Final Report of The Prince George Mayor's Task Force on Air Quality Improvement



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Executive Summary

The Mayor's Task Force on Air Quality Improvement was established by Mayor Colin Kinsley at his State of the City address in January 2006, fulfilling a promise made during the fall 2005 civic election campaign. The purpose of this report is to provide a review of what has been done with respect to air quality since the 1998 Prince George Air Quality Management Plan was released; to identify what factors have constrained efforts to improve air quality, and those that have enabled improvements; and to provide recommendations on ways to improve air quality monitoring, practices, and research. The task force presented its preliminary findings in an Interim Report to City Council on October 29, 2007 and to the Board of the Regional District of Fraser-Fort George on November 15, 2007. Subsequently, a consultation process was undertaken, and the feedback received from that consultation is incorporated in this final report.

The first two sections of this report provide an introduction to the work of the Task Force and a background on air quality issues in Prince George. They note that data show Prince George's primary air quality issues are related to elevated levels of particulate matter (PM_{10} and $PM_{2.5}$) and of various reduced sulphur compounds (Total Reduced Sulphur, or TRS) that cause odours. Of the major pollutants, particulate matter is the air pollutant with the greatest potential to impact health. The impacts on human health are reviewed in the Background section of this interim report. An overview of the legislative, regulatory, governance and management framework with respect to air quality is also provided.

The third section of the report provides a detailed description of the findings of the Task Force. It is organized into eight primary areas: air quality governance and management; regulatory tools; education and public awareness; land use and development; industrial air pollution emissions; air quality monitoring; research; and emerging issues. In each area, the Task Force reviews the current situation, what was heard during consultations in advance of this report, and then provides key recommendations related to the area.

The fourth section outlines the consultation processes used to further refine and finalize the interim report. A public information display was made available, and input was received via a web-based survey, email outreach, written submissions sent to City Hall, and other methods. The section then summarizes the feedback received on the interim report. All of the feedback received is listed in Appendix C.

The fifth section provides a summary of the Task Force process and activities, and finishes with a comprehensive list of key, priority recommendations requiring action in order to accelerate efforts at improving the air quality in Prince George.

Acknowledgements

The Prince George Mayor's Task Force on Air Quality Improvement would like to thank Mayor Colin Kinsley and Prince George City Council for the opportunity to participate in this process, and in the important discussion about how we might work as a community to improve air quality in Prince George for the benefit of all.

The preparation of this report would not have happened without the support, assistance and involvement of a number of individuals and organizations. Firstly, we would like to thank Dr. Howard Brunt for creating the foundation for this task force to do its work and for leading the stakeholder consultation process. We also gratefully acknowledge the active support of and participation in this process by the City of Prince George, the Regional District of Fraser-Fort George, the BC Ministry of Environment, the Prince George Chamber of Commerce, the Prince George Air Quality Implementation Committee, the Research Working Group, the Monitoring Working Group, the People's Action Committee for Healthy Air, and the North Nechako and Heritage Residents' Association.

The support of Prince George City Staff, and especially of Suzie Davidson, Wendy Lloyd and Don Schaffer, was invaluable in the preparation of this interim report.

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Introduction

Air quality is not a new issue in Prince George, with efforts to address air quality dating back to the 1980s. The effect of fine particulate matter on overall quality of life has been a longstanding, if not well understood issue, and research conducted by various organizations over the last decade has amplified concerns.

The Prince George Air Quality Technical Management Committee released an air quality management plan in 1998. That plan resulted in the formation of a multi-stakeholder committee to implement its recommendations (the Prince George Air Quality Implementation Committee). A progress report was produced in 2004 and implementation work continues.

The Mayor's Task Force on Air Quality Improvement (hereafter the Task Force) was established by Mayor Colin Kinsley at his State of the City address in January 2006, fulfilling a promise made during the fall 2005 civic election campaign.

PURPOSE AND APPROACH

The members of the Task Force were appointed through the Mayor's office and include representatives from academia, government, the not-for-profit sector, and the public at large. Each member has experience in air quality and environmental management (see Appendix A1). The Task Force reports directly to City Council, and is tasked with producing this interim report followed by a final report by December 2007, at which time the work of the Task Force will be complete. (See Appendix A2 for the Task Force's complete Terms of Reference).

The Task Force was asked to review what progress has been made since the release of the 1998 Plan and the 2004 progress report, and to then provide a report to Prince George City Council, that will include but not be limited to:

- a review of what has been done in the City of Prince George to date with respect to air quality and determine what advances have occurred in other jurisdictions that may be of value to its airshed;
- identification of factors that have either constrained or enabled the improvement of air quality in the past decade in the airshed;
- recommendations about ways to improve air quality monitoring, practices, and research that build upon previous air quality plans and reports.

The Task Force took a number of actions to fulfill its responsibilities.

1. The members met to review the Terms of Reference. Members agreed that the work should not duplicate previous or current efforts regarding air quality. The Task Force would look at broader, over-arching issues and develop pragmatic recommendations.
2. The members commissioned two studies which were conducted by a graduate student at UNBC. These studies researched: (a) Best Practices in Air Quality Management (Millar 2007a, see Appendix B1); and best management practices for controlling emissions in relevant industrial sectors (see Appendix B1); and, (b) Best Practices in Air Quality Control for Pulp Mills, Sawmills and oil Refineries (Millar 2007b, see

Appendix B2). Also related to research, the Task Force is aware of the fine particulate speciation studies and comprehensive dispersion modelling study currently underway. However the results will not be available until Spring 2008, after the Task Force's work is complete. This is not considered to be a limitation on the work of the Task Force, since the Task Force's mandate was to make recommendations on broader, system-wide issues, rather than at the level of individual emitters in the airshed.

3. The Task Force sought input from various sources, organizing its consultation efforts into two phases. During the first half of 2007, members consulted with community groups, government agencies, the private sector and individual residents in a series of separate meetings. The input received from these consultations was incorporated into an Interim Report that was presented to Prince George City Council on October 29, 2007, and to the Fraser-Fort George Regional District Board on November 15, 2007.

4. The second consultation phase occurred between October 29 and November 16 2007. The Task Force sought input on the interim report and recommendations in several ways:

    - a facilitated open house for the public (November 5) and for stakeholders (November 6);
    - a display staffed by Task Force members on Saturday November 3 in the Bob Harkins branch of the Prince George Public Library; and,
    - written submissions and comments that were sent to City Hall and through its website, via a survey and email.

The second round of input was incorporated into this Final Report.

In the course of its work, the Task Force has become well aware of the linkages between air quality, greenhouse gas emissions (GHG) and energy efficiency. This report does make reference to the latter two issues in some sections. However, while these inter-relationships are important, the Task Force focused its work on the air quality issues with the highest priority in the Prince George airshed – particulate matter and odour – in accordance with its Terms of Reference.

Background

AIR QUALITY IN PRINCE GEORGE

Overview

The outdoor levels of various pollutants are monitored at a number of locations in and around the city of Prince George (Figure 1 shows the monitoring locations). The monitoring program is overseen by the BC Ministry of Environment and paid for by the MoE as well as by the owners of the main pollutant sources.

The data from this network show that Prince George has a problem with elevated levels of particulate matter (PM_{10} and $PM_{2.5}$) that are known to cause health impacts, and of various reduced sulphur compounds (called total reduced sulphur or TRS) that cause odours. Levels of other pollutants are less of a concern.

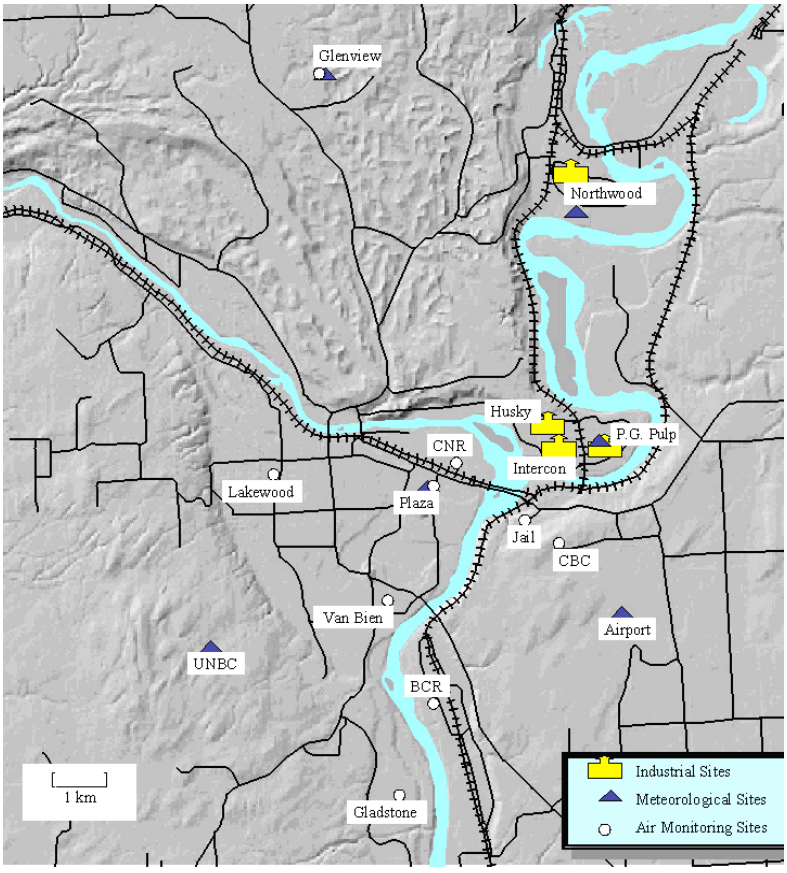


Figure 1: Air Quality and Meteorological Monitoring Sites, topography and locations of some industry in Prince George. (BC Environment, 2006)[1]. Not shown is the Beaverley background monitoring site.

[1] *BC Environment, 2006: 2004 Annual Air Quality Report for Prince George. http://wlapwww.gov.bc.ca/nor/pollution/environmental/air/air_report_04.pdf*

Air pollutant levels in the outdoors are determined by three factors. It is necessary to understand these factors in order to understand the air pollution problem in Prince George.

1. **Sources:** Amount and type of air pollutants emitted, as well as the location and other source characteristics, such as the elevation and temperature of the emission, and whether the source is from a point (e.g. a mill stack) or distributed over an area (e.g. vehicle emissions). Controlling sources is the main approach to controlling air pollutant levels.
2. **Atmosphere:** The wind speed and direction as well as the amount of mixing in the air act both to transport and dilute pollutants. Pollutant levels from a source decrease with distance from the source as mixing with clean air dilutes the pollution. Short-term elevated pollutant levels resulting in air quality advisories are usually caused by atmospheric conditions that prevent dilution (e.g. low wind speeds and thermal inversions) and not by an increase in the emissions from sources.
3. **Receptors:** Those affected by the pollution – the citizens of Prince George. The location of people in relation to the sources, as well as their susceptibility to pollution and level of activity, will determine the impacts of pollution on health.

The air pollution problem in Prince George results from **sources** that are too close to **receptors** (people living in the built-up areas) for the **atmosphere** to be able to sufficiently dilute them.

Prince George has several pollutant sources, as well as frequent light winds and thermal inversions that combine with valley terrain to trap pollutants. The result is elevated pollutant levels. Any solution to the air pollution problem must consider all of these factors.

People can't control the atmosphere. However, communities can reduce the impacts of air pollution, either by increasing the distance between sources and receptors, or by changing the sources. Source changes that would reduce pollutant levels include:

- reducing the amount emitted;
- reducing the amount emitted during times of poor atmospheric dispersion (episode management); and/or,
- increasing the height, temperature, or velocity (by dilution with clean air) of the emissions.

Particulate Matter

Particulate matter (PM) consists of solid and liquid components originating from a number of different sources. It is categorized and monitored according to the size of the particle. PM_{10} refers to particulate matter less than 10 micrometers in diameter ($1/5^{th}$ the width of a human hair), while $PM_{2.5}$ is a subset of PM_{10} that is less than 2.5 micrometers in diameter ($1/20^{th}$ the width of a typical human hair). The smaller particles (i.e. $PM_{2.5}$) can penetrate deeper into the respiratory tract, and from there move into the circulatory system, resulting in cardiovascular effects.

In addition to several natural sources, PM_{10} and $PM_{2.5}$ particles are produced directly by combustion (e.g. burning of wood and fuel), are found in dust from roads and other locations, and are also formed in the atmosphere as secondary pollutants from the chemical transformation of various gases. Particulate matter produced by combustion and through chemical reaction are in the smaller size range (less than 2.5 micrometers in diameter),

and thus are of greater health concern than dust which tends to be in the size range between 2.5 and 10 micrometers in diameter.

Prince George has among the highest levels of PM_{10} and $PM_{2.5}$ in BC. The Canada Wide Standard (CWS) states a community's air must not exceed 30 $\mu g/m^3$ of $PM_{2.5}$ more than an average of seven days per year over three years to meet that standard. In 2003 Prince George exceeded 30 $\mu g/m^3$ on fifteen days. In 2004 the standard was exceeded on fourteen days. Currently, however, Prince George is in compliance with the CWS for $PM_{2.5}$.

Air quality advisories are issued in Prince George when 24-hour average values of PM_{10} exceed 50 $\mu g/m^3$ at the Plaza 400 monitoring site. In 2004 this condition occurred on twelve days and on fifteen days in 2003. This trend actually shows a decrease in the number of days the Ambient Air Quality Objective is exceeded compared to the mid 1990s, when PM_{10} levels exceeded 50 $\mu g/m^3$ on 20 to 30 days a year on average. However, conditions which exceed the Ambient Air Quality Objective for PM_{10} are still an issue in Prince George.

Figures 2 through 5 show the levels of PM_{10} and $PM_{2.5}$ in Prince George compared to other communities in BC, and also show the trends for each of these pollutants. The figures show that Prince George has among the highest levels in BC for these two pollutants. Trends between years are more difficult to interpret – changes in weather patterns from one year to the next can mask trends due to pollutant emissions. There appears to be evidence of an increasing trend in $PM_{2.5}$ until 2003, with annual average levels decreasing since then. Conversely, there appears to have been a decreasing trend in PM_{10} until 2003 with some more elevated levels in recent years.

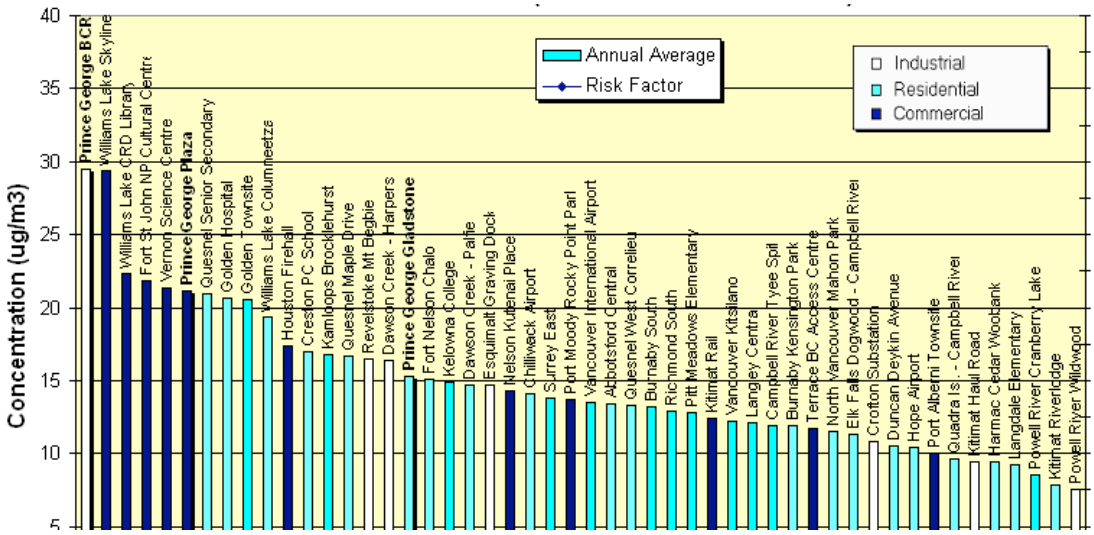


Figure 2: PM_{10} levels compared with other BC locations with continuous monitoring for 2006. (BC Environment, 2007 – Personal Communication, Dennis Fudge).

