

# **Boundary Air Quality Management Plan**



**Prepared for the Boundary Air Quality Committee**

**October 2008**

## **Acknowledgments**

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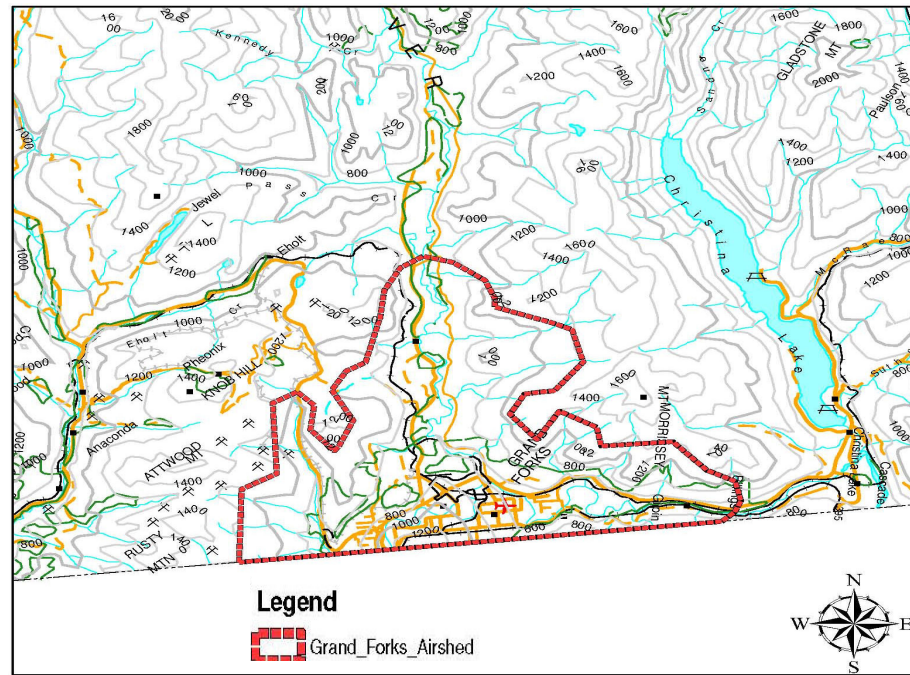
## 1.0 Introduction

The Boundary Airshed covers an area within the Boundary Region of approximately 240 square kilometers including the City of Grand Forks and rural areas adjacent to the city within “Area D” of the Regional District of Kootenay Boundary (RDKB). Although the population and activity levels within the airshed are not particularly high when compared to other airsheds in B.C., the area can experience relatively high concentrations of particulate matter, especially during stagnant weather conditions. This creates a human health risk, can degrade visibility and negatively impact tourism.

Air quality and human health are closely connected. Air pollution can lead to people taking more medications, visiting their doctor more often, being admitted to hospital more often, or even dying prematurely, and it has been estimated to increase BC’s health care costs by \$85 million per year.<sup>1</sup> Taking action to reduce particulate levels in the Boundary Airshed can meet multiple objectives around health, quality of life, climate action and building a more sustainable community.

This plan provides an overview of the Boundary Airshed and summarizes the goals and actions that support the desire of area residents for healthy air, sustainability, and high quality of life. Further background information on the BAQC, air quality monitoring data and trends, past studies, health impacts of common air pollutants, and BC Air Quality Objectives can be found in the Appendices to this plan.

**Figure 1:  
Location of the  
Boundary  
Airshed**



<sup>1</sup> BC Air Action Plan, p.6

**Boundary Air Quality Committee (BAQC)**

The Boundary Air Quality Committee (BAQC) was established in February 2006 with the mandate of developing “an air quality management plan that improves the quality of life and health in the Boundary Region while sustaining a viable economic base.”<sup>2</sup> The BAQC is an advisory committee to Grand Forks City Council, and is made up of representatives from the City, Regional District, the B.C. Ministry of Environment, local industry and community members (See Appendix 2 for a complete list of members).

Community engagement has been a priority for the BAQC, which set up a Community Engagement Team (CET) in its early stages. The CET has assisted the BAQC in conducting several public meetings in 2006 and 2007, a community survey on air quality (see Appendix 1), and providing ongoing outreach activities. All meetings of the BAQC have been open to the public, and significant efforts have been made to ensure that the committee is inclusive and representative of the diversity of stakeholders in the region.

