that cost. The AQMP will be implemented through an annual priority setting process and annual budgets as directed through the Regional Air Quality Committee and Regional District Board.

Strategy #1: Reduce Emissions from Major Regional Sources

Reducing primary particulate matter emissions, as well as ozone and particulate matter precursor emissions from the major sources in the Central Okanagan will help to *minimize the risk to public health from air pollution* and *improve visibility*.

Table 4	**Actions for Open Burning**
The RDCO will:	
Continue to strive for consistent regulations and policy among all fire protection areas within the Central Okanagan, which limit the impact of smoke from open burning.	Educating open burning permit holders in the Central Okanagan about best management practices to limit smoke from open burning is much more effective if all fire protection areas have the same regulations and policies. In addition, improvement in ambient air quality will occur if all fire protection areas adopt the most effective regulations and policies to limit the impact of smoke in the region.
Continue to seek alternative measures that reduce open burning.	Investigate and facilitate cost effective measures that will limit open burning in the region (i.e.: chipping, air curtain incineration, flail mowing, etc.).

Table 4 Continued *Actions for Open Burning*

Continue to assess current open burning regulations and policies.	The RDCO will continually review open burning policies and regulations in order to determine if amendments should be made to improve air quality.
Continue to seek alternative measures that reduce open burning of Pine Beetle infested trees.	Investigate and facilitate cost effective measures that will limit open burning in the region (i.e. chipping, air curtain incineration, pheromone treatment, wood debris marketing, etc.).
Strongly encourage the provincial government to develop legislative guidelines for air curtain incinerator (trench or box burning) operations.	The RDCO will encourage the provincial government to develop specific legislative guidelines in order to control the use of air curtain incinerators (trench or box burning) to ensure residents in the vicinity of the operation are not negatively impacted by smoke, ash, dust or odours.
Continue to provide open burning Best Management Practices education in order to reduce smoke impacts in the region.	Continue to proactively provide open burning best management practices information to open burning permit holders in order to reduce smoke impacts on the community. Currently the Kelowna Fire Department inspects all open burn piles for compliance and reviews regulations and best management practices with the permit holder.
Continue to liaise with the Ministry of Forests and the Ministry of Environment in order to manage smoke attributed to forest harvest debris burning and prescribed burning.	The goal of this partnership is to maintain two way communications in order to coordinate measures that will reduce or eliminate air quality episodes attributable to forest harvest debris burning and prescribed burning, and reduces impacts from forest harvest debris burning and prescribed burning at any time.

Table 5	Actions for Solid Fuel Burning Appliances
The RDCO will:	
Continue to assess current solid fuel burning appliance regulations and policies.	The RDCO will continually review solid fuel burning appliance policies and regulations in order to determine if amendments should be made to improve air quality.
Continue to provide Best Management Practices education to solid fuel burning appliance users.	Raise awareness and educate the wood burning public about, the importance of efficient, safe, smoke-free wood burning.
Continue to facilitate incentive programs to get cleaner and more fuel-efficient wood stoves into homes.	Encourage wood burners to take action to improve their ability to burn wood smoke-free, efficiently and safely by offering information and financial incentives for positive change.

Table 6	Actions for Cars, Trucks and Buses
The RDCO will:	
Continue to achieve emission reductions by incorporating the regional air quality objective of continuous improvement into management of the transit fleet through acquisition of low emission vehicles/fuels and retrofits to older vehicles.	Encourage BC Transit to provide the Central Okanagan with low emission transit vehicles to help improve air quality and to provide an example to the community.
Promote adoption of local governments anti idling policy and assist major transport centres with the introduction of anti-idling measures.	The RDCO, City of Kelowna, District of Peachland and District of Lake Country have implemented anti idling policies within each of their organizations. The Regional Air Quality Program will promote the benefits of such a policy to help businesses apply it to their unique fleets.
Promote Natural Resources Canada's model Sustainable Fleet Management Policy for use by businesses and local governments.	The Regional Air Quality Program will promote Natural Resources Canada's model Sustainable Fleet Management Policy, inform businesses and local governments about the benefits of such a policy and help them apply it to their unique fleets.