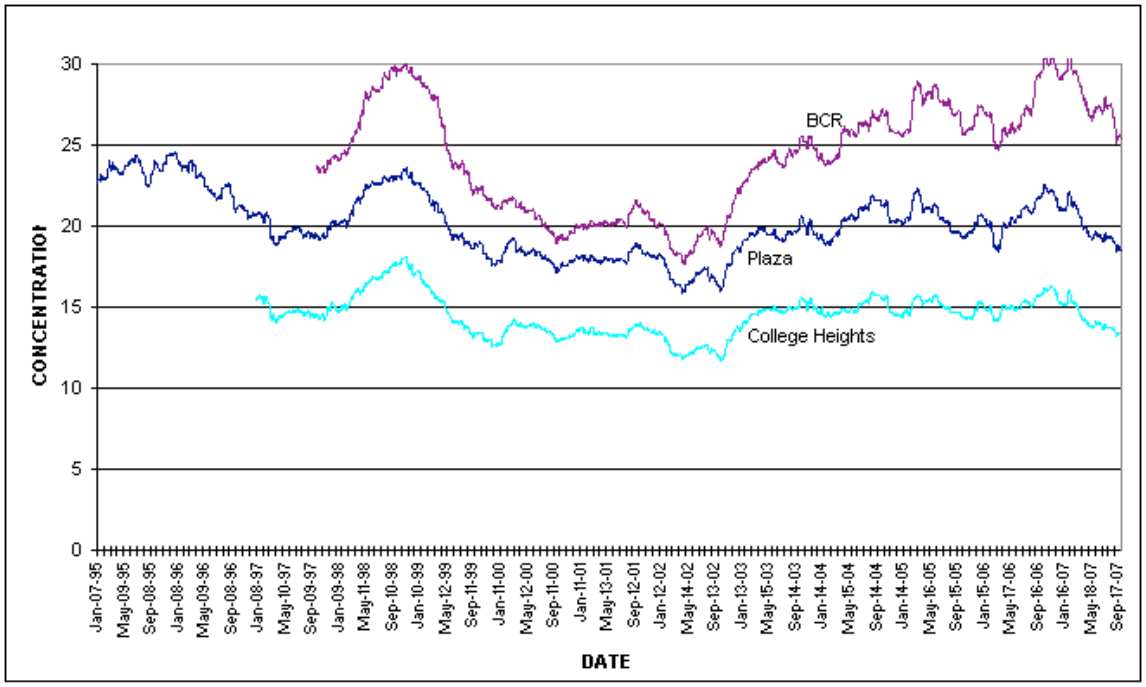


Figure 3: Trends in PM_{10} at Plaza 400, BCR and College Heights (BC Environment, 2007 – Personal Communication, Dennis Fudge).

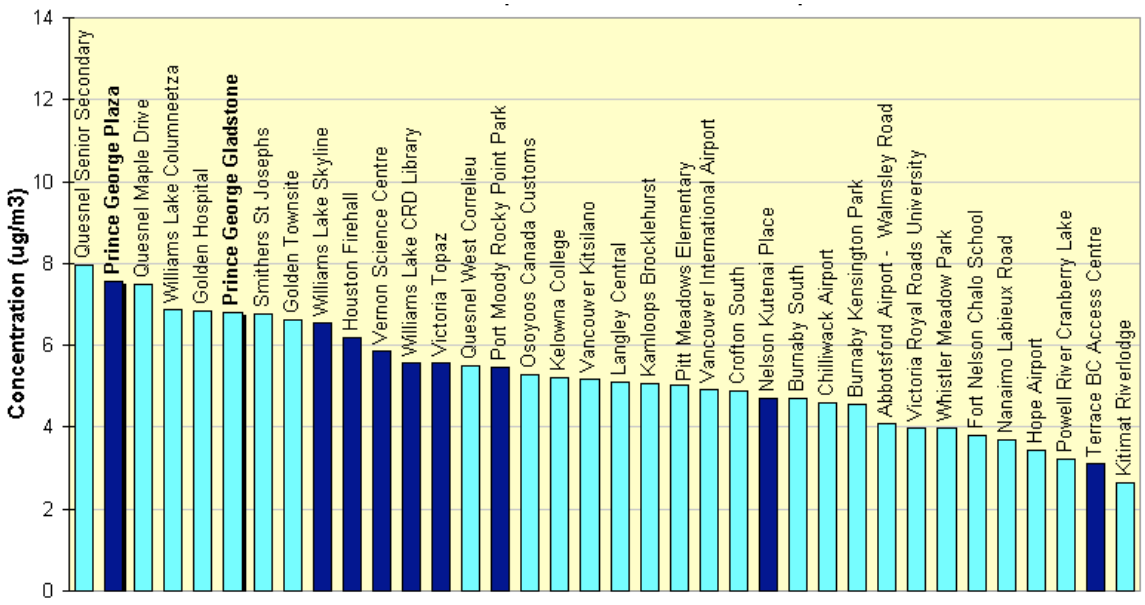


Figure 4: Annual average $PM_{2.5}$ concentrations compared with other BC communities for 2006. The monitoring location is broken down by whether the station is residential (light blue) or commercial (dark blue). (BC Environment, 2007 – Personal Communication, Dennis Fudge).

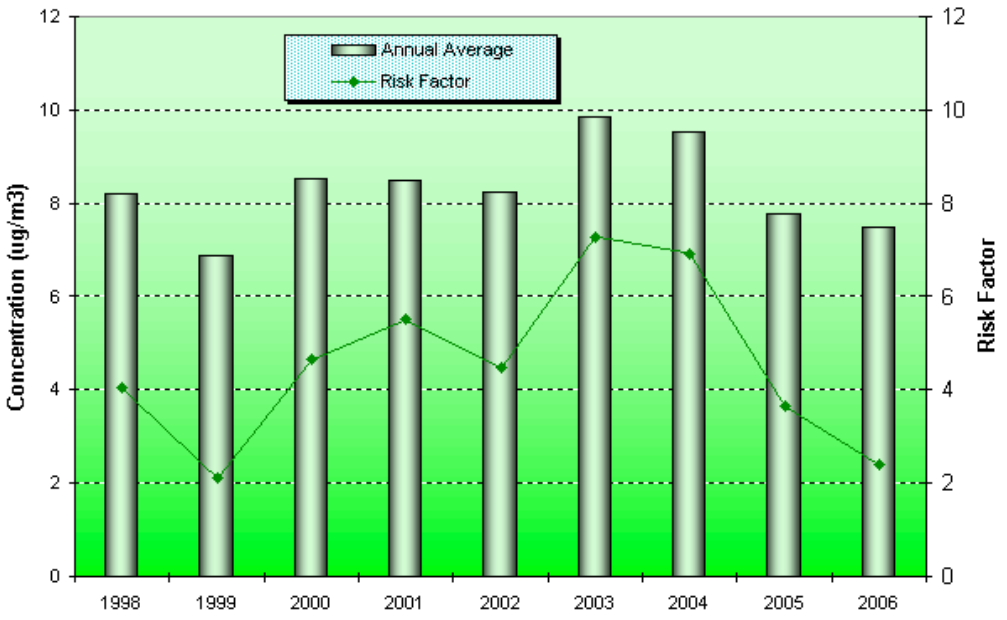


Figure 5: Trends in annual average $PM_{2.5}$ at Plaza 400. The right hand axis and the line connected by circles is a calculated "risk factor" which is a relative health index normalized to 2000 average values based on increments > 25 ug/m^3. (BC Environment, 2007 – Personal Communication, Dennis Fudge).

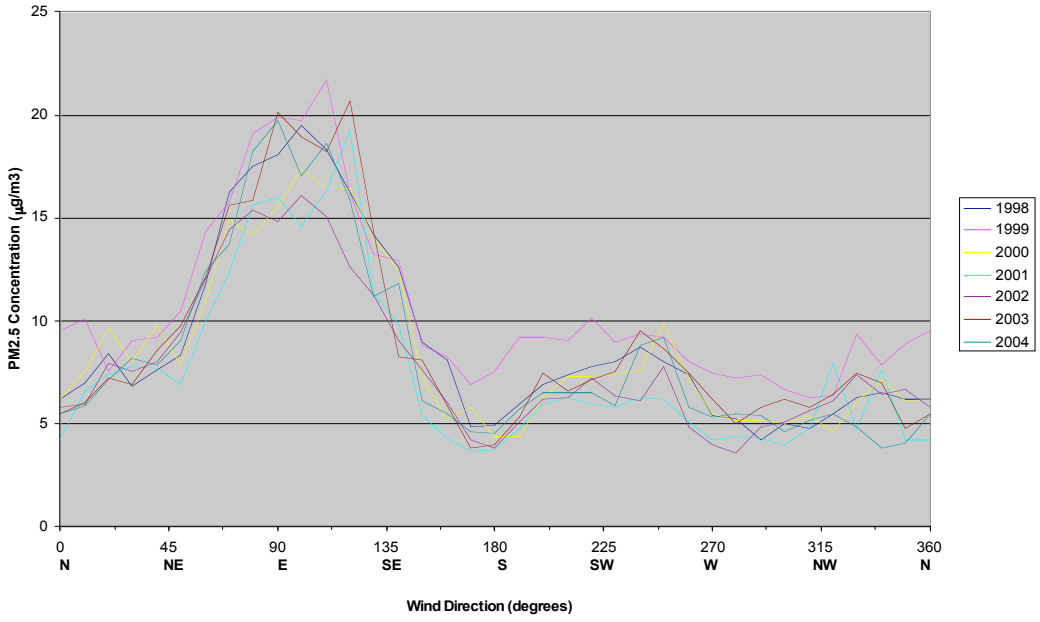


Figure 6: Variation in annual distributions of Prince George Plaza 400 $PM_{2.5}$ concentrations (µg/m^3) by wind direction (degrees), from 1998 to 2004. Wind direction is the direction from which the wind is blowing. (Fudge and Sutherland, 2006[2])

[2] *Fudge, D., D. Sutherland, 2006. Wind Sector Analysis – Update to June 2004 progress report prepared by the Prince George Air Quality Implementation Committee – prepared January 2006. BC Ministry of Environment internal report. 8 pp*

An analysis of pollutant levels at the Plaza 400 monitoring site that uses the wind direction to infer likely sources (see Figure 6) indicates the following:

1. **PM_{10}:** about 32% of the sources are from the northeast industrial sector, while 14% are from residential, 5% from the BC Rail area, 10% unknown and 39% are considered "background" levels.
2. **$PM_{2.5}$:** about 44% of the sources are from the northeast industrial sector, 17% from residential, 6% from the BC Rail area, 12% unknown and 20% are considered "background" levels (Fudge and Sutherland, 2004).

Background levels are from PM entering the Prince George airshed from outside the airshed. Sources are both natural, such as from wind erosion of soil and wildfires, as well as human-made, such as open burning and transport from other areas. These results are from a fairly simple analysis considering only wind direction, and should be considered tentative until they are substantiated by other studies. The data used in this analysis can only show the direction from which the pollutants are coming at the location of the monitoring site – they cannot differentiate between different sources in the same direction, or account for changes in wind direction that might occur across the airshed. The results do indicate however that particulate matter comes from a variety of sources.

Total Reduced Sulphur

Total Reduced Sulphur (TRS) is a mixture of five odorous compounds, including hydrogen sulphide (H_2S), that cause odour in Prince George. The levels of TRS observed in Prince George are well below the levels that would cause health impacts in most people, but are frequently above many people's odour detection threshold.

The only significant sources of TRS are industrial – the pulp mills and the oil refinery. Levels of TRS have decreased by about 75% since 1990 due to new pollution controls installed at the pulp mills. The wind sector analysis for the Plaza 400 monitoring site by Fudge and Sutherland (2004) indicates that 83% of TRS originates from the northeast industrial sector, 4% from residential areas, 1% from the BC Rail area, 11% unknown and 1% of the levels are considered "background."

The main concern with TRS is that it is a nuisance that affects people's perception of the air – it smells bad. This may affect people's decisions – whether to come to or live in Prince George, whether to visit or work in the downtown area (where levels are higher due to proximity to the sources). These impacts may therefore be quite important economically and socially.

HEALTH IMPACTS

Of the major pollutants, particulate matter is the air pollutant with the greatest potential to impact health. Impacts from exposure to PM include mucous membrane irritation, coughing, watery eyes, decreased activities of daily living, missed days at school or work, and increased use of medication. PM air pollution has also been linked to significant adverse effects including exacerbations of asthma, acute respiratory symptoms, chronic bronchitis, decreased lung function and premature death. Visits to emergency rooms and admission to hospital are caused by worsening cough, wheeze, chest tightness, and worsening of chronic heart or lung conditions. These more serious

outcomes represent the tip of a large iceberg of disease and disability (Figure 7). Long term exposure accounts for more damage than the short term peaks.[3] [4]

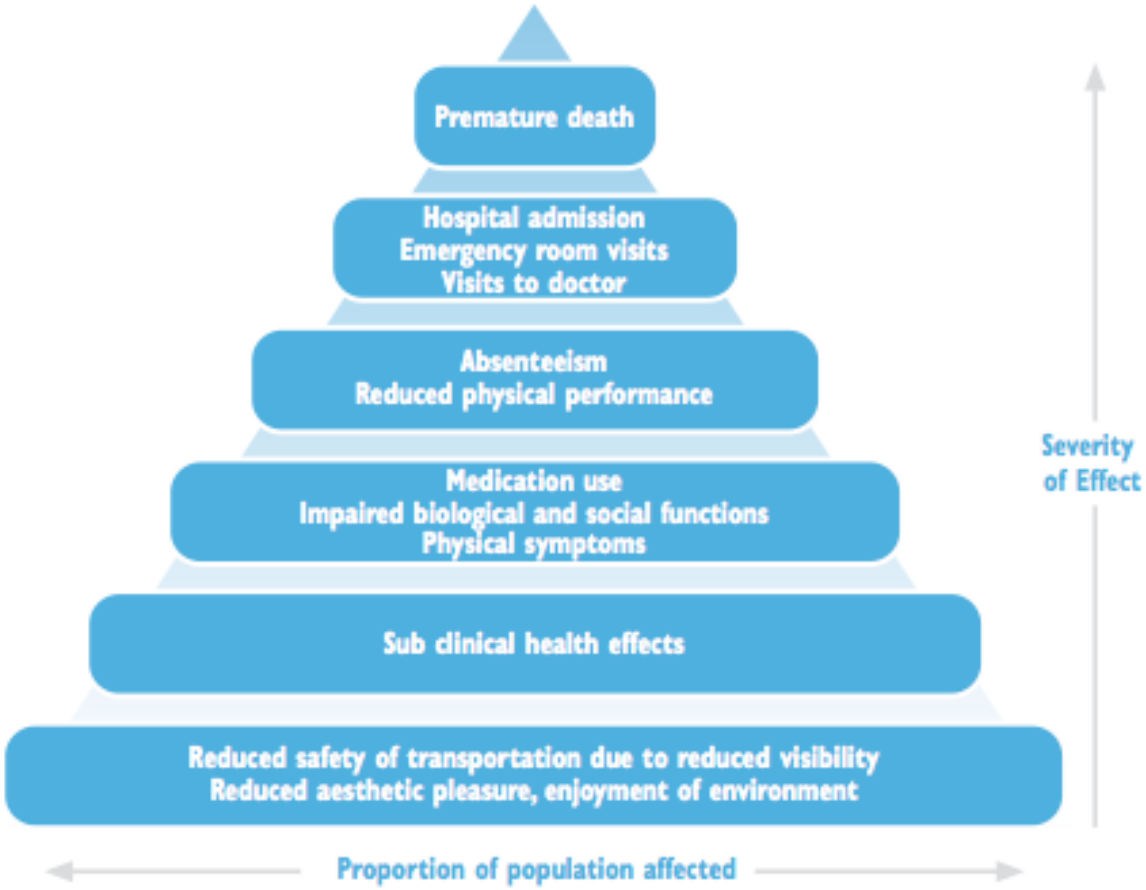


Figure 7: Effects of pollution on health and well-being. (Provincial Health Officer's Annual Report 2003; adapted from Health Effects from Air Pollution (Pyramid of Health Effects), by Health Canada, n.d.)

There does not appear to be any "safe" level for PM. The relationship between particulate concentration and illness or death is more or less linear: for every additional microgram of fine particulate in the air 0.6-1.6% more people will die every year; this means a few thousand additional deaths per year across Canada.[5]

The World Health Organization estimates that air pollution is responsible for 800,000 premature deaths worldwide every year. In British Columbia the premature death toll from air pollution has been estimated to be between 140

[3] *BC Ministry of Health Services 2004 Every Breath You Take; Air Quality in British Columbia, A Public Health Perspective The Provincial Health Officer's Annual Report 2003 http://www.healthservices.gov.bc.ca/pho/pdf/phoannual2003.pdf*

[4] *State of the Air in British Columbia 2005; BC Lung Association www.bclung.ca*

[5] *Bates DV, Koening J, Brauer M. RWDI West Inc Health and Air Quality 2002 Phase 1 Methods for Estimating and Applying Relationships between Air Pollution and Health Effects; BC Lung Association, May 2003*

and 400 deaths per year, with 700 to 2000 hospital admissions and 900 to 2700 emergency room visits caused annually by air pollution.[6]

Over the past ten years, new research has changed society's understanding of air quality and health in at least two important ways. It is now known that air quality varies significantly within a community as well as between communities. People who live near a major traffic artery or a train yard, directly downwind of an industrial site, or directly downwind of uncontrolled open burning, may experience a disproportionate risk of heart and lung disease.[7] People with low incomes are more likely to be living in these less than optimum conditions and they consequently bear a greater burden of illness and death from air pollution.