**Background and Characteristics of the Boundary Region Airshed**

The City of Grand Forks has a population of approximately 4,159, with an additional 3,213 individuals comprising the rural population outside of the City and within the Boundary Airshed area (BC Statistics, 2006). The local economy is based on forestry, agriculture, services, and tourism. A significant industrial area is in relatively close proximity to the downtown,

<sup>2</sup> See BAQC mandate statement: <http://www.city.grandforks.bc.ca/air/>

**Figure 2: Boundary Airshed Milestones**

- 1992 PM<sub>10</sub> monitoring starts atop City Hall
- 1996 Grand Forks City Council and Area D representative Basil Jmaiff form first Air Quality Committee
- 1996 First public complaint about Cantex Asphalt Plant Operation
- 1997 Province’s portable air monitoring trailer installed at Councillor O’Doherty’s home for six months
- 1998 The Reid Report – an intensive year-long air quality study of Grand Forks
- 1999 Creation of the “Pollution Hotline”
- 2002 Friends of the Granby appeal Roxul permit and are denied
- 2002 The Adams Report – a foundation for air quality management planning in Grand Forks
- 2005 PM<sub>2.5</sub> monitor is installed
- 2006 Willis Report – a study of fine and coarse fraction PM in the Boundary Region
- 2006 Boundary Air Quality Committee is formed in February 2006, community air quality survey conducted
- 2007 Emissions inventory completed for the Boundary Region; new Roxul permit apportions the airshed so that all industries combined can no longer exceed 12 µg/m<sup>3</sup> of PM<sub>2.5</sub>
- 2008 TEOM data for PM<sub>2.5</sub> available in real time; wood stove exchange program; idle free ambassador program; Roxul’s new pollution abatement system starts operation; Grand Forks receives Green City Award at UBCM.

and a major highway runs through the City.

The predominant landscape of the Boundary Airshed is that of a mountain valley. This creates a natural 'bowl' that can limit the movement of air and pollutants within its boundaries, especially during stagnant weather conditions.

Grand Forks was first identified by the Ministry of Environment as having elevated particulate matter (PM) levels in the 1990s, and a PM<sub>10</sub> monitor was installed in 1992 to measure coarse fraction particulate levels. Since then, considerable effort has gone into gaining a better understanding of specific airshed issues and dynamics. Some key airshed milestones and actions are outlined in Figure 2.

The Reid Report<sup>3</sup>, completed in 1998, found that the Grand Forks downtown area is most affected by elevated levels of PM<sub>10</sub>. It also determined that wind speeds in Grand Forks are generally low compared to other communities in BC's interior, accordingly pollutants that should dissipate do not, resulting in higher ambient pollutant concentrations.

The Adams Report<sup>4</sup>, completed in 2002, found that the levels of inhalable particulate matter (PM<sub>10</sub>) in the area are among the highest in the southern interior and present a concern to public health. Further, the distribution of particulate matter readings during the days of the week suggested that human activities play a significant role in the higher readings. Various recommendations were proposed, including the establishment of respirable particulate matter (PM<sub>2.5</sub>) monitoring.

The Willis Report<sup>5</sup>, completed in 2006, observed a relatively high ratio of fine to coarse fractions of PM, which led to a recommendation for continuous monitoring of PM<sub>2.5</sub> (fine fraction PM) as being most beneficial for the community. The report also observed that seasonal wind speeds in the Boundary Airshed follow the general pattern of the BC interior with higher averages in the summer and lower averages in the winter (when more stagnant weather patterns preside). Boundary Airshed has a large percentage (44%) of 'calms' (for this analysis, defined as wind speeds less than 1 m/sec) in the winter season.

Appendix 1 provides a summary of PM<sub>10</sub> and PM<sub>2.5</sub> air quality monitoring data for the Boundary Airshed.

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<sup>3</sup> Peter D. Reid & Steven C. Josefowich, *Results of a Year-Long Intensive Air Quality Study in Grand Forks, British Columbia*, February 1998, BC Ministry of Environment.