Promote trip reduction services in business and residential outreach programs.	The Regional Transportation Demand Management (TDM) group will continue to promote the benefits of combining multiple errands in one-vehicle trips and the TDM programs that provide alternatives to single-occupancy vehicle transportation.
Strongly encourage the federal government to implement stringent national fuel efficiency standards for light and heavy-duty vehicles.	The RDCO will continue to actively encourage the federal government to implement stringent national fuel efficiency standards for light and heavy-duty vehicles, with the provision that they will not result in increased particulate matter emissions.
Strongly encourage the federal and provincial governments to promote cleaner, fuel-efficient vehicle purchases by providing financial incentives.	To encourage cleaner, fuel-efficient vehicle purchases and increase their representation in the private vehicle fleet, the RDCO will recommend that the federal and provincial governments provide private vehicle owners with additional incentives such as rebates and reduced sales taxes.
Strongly encourage ongoing federal government actions to improve national non-road engine emission and fuel standards.	Environment Canada is developing national regulations to restrict the level of sulphur in non-road diesel fuel and establishing emission standards for some non-road sources (e.g., small spark-ignition engines, compression ignition engines and other categories of non-road engines - outboard engines and personal watercraft, recreational vehicles, and large spark-ignition engines). Environment Canada is also investigating how greenhouse gas emissions can be reduced from the non-road sector. The RDCO will participate actively in federal consultation on emerging non-road regulations, and recommend implementation of the strictest feasible non-road engine and fuel emission standards that will reduce particulate matter, sulphur dioxide, nitrogen oxide, volatile organic compound and greenhouse gas emissions as soon as possible.

Table 7	Actions for Industrial, Commercial and Institutional Sources
The RDCO will:	
Support the development of federal and provincial government Industrial/Commercial/Institutional (ICI) emission reduction programs, and implement locally relevant actions that support continuous improvement.	The RDCO will participate in developing national and provincial ICI emission reduction initiatives, and strive for the most stringent regulations and guidelines feasible.
Continue to work with local industry and commercial business to ensure they are implementing Best Management Practices in order to reduce contaminant emission impacts in the region.	The RDCO and City of Kelowna will continue to work closely with local industry and commercial business to limit contaminant emission impacts in the region.

Table 8	Actions for Construction and Agricultural Equipment
The RDCO will:	
Strongly encourage ongoing federal government actions to improve national non-road engine emission and fuel standards.	Environment Canada is developing national regulations to restrict the level of sulphur in non-road diesel fuel and establishing emission standards for some non-road sources (e.g., small spark-ignition engines, compression ignition engines and other categories of non-road engines - outboard engines and personal watercraft, recreational vehicles, and large spark-ignition engines). Environment Canada is also investigating how greenhouse gas emissions can be reduced from the non-road sector. The RDCO will participate actively in federal consultation on emerging non-road regulations, and recommend implementation of the strictest feasible non-road engine and fuel emission standards that will reduce particulate matter, sulphur dioxide, nitrogen oxide, volatile organic compound and greenhouse gas emissions as soon as possible.

Table 8 Continued *Actions for Construction and Agricultural Equipment*

Encourage non-road diesel engine retrofits and accelerate the use of cleaner fuels.	To reduce particulate matter, sulphur dioxide, nitrogen oxide, volatile organic compound and greenhouse gas emissions from existing non-road engines, the RDCO will encourage users of non-road equipment (such as construction companies and local governments) to implement cost-effective emission reduction measures.