New research has also clarified that air pollution – and specifically exposure to PM – causes heart problems as much as it causes lung problems.[8] Healthy young adults have recently been shown to experience increased cardiovascular risk (inflammatory and clotting changes) with severe air pollution[9]. An earlier study[10] demonstrated that air pollution quadruples cardiac risk for current smokers and doubles the risk for former smokers as compared to non smokers.

In BC, interior and northern communities are generally the communities with the highest levels of PM pollution. Typically, the source is incomplete combustion of wood and wood products. Wood smoke contains a number of toxic products of combustion. Several studies have demonstrated a connection between wood smoke and lung disease. Industrial operations (sawmills, pulp mills), residential wood burning, backyard burning, and burning debris from forestry operations, particularly with the pine beetle epidemic, are major sources of wood smoke particulate pollution.

While the greatest contributor to air pollution in the Interior and North is incomplete combustion of wood and wood products, in a diverse community like Prince George there are many other activities such as land development, burning fossil fuels for energy and transportation, industrial operations, and burning debris from agricultural operations, which also contribute to air pollution. As the population increases, as human activity increases, many of the activities that produce air pollution will increase.

In the transportation sector, apart from cars, some of the highest emissions nationally come from small two stroke gasoline engines. Other fossil fuel-based emissions come from diesel trucks, buses, and marine engines. In ports, ships running on heavy bunker fuel are significant polluters. Fleets of diesel trucks idling while waiting to pick up cargo compound the problem. Additional pollutants of concern include locomotive emissions. Locomotives contribute 4% of all PM originating from the transportation sector nationally. While this may seem small, railways and switching yards are often located close to communities. Another source of PM air pollution is the plastic used

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[6] *4. Dodds, P. and Copes, R. Wood Smoke, Forest Fires and PM 2.5 in British Columbia, BC Medical Journal 2005; 47: 132-133*

[7] *Copes, R. interview in Your Health and the Air You Breathe Spring 2007. BC Lung Association*

[8] *Miller, K.A. et al, Long-Term Exposure to Air Pollution and Incidence of Cardiovascular Events in Women; N Engl J Med 2007; 356: 447-58*

[9] *Chan, C.C. et al, Effect of Urban Air Pollution on Inflammation, Oxidative Stress, Coagulation, and Autonomic Dysfunction in Young Adults Am. J. Resp. Crit. Care Med 2007, August 15.*

[10] *Pope, C.A. et al, Cardiovascular Mortality and Long Term Exposure to Particulate Air Pollution, Circulation 2004; 109: 71-7*

for storage and maintenance structures in the agricultural sector. It is difficult to dispose of, and much of it ends up being disposed of by open burning.[11]

Recent research has also uncovered significant health risks from exposure to diesel exhaust. Diesel exhaust particles contain a mixture of chemicals including carbon, toxic organic compounds, gases and trace metals. Recent studies indicate that diesel exhaust causes cancer in humans. Diesel particulate matter is thought to be the source for 70% of cancer arising from air pollution. There is also new evidence that the particulate phase of diesel exhaust causes myocardial ischemia, (insufficient oxygen getting to heart muscle).[12] [13]

The impact on health from community air pollution has long been underestimated. One of the key reasons is that evidence for direct links between a polluted airshed and the health of its population is quite limited. Research over the past ten to fifteen years has greatly expanded our understanding of the effects of air pollution on health, but the findings are based on disease and death patterns in very large populations, often data from several U.S. mega-cities combined.

For the same reason, there is little information specific to the populations of smaller centres. At least twice there have been well-designed studies that attempted to characterize the health impacts of air pollution in the City of Prince George. Each time the study was inconclusive, because the numbers of people available for such a study are too small. The 2003 Report of the Provincial Health Officer called for improved estimates of mortality attributable to air pollution in Interior and Northern communities. Since then new information has become available; in particular the research suggests that long-term exposure to PM has a greater impact on mortality than short-term exposure.

In 2007, Elliott and Copes released a document[14] that estimated the mortality in Prince George and other large communities in the Interior of B.C. The method is theoretical rather than actual, providing a best estimate rather than an actual count of deaths, given the current state of knowledge. Using this method they estimate that in the five years between 2001 and 2005 there have been 165 deaths in Prince George attributable to air pollution, an average of 33 per year. This places air pollution as a significant contributor to mortality, significantly under-estimated until the effects of long term exposure were better understood. Causes of death within the same range and time period in Prince George include: diabetes (95) lung cancer (240) and alcohol-related deaths (240).[15]

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[11] *Towards a Healthier Future: Meeting our Air Quality Resolutions: 2006 BC Lung Association www.bclung.ca*

[12] *Mills NL et al, Ischemic and Thrombotic Effects of Dilute Diesel-Exhaust Inhalation in Men with Coronary Heart Disease; N Engl J Med 2007 Sep 13; 357: 1075-82*

[13] *Mittleman MA. Air Pollution, Exercise and Cardiovascular Risk. N Engl J Med 2007 Sep 13; 357: 1147-9.*

[14] *Elliott C. and R. Copes, Estimate of Mortality Burden of Air Pollution in Northern and Interior British Columbia, 2001-2005; Division of Environmental Health Services, BCCDC 2007*

[15] *Haggerstone J. personal communication; source: B.C. Vital Statistics Annual Report 2001-2005 Mortality Tables*

AIR QUALITY GOVERNANCE AND MANAGEMENT

Air quality management in Canada is primarily a provincial responsibility. However, the federal government has a key mandate to carry out monitoring and research, as well as to manage air issues which have a trans-boundary or international component.

National Air Quality Governance and Management

Federally, Environment Canada has principal jurisdiction over air pollution issues. It works closely with the provinces and territories, municipalities, industry and the Canadian public to reduce the impacts of air pollution. The principle piece of federal legislation is the Clean Air Act, which was created to help protect human health and the environment by taking an integrated approach to reducing emissions of both air pollutants and greenhouse gases.

The Canadian Council of Ministers of the Environment (CCME) has established Canada-wide standards to protect the health of Canadians through improved air quality. The standards include a numeric limit and a timeline for attainment, as well as a schedule for reporting on progress.

Of particular interest to Prince George is the standard for Particulate Matter. The Canada Wide Standard (CWS) for $PM_{2.5}$ is 30 $\mu g/m^3$ – in other words, a community's air must not exceed 30 $\mu g/m^3$ more than an average of seven days per year, averaged over three consecutive years to meet that standard. The goal is to reach that target by 2010.

It should be noted that the Canada Wide Standard is a negotiated standard. As such, it is not as rigorous as the health-based standards recommended by Health Canada.

Provincial Air Quality Governance and Management

At the provincial level, the Ministry of Environment (MoE) is responsible for and/or involved in air quality research, implementing airshed plans, industrial permitting, creation and enforcement of legislation and regulations, and in public education. The key piece of provincial legislation relating to air quality is the BC Environmental Management Act which regulates discharge of waste into the environment. The Environmental Management Act also enables provincial authorities to issue pollution prevention orders. The key pieces of the Act of relevance in Prince George are the following regulations:

- **MoE Open Burning Smoke Control Regulation**
  The regulation applies to the burning of debris on the parcel of land from which the debris originated, for purposes such as land clearing, silviculture, forestry, wildlife habitat enhancement and domestic range improvement. The intent of the regulation is to standardize requirements for emission impact reductions for activities that are exempt from the requirement to hold a permit or approval under the Environmental Management Act.

- **MoE Solid Fuel Burning Regulation**
  The Solid Fuel Burning Domestic Appliance Regulation specifies particulate emission limits and labeling and testing requirements for new wood stoves, fireplace inserts and factory built fireplaces manufactured in BC, or sold or imported for use in BC.

- **MoE Asphalt Regulation**

  The Asphalt Plant Regulation applies to every hot-inplace asphalt recycling plant and hot mix asphalt plant operating in BC and the use of cutback asphalt in BC. The regulation regulates owners and operators in regards to emission limits, operating parameters, monitoring requirements, maintenance and emergency procedures.

The Ministry has had an Interim PM_{10} Objective since 1994. This is a numerical, non-legal guideline defining an acceptable level of an air contaminant in ambient air.

Municipal Air Quality Governance and Management

Locally, the City of Prince George participates on air quality management committees and is actively participating in the Partners for Climate Protection program. The City creates and enforces air quality bylaws and policies with respect to the environment, administration, and transportation. Of particular interest is the City of Prince George's *Clean Air Bylaw.* The bylaw includes regulations for wood burning appliances, open burning, recreational fires, and fugitive dust control, and sets guidelines for offences and penalties.

In December 1995, a working level agreement was reached between the City of Prince George, the Regional District of Fraser-Fort George and the former Ministry of Environment, Lands and Parks to coordinate air quality management in the Prince George airshed. The Prince George Airshed Technical Management Committee was then formed to prepare a management plan.

Prince George City Council and the Fraser-Fort George Regional District Board approved the *Prince George Air Quality Management Plan – Phase One* in 1998 (hereafter referred to as 'the Plan'). The fundamental motivation for creating the Plan was concern that poor air quality in the Prince George airshed was negatively impacting residents' health and quality of life.

Phase One of the Plan identified measures to improve air quality in the Prince George airshed, in particular to achieve acceptable levels of fine particulate matter. It contained 28 recommendations for actions to reduce and manage pollutant sources, including industrial emissions, road dust, and residential sources such as open burning and woodstoves. The Plan also addressed land use planning, poor air quality episode management, and the monitoring and research required to measure progress and to identify future management needs.

One of the recommendations of Phase One was to set up an Airshed Management Steering Committee, which resulted in the creation of a multi-tier committee structure as shown in Figure 8. The Plan's implementation is the responsibility of the Prince George Air Quality Implementation Committee (PGAQIC). This committee is a multi-stakeholder group with representatives from government, industry, the public, and the University of Northern British Columbia (UNBC). It meets on a regular basis to discuss how best to implement the Plan. See Appendix A3 for a complete description of the committee structure.

STATUS OF AIR QUALITY MANAGEMENT

In 2004, a progress report was completed by the Implementation Committee to provide an update on the developments resulting from the 28 recommendations in Phase One of the Plan.

That progress report noted the Phase One recommendations that had been completed, such as the elimination of beehive burners in the Prince George area, the creation of the Clean Air Bylaw, reductions in pulp mill particulate emissions, and the incorporation of air quality into the City's Official Community Plan. It also identified a number of recommendations still in the process of being acted upon. These include management of poor air quality episodes, a health study group, and airshed research.

To continue efforts at improving air quality in Prince George, the Air Quality Implementation Committee has created Phase Two of the Prince George Air Quality Management Plan. Phase Two brings forward recommendations identified as ongoing in the progress report and identifies a number of new recommendations. Phase Two is also the bridge between Phase One – the completion of the Source Modeling Study being conducted by the Research Working Group – and Phase Three, which will act upon the research being conducted. The Phase Two report was accepted by City Council and the Regional District Board in Spring 2007.

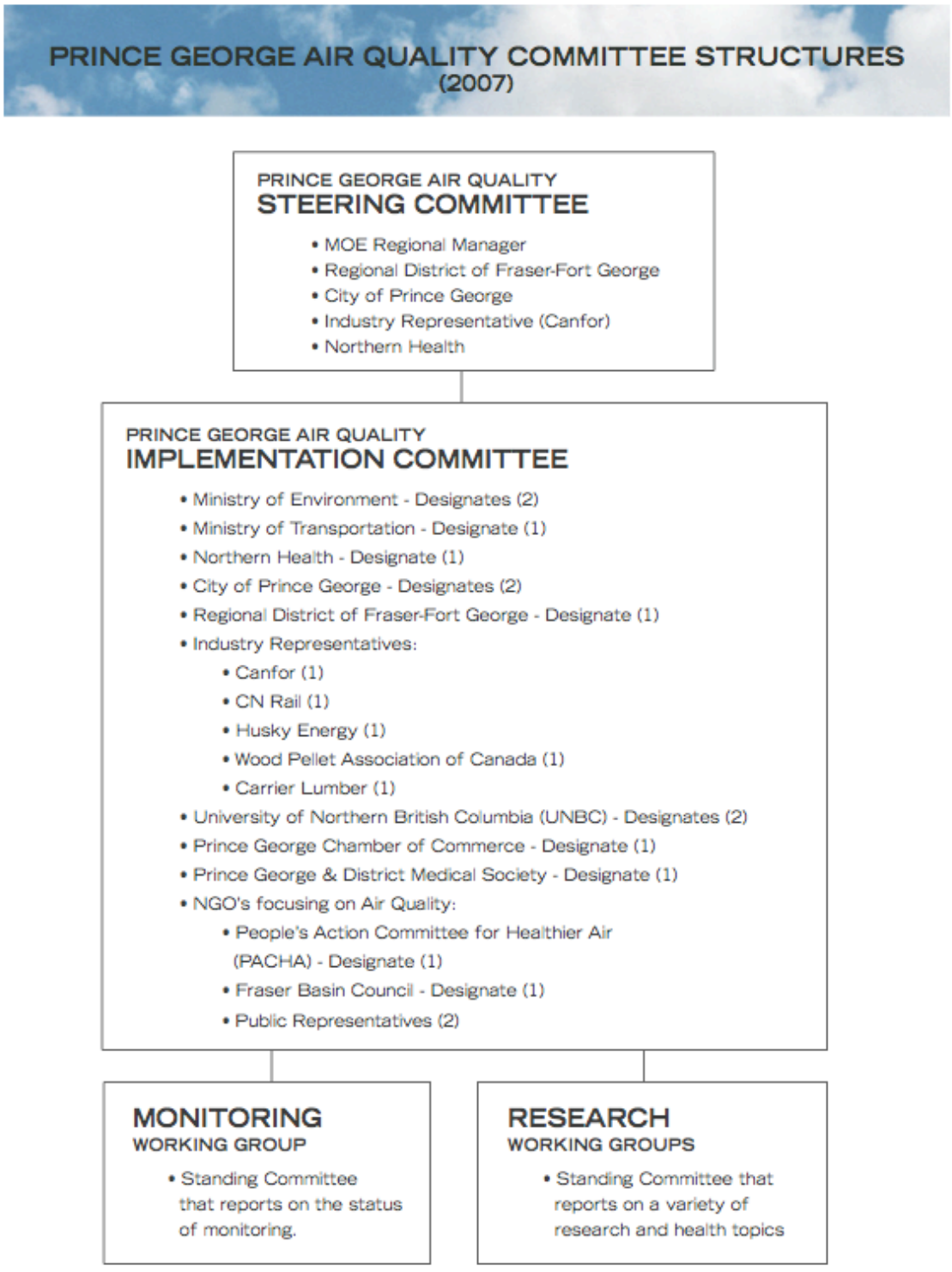


Figure 8: Current Prince George Air Quality Management Structure

Findings

AIR QUALITY GOVERNANCE AND MANAGEMENT

Current State

Air quality management planning has come a long way in the past decade. When Prince George began preparing its Air Quality Management Plan in 1995 there were only a few local governments in Canada attempting to manage air quality from a cooperative rather than a regulatory point of view. Now there are many jurisdictions creating air quality management plans, and learning from each other in the process.

This Task Force commissioned a report – *Best Practices in Air Quality Management (Millar 2007a – see Appendix B1)* – that identifies a number of characteristics of collaborative management considered important to the effective functioning of multi-stakeholder groups. Some of these include:

- availability of resources for planning process;
- willingness to participate;
- open membership;
- dedicated coordinator position to guide the process;
- development of clear and effective communication methods;
- establishment of clear decision-making rules;
- management approach that addresses a full range of environmental, social, and economic factors;
- implementation measures that are supported by information and education programs; and,
- decision making based on sound scientific research and data.

The critical factors that appear to play a role in the successful development and implementation of collaborative management plans include:

- sufficient funding and active in-kind support of members;
- a clear and concise management plan that prioritizes actions, states and monitors interim completion deadlines, and establishes strategic measures to aid in effective implementation; and,
- the establishment of a funded coordinator position to ensure effective communication between committees, monitor progress and set deadlines.