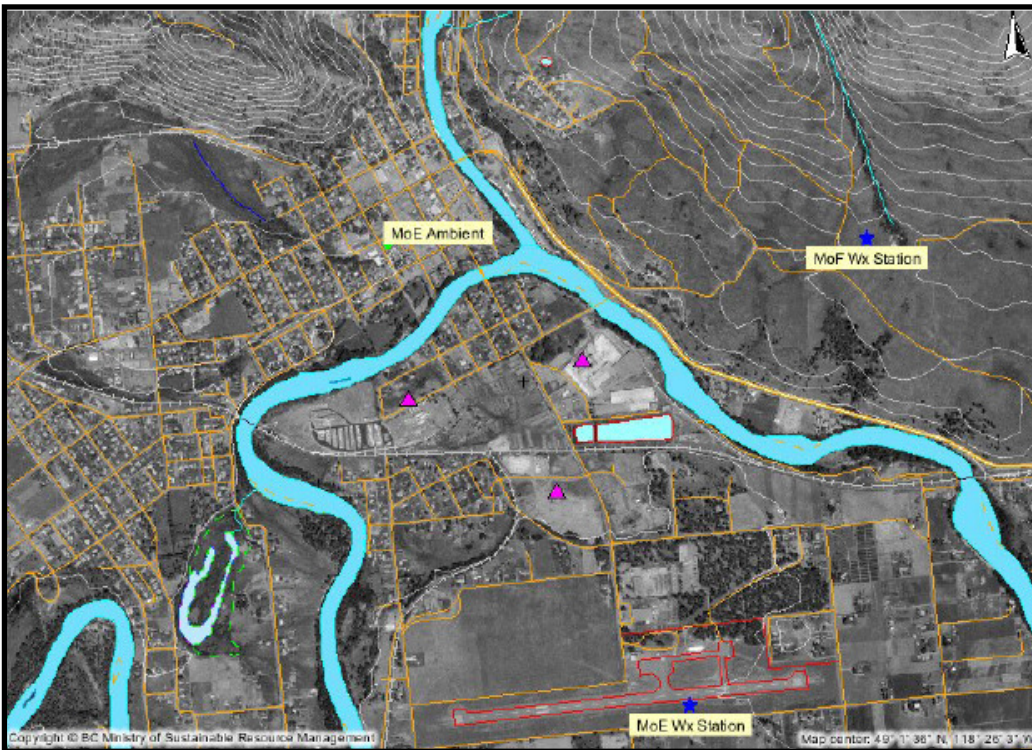
<sup>4</sup> Ralph Adams, *Summary of Air Quality in Grand Forks prepared for Grand Forks City Council*, 2002, BC Ministry of Water, Land and Air Protection.

<sup>5</sup> Paul Willis, *Grand Forks Particulate Matter Analysis and Recommendations*, 2006, BC Ministry of Water, Land and Air Protection.

### ***Air Quality Monitoring***

Grand Forks has had PM<sub>10</sub> monitoring since 1992 and PM<sub>2.5</sub> monitoring since 2005. Locations of current air quality monitoring and weather stations are shown in Figure 3 below. Current monitoring equipment is installed atop City Hall and consists of a TEOM PM<sub>2.5</sub> continuous monitor, plus Partisol PM<sub>2.5</sub> and PM<sub>10</sub> monitors that collect data every sixth day. The Ministry of Environment weather station is located at the Grand Forks airport.

**Figure 3: Monitoring Stations in Grand Forks**



### ***Sustainable Community Plan***

The City of Grand Forks will be completing its Sustainable Community Plan (SCP) in 2009, which will serve as its Official Community Plan (OCP). As OCP, it provides goals, objectives and policies for the City of Grand Forks and sets out land-use management strategies for the City's growth. It also delineates policy by which the City and the public can evaluate development proposals to ensure manageable and economic growth. The OCP forms the basis for land use bylaws and capital expenditures and is to be consistent with the City's waste management plans, domestic water supply improvement programs, public works programs and other capital expenditures.

The goals of the SCP and of this AQMP are complementary, and it is fully expected that implementation of the SCP will help support the goals of this plan.

## 2.0 Sources of Air Pollutants in the Boundary Airshed

As per the table below, the main pollutants of concern in the Boundary Airshed are fine and coarse particulate matter (PM<sub>2.5</sub> & PM<sub>10</sub>). To assist with the development of appropriate strategies and actions, the following broad categories of emissions have been identified: smoke, dust, engine emissions and industrial emissions. Both smoke and dust emissions are made up of several sub-categories based on source. These source-based sub-categories are identified in the Action Plan, Table 3.