Table 9	**Actions for Communities**
The RDCO will:	
Continue Okanagan Airshed Coalition participation	The three Regional Districts (Central Okanagan, Okanagan-Similkameen, North Okanagan) have entered a partnership with the goal of improving outdoor air quality in the Okanagan Airshed and, thereby, improving health and quality of life. The purpose of this partnership is to develop a comprehensive strategy for air quality management by assessing issues, prioritizing problems, and developing appropriate actions to protect public health and the environment.
Continue agency cooperation	Governments must work together to implement air quality initiatives within the Central Okanagan region as well as the Okanagan Airshed. Co-operation between responsible agencies should continue to be fostered (e.g.: through the Technical Steering Committee and Regional Air Quality Committee) so that important issues are addressed with a minimum duplication effort.
Partner with local governments, businesses and major utilities to develop and promote clean and efficient energy sources and technologies for space heating.	By developing and promoting clean and energy efficient space heating (such as low energy use building design and operations, community energy systems, and heating alternatives to fossil fuel combustion like geo-exchange, passive solar gain, active solar, etc.), the RDCO and other partners will help reduce emissions of particulate matter, nitrogen oxides and greenhouse gases.

Assist interested parties to identify and implement energy reduction measures in new building construction, renovation and retrofit projects by providing them with educational materials, business case analyses and technical assistance.	To increase the proportion of new green building construction in the Central Okanagan, the RDCO and City of Kelowna will help local governments use rating systems such as Leadership in Energy & Environmental Design (LEED®) for their civic buildings. The RDCO and City of Kelowna will also promote acceptance and application of green building principles, strategies, and technologies among professionals and building developers. Through education and outreach efforts, the RDCO and City of Kelowna will support the application of a rating system, such as LEED for Existing Buildings (LEED-EB®), to civic building retrofits and operations and encourage its application to private sector retrofit projects for commercial and institutional buildings.
Expand the delivery of a natural yard care outreach programs for homeowners.	In partnership with several local governments, community and professional groups, the RDCO and City of Kelowna have developed programs that encourage homeowners to adopt more sustainable yard care practices such as reducing or eliminating the use of chemical fertilizers, gasoline-powered lawn mowers and other yard care equipment. The RDCO and City of Kelowna plan to work with local governments and delivery partners to expand this program to reach more residents.
Establish a regional greenhouse gas emission reduction target and program objectives, and work with local governments on the development and implementation of greenhouse gas reduction initiatives.	The RDCO and City of Kelowna will develop a regional greenhouse gas emission reduction target and inform the public about progress toward meeting this target. Community energy planning looks at a community's energy use from the perspective of long-term integrated resource planning, energy efficiency and sustainable practices.
Incorporate the AQMP's goals into long-range plans, such as the Regional Growth Strategy, the City of Kelowna Strategic Plan, the Regional Transportation Plan and municipal Official Community Plans.	To protect air quality, the RDCO and municipalities within the RDCO will explicitly consider the implications for air quality and global climate change while developing other long-range plans.

Strategy #2: Enhance Air Quality Information, Public Awareness

General education and promotional activities are considered valuable in building awareness and in bringing about individual change in behaviour. The current level of educational and promotional activity should be maintained within the context of an annual and 5-year plan. This strategy has the following actions:

Table 10 Actions to Enhance Air Quality Information, Public Awareness	
The RDCO will:	
Continue to provide air quality monitoring information to the general public.	Since 1999, the City of Kelowna has been monitoring 20 environmental indicators (including air quality) specific to quality of life and environmental health in the Central Okanagan. By tracking local environmental conditions over time, it is possible to identify where improvements may need to be made. All indicators are monitored and updated yearly; every 5 years a comprehensive State of the Environment Report is produced.
Continue to involve the public in air quality planning processes.	The RDCO will continue to include involvement of the public and stakeholders in the process of developing strategies to reduce air pollution.
Continue to provide air quality education programs to residents and students within the Central Okanagan.	The Regional Air Quality Program offers free interactive educational presentations that examine the causes of poor air quality in the Central Okanagan and provides examples of how we can help improve local air quality and reduce air pollution. Other educational sessions provide information on the greenhouse effect, human impacts on the climate of South Western British Columbia and how cars and trucks seriously impact air quality.
Continue to provide educational programs and information with the goal of reducing vehicle emissions.	The Transportation Demand Management (TDM) group focuses on raising awareness about the various effects that vehicles have on our environment, our health and our community. Offering a variety of activities and interactive programs the goal is to encourage residents to respect and protect their environment.