What Was Heard

There were a number of recurring themes heard throughout the initial stakeholder consultations when it came to air quality governance and management. Of greatest concern was the lack of formal and ongoing funding for the present committees and the research being conducted. Also of concern was the perception that the committees are slow to produce results. From a management standpoint, it was recommended that some changes be made to the committee structure and administration, including:

- a mechanism to involve each person on the committee;
- consensus decision-making be used;

- training in consensus techniques be provided for the participants; and,
- gaps in communication between committees and decision-makers be addressed.

At the public and stakeholder consultations the greatest concern was the need for stronger leadership at all three levels of government, with the City taking on an important role based on its status as public representative. The community members and stakeholders recognized the importance of funding solutions and wanted to see a dedicated budget for air quality issues. There was a strong sense that those responsible for air quality emissions should be paying for the solutions, and it was recognized that the mechanisms to make this possible would need to be implemented at the local, provincial and federal levels.

The discussions of the existing committee structure produced a number of recommendations, some of which are noted below:

- priorities need to be more focused and government and emitters need to support the process with resources (monetary and cooperation);
- there should be representation from asphalt/cement/gravel companies on the committees;
- the role of the Steering Committee needs to be redefined, or eliminated;
- there should be more public representation (perhaps from neighbourhood groups or community associations); and,
- stronger communication is needed and more power should be granted to decision making bodies.

There were also a number of suggestions regarding the recommendation to hire a paid air quality coordinator:

- the person should be independent from any of the government agencies,
- he or she should have air quality knowledge and act as an advocate for air quality
- he or she must have good coordinating skills and be able to work with all levels of government; and,
- consideration should be given to hiring more than one person, and/or providing additional support to the coordinator.

Task Force Recommendations

The first major recommendation of the Task Force regarding air quality governance and management is that the present committees be restructured as follows:

- **Replace the current air quality management structure with a single cooperative Roundtable on Air Quality with a range of interests represented.**

The Roundtable on Air Quality would be similar in membership and mission to the present Prince George Air Quality Implementation Committee (PGAQIC). (For the convenience of readers, we will continue to refer to it by the same name – PGAQIC – in this document.)

The Roundtable should have the following Working Groups:

- Monitoring Working Group;
- Research Working Group;
- Education and Awareness Working Group.

Government Representatives to the Roundtable should include:

- one City of Prince George designate;
- one Regional District of Fraser Fort George designate;
- two Ministry of Environment designates (one from Permitting and one from Air Quality);
- one Ministry of Transportation designate;
- one Northern Health designate;

Industrial Representatives to the Roundtable should include:

- one pulp mill designate;
- one wood products designate;
- one asphalt/cement/gravel industrial designate;
- one railway designate;
- one oil and gas designate;

Non-governmental and public representatives to the Roundtable should include:

- one University of Northern British Columbia designate;
- one Prince George Chamber of Commerce designate;
- one Prince George and District Medical Society designate;
- one environmental organization (focusing on air quality) designate;
- one Fraser Basin Council designate;
- one First Nations designate;
- two public designates;

If not already a member of the Roundtable, the Chairs of each of the three Working Groups should be represented on the Roundtable. Each designate should be a representative of their sector or working group. All Roundtable meetings should be public meetings (where the public can observe the proceedings). The committee structure and terms of reference should be final by September 2008. The Roundtable should present to Prince George City Council and to the Board of the Regional District of Fraser-Fort George.

It should be noted that the creation of the Roundtable does not remove the responsibilities of the government agencies for implementation of the actions already outlined in existing documents, nor does it alleviate their legislative authority. The roundtable should be accountable for coordinating the implementation of the Air Quality Management Plans.

Other recommendations of the Task Force regarding air quality governance and management are as follows:

- **The PGAQIC should establish a paid coordinator position with a dedicated mandate to facilitate and support the air quality management planning committee structure. This person should serve as an employee of the PGAQIC. The position should be secured for three years and funded by the City of Prince George, Ministry of Environment, Regional District, Northern Health, and Permit Holders. The funding formula should be agreed to by March 2008 with funding secured by May 2008. This position should be established by May 2008.**

- **The PGAQIC should**
  - **produce a publicly available annual report which is presented to Prince George City Council, the Regional District Board and published in the local newspapers;**
  - **make quarterly presentations to Prince George City Council and Regional District Board; and,**
  - **hold two meetings per year in which Prince George City Council members and the Regional Board members are invited to discuss air quality issues.**
- **The City of Prince George, Ministry of Environment, Regional District, Northern Health, and Permit Holders should provide formal, ongoing funding for air quality planning, management, education, and research. Non-governmental organizations and public members' time should be considered in-kind funding. The funding formula should be agreed to by March 2008 with funding secured by May 2008.**
- **The PGAQIC should include measurable outcomes and timelines in their management plans.**

REGULATORY TOOLS

Current State

A number of government jurisdictions have legislation, regulations, and bylaws that play an important part in the management of air quality. Of particular interest in Prince George are the standards and objectives set for particulate matter, and the regulations and bylaws that directly impact the levels of PM allowed to be emitted into the airshed. These include policies on open burning, asphalt plant operations, wood burning, wood burning appliances, and fugitive dust control. For example, the City has led the way in BC in developing a number of best practices to improve air quality, such as:

- earlier and more frequent sweeping of traction materials on the streets after winter; and,
- using dust suppressing liquids for street sweeping and requiring such methods for private parking lots through a bylaw.

There are, however, problems with overlapping jurisdictions involved with open and controlled burning which causes confusion among developers, contractors, and the public which should be addressed. The airshed management society in the Skeena Region provides a good example of agencies and stakeholders working together to reduce impacts of open burning.

Biomass burning in private homes through wood burning appliances, fireplaces and outdoor wood boilers is currently controlled under the City of Prince George Clean Air Bylaw which limits use of these appliances during air quality advisories, and specifies that new wood burning appliance installations must be CSA/EPA-approved for emissions. With an increase in the price of natural gas, it is likely that there will also be an increase in the frequency of wood burning for heat, much of which will occur in older wood burning appliances that have much higher particulate matter emission rates than current CSA/EPA-emissions-approved appliances. While current research projects will be able to quantify the overall contribution of wood burning appliances to regional particulate matter levels, it is generally accepted that the local (i.e. within an immediate neighbourhood) contribution of PM from wood burning can be quite high.

Outside of city limits there are also air quality issues that need to be addressed. Air pollution sources such as open burning, use of residential woodstoves and outdoor wood boilers can have a significant impact within a neighborhood especially when venting conditions are poor. Residents of the Regional District have an equal right to be protected from these air pollution sources.

What Was Heard

The feedback received from stakeholders generally focused on the need for provincial legislation to enable municipalities to have the discretion to enforce more stringent air quality standards than those required by provincial and federal legislation. For example, this feedback included:

- a request that asphalt plant emissions in the Prince George area meet or surpass the Greater Vancouver Regional District's regulations;
- a recommendation that the provincial Open Burning regulations be updated; and,
- a suggestion that the guidelines set out by the provincial government in the *Environmental Management Act* should be required, enforceable standards (e.g. a $PM_{2.5}$ standard upon which air quality advisories would be based in jurisdictions that determine it to be the priority air pollutant).

There was also general agreement among a number of stakeholders that both the provincial regulations and the City's bylaws (e.g. Clean Air Bylaw) must be enforced more consistently and stringently.

The above feedback was consistent with the comments that were heard at the public and stakeholder consultation of the recommendations. There was consistent concern over the enforcement of the Clean Air Bylaw and provincial legislation, and the need for additional staff to be available at times when burning and street sweeping typically occurs (evenings and weekends).

Task Force Recommendations

- **The BC Ministry of the Environment should create a $PM_{2.5}$ objective that will be one of the factors upon which air quality advisories in Prince George are issued. This should occur by December 2008.**

- **City Council should direct City administration to incorporate the recommendations from Phase Two of the Air Quality Management Plan into the Clean Air Bylaw and streamline any existing concerns with the bylaw.**
- **The recommended timeline for bylaw changes is as follows:**
  - **draft of changes – May 2008;**
  - **public consultation – June 2008;**
  - **final draft – September 2008.**

- **The City of Prince George should:**
  - **review the effectiveness of its bylaw enforcement procedures related to the Clean Air Bylaw and other relevant bylaws (e.g. Highways Bylaw), and establish a clear policy after public consultation. The policy should be finalized by September 2008 (in coordination with the bylaw review). Progress can be tracked with reports to City Council and advertising for the public consultation sessions.**
  - **hire an additional Bylaw Enforcement Officer whose main responsibility would be enforcement of the Clean Air Bylaw. A budget should be set and the position advertised by April 2008.**
  - **incorporate fines into the Clean Air Bylaw. These should be incorporated by February 2008, with the understanding that there may be changes as part of the bylaw review.**
- **The Regional District should review the City of Prince George's Clean Air Bylaw to consider the feasibility of implementing a similar policy with respect to indoor and outdoor wood burning appliances as recommended in Phase Two of the Air Quality Management Plan, and provide a response to the PGAQIC by June 2008.**
- **The PGAQIC should work with the City, Regional District and Provincial governments to provide and implement incentives to remove older woodburning appliances and replace them with CSA/EPA-emissions-certified stoves as part of an ongoing program. It is suggested that the City match incentives offered by the woodburning appliance industry and the Province, up to a specified number of replacements each year, and provide a tax credit on City property taxes. The offering of "Burn it Smart" and other educational initiatives on clean burning should be continued and expanded. The implementation of this program should begin in Spring 2008. Progress may be tracked through annual reports from PGAQIC and updates to City Council.**
- **The City of Prince George should lead in the establishment of a formal "Open and Controlled Burning Committee" for the Prince George area, including provincial (Ministry of Environment and Ministry of Forests), municipal, fire, and regional representatives in order to assure better communications and to formalize a procedure for decision making. The information from this committee should be available on websites accessible to the public and letters should be written to local associations (eg. construction, engineering, and development) and City of Prince George Development Services with updates to the decision making process. This committee should begin meeting in March 2008.**

EDUCATION AND PUBLIC AWARENESS

Education and public awareness are important aspects of an airshed management plan and its implementation. Case studies of other collaborative groups have indicated that public consultation and participation is linked to higher success rates, promotes broader understanding, builds trust and reduces cynicism (Millar, 2007a – see Appendix B1). Both public information and school-age education programs have been identified as critical elements of successful collaborative airshed management practices.

Current State

Although public input was sought during the development of Prince George's Air Quality Management Plan, ongoing education and awareness activities have been limited.

However, the City of Prince George has undertaken several education initiatives on its own. It also participates in provincial and national programs, including Environment Week, the Commuter Challenge, Burn it Smart Workshops, the Open Burning Program and Anti-idling Campaign. These programs have helped to educate the public about their own actions and how they can reduce their individual impact on air quality.

The BC Lung Association is a province-wide organization that provides information to the public about air quality, as well as a variety of services related to indoor and outdoor air quality. Seminars and open houses on pollution and air quality are organized throughout the year in BC communities. Educators are available to give one-on-one telephone and in-person consultations on pollution and air quality as they relate to lung health promotion and lung disease prevention.

Annual air quality reports for the airshed are produced by the Ministry of Environment and are available to the public online, from the Ministry, or at the UNBC library. There is a two- to three-year time lag before this detailed analysis of the Prince George monitoring data is available to the public. This time lag is due to the time-consuming process of quality assurance, analysis and internal review required to produce the detailed and scientifically sound report, and due to the workload of the Ministry staff. The reports could be produced more rapidly if staffing levels at the Ministry of Environment were sufficient.

Currently there is a public perception that little is being done to address air quality issues in Prince George. The PGAQIC has recently taken steps to address this perception by implementing a communications plan, which includes an informative website and a public input process. The recent formation of the People's Action Committee for Healthy Air (PACHA) has also provided an additional avenue for public awareness. PACHA is a watchdog group, registered as a society with the Province of BC, that deals with air quality issues in the Prince George airshed on behalf of its members and the general population of the city. PACHA supports clean air initiatives through the city, has hosted information seminars on air quality and is willing to provide public education programs through its large number of volunteers. Other resident associations, such as the North Nechako and Heritage Residents' Associations have also raised concerns about poor air quality.

The Task Force-commissioned report, *Best Practices in Air Quality Management (Millar 2007a* – Appendix B1*)*, looked at five case studies of community airshed management plans, including Prince George's. In all cases – except Prince George's – community education is identified as an objective of the plan, with programs and initiatives clearly stated. Membership in the managing committee is clearly voluntary and open to the public. Some other mechanisms used by other groups for facilitating public awareness and community education include:

- a dedicated coordinator position, one of whose duties is to facilitate public education on air quality;
- an official public meeting held annually or an annual general meeting of all committees that is open to the public;
- a mechanism to receive input and comments from the public at all times;
- development of programs to be taught in both elementary and secondary schools;

- a conference held every two years to provide a venue for air quality presentations and discussions amongst stakeholders and community groups;
- a communications committee or working group to ensure that public awareness and community education is an ongoing priority;
- use of newsletters, news releases, public notices, public presentations and various displays at community events to inform and involve public;
- periodic surveys used to seek public opinion and help identify and prioritize issues; and,
- adaptations or new developments in the plan undergo public consultative processes.

An informed public and positive attitude regarding air quality improvement is essential for successful development and implementation of an airshed plan. It is important that a community's residents feel they are working together to achieve better air quality in Prince George and that each person doing their part will make a difference. This awareness can be achieved with regular interaction between the public and the PGAQIC membership that facilitates ongoing communication and demonstrates clear progress.

What Was Heard

During initial consultations the Task Force heard repeatedly that there is a lack of public understanding regarding what has been done in Prince George to improve air quality. Others feel that residents of Prince George are suffering as a result of poor air quality. An executive member of the Prince George Chamber of Commerce identified poor air quality as one of the most common reasons people leave the city. A letter from 47 future health care practitioners from the Northern Medical Program expressed their view that "sacrificing air quality [appears to be the] price the city is willing to pay to support the current economic situation," but that poor air quality is a major deterrent in their minds when considering where they will practice medicine. Other comments received during initial consultations indicated a need for regular public information sessions to provide residents with a better understanding of the effects of air quality and to obtain more public input. Increased education on wood-burning and the implementation of an Air Care program (vehicle emission monitoring) were also suggested.

Public feedback on the Task Force's Interim Report showed clearly that the public is very concerned and disheartened regarding the perceived lack of action on improving air quality in the city. Many feel that both City Council and the Ministry of Environment are failing at their duty to protect their right to clean air and they want accountability for those public agencies as well as those responsible for the pollution. The public wants daily reports on air quality levels, easy access to understandable information on the main pollutants and their health impacts, education for the youth of the city through school programs, information to help individuals make personal changes to improve air quality, and financial incentives to make these changes possible by everyone. Most importantly they want involvement in an accessible and transparent process to achieve significant air quality improvements in a short time-frame. Some of the specific recommendations heard during the consultation period regarding public education were as follows:

- adequate budget for the coordinator to run public education programs;
- a health campaign similar to the anti-smoking campaign to inform people of the serious health effects of air pollution, starting with the preschool age-group and reaching all social groups;

- events that celebrate the successes of air quality improvements being made so that the public can feel the progress;
- programs run in the schools to educate youth about air quality and what they can do to make a difference (e.g., one idea was to turn air quality monitoring into an educational tool where student clubs could collect samples and report data weekly to a central agency);
- seasonal but preferably weekly reports on the state of Prince George's air quality so that residents have the most up-to-date air quality information;
- an education campaign that addresses different areas so that each individual can find a way to make personal changes to improve air quality (wood-burning practices, idling of vehicles and vehicle maintenance, energy efficiency, alternate transportation etc.);
- reporting of permit violations in the local paper to give industries an incentive to become good corporate citizens;
- regular town hall meetings starting immediately;
- public access to real-time ambient monitoring and emissions data on-line to make major industries accountable 24- hours a day;
- workshops aimed at raising public awareness on pollution prevention and promotion of individual participation and responsibility in improving air quality; and,
- funding for the coordinator to work out of a store-front style office that is accessible to the public and can provide information, interactive activities and a venue for public discussion.

It was also mentioned at the consultation that there is an air quality complaint line available for the public. The number is 565-4487.