**Table 1: Main Categories of Emissions**

Category	Main Sources
Dust	Roads, construction, agriculture, fugitive dust from industrial sites
Industrial Emissions	Roxul, Interfor (formerly Pope & Talbot), Pacific Abrasives, Selkirk Paving
Smoke	Residential wood heating, backyard burning, open burning/controlled burning, forest fires
Engine Emissions	Vehicles, non-road engines

Depending on the size and nature of the source, air quality concerns can be highly localized, such as a residence with a smoky woodstove that affects a small cluster of neighbouring houses, or they can show up at a more general airshed level - the cumulative impact of many small sources together with larger point sources. Because of the complex dynamics of pollutants in the airshed, determining the sources and causes of elevated pollutant levels with any level of confidence requires considerable study and analysis.

To better understand the relative contributions of emissions from different sources, SENES Consultants Ltd was commissioned to complete an emissions inventory in 2006.<sup>6</sup> The inventory provided an in-depth snapshot of both individual and composite emissions for 135 sources in the Boundary Airshed for six common air contaminants and three greenhouse gases.<sup>7</sup>

The inventory estimated that 586 tonnes of PM<sub>10</sub> and 301 tonnes of PM<sub>2.5</sub> were emitted by Boundary Airshed sources in 2006, with a further 229 tonnes of secondary PM<sub>2.5</sub> formed in the atmosphere as a result of the primary emissions.

Approximately 50 percent of the total suspended particulate emissions (TSP) came from area dust sources, and 46 percent from industrial sources. For PM<sub>2.5</sub>, 59 percent was emitted by industrial sources on an annual average basis,

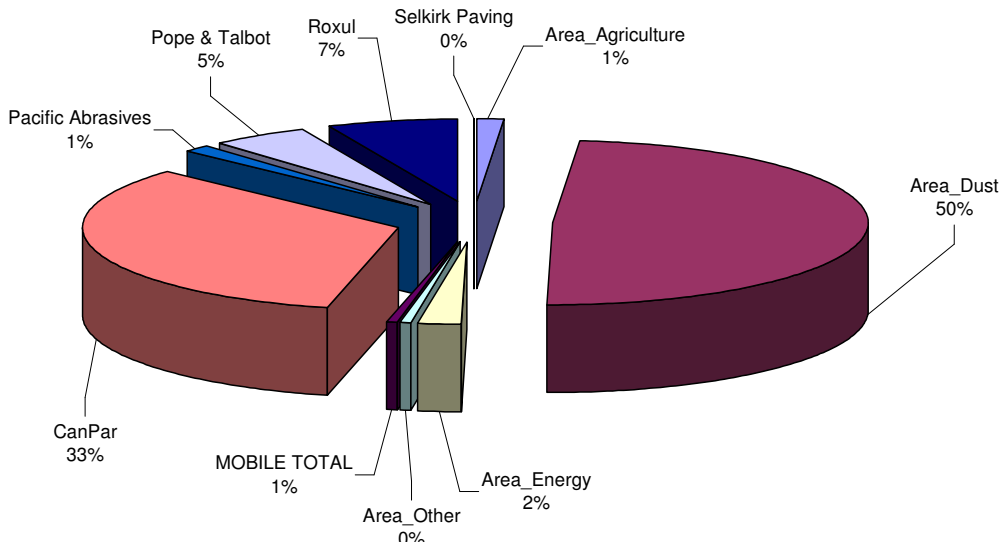
<sup>6</sup> *Grand Forks Air Emission Inventory for 2006*, SENES Consultants Limited, December 2007.

<sup>7</sup> Common air contaminants estimated in the inventory: nitrogen oxides (NO<sub>x</sub>), sulphur dioxides (SO<sub>x</sub>), Particulate Matter (as TSP, PM<sub>10</sub> and PM<sub>2.5</sub>), carbon monoxide (CO), volatile organic compounds (VOCs) and ammonia (NH<sub>3</sub>). Greenhouse gases were: carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), and nitrous oxide N<sub>2</sub>O.

decreasing to 41 percent in winter months as area energy sources (primarily residential wood heating) increased to 22 percent from an annual average of 9 percent. See Figures 4, 5 and 6 below for additional source overview for TSP and PM<sub>2.5</sub>. Emissions from the major industrial sources in Grand Forks are apportioned in such a manner that their combined emissions will not exceed an ambient contribution of 12 µg/m<sup>3</sup> PM<sub>2.5</sub>.