Improve communication of air quality information, and promote actions for local governments, businesses and residents.	The RDCO will provide guidance for local governments and businesses regarding actions they can take to support the goals of the AQMP. To assist them in making informed decisions, the RDCO will continue to provide researchers and policy-makers with information on ambient air quality, emissions, emission reduction studies and other research. Air quality messaging will be developed so that residents become more aware of their role in improving air quality. This messaging will be incorporated into current outreach programs such as the Living Greener Program.
Promote the new Air Quality Health Index	The Air Quality Health Index or "AQHI" is a scale designed to help the general public understand what the air quality means to their health. It is a new tool developed by environmental and health professionals to communicate the health risk posed by local air pollution conditions. It is designed to help the public make decisions to protect their health by limiting short term exposure to air pollution, adjusting activity levels during increased levels of air pollution as well as reducing personal contribution to air pollution. This index pays particular attention to people who are sensitive to air quality by identifying specific health messages for this group.

Strategy #3: Facilitate Air Quality Research to Achieve Air Quality Goals

Research is essential for obtaining a better understanding of current and future air quality and contaminant effects. Research gaps currently exist in our understanding of the mechanisms involved that degrade Central Okanagan air quality. The RDCO will continue to work with Environment Canada and the Ministry of Environment on air quality research in order to achieve air quality goals. In order to identify management priorities the following research components are required:

Table 11 Actions to Facilitate Air Quality Research to Achieve Air Quality Goals

The RDCO will:

Continue to encourage the Ministry of Environment to update and improve ambient air monitoring network.	The RDCO will continue to encourage the Ministry of Environment to update and improve the monitoring network in the Central Okanagan airshed to respond to regional air quality management priorities and needs.
Continue to work with Environment Canada and the Ministry of Environment to conduct and enhance detailed emission inventories in concert with other jurisdictions in Canada.	A detailed and accurate emissions inventory is essential for ongoing air quality management. The RDCO should work with Environment Canada and the Ministry of Environment to provide a comprehensive review and update emission estimates for all point, area and mobile sources every 5 years. As knowledge about health risk of air contaminants continues to grow, the RDCO will continue to improve and enhance its emissions inventories and forecasts. Adding more priority contaminants to the inventories and moving to geographic information system-based emission inventories will help to identify potential localized areas of concern. Emission inventories will also be used to evaluate the success of emission reduction measures in the AQMP.
Work with Environment Canada and the Ministry of Environment to conduct emissions forecasting for all sources of emissions to enhance understanding of emission areas that might require further controls.	Projected regional population, economic and development statistics are used to predict future changes in emission levels. These predictions are used to determine emission areas that might require further controls.

Table 11 Continued *Facilitate Air Quality Research to Achieve Air Quality Goals*

Continue to work with Environment Canada and the Ministry of Environment on source apportionment studies of particulate matter to enhance understanding of emission areas that might require further controls.	Single particle fingerprints are used to relate PM to various sources, especially sources producing the carbonaceous fraction such as biomass burning and vehicles.
Conduct dispersion modeling in concert with Environment Canada and the Ministry of Environment to enhance understanding of emission areas that might require further controls.	This model is used to simulate the concentration and dispersion of pollutants throughout the airshed depending on weather conditions and sources of emissions. This model can be used to estimate pollution concentrations (loading) in the airshed given a predicted change in emissions. By using an emissions model you may estimate: [e.g. 1) The impact a new sawmill may have on air quality or 2) The impact increased traffic may have on air quality, etc.]. These predictions are used to determine emission areas that might require further controls.
Work with Environment Canada to conduct cost/benefit analysis of emission reduction measures.	A comprehensive cost/benefit analysis would permit comparison of the benefits of specific emission reduction measures against their corresponding costs, resulting in economically efficient emission reduction measures.