Task Force Recommendations

- **The paid coordinator employed by the PGAQIC (as previously recommended) should organize community outreach, public education and awareness programs, funding initiatives and other related tasks.[16] These programs could be coordinated with other community groups, government agencies and educational institutions. Public education programs run by the coordinator should start by the summer of 2008. Educational activities can be tracked by including them in annual reports and in the updates to Council and the Regional District Board.**

[16] *Some suggested programs include: presentations and activities with children at schools (Clean Air Hamilton is developing special curriculum that may be used); a booth at an annual public event such as the Children's Festival; monthly air quality information days at the Prince George Public Library; special activities to celebrate Clean Air Day to be held at a local park or other public venue, including acknowledgment of air quality improvements that have been made and recognition of "Good Corporate Citizens"; a biennial public workshop or conference to strengthen communication and networking between interested stakeholders and the public.*

- **An Education and Awareness Working Group should be added to the air quality management structure. The working group will ensure community education and awareness is an ongoing priority and will help implement the recommended education programs and events. This working group should be established by March 2008. The BC Lung Association should be invited to be a member of the working group. Minutes for this working group should be made available on the PGAQIC website.**
- **Northern Health should work to increase public awareness of the health impacts of poor air quality in coordination with the Education and Awareness Working Group beginning in 2008.**
- **The PGAQIC should include public education and community engagement as part of Phase Three of the Management Plan to ensure that public outreach is extensive and ongoing.**
- **The Ministry of Environment should produce annual air quality reports more promptly. The 2007 Annual Report should be released to the public by the end of September 2008, with the 2005 and 2006 reports being released to the public by June and December 2008 respectively. In addition to the annual reports, a time series of ambient air pollution levels should be produced from unofficial data with an appropriate disclaimer, and made available on a website on a near real time basis. The availability of this data online should be advertised to the public and be included in the annual reports.**
- **The PGAQIC should actively engage the public by holding an annual forum that is open for public participation and feedback. The first meeting should occur in early June 2008 as part of Clean Air Day activities. In addition to this annual forum, all meetings of the PGAQIC should be open to the public for observation, and a mechanism to receive input and comments from the public at all times should be available and advertised to the public.**

LAND USE AND DEVELOPMENT

A significant factor in managing air quality – both directly and indirectly – is land use and development in the community. Air quality is directly affected by the location of emission-producing heavy industry (although the emissions are regulated by provincial authorities). Air quality is also indirectly affected by emissions from thousands of small unregulated sources such as vehicles, railways, buildings, light industry, commercial operations and road dust – all of which are part of land use and development.

Current State

Like all local governments in BC, the City of Prince George has the authority under the *Local Government Act* to regulate land use and development within its boundaries through two main mechanisms: the Official Community Plan (OCP) and the Zoning Bylaw. While both mechanisms are used to address the issue, there are jurisdictional limits to what local governments may do with respect to air quality.

The City's Official Community Plan (2001) looks to the future and sets out the long term vision and goals for the community, with policies covering growth management, environmental quality, and land use. During the public

involvement process, the need to significantly improve air quality was identified as one of eight significant planning issues. The OCP, Chapter 4 – Environmental Quality, includes air quality and identifies six strategies to help improve it:

- review frequency of street sweeping;
- establish guidelines for cleaning paved commercial and public parking lots;
- minimize amount of traction material for streets during winter;
- encourage alternatives to backyard burning;
- encourage technological changes to reduce emissions; and,
- promote compact development and alternate transportation to decrease dependence on private vehicles.

In the OCP, Chapter 3 – Growth Management, Policy 12 concerning Industrial Lands states that for existing heavy industrial uses, air quality is to be monitored with an emphasis on reduced emissions and minimization of impacts on city neighborhoods. New heavy industrial businesses will be encouraged to work with the City of Prince George and the Regional District of Fraser Fort George to locate at appropriate sites. Further, the OCP states that new industrial development within the city will be in the form of uses which do not create adverse environmental impacts.

The City's OCP also designates Development Permit Areas, including those for industry. These are the Carter Industrial area, Queensway East, and any lot designated or zoned industrial within 50 metres of a major road.

The Zoning Bylaw implements the OCP, by regulating current land uses and development, and specifying what is allowed for each parcel of land. Recently updated, the City's Zoning Bylaw No. 7850, 2007 includes separate zones for General Industrial, Heavy Industrial, Special Heavy Industrial, and Concrete and Asphalt. These zones determine where heavy industry and concrete and asphalt plants are allowed to locate.

The Zoning Bylaw also includes Development Permit Guidelines which allow local government to regulate development on a more detailed level (including form and character) for specific sites and uses. The Industrial Development Permit Guidelines deal with aspects such as a building's siting and design, lighting, parking and landscaping.

The City may designate development permit areas and create related guidelines for the protection of the natural environment, its ecosystems and biological diversity. However, it can only do so in specific areas and with respect to natural features. Designating a large portion of the city as an Air Quality Protection Development Permit Area would not be permitted under current legislation. Therefore, the City may not refuse to issue a development permit on the basis of air quality concerns.

For many years, some have suggested that heavy industry should be located outside of the City, and especially outside of "the Bowl" area. The Regional District of Fraser-Fort George conducted a land use study in 2000/01 which considered a number of potential sites for future heavy industry in rural areas around Prince George. The Regional District is presently in the process of updating the Industrial Land Use Study. Regional Districts are also governed by the *Local Government Act*, and thus subject to the same limitations as the City in dealing with air quality.

The City has adopted land use practices of other local governments to help improve air quality. For example:

- using preferential taxation powers to encourage redevelopment of downtown properties, thus encouraging compact development and less reliance on private vehicles; and,
- adopting a unique zone to limit concrete and asphalt plants to specified sites, rather than allowing them throughout industrial use zones.

A relatively new concept – eco-industrial areas – is being pursued in BC and elsewhere in Canada. Generally, the idea is to locate industrial plants immediately adjacent to each other, so that the waste output from one is used as the resource or input material for another. The close proximity reduces the need for transportation, and also provides an opportunity to share infrastructure and services and to use waste heat – all of which helps to reduce overall air emissions. The concept is also being applied to existing industrial areas. Some examples of both new sites and retrofits are found in Regina, Saskatchewan, Hinton, Alberta and Delta, BC.

In Prince George, this approach has been well established for decades. A few examples are the pulp mills and chemical plants on the north side of the Nechako River, and the saw mills, planer mills and pellet plants in the BCR Industrial site. The problem Prince George faces is that these heavy industrial areas are in the Bowl and therefore present concerns for air quality. However, there is an opportunity to pursue the application of eco-industrial principles to the existing heavy industry areas, as well as potential new heavy industry areas.

The City is interested in promoting energy efficiency. Constructing energy efficient homes and businesses helps decrease emissions, because less fuel (e.g. natural gas, oil, wood) is burned for heating. The City, however, must comply with the provincial building code. While it can encourage developers to pursue energy efficient design and construction, it has no jurisdiction to require anything beyond the provincial standards.

What Was Heard

The Task Force heard many concerns about how and why emission sources are located where they are, as well as concerns about overall development patterns in the city. A number of common themes were identified:

- lack of support for locating new industry in the Bowl;
- a desire to see planning and zoning that contributes to improvements in air quality;
- support for incorporating air quality factors into development permit approvals, including possibly using the Municipal Environmental Impact Assessment process;
- need to study costs and benefits of relocating asphalt plants outside of the Bowl, including considering land exchanges with government;
- concern with the proximity of commercial transportation routes to residential areas; for example Queensway and the South Fort George neighbourhood;
- support from community to better identify point sources of emissions;
- calls for better coordination among different levels of government on air quality issues in general and industrial developments in particular;
- a desire to move the discussion about air quality past the current economy (jobs) versus air quality (health) dichotomy;
- a hope that air quality can be used as a catalyst for improving the quality of life in Prince George, thus keeping existing and attracting new residents and businesses;

- a desire to see financial incentives used to encourage redevelopment and compact development, and to reduce air emissions; and,
- support for the creation of attractive walking and cycling routes to encourage both, and for the promotion of more transit (e.g., smaller buses running more frequently; shuttle buses in the downtown core).

Task Force Recommendations

- **The City should work with the MoE to develop an integrated approval process by aligning the information, assessment and approval processes of the City and Province, so that City approvals and permits are issued after all Provincial approvals and permits are issued to the proponent. These processes should be in place by June 2008.**
- **The City should work with the Regional District of Fraser Fort George and MoE to determine the effects of all potential emissions from the areas considered in the heavy industry land use study (e.g., the proposed industrial plant, related commercial truck and rail transportation, and employee commuting).**
- **The City should retain legal counsel to conduct a review of provincial legislation and make recommendations to the provincial government on how local governments' authority and available tools (e.g. development permits) may be amended to better deal with air quality. This process should begin by March 2008.**
- **The City and affiliated organizations should revise their economic development strategy to pursue forms of business development and job creation that do not adversely affect air quality. This new strategy should be developed by October 2008.**
- **The City should explore the application of eco-industrial principles with local industry, as part of an overall strategy to reduce emissions. This strategy should be developed by December 2008.**

INDUSTRIAL, COMMERCIAL AND TRANSPORTATION EMISSIONS

Current State

Industrial air pollution emissions are regulated by the BC Ministry of Environment. As discussed previously in this report, ambient air quality levels of particulate matter in the Prince George airshed are unacceptably high. This effectively limits the capacity of the Prince George airshed to accept new air pollution sources and therefore the industries that produce them. Consequently, without lowering ambient air levels by reducing existing source emissions, the economic growth of the City is potentially limited.

A report commissioned by the Task Force (Millar, 2007b) and included as Appendix B2, reviewed the emissions and pollution control technologies used by the pulp mill, sawmill, and refinery industries in Prince George and compared them with other facilities in BC and internationally. It examined both total emissions and the intensity of emissions (emissions per unit of production). Good information was available for and provided by the pulp industry, while less certain information was available in the sawmill industry. It needs to be emphasized that the

Millar report could only provide an overview. A more detailed engineering analysis of each facility is needed before facility-specific recommendations can be made.

For the pulp industry, the report's findings indicate that the emissions per unit of production from pulp mills in Prince George are within the range of those reported elsewhere in North America and in Europe. Per unit production of PM is above average at the Northwood and the PG Pulp mills (but not the highest of those mills compared), and below average for the Intercontinental mill. The European Union has established a range between 0.2 to 0.5 kg/ADt (kilograms of emissions per Air Dried tonnes of pulp production) for total particulate matter – a range that it considers achievable for kraft pulp mills. In Prince George, only the Intercontinental mill's particulate matter emissions fall within this range.

In Prince George, the Husky Energy refinery's emissions of particulate matter are among the lowest in total and based on a per unit basis of the twelve refineries examined. The emissions of SO_2, however, ranked third highest of the twelve refineries based on per unit of production basis.

The emissions data for sawmills is more scant and less reliable than for the other two industries, making it difficult to assess or compare the emissions from sawmill operations in Prince George with those elsewhere. National Pollution Release Inventory (NPRI) data indicate that emissions of particulate matter from Prince George sawmills are within the range of those from other facilities in Canada.

The Millar (2007b) report indicates that in nearly all cases, improvements in direct pollution controls could be made.

What Was Heard

The consultation after release of the interim report indicated general support for the recommendations proposed initially for industrial, commercial and transportation emissions. But there were also many suggestions that stronger statements be made regarding the review of industrial permits, and that responsible bodies and timelines for implementation be indicated where appropriate. Full details and a summary of the consultations can be found in Appendix C.

Task Force Recommendations

- **The BC Ministry of Environment should enact the area-based management provisions of the Environmental Management Act in order to improve air quality in Prince George. Prince George could be treated as a test case for the Ministry to develop policy and practices for this portion of the Act. This would likely involve authorizing regional Ministry of Environment officials to use a permitting process to override regulations and codes of practice where necessary to consider cumulative impacts and impose more stringent standards. This recommendation should be implemented in 2008.**[17]

[17] *It is felt that this recommendation would give considerable flexibility in the creative and effective management of air quality in Prince George, including the consideration of the location of new industry, and the provision of reduction incentives for new industry. For example, the asphalt plant industry could be better managed for air quality impacts using area-based management provisions of the Environmental Management Act. Currently, allowable emissions from asphalt plants are set under a province-wide regulation that does not*

- **All industrial, commercial and transportation operations, regardless of size or total impact on air quality, should understand their air emissions, have knowledge of best practices in controlling air emissions in their business, and have a plan in place for lowering their air pollution emissions. For industrial operations that are regulated by the BC Ministry of Environment, this plan can be part of the permitting process. For other operations, this plan should be part of the City of Prince George business licence application/renewal process, and can take the form of a short questionnaire. This will be an ongoing process that should start in 2009. The information collected by the BC Ministry of Environment and the City of Prince George should be included in the PGAQIC Annual Report.**
- **The BC Ministry of Environment and the PGAQIC should work with all industrial, commercial and transportation operations with PM emissions that are shown (by modelling and other studies) to have a significant impact on ambient air quality to set out targets, as well as two-, five- and ten-year timelines to reduce the impact of these sources on ambient levels. Targets should cumulatively keep Prince George in compliance with the Canada Wide Standard for $PM_{2.5}$ in the short term and lower the impact of those sources by 40% of their 2006 contributions by 2016. Priority should be given to those sources that do not use the current Best Available Control Technology. This should be an ongoing process, with initial targets and plans in place by January 2009. Progress in meeting these targets and timelines should be reported annually to the BC Ministry of Environment for inclusion in the PGAQIC annual report.**
- **The BC Ministry of Environment should review all air pollution permits with a view to lowering the allowed emissions over time. This will be an ongoing process starting in 2008. The BC Ministry of Environment will report changes to any permits to the PGAQIC for inclusion in their annual report.**
- **The BC Ministry of Environment, the City of Prince George, and the Regional District of Fraser-Fort George should ensure that new sources of pollutants that are estimated to measurably impact air quality in the airshed are not allowed until existing sources have been lowered sufficiently for significant continuous improvement in ambient levels. New developments, if allowed, must use the Best Available Control Technology. This recommendation should take effect immediately. Any new sources of pollutants in the airshed and their estimated emissions should be included in the PGAQIC annual report.**

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consider cumulative effects on ambient air quality. There are three emission concentration levels that are specified in the regulations – for BC, the Lower Fraser Valley, and the GVRD (in order of decreasing allowable concentration). The province recently changed the regulation, after requests from residents and the City, so that asphalt operations in Prince George must meet the Lower Fraser Valley emission standards, and operations have installed new equipment to meet this emission standard. Over time, area-based management provisions could allow local Ministry of Environment officials to implement the GVRD standards for this industry, and to control the location of new asphalt plants.

- **The BC Ministry of Environment should require that permit holders submit continuous stack monitoring data where it is currently being monitored, and add the requirement for this monitoring to the permit of existing and new sources that have or could have a significant impact on air quality. This recommendation should take effect as permits are reviewed. The BC Ministry of Environment should produce a summary of emissions for inclusion in the PGAQIC annual report.**
- **The BC Ministry of Environment should work with industry and other significant emitters to begin episode management by first implementing the episode management recommendations from the Phase One and Two Air Quality Management Plans. They should then follow through by enacting the plans contained in those recommendations. Planning for this should occur in 2008 with implementation aimed to start in 2009.**
- **The BC Ministry of Environment, City of Prince George and PGAQIC should build upon the experience in the Greater Vancouver Regional District and investigate instituting a zero net cost Air Care program in Prince George for gasoline and diesel vehicles. This investigation should occur in 2009.**
- **The City should work with the Provincial and Federal governments to assess ways of regulating emissions from railway operations in the Prince George airshed. Consultations should begin by November 2008.**

AIR QUALITY MONITORING

Monitoring air pollutants is an essential component of airshed management that enables identification and prioritization of issues, short- and long-term planning and assessment of success or failure of management actions. Data provide a basis for decisions based on science.

Current State

Prince George has a monitoring network that currently includes nine air quality monitoring sites. The cost of operating these monitors is shared by the Ministry of Environment and emitters that contribute more than one percent of these pollutants to the airshed and hold an emission permit with the Ministry of Environment. These stakeholders voluntarily work together to monitor air pollution in this airshed and make up the Monitoring Working Group, a sub-committee of the PGAQIC. The monitoring stations are operated and maintained by the Ministry of Environment and are required to meet provincial quality assurance standards.

Table 1 shows all of the pollutants that are monitored in the airshed. Two different size fractions of particles (PM_{10} and $PM_{2.5}$) are monitored both continuously and non-continuously at various sites. Odorous compounds are monitored through the measurement of Total Reduced Sulphur or TRS at the Jail, Plaza and Lakewood stations. Results of the monitoring, including comparisons with other jurisdictions, are described in the detailed annual air quality reports produced by the BC Ministry of Environment and made freely available in hard copy from BC MoE and online at http://wlapwww.gov.bc.ca/nor/pollution/environmental/air/index.html. The monitoring is also used by the BC Ministry of Environment to issue Air Quality Advisories when pollutant levels exceed established criteria.

Location	Ongoing Program	2005-06 Additions
Jail	TRS, SO2	No Change
Plaza	$PM_{2.5}$, PM_{10} (C/NC), TRS, NOx, SO2, O3, CO	$PM_{2.5}$ and PM_{10} (NC)-3-day schedule
Van Bien School	PM_{10} (NC)	$PM_{2.5}$ and PM_{10} (NC)-3-day schedule
Lakewood Jr. School	PM_{10} (NC) , TRS	$PM_{2.5}$ and PM_{10} (NC)-3-day schedule
Gladstone School	PM_{10} (C)	$PM_{2.5}$ (C); $PM_{2.5}$ (NC)-3-day schedule, SO2
CNR Site	PM_{10} (NC)	PM_{10} (NC)-3-day schedule
BCR Warehouse	PM_{10} (C)	No Change
CBC Transmitter Site	SO2	No Change
Background Site (Beaverley)	Not Done	$PM_{2.5}$ and PM_{10} (NC)-3-day schedule

Table 1: Summary of monitoring stations in the airshed with pollutants monitored and additions made in 2005-06. Meteorological measurements are not indicated.

- *TRS = Total Reduced Sulphur Compounds (as H2S)*
- *SO2 = Sulphur Dioxide*
- *NOx = Nitrogen Oxides (includes nitric oxide (NO) and nitrogen dioxide (NO2))*
- *PM_{10} = Particulate Matter less than 10 microns in size*
- *$PM_{2.5}$ = Particulate Matter less than 2.5 microns in size*
- *C = Continuously Monitored*
- *NC = Non-continuously Monitored*
- *O3 = Ozone*
- CO = Carbon Monoxide

As new sources are added to the airshed, additional monitoring is often necessary. The North Nechako monitoring site, which is situated near the residential areas across the Nechako River from the asphalt plants, has been added to assess the impact of these industrial operations and address the concerns of citizens in that area. PM_{10}, $PM_{2.5}$ and PM_1 are all being monitored continuously at this site using a new GRIMM monitoring system. $PM_{2.5}$ is also being monitored non-continuously to corroborate the new system. Volatile organic carbons (VOC) and polycyclic aromatic hydrocarbon (PAH) are also being monitored during significant odor episodes.

The Beaverley site mentioned previously is also newly added. It is being monitored to provide a background measure of PM_{10} and $PM_{2.5}$ using non-continuous filter samples. This additional site will enable a more reliable assessment of the magnitude of Prince George's overall contribution of particulate matter to the airshed. Several $PM_{2.5}$ monitors have also been added despite the lack of a $PM_{2.5}$ objective being set by the province.

Prince George's monitoring network is one of the most extensive in the province and provides a wealth of data to those managing particulate matter and odour in the Prince George airshed. Accurate data from a number of

locations is crucial to understanding the complex situation in Prince George, especially for particulate matter. This data enables managers to make day-to-day decisions regarding air quality in the city. Historical data is important for measuring progress and making long-term decisions.

The current system, following the polluter pay principle, has been successful. However, there needs to be a mechanism for including significant polluters that do not require a permit from the Ministry of Environment (e.g. asphalt plants). The purchase, maintenance and operation of monitoring equipment are very costly and many of the monitors in the local network are near retirement.

Although everyone agrees that the polluter pay principle that underlies the work of the Monitoring Group is appropriate, there has been external funding available for the purchase of monitoring equipment in other airsheds. Prince George should consider accessing these funding sources. Addition of a mobile monitoring unit to provide flexibility to address new problems or temporarily replace problem equipment would also be very useful.

What Was Heard

At the public and stakeholder consultation sessions there was mostly support for the interim recommendations. However, there were a lot of requests for additional monitoring such as reinstating the monitoring on the Hart Highway and installing a monitor at ground level in an area with higher ambient levels, such as the Fort George Park area. It was assumed that doing so would provide a better indicator of what individuals are breathing compared to the Plaza 400 monitor, which is located six stories up. There was also a general consensus that the public should have access to monitoring data in real-time.

An important link was also made several times between monitoring and education. It was suggested that monitoring programs could be run in schools where students and parents would be involved in collecting data and reporting to the MoE. Such a program is feasible and an example was run on the Fort Nelson First Nation Reserve. Many also felt the mobile monitor would be a valuable educational tool as it would enable people to see their own impacts, such as the effect of woodstoves in a neighbourhood. It was suggested that the mobile unit should be transported by a hybrid vehicle to set an example and be used as a public education tool as well as a means to address complaints, deal with new problems and provide data for research. Many thought that more than one mobile monitor would be useful.

It was noted that the monitoring data means very little if it is not properly utilized, and that there is not currently the skilled manpower at the MoE to deal with additional data. It was therefore suggested that the ministry increase staffing to analyze data in a timely matter and make data analysis and reporting a higher priority.

There was also a lot of discussion regarding the use of monitoring data to assess the impact of sources. Some felt that the current network was inadequate in terms of identifying sources and it was suggested that monitoring should be able to capture the effects of the main polluters. It was also suggested that there should be more monitoring around transportation corridors to better assess the impact of traffic.

Task Force Recommendations

- **At a minimum, maintain or, as needed, add to the current monitoring network. The PGAQIC should become involved in the current BC Ministry of Environment review of the Provincial monitoring network to ensure that the reviewers have specific information about the situation in Prince George before making decisions regarding the local monitoring network. Participation in this review should occur immediately and be reported on at a subsequent PGAQIC meeting.**
- **The PGAQIC and its Monitoring Working Group should pursue adding a mobile monitoring unit to the current monitoring system. The PGAQIC should assess the cost of the mobile unit and secure funding by January 2009.[18]**
- **MoE should make real-time monitoring data available to the public online at all times. The data should be clearly labelled as unofficial data that has not undergone quality assurance procedures. The data should be made available starting in March 2008 and should be advertised to the public in local newspapers along with information about the air quality complaint line and with a link made available on the PGAQIC website. Information about the online data should also be provided in quarterly and annual reports from the MoE.**
- **The PGAQIC and BC Ministry of Environment should work together to formalize a procedure to include significant polluters that do not require a permit from the Ministry of Environment in the Monitoring Working Group by December 2008.[19]**

RESEARCH

The management of air quality is a challenging task that needs continual assessment and adjustment as new information becomes available and the mix of pollutants in the airshed changes over time. For air quality management to be effective, it must be based on the best information available. Therefore it is expected that there will be a continuing need for research on various aspects of air quality in Prince George. A number of research projects on air quality in Prince George have been conducted by industry, government and academia in recent years, and several studies that are important for air quality management are currently underway. Research on air quality in Prince George is coordinated by the Research Working Group (RWG) of the PGAQIC.

Past Studies

Some of the studies on air quality in Prince George conducted over the past decade are summarized below:

[18] *This unit could be used to address complaints, to deal with new issues, for public education and for research. It may also be used for impact assessment of new projects at the cost of the developer if available. Another use may be to temporarily replace broken equipment at a permanent monitoring site while repairs or replacements are made, at the cost of whoever is responsible for the operation of the broken equipment.*

[19] *This will ensure that all polluters are held accountable for monitoring their emissions according to the "polluter pay" principle that underlies the work of the Monitoring Working Group.*

- **Ainslie wood waste burning study**

  Bruce Ainslie, a postdoctoral fellow at UNBC, conducted a modelling study in 2007 of the impact of wood burning on air quality ($PM_{2.5}$ levels) around Prince George on behalf of the City. Calpuff as well as Aermod were used in the study in which theoretical wood burning piles were inserted at various distances and directions from the City and their modeled effects on $PM_{2.5}$ levels on the developed areas of the city were assessed and compared with the Canada Wide Standard. It was found that no burning should be allowed within ten kilometres of the city centre, and that burning should not be permitted within twenty kilometres of the city centre under poor ventilation conditions. Under good ventilation conditions burning could be allowed between ten and fifteen kilometres of the city, while it could be considered beyond fifteen kilometres from the city centre under good and fair ventilation conditions.

  Ainslie, B., P. L. Jackson, 2007. *Determination of acceptable locations for the open burning of wood waste piles in the Prince George Airshed using atmospheric dispersion models,* Report for the City of Prince George, 43 pp.

  Ainslie, B., P. L. Jackson, 2007. *The use of atmospheric dispersion models to determine influence regions in the Prince George B.C. airshed from the burning of open wood waste piles.* Submitted to Environmental Manager October 2007.

- **Breed PM_{10} study**

  Christine Breed, as part of her MSc Thesis at UNBC, studied the chemical composition and morphology of particulate matter on PM_{10} filters collected in Prince George in 1995 and 1996 (Breed, et al, 2002). She found that episode days were characterized by particles of geologic origin (i.e. dust) while non-episode days were characterized by smaller particles ($PM_{2.5}$) of combustion origin.

  Breed, C., 1998. *Characterization and source apportionment of particulate matter less than 10 microns in diameter in the Prince George airshed.* M.Sc. Thesis, University of Northern British Columbia

  Breed, C. A., J.M Arocena, D. Sutherland, 2002. *Possible sources of PM_{10} in Prince George (Canada) as revealed by morphology and in situ chemical composition of particulate.* Atmospheric Environment, 36, 1721-1731.

- **Fudge/Sutherland wind sector study**

  This internal study, conducted by BC Environment staff in 2004 and updated in 2006, studied the Plaza 400 pollutant data and wind direction information to make inferences about wind sectors contributing to pollutant levels. The study found that about 44% of the $PM_{2.5}$ comes from the direction of the northeast industrial sector; about 20% is background; about 17% is from the direction of residential areas; 12% is from unknown sources; and the remainder is from commercial and industrial locations outside of the northeast sector.

  Fudge, D., D. Sutherland, 2004. *Source contribution in the Prince George airshed using sector analysis,* BC Ministry of Water, Land and Air Protection Internal report. 15 pp.

Fudge, D., D. Sutherland, 2006. *Wind Sector Analysis – Update to June 2004 progress report prepared by the Prince George Air Quality Implementation Committee – prepared January 2006.* BC Ministry of Environment internal report. 8 pp.

- **Jacques Whitford PM_{10} modelling study**

  Conducted for the former Northwood Pulp & Timber Company by the consultant Jacques Whitford in 1998-1999, this study used the Calpuff system to model PM_{10} in the Prince George airshed. Permit levels were used from industrial sources, and the emission inventory for many of the non-industrial sources was quite approximate, which made conclusions more difficult to reach. During episode days in March (normally dominated by dust), modelling indicated that pulp mill sources accounted for about one-third of the observed ambient levels of PM_{10}.

Jacques Whitford Environment Ltd., 1999. *Prince George PM10 Study,* report for Northwood Pulp and Timber Company.

- **Layte air quality management study**

  Gina Layte Liston, as part of her MSc research project at UNBC (Layte, 1999), studied the air quality management planning process in Prince George and in a number of other jurisdictions. Her recommendations provided the template for the current air quality management process in Prince George.

Layte, G.A., 1999. *Towards an air quality management strategy for the Prince George Region.* M.Sc. Project, University of Northern British Columbia, 129pp.

- **McEwen SO_2 modelling study**

  Bryan McEwen, as part of his MSc Thesis at UNBC (McEwen, 2002), in a methodological study, examined the impact of using atmospheric model data to provide the meteorological data for Calpuff, compared with using observations alone. He found that when fewer than three meteorological observing sites are available, the atmospheric model can improve predictions of SO_2.

McEwen, B.A., 2002. *Application of high resolution mesoscale model fields with the Calpuff dispersion modelling system in Prince George, B.C.,* M.Sc. Thesis, University of Northern British Columbia, 160pp.

- **Noullett personal exposure study**

  Melanie Noullett, as part of her MSc Thesis at UNBC (Noullett, 2004), studied the personal exposure of school children in Prince George to $PM_{2.5}$ during a six-week winter period in 2001. She found that both outdoor and indoor sources were important for the personal exposure, and that there is a relationship between personal exposure and inversion conditions in the atmosphere.

Noullett, M., 2004. *Exposure to fine particulate air pollution in Prince George, British Columbia,* M.Sc. Thesis, University of Northern British Columbia, 262 pp.

Noullett, M., P.L. Jackson. M. Brauer, 2006. Winter measurements of children's personal exposure and ambient fine particle mass, sulphate and light absorbing components in a northern community, Atmospheric Environment, 40, 1971-1990.

- **Oster survey study**

  Michelle Oster, as part of her MSc research project at UNBC (Oster, 1997), studied public perception of air quality in Prince George through a survey. Results suggested that Prince George residents were not satisfied with current airshed conditions, believing poor air quality affected their quality of life. A majority of respondents also indicated they would participate in pollution-reducing activities if it would help improve outdoor air quality.

Oster, M., 1997. *Survey on public perceptions of outdoor air quality issues in the city of Prince George.* M.Sc. Project, University of Northern British Columbia, 61 pp.

- **Paprican particulate matter study**

  This study, conducted by Paprican in 2002-2003, analysed speciated PM_{10} and $PM_{2.5}$ data sampled by wind direction over a 269-day period at the Prince George Railway and Forestry Museum. The results showed elevated levels of $PM_{2.5}$ and, to a more limited extent, PM_{10} coming from the pulp mill sector, as well as the influence of the nearby rail and lumber yards. Elevated levels of sulphate and sodium were consistently associated with wind directions from the pulp mill area.

O'Connor, B. 2003. *$PM_{2.5}$ and PM10 monitoring at the Railway Museum site. Presented to the Prince George Air Quality Implementation Committee – Research Working Group, June 20, 2003. 14 pp.*

- **RWDI emission inventory assessment**

  Contracted by the Prince George Air Quality Implementation Committee Research Working Group in 2004, RWDI Consultants did an assessment of the emission inventory for particulate matter in Prince George and made recommendations on improvements needed to allow the information to be used for modelling.

Stiebert, S., M. Bohm, K. Preston, 2004. *Prince George emission inventory improvement strategy,* Report prepared for the Prince George Air Quality Implementation Committee – Research Working Group and the City of Prince George, 27 pp.

Current Studies

The results from four studies currently underway will greatly assist air quality management in the Prince George airshed.

1. **STI/BC Ministry of Environment speciation study**

   This study uses information on the metals and ions from $PM_{2.5}$ filters collected every three days over a 16-month period to better understand the sources contributing to $PM_{2.5}$ in Prince George. Interpretation of the results will indicate which sources contributed to the 24-hour average $PM_{2.5}$ levels every third day

at the Plaza 400 monitoring site. They will also provide a "ground truth" for the dispersion modelling study described below. Results are expected near the end of 2007.

2. **UNBC/ Janice Allen speciation study**

   Ms. Allen (MSc candidate) is also using speciation data from Plaza 400 for both $PM_{2.5}$ and PM_{10} for an extended time period to be able to infer information on the coarse and fine (PM_{10} to $PM_{2.5}$) fractions of particulate matter. Results are expected in early 2008.

3. **PGAQIC-RWG / UNBC dispersion modelling study**

   This comprehensive modelling study is simulating PM ambient levels based on all sources for the 2000 through 2005 period using the Calpuff modelling system. Results are expected in mid-2008, and will be able to tell the impact of individual sources on ambient $PM_{2.5}$ levels at each point in the airshed. The modelling will also indicate the impact of reducing particular sources on ambient air quality levels, and can therefore help prioritize source reduction strategies.

4. **PGAQIC-RWG / Canfor / Paprican odour study**

   An odour study is being designed to: 1) identify odourous compounds in the Prince George airshed; 2) conduct an emission inventory at industrial facilities; and 3) conduct dispersion modelling of the odourous compounds to identify sources impacting ambient odour levels.

The studies conducted in the past and currently underway represent best practices in research of this type. The coordination and involvement of the RWG in current studies ensures that they can effectively contribute to air quality management.

Task Force Recommendations

- **The PGAQIC and its Research Working Group should assess the results of studies that are currently underway to understand PM and TRS and use them to guide air quality management – specifically the production of Phase Three of the Air Quality Management Plan. This should occur as the studies are completed, during 2008. The PGAQIC should have a goal of producing Phase Three of the Air Quality Management Plan in 2009.**

- **The City of Prince George, BC Ministry of Environment, Regional District of Fraser Fort George, Northern Health and industry should make an annual allocation of funds available for ongoing and future research needs in support of air quality management, by April 2008.**

EMERGING ISSUES

Several new developments have occurred or are being considered that may have air quality implications in the City of Prince George.

Inland Container Port

The addition of a rail/inland container offloading and onloading site at the CN Rail yard may have air quality impacts due to increased rail and vehicular traffic in the Prince George Bowl area. Of particular concern is an increase in the numbers of switching locomotives, as well as the types of locomotives and the number of trains

each day. If current research indicates the benefit, it may be important for CN to switch to hybrid switching locomotives. The designation of routes for truck traffic and dangerous goods traffic should be made in a way that takes air quality into account.

Airport Expansion and Industrial Development

The recent announcement of runway expansion at the Prince George Airport, and the proposed rezoning of lands surrounding the airport to allow industrial growth, needs to be assessed in terms of its impact on air quality. Of particular concerns are routes for truck traffic, as well as paving of roads and yards.