5.0 PERFORMANCE MEASURES

There are known health and other impacts associated with particulate matter and ozone. Consequently, improvements in these two air pollutants provide social benefits. A study of "Health Effects and Benefits Estimates" completed by Environment Canada in 2006 demonstrates that even small improvements in air quality ($PM_{2.5}$ and ozone) will yield substantial economic benefits. For the Regional District of Central Okanagan the quantifiable annual benefits estimates associated with a 10% improvement in $PM_{2.5}$ and ozone are $16,646,630 for $PM_{2.5}$ and $1,833,540 for ozone.

The following performance measures will be used to monitor progress in achieving the goals of the AQMP over the next decade.

- Ensure that the daily average concentrations of PM_{10} (particulate matter less than 10 microns in diameter) remain below the provincial air quality objective of 50 micrograms per cubic meter.
- Ensure that the daily average concentrations of $PM_{2.5}$ (particulate matter less than 2.5 microns) remain below the Canada Wide Standard of 30 micrograms per cubic meter. Achievement to be based on the 98th percentile ambient measurement annually, (not the extreme maximum daily average) averaged over 3 consecutive years.
- Ensure that the average ozone concentrations of the eight highest consecutive hourly observations each day remain below the Canada Wide Standard of 130 micrograms per cubic meter (65 parts per billion) (based on the 4th highest annual value, averaged over 3 consecutive years).
- Ensure the annual average $PM_{2.5}$ concentration does not exceed the highest annual average measured since 1998 (ignoring those $PM_{2.5}$ concentrations that were influenced by wildfires).
- Ensure the annual average $PM_{2.5}$ concentration will decline (ignoring wildfires) from 2007 to 2015.

Actions needed to accomplish these objectives are to continue to reduce emissions of PM_{10} and $PM_{2.5}$, and to continue to reduce emissions of volatile organic compounds and nitrogen oxides that are precursors to $PM_{2.5}$, and ozone formation.

6.0 CONDUCT A FIVE-YEAR REVIEW OF THE PLAN

A five-year review presents the opportunity to evaluate progress towards or away from goals and targets. It also provides an opportunity to re-evaluate the content of the plan, to ensure that it is still relevant. This would include a review of goals, indicators, and measures. In particular, the review should identify which measures should be continued or cancelled, and identify new measures to include in the revised plan.

APPENDIX: GLOSSARY OF AIR QUALITY TERMS

The following definitions explain some common terms used when discussing air quality and air quality management issues in BC.

What is an airshed?
Topography (hills and valleys) and weather conditions can interact to prevent the mixing and exchange of air from inside and outside a given area. This area is called an "airshed." A good example of an airshed is a valley where the surrounding mountains act as a physical barrier to air moving out of the valley when the air is still. An ocean coast can also define a boundary of an airshed where sea breezes can prevent air from moving out of coastal valleys. Because weather and wind conditions change from day to day, the boundary of an airshed isn't constant; it can change with the weather.

Air Pollutants are any gas, liquid or solid substances that are present in the atmosphere in high enough concentrations to be considered harmful to the environment or human health. Common examples of pollutants include: dust, wood smoke, nitrogen dioxide, ground-level ozone, and particulate matter.

Aerosol: Suspensions of tiny liquid and/or solid particles in the air.

Greenhouse gases (GHG's) are gases that contribute to global climate change. The major GHG's are carbon dioxide (CO2), methane (CH4) and nitrous oxides (N2O).

Air Emissions are any kind of substance released into the air from natural or human sources. An emission inventory provides information on the amount of emissions coming from various sources in a given area within a given period of time (usually a year).