Increased Biomass Burning

The Mountain Pine Beetle epidemic, in combination with a desire for carbon-neutral energy, has created an economic environment where biomass burning for energy generation will likely increase. It will be necessary to ensure that the impacts from these developments do not have a negative impact on air quality in the city by ensuring that the locations are appropriate and pollution control technology is the best available.

Beyond co-generation and the beneficial use of biomass, there is a need to find alternatives to the open and controlled burning of the debris created by the harvesting of the beetle-infested trees and land clearing from development. This is of great concern since the local landfill has reached its capacity for storing and composting the land clearing debris and the emissions from open burning are not acceptable to residents.

An emerging issue is the number of outdoor wood-fired boilers which are increasing because of high energy costs and plentiful beetle-killed wood. Outdoor boilers are not yet regulated through provincial emission control requirements, but their very large output of particulate matter creates significant local air pollution. The City of Prince George has passed a bylaw prohibiting the installation of non-emissions-certified wood burning appliances within city limits, but the issue is not widely appreciated or understood in the community.

A City Ring Road

Many comments were received about the need to build a road around the city for industrial and commercial truck traffic and hazardous goods transport, with links to the major industrial complexes. This proposal would require comprehensive study by the City and Regional District as it would have significant bearing on the City's and surrounding areas' future development patterns. While there may be benefits to air quality, significant costs would be incurred, especially for bridges. Other factors – such as potentially inducing even greater urban sprawl and more emissions – would also need to be considered.

Sustainable Community Concept

Air quality is inextricably linked to energy efficiency, greenhouse gas emissions and climate change. In turn, these elements are related to the broader concept of sustainable communities. While the City has begun addressing these challenges, all these elements need to be addressed jointly in an integrated strategy, including economic development. Some in the business sector are concerned about the economic implications of improving air quality, while others see it as an opportunity. Not taking action on air quality has economic costs as well. Several residents observed that Prince George is at a critical juncture – it can become a wonderful liveable community, or it can reinforce its past image as an unpleasant industrial town.

Task Force Recommendations

- **The City should include detailed assessments of the impacts on air quality of these emerging issues and future developments as part of a comprehensive planning approach – from creating a vital community vision to implementing actions at the detailed development and approvals level. These assessments should begin in 2008 with the current OCP review process, and then be ongoing.**

Conclusions

Air quality management is a continuous process requiring the active involvement of stakeholders and the public, the application of new research and technologies, the setting and evaluation of targets, and continuous monitoring and assessment of progress.

The Task Force has tried to provide an overview of air quality in Prince George including its management, regulation, monitoring, education and research, and provide recommendations that will make the system more effective in improving air quality in the future.

To enable improvement of air quality in Prince George, the Task Force believes that the City, its businesses and the general public should adopt the following principles from the *Prince George Air Quality Management Plan – Phase One*:

a. *Acceptable air quality is everyone's right; protecting air quality is everyone's responsibility.*

b. *Acceptable air quality is an important contributor to a healthy community and a sustainable economy.*

c. *Achieving acceptable air quality requires that local, provincial and federal government agencies work together. Public and industry involvement is also necessary.*

These principles mean that we all need to have collective and individual goals of continuous improvement in air quality.

In the following section, the key recommendations from the Findings section of this report are tabulated along with responsible agencies, suggested timelines, budgetary implications and how progress should be tracked.

RECOMMENDATIONS

	RECOMMENDATION	RESPONSIBILITY	TIMING	PROGRESS TRACKING
1.	City Council, as part of its priority setting process, should consider including improving air quality among its top priorities.	▪ City	▪ 2008	▪
2.	The City should work with the appropriate agencies (BC Ministry of Environment, Regional District of Fraser-Fort George, Northern Health, Environment Canada) on the recommendations listed below, and develop an action plan and timelines to enact the recommendations.	▪ City, MoE, RDFFG, Northern Health, Environment Canada	▪ March 2008	▪
3.	Replace the current air quality management structure with a single cooperative Roundtable on Air Quality with a range of interests represented.	▪ City, MoE, RDFFG, Northern Health, Industry	▪ September 2008: Finalize committee structure and terms of reference	▪
4.	The PGAQIC should establish a paid coordinator position with a dedicated mandate to facilitate and support the air quality management planning committee structure. This person should serve as an employee of the PGAQIC. The position should be secured for three years and funded by the City of Prince George, Ministry of Environment, Regional District, Northern Health, and Permit Holders.	▪ *Staffing*: City and/or PGAQIC ▪ *Funding*: City, MoE, RDFFG, Northern Health and Permit Holders	▪ March 2008: Establish funding formula ▪ May 2008: Secure funding and establish position	▪

	RECOMMENDATION	RESPONSIBILITY	TIMING	PROGRESS TRACKING
5.	The PGAQIC should ▪ produce a publicly available annual report which is presented to Prince George City Council, the Regional District Board and published in the local newspapers; ▪ make quarterly presentations to Prince George City Council and Regional District Board; and, ▪ hold two meetings per year in which Prince George City Council members and the Regional Board members are invited to discuss air quality issues.	▪ City, MoE, RDFFG, Northern Health and Permit Holders	▪ March 2008: Establish funding formula ▪ May 2008: Secure funding	▪
6.	The City of Prince George, Ministry of Environment, Regional District, Northern Health, and Permit Holders should provide formal, ongoing funding for air quality planning, management, education, and research. Non-governmental organizations and public members' time should be considered in-kind funding.	▪ City, MoE, RDFFG, Northern Health and Permit Holders	▪ March 2008: Establish funding formula ▪ May 2008: Secure funding	▪
7.	The PGAQIC should include measurable outcomes and timelines in its management plans.	▪ PGAQIC	▪ 2008	▪
8.	The BC Ministry of the Environment should create a $PM_{2.5}$ objective that will be one of the factors upon which air quality advisories in Prince George are issued. This should occur by December 2008.	▪ City, MoE	▪ December 2008	▪ Status reports to City Council

	RECOMMENDATION	RESPONSIBILITY	TIMING	PROGRESS TRACKING
9.	City Council should direct City administration to incorporate the recommendations from Phase Two of the Air Quality Management Plan into the Clean Air Bylaw and streamline any existing concerns with the bylaw.	▪ City	▪ May 2008: Draft of changes ▪ June 2008: Public consultation ▪ September 2008: Final draft	▪
10.	The City of Prince George should: ▪ review the effectiveness of its bylaw enforcement procedures related to the Clean Air Bylaw and other relevant bylaws (e.g. Highways Bylaw), and establish a clear policy after public consultation in coordination with the bylaw review; ▪ hire an additional Bylaw Enforcement Officer whose main responsibility would be enforcement of the Clean Air Bylaw; ▪ incorporate fines into the Clean Air Bylaw, with the understanding that there may be changes as part of the bylaw review.	▪ City	▪ February 2008: Incorporate fines into Clean Air Bylaw ▪ April 2008: Set budget and advertise for new Bylaw Enforcement Officer ▪ September 2008: Finalize bylaw enforcement procedures	▪ Reports to City Council and advertising for the public consultation sessions
11.	The Regional District should review the City of Prince George's Clean Air Bylaw to consider the feasibility of implementing a similar policy with respect to indoor and outdoor wood burning appliances as recommended in Phase Two of the Air Quality Management Plan.	▪ RDFFG	▪ June 2008: Board response to feasibility of such a policy	▪

	RECOMMENDATION	RESPONSIBILITY	TIMING	PROGRESS TRACKING
12.	The PGAQIC should work with the City, Regional District and Provincial governments to provide and implement incentives to remove older woodburning appliances and replace them with CSA/EPA-emissions-certified stoves as part of an ongoing program. It is suggested that the City match incentives offered by the woodburning appliance industry and the Province, up to a specified number of replacements each year, and provide a tax credit on City property taxes. The offering of "Burn it Smart" and other educational initiatives on clean burning should be continued and expanded.	▪ PGAQIC, City, RDFFG, Province, Industry	▪ Spring 2008: Begin incentive and promotion program	▪ PGAQIC annual reports and updates to City and Regional Board
13.	The City of Prince George should lead in the establishment of a formal "Open and Controlled Burning Committee" for the Prince George area, including provincial (Ministry of Environment and Ministry of Forests), municipal, fire, and regional representatives in order to assure better communications and to formalize a procedure for decision making. The information from this committee should be available on websites accessible to the public and letters should be written to local associations (eg. construction, engineering, and development) and City of Prince George Development Services with updates to the decision making process.	▪ City, MoE, MoF, RDFFG	▪ March 2008: First meeting of new committee	▪

	RECOMMENDATION	RESPONSIBILITY	TIMING	PROGRESS TRACKING
14.	The paid coordinator employed by the PGAQIC (as previously recommended) should organize community outreach, public education and awareness programs, funding initiatives and other related tasks. These programs could be coordinated with other community groups, government agencies and educational institutions.	▪ PGAQIC, City	▪ Summer 2008: Start public education programs	▪ Record educational activities in annual report and in updates to City Council and Regional Board
15.	An Education and Awareness Working Group should be added to the air quality management structure. The working group will ensure community education and awareness is an ongoing priority and will help implement the recommended education programs and events. The BC Lung Association should be invited to be a member of the working group.	▪ PGAQIC	▪ March 2008: Establish Working Group	▪ Minutes from Working Group meetings made publicly available
16.	Northern Health should work to increase public awareness of the health impacts of poor air quality in coordination with the Education and Awareness Working Group.	▪ Northern Health	▪ 2008	▪
17.	The PGAQIC should include public education and community engagement as part of Phase Three of the Management Plan to ensure that public outreach is extensive and ongoing.	▪ PGAQIC	▪ 2008/2009	▪

	RECOMMENDATION	RESPONSIBILITY	TIMING	PROGRESS TRACKING
18.	The Ministry of Environment should produce annual air quality reports more promptly. In addition to the annual reports, a time series of ambient air pollution levels should be produced from unofficial data with an appropriate disclaimer, and made available on a website on a near real time basis.	▪ MoE	▪ September 2008: Release 2007 annual report, and annually thereafter ▪ June/December 2008: Complete and release 2005 and 2006 reports respectively	▪ Release of reports and posting on MoE and PGAQIC websites
19.	The PGAQIC should actively engage the public by holding an annual forum that is open for public participation and feedback. The first meeting should occur in early June 2008 as part of Clean Air Day activities. In addition to this annual forum, all meetings of the PGAQIC should be open to the public for observation, and a mechanism to receive input and comments from the public at all times should be available and advertised to the public.	▪ PGAQIC	▪ June 2008: Hold first annual public meeting, and ongoing thereafter	▪ Advertise meeting details and post recorded minutes on website
20.	The City should work with the MoE to develop an integrated approval process by aligning the information, assessment and approval processes of the City and Province, so that City approvals and permits are issued after all Provincial approvals and permits are issued to the proponent.	▪ City, MoE	▪ June 2008: New processes in place	▪

	RECOMMENDATION	RESPONSIBILITY	TIMING	PROGRESS TRACKING
21.	The City should work with the Regional District of Fraser Fort George and MoE to determine the effects of all potential emissions from the areas considered in the heavy industry land use study (e.g., the proposed industrial plant, related commercial truck and rail transportation, and employee commuting).	▪ City, RDFFG, MoE	▪ 2008	▪
22.	The City should retain legal counsel to conduct a review of provincial legislation and make recommendations to the provincial government on how local governments' authority and available tools (e.g. development permits) may be amended to better deal with air quality.	▪ City	▪ March 2008: Begin review	▪
23.	The City and affiliated organizations should revise their economic development strategy to pursue forms of business development and job creation that do not adversely affect air quality.	▪ City	▪ October 2008: Develop new strategy	▪
24.	The City should explore the application of eco-industrial principles with local industry, as part of an overall strategy to reduce emissions. This strategy should be developed by December 2008.	▪ City, Industry	▪ December 2008: Develop new strategy	▪

	RECOMMENDATION	RESPONSIBILITY	TIMING	PROGRESS TRACKING
25.	The Ministry of Environment should enact the area-based management provisions of the Environmental Management Act in order to improve air quality in Prince George. Prince George could be treated as a test case for the Ministry to develop policy and practices for this portion of the Act. This would likely involve authorizing regional Ministry of Environment officials to use a permitting process to override regulations and codes of practice where necessary to consider cumulative impacts and impose more stringent standards.	▪ MoE	▪ 2008	▪
26.	All industrial, commercial and transportation operations, regardless of size or total impact on air quality, should understand their air emissions, have knowledge of best practices in controlling air emissions in their business, and have a plan in place for lowering their air pollution emissions. For industrial operations that are regulated by the BC Ministry of Environment, this plan can be part of the permitting process. For other operations, this plan should be part of the City of Prince George business licence application/renewal process, and can take the form of a short questionnaire.	▪ City, MoE, RDFFG, Industry	▪ 2009: Start ongoing process.	▪ Progress reported annually by MoE and City for inclusion in PGAQIC annual report

	RECOMMENDATION	RESPONSIBILITY	TIMING	PROGRESS TRACKING
27.	The BC Ministry of Environment and the PGAQIC should work with all industrial, commercial and transportation operations with PM emissions that are shown (by modelling and other studies) to have a significant impact on ambient air quality to set out targets, as well as two-, five- and ten-year timelines to reduce the impact of these sources on ambient levels. Targets should cumulatively keep Prince George in compliance with the Canada Wide Standard for $PM_{2.5}$ in the short term and lower the impact of those sources by 40% of their 2006 contributions by 2016. Priority should be given to those sources that do not use the current Best Available Control Technology.	▪ MoE, PGAQIC, Industry	▪ January 2009: Initial targets and plans in place, then ongoing thereafter	▪ Progress reported annually to MoE for inclusion in the PGAQIC annual report
28.	The BC Ministry of Environment should review all air pollution permits with a view to lowering the allowed emissions over time.	▪ MoE	▪ 2008: Initial review, then ongoing thereafter	▪ Progress reported annually by MoE to PGAQIC for including in annual report
29.	The BC Ministry of Environment, the City of Prince George, and the Regional District of Fraser-Fort George should ensure that new sources of pollutants that are estimated to measurably impact air quality in the airshed are not allowed until existing sources have been lowered sufficiently for significant continuous improvement in ambient levels. New developments, if allowed, must use the Best Available Control Technology.	▪ City, MoE	▪ Immediately	▪ Any new sources of pollutants in the airshed, and their estimated emissions, included in PGAQIC annual report

	RECOMMENDATION	RESPONSIBILITY	TIMING	PROGRESS TRACKING
30.	The BC Ministry of Environment should require that permit holders submit continuous stack monitoring data where it is currently being monitored, and add the requirement for this monitoring to the permit of existing and new sources that have or could have a significant impact on air quality.	▪ MoE, Industry	▪ 2008: Ongoing as permits are reviewed	▪ MoE produce summary of emissions for inclusion in the PGAQIC annual report
31.	The BC Ministry of Environment should work with industry and other significant emitters to begin episode management by first implementing the episode management recommendations from the Phase One and Two Air Quality Management Plans. They should then follow through by enacting the plans contained in those recommendations.	▪ MoE, Industry	▪ 2008: Planning for episode management ▪ 2009: Implement episode management recommendations	▪
32.	The BC Ministry of Environment, City of Prince George and PGAQIC should build upon the experience in the Greater Vancouver Regional District and investigate instituting a zero net cost Air Care program in Prince George for gasoline and diesel vehicles. This investigation should occur in 2009.	▪ City, MoE, PGAQIC	▪ 2009: Begin investigation	▪ Results of investigation reported in the PGAQIC annual report
33.	The City should work with the Provincial and Federal governments to assess ways of regulating emissions from railway operations in the Prince George airshed. Consultations should begin by November 2008.	▪ City, Province, Federal governments	▪ 2008: Begin consultations	▪

	RECOMMENDATION	RESPONSIBILITY	TIMING	PROGRESS TRACKING
34.	At a minimum, maintain or, as needed, add to the current monitoring network. The PGAQIC should become involved in the current BC Ministry of Environment review of the Provincial monitoring network to ensure that the reviewers have specific information about the situation in Prince George before making decisions regarding the local monitoring network.	▪ PGAQIC, MoE	▪ Immediately: Become involved in provincial review.	▪ Report out on provincial review to PGAQIC meeting and make results of review publicly available
35.	The PGAQIC and its Monitoring Working Group should pursue adding a mobile monitoring unit to the current monitoring system. The PGAQIC should assess the cost of the mobile unit and secure funding by January 2009	▪ PGAQIC, Monitoring Working Group	▪ January 2009: Assess costs and secure funding for mobile unit	▪
36.	MoE should make real-time monitoring data available to the public online at all times. The data should be clearly labelled as unofficial data that has not undergone quality assurance procedures.	▪ MoE	▪ March 2008: Begin making data available	▪ Advertise in local newspapers, include information in quarterly and annual reports from MoE and include link to information from PGAQIC web site
37.	The PGAQIC and BC Ministry of Environment should work together to formalize a procedure to include significant polluters that do not require a permit from the Ministry of Environment in the Monitoring Working Group.	▪ PGAQIC, MoE	▪ December 2008: Procedure in place for including non-permitted polluters in MWG	▪ City and MoE report to PGAQIC in public meeting and in recorded minutes on status of action

	RECOMMENDATION	RESPONSIBILITY	TIMING	PROGRESS TRACKING
38.	The PGAQIC and its Research Working Group should assess the results of studies that are currently underway to understand PM and TRS and use them to guide air quality management – specifically the production of Phase Three of the Air Quality Management Plan.	▪ PGAQIC, Research Working Group	▪ 2008: As studies are completed ▪ 2009: Completion of Phase Three of the Air Quality Management Plan	▪
39.	The City of Prince George, BC Ministry of Environment, Regional District of Fraser Fort George, Northern Health and industry should make an annual allocation of funds available for ongoing and future research needs in support of air quality management.	▪ City, MoE, RDFFG, Northern Health, Industry	▪ April 2008: First allocation of funds, and annually thereafter	▪
40.	The City should include detailed assessments of the impacts on air quality of emerging issues and future developments as part of a comprehensive planning approach – from creating a vital community vision to implementing actions at the detailed development and approvals level.	▪ City	▪ 2008: Begin assessments with current OCP review, then ongoing thereafter	▪

Glossary

(NOTE: This Glossary is based on one from the Prince George Air Quality Management Plan Phase II.)

Acceptable Air Quality

The level of a particular air contaminant that meets an ambient air quality objective.

Air Contaminant

An airborne substance that, when present in the air in sufficient concentrations, is capable of causing human health and other harmful environmental effects.

Air Quality

The physical and chemical characteristics of ambient (outside) air that determine its acceptability for human use and environmental protection. Air Quality is generally defined by numerical criteria for individual contaminants, based on human health or other environmental studies. Air quality includes smell and taste as well as the chemical composition of air.

Air Quality Advisory

A notice issued by MoE indicating that an ambient air quality objective has been exceeded, or is predicted to be exceeded, and that current meteorological conditions are predicted to continue for the next six hours or more. Notices are issued to advise the public to heed those precautions that are appropriate to the pollution levels, and to advise or require industry and other source owners, including the public, to take appropriate emission reduction measures.

Air Quality Management

Administrative activities carried out to implement an air quality management plan, including amendment of permits for industrial and other point contaminant sources, establishment of by-laws and other local and regional regulatory controls on mobile and area contaminant sources, and public education on ways to reduce and eliminate use of air contaminants in everyday activities.

Air Quality Management Plan

A blueprint for managing community development and for controlling air contaminant sources so as to improve or maintain air quality for the protection of human health and the environment in an airshed.

Ambient Air Quality Objective

A numerical, non-legal guideline defining an acceptable level of an air contaminant in ambient air. Various levels (A, B and C) are used to define various endpoints (or protection criteria) and degrees of protection. Different averaging periods (1-hour, 24-hour, annual) are also used to indicate the exposure period that is most critical to preventing each defined effect. For example, if protection of vegetation from reduced growth rates is the endpoint, then the Level A, 1-hour SO_2 objective must be attained.

Canada Wide Standard

The Canadian Council of Ministers of the Environment (CCME) has established Canada Wide Standards (CWS) to protect the health of Canadians through improved air quality. The standards include a numeric limit and a timeline for attainment, as well as a schedule for reporting on progress. Of particular interest to Prince George, there is a standard for PM. The Canada Wide Standard and related provisions for PM are:

- a CWS for $PM_{2.5}$ of 30 µg/m3, 24-hour averaging time, by year 2010;
- achievement to be based on the 98th percentile ambient measurement;
- annually, averaged over three consecutive years.

This means that 24-hour average $PM_{2.5}$ levels can exceed this value an average of only seven days per year to be in compliance with the CWS.

The development of Canada Wide Standards was a significant step forward in an effort to harmonize standards. These standards are a set of common minimum targets acceptable for all provinces and the federal government. However, they may not be sufficient to achieve the level of air quality desired by an individual province, and it is possible that conforming to CWS could lead to a deterioration of air quality in some areas. The Canada Wide Standard is a negotiated standard and, as such, is not as rigorous as the health based standards recommended by Health Canada

Episode

A period of unacceptable air quality, when ambient levels of a particular air contaminant exceed an ambient air quality objective or objectives. For example, a PM_{10} episode is defined in the Prince George airshed as two or more consecutive days exceeding the 24-hour, Level B objective.

Lowest Achievable Discharge Rate

A comparable jurisdiction's most stringent authorized discharge limitation, unless such limitation is demonstrated to be unachievable, or the most stringent discharge limitation that is achieved in practice, whichever is most stringent. (Ministry of Environment, Lands and Parks (now MoE) Standards and Guidelines Policy – October 7, 1997)

Open Burning

The combustion of materials, including garden and lawn clippings and tree prunings, without control of the combustion air, and without a stack or chimney to vent the products of combustion to the atmosphere. Open burning does not include use of barbeques.

Permitted Emission Sources

Releases of contaminants under MoE *Environment Management Act* emission permits, including mostly industrial sources.

PM_{10}

Fine particulate matter with a maximum particle diameter of 10 microns (µm = one millionth of a meter). This is about 1/5 the width of a human hair. Includes particles that are inhalable into the lungs.

$PM_{2.5}$

Ultra-fine particulate matter with a maximum particle diameter of 2.5 µm: the main particulate component of wood smoke and vehicle emissions.

The Prince George Airshed

The mass of air contained within the municipal boundaries of Prince George and the immediate surrounding communities of the Regional District, and particularly that air mass contained and affected by the natural topographical features at the confluence of the Nechako and Fraser Rivers.

NO_x

Nitrogen oxides, which include nitric oxide (NO) and nitrogen dioxide (NO_2), and are formed during combustion of fuels from reaction between oxygen and atmospheric nitrogen gas (N_2)

SO_2

Sulphur dioxide, formed from burning of material containing sulphur and includes the incineration of total reduced sulphur (TRS) during combustion of fuel, and pulping chemicals, and the flaring of hydrogen sulphide during oil and gas processing and refining.

TRS

Total reduced sulphur, which includes hydrogen sulphide, dimethyl sulphide and disulphide, and methyl mercapton, is formed in the absence of oxygen during pulping processes and released primarily from effluent disposal, and is entrained in oil and gas deposits and released during transport, gas processing and oil refining.

VOC

Volatile organic compounds, or carbon-containing compounds, are hydrocarbons that form gases when released as a result of combustion, industrial processes, and evaporation of liquid fuel. Natural biological sources release most of the VOC, although man-made sources may predominate in urban airsheds. Some VOCs have direct health and environmental effects, while other compounds react with other atmospheric gases to promote ozone and $PM_{2.5}$ formation.

Wood burning

Combustion of a solid wood fuel.

Appendix A1

PRINCE GEORGE AIR QUALITY TASK FORCE MEMBER BIOGRAPHIES



Joan Chess, BA MA MCIP

Joan is a registered planner with 25 years experience in community and regional planning, mostly gained in BC's northern interior. She has worked with provincial, local and First Nations governments. Joan is currently the Manager for the Fraser Basin Council's Upper Fraser Region, a position she has held for 14 years. She has been a resident of Prince George for 26 years.



Peter Jackson, BSc PhD

Peter is Professor of Atmospheric Science in the Environmental Science and Engineering Program at the University of Northern British Columbia. Since coming to Prince George in 1995, one of his research areas has become air quality. He was a member of the committee that produced Prince George's first air quality management plan starting in 1995, and is currently a member of the Research Working Group. Peter became chair of the Task Force during the summer of 2007.



Gina Layte Liston, BSc MSc

Gina was born and raised in Prince George. She completed her Bachelor's Degree in Biology at UBC and her Master of Science-Environmental Science at UNBC. Her thesis was titled *Air Quality Management Planning in the Prince George Region*. After graduating, Gina began work at the City of Prince George as the Environmental Coordinator. From 1996 to the present she has worked on air quality in a number of different capacities, including a member of the team that created the Phase One Management Plan, Chair of the Prince George Air Quality Implementation Committee, member of the Air Quality Research and Monitoring Groups, and through her position with the City of Prince George.



Lorna Medd, BA BSc MD MSc FRCPC

Lorna trained at the University of Manitoba and UBC. Initially she spent several years providing health care to fly-in communities in northern Manitoba and the Northwest Territories. Since 1990 she has worked in Public Health in BC for the past 11 years as Medical Health Officer in Prince George and the Northern Interior. Since 1996, she has been a member of the Prince George airshed planning group. She has a particular interest in ecosystem health, and has worked extensively on tobacco control and air quality.



Melanie Noullett, BSc MSc

Melanie grew up in Prince George enjoying most of her winters on the ski hill and summers at nearby lakes. Her love of the outdoors led her to complete both Bachelor and Master degrees in Environmental Science at UNBC. Her Master's thesis focused on children's exposure to fine particulate air pollution. Since completing her studies Melanie has worked as a research associate and sessional instructor at UNBC and is now staying home with her two young children, while also acting as a consultant and active volunteer.

Appendix A2

PRINCE GEORGE AIR QUALITY TASK FORCE TERMS OF REFERENCE REVISED JANUARY 20, 2007*

(hereafter referred to as 'the Taskforce')

1.0 Background:

The Prince George City Council and the Fraser-Fort George Regional District Board approved the "Prince George Air Quality Management Plan (PGAQMP) – Phase One", hereafter referred to as 'the Plan', in 1998. The fundamental motivation for creating the Plan was overwhelming evidence that poor air quality in the Prince George airshed was impacting the health and quality of life of our residents.

The Plan – Phase One identifies measures to improve air quality in the Prince George airshed, in particular to achieve acceptable levels of fine particulate matter. It contains 28 recommendations for actions to reduce and manage pollutant sources, including industrial emissions, road dust, and residential sources such as open burning and woodstoves. The Plan also addresses land use planning issues, poor air quality episode management, and the monitoring and research required to measure progress and to identify future management needs. Some of the recommended actions have been completed or are being implemented.

The Phase One – Progress Report was released in 2004. It provided an update on progress of the recommendations from the Phase One Management Plan.

In 2004 and 2005, a number of reports were published by the BC Lung Association and the Provincial Medical Health Officer that brought further focus to the fact that the City of Prince George had some of the poorest air quality with respect to particulate matter in the Province.

2.0 Purpose:

The Taskforce will review what progress has been made following the 1998 Plan and the 2004 Report and provide a report with recommendations to the Prince George City Council, including but not limited to:

- Review what has been done in the City of Prince George to date with respect to air quality and determine what advances have occurred in other jurisdictions that may be of value to its air shed;
- Identify factors that have either constrained or enabled the improvement of air quality in the past decade in the air shed;
- Make recommendations about ways to improve air quality monitoring, practices, and research that build upon previous air quality Plan and Report.

3.0 Membership

Howard Brunt, Chair
Peter Jackson
Joan Chess
Gina Layte Liston
Lorna Medd
Melanie Noullett
Additional members TBA

4.0 Conduct of Business

- The start date for the taskforce is January 2007 with an interim reporting date of June 2007 and a final report due by December 2007;
- Meetings will be at the call of the Chair or by consent of a majority of members;
- Minutes will be recorded; and, the Taskforce will approve the minutes;
- The City of Prince George will provide the administrative assistance as needed;
- Funding for consultants or to support other work by the committee will be provided by the city;
- The taskforce is to act independently in the best interests of the people residing in the Prince George air shed;
- The work of the task force will be done in a consultative way with stakeholders drawn from the public, a variety of organizations, government, and industry.

5.0 Reporting and Communication:

- The Task Force Chair or designate will speak for the Committee;
- The Task Force will report to the Prince George City Council.

**These Terms of Reference were revised from the original draft following the first meeting of the taskforce on January 9, 2007*

Appendix A3

PRINCE GEORGE AIR QUALITY MANAGEMENT COMMITTEES

Prince George Air Quality Steering Committee

The Steering Committee's objectives include but are not limited to:

- the establishment of an administrative and financial support system;
- coordinating activities of the management agencies in support of the Prince George Air Quality Management Plan's objectives;
- provide vision and direction to the Implementation Committee.

The Steering Committee will report to the following authorities:

- Prince George City Council;
- Regional District of Fraser-Fort George Board;
- Canfor Vice-President;
- Northern Health Authority Chief Executive Officer; and
- Deputy Minister of Environment.

Prince George Air Quality Implementation Committee

The Committee will provide recommendations to the Air Quality Steering Committee, including but not limited to:

- reviewing and implementing the Prince George Air Quality Management Plan - Phase One and future phases;
- determining an annual operating budget including financial requirements for air quality research and monitoring;
- identifying opportunities for grant funding and other revenue sources;
- devising a five year capital plan, updated annually;
- identifying administrative and staff support requirements;
- developing a reporting and communication system; and,
- preparing and implementing further phases of the Plan.

The Committee will also educate, inform, and receive input from the community about air quality matters.

The Committee will develop a reporting and communication system, which includes input from the public.

The Committee will report to the Air Quality Steering Committee.

Sub-committees may be formed from time to time to perform certain tasks; these committees will report directly to the PGAQIC.

Membership Subcommittee

The Membership Subcommittee will provide recommendations to the Air Quality Implementation Committee, including but not limited to:

- a plan to recruit members to fill vacant positions;
- advertising for new public members; and,
- reviewing applications from potential public members and selection of new members.

Communications Subcommittee

The Communications Subcommittee will provide recommendations to the Air Quality Implementation Committee, including but not limited to:

- determining an annual operating budget including financial requirements for communications, to be approved by the Implementation Committee;
- act as the main contact for any contractors hired for communication purposes;
- make regular reports to the Implementation Committee regarding the progress of the communications plan;
- interact with and provide guidance to the communications contractor in developing a communication plan;
- assist the communications contractor with the implementation of the communications strategy; and,
- under the expert direction of the communications contractor, manage any communication priorities as they arise.

Monitoring Working Group

The Working group will make decisions with respect to the monitoring program and network in conjunction with the Research Working Group. The following are the list of functions of the Monitoring Working Group:

- meet on a regular basis as determined by the group;
- conduct a comprehensive and cost effective air quality monitoring program;
- share in the current and future monitoring costs (operating and capital) of the program; and,
- make emergency decisions for unexpected capital expenditures.

The Working Group membership and breakdown was established as follows:

- The percent contribution of each pollutant (PM, ozone, etc.) was derived from the 2002 source breakdown, with a 1% cutoff applied. Contribution amounts were taken from *Waste Management Act* permit levels as well as the City of Prince George and the Regional District of Fraser Fort George.
- This percent breakdown was multiplied by the monthly cost factor for each type of monitor.
- Costs for monitoring PM were divided into PM-combustion and PM-dust and costs allocated by:
  - assigning the $PM_{2.5}$ monitoring costs to PM-combustion;
  - assigning 50% of the PM_{10} monitoring costs to PM-combustion, based on the PM_{10} and $PM_{2.5}$ split in the Plaza 400 ambient monitoring results;
  - assigning the other 50% of the PM_{10} monitoring costs to PM-dust, with 50% of these costs assigned (essentially arbitrarily) to the City, to cover the public roads, and 50% divided equally among the other contributors, to cover use of public and private roads and other private lands.

- The Ministry of Environment is a member of the committee.

Research Working Group

The goal of the Research Working Group is to facilitate the understanding of air quality and its effects, in order to manage the Prince George airshed.

The objectives of the Research Working Group are to:

- coordinate air quality studies in the airshed;
- facilitate sharing of information, data and results among researchers and other partners;
- provide recommendations to the Air Quality Implementation Committee on research needs, costs and management implications;
- determine and prioritize emission sources in the Prince George airshed; and,
- recommend management action based on predicted benefit to the Prince George airshed.

Appendix B

Appendix B1 (*Best Practices in Air Quality Management, Millar 2007a*) and Appendix B2 (*Best Practices in Air Quality Control for Pulp Mills, Sawmills and Oil Refineries, Millar 2007b*) are included as separate attachments with the Final Report of the Prince George Mayor's Task Force on Air Quality Improvement. They can also be found at http://www.city.pg.bc.ca/pages/maqtaskforce/.

Appendix C

Appendix C1 (*Notes from the Public Information Session of November 3, 2007 at the Prince George Public Library),* Appendix C2 (*Report of the Public and Stakeholder Consultations for The Mayor's Task Force on Air Quality*), and Appendix C3 (*Feedback Received by the Mayor's Task Force on Air Quality*) are included as separate attachments with the Final Report of the Prince George Mayor's Task Force on Air Quality Improvement. They can also be found at http://www.city.pg.bc.ca/pages/maqtaskforce/.