Sources of air pollution are normally described by the activity that caused the emission. Sources can be natural or human generated. Natural sources include wind-blown dust, volcanoes, and forest fires. Human sources include the burning of fossil fuels (oil, gas and coal), stirring up dust (while driving or during construction), and burning of wood or leaves.

A **point source** is a single, stationary source of pollution that can be well defined. A smokestack is an example of a point source; it is easy to measure and define the source of the pollutants. It is also easy to regulate using an emission permit process.

A **non-point source** is a combination of a variety of pollution sources that are difficult or too small to measure on an individual basis. There are far too many cars, fireplaces, and lawnmowers to track exactly how much each one is emitting by itself, but they can all add up to a significant amount of total emissions. Therefore, for the purpose of developing an emission inventory, these sources are combined into categories called "non-point" sources.

Ambient air quality refers to the air in our immediate surroundings. Ambient air quality describes the level of air pollutants in a particular region. Poor ambient air quality means pollutant levels are high enough to cause concerns. Ambient air quality is measured near ground level, away from direct sources of pollution.

Carbon Monoxide: One of the six criteria pollutants. A colourless, odourless and poisonous gas produced by incomplete burning of carbon in fuels.

Concentration is the amount of a pollutant in the air at a given location, expressed as the weight of volume of pollutant per volume of air, such as parts per billion (ppb) or micrograms per cubic metre of air ($\mu g/m^3$).

Parts per billion ("ppb"): denotes one particle of a given substance for every 999,999,999 other particles. This is roughly equivalent to one drop of ink in a lane of a public swimming pool, or one second per 32 years. One part in 10^9.

Microgram (µg or mcg): a metric unit of mass equal to 0.001 milligram (mg) or one millionth of a gram. One $\mu g/m^3$ is similar to a grain of sand suspended in a small apartment.

Exposure is a combination of the level of a pollutant and the amount of time that a person spends in the presence of a pollutant. Exposure determines the level of risk associated with different levels of pollutants.

Fine particles: Particulate matter with an aerodynamic diameter of 2.5 microns or less (PM2.5). Fine particles are responsible for most atmospheric particle-induced extinction. Ambient fine particulate matter consists basically of five species: sulphates, ammonium nitrate, organics, elemental carbon, and soil dust.

Fine particulate matter: particulate matter with an aerodynamic diameter less than 2.5 microns (PM2.5).

Microgram (µg or mcg): a metric unit of mass equal to 0.001 milligram (mg) or one millionth of a gram. One $\mu g/m^3$ is similar to a grain of sand suspended in a small apartment.

Micron: a unit of length equal to one millionth of a meter; the unit of measure for wavelength.

Monitoring: Measurement of air pollution and related atmospheric parameters.

Nitrogen dioxide: a gas (NO2) consisting of one nitrogen and two oxygen atoms. It absorbs blue light and therefore has a reddish-brown color associated with it.

NOx: Nitrogen oxides. One of the six criteria pollutants. The term used to describe the sum of nitric oxide (NO), nitric dioxide (NO2), and other oxides of nitrogen, which plays a major role in the formation of ozone. The major sources of man-made NOx emissions are high temperature combustion processes, such as those occurring in automobiles and power plants.

Ozone: One of the six criteria pollutants. Ozone (O3) is a photochemical oxidant and the major component of smog.

Particulate matter: Material that is carried by liquid or solid aerosol particles with aerodynamic diameters less than 10 microns.

Parts per billion ("ppb"): denotes one particle of a given substance for every 999,999,999 other particles. This is roughly equivalent to one drop of ink in a lane of a public swimming pool, or one second per 32 years. One part in 10^9.

Smog: A mixture of air pollutants, principally ground-level ozone, produced by chemical reactions involving smog-forming chemicals.

Sulphur dioxide: a gas (SO2) consisting of one sulphur and two oxygen atoms. This is of interest because sulphur dioxide converts to an aerosol that is a very efficient light scatterer. Also, it can convert into acid droplets consisting primarily of sulphuric acid.