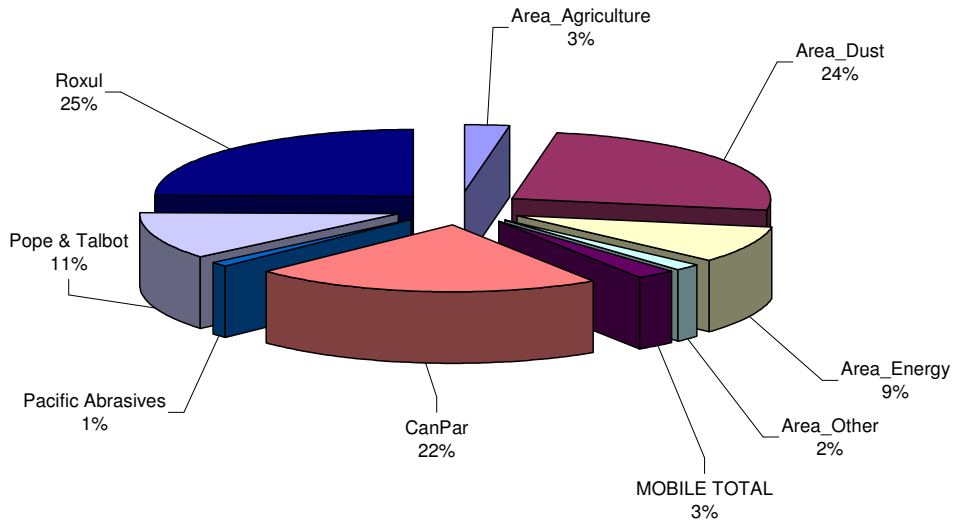
As an area that experiences elevated levels of both PM<sub>10</sub> and PM<sub>2.5</sub> within a complex airshed, the Boundary Airshed will derive further insights on what is occurring in the local airshed from its planned dispersion modeling study.

**Figure 4: Primary TSP Emissions by Source Type (total = 1259 tonnes)<sup>8</sup>**

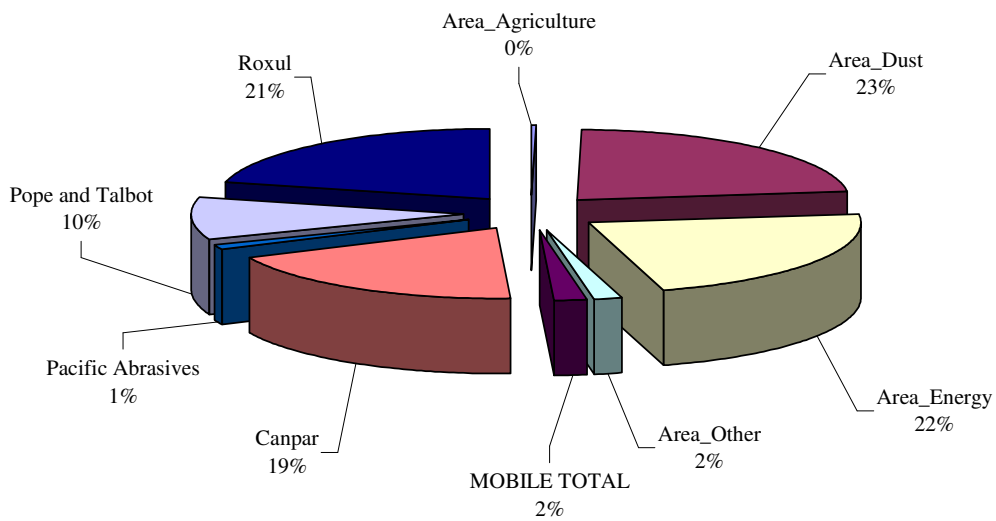


<sup>8</sup> Canpar permanently closed its doors in December 2007.

**Figure 5: Primary PM<sub>2.5</sub> Emissions by Source Type (total = 301 tonnes)<sup>9</sup>**



**Figure 6: Primary PM<sub>2.5</sub> Emissions by Source Type in Winter (total = 88 tonnes)<sup>10</sup>**



<sup>9</sup> See note 8.

<sup>10</sup> See Note 8.

### 3.0 Goals of the Boundary Air Quality Management Plan

Five overarching goals have been identified to guide the overall framework for Boundary's air quality management plan. The goals have been selected to reflect and communicate key values for air quality management that encompass the needs and desires of Boundary area stakeholders. The goals are interconnected and complementary, providing a holistic, community based approach to air quality management.

**Table 2: Goals of Management Plan**

<b>Value</b>	<b>Goal Statement</b>	<b>Description</b>
<b>AIR QUALITY</b>	<b>Prevent future deterioration of the Boundary Airshed by meeting and exceeding Canada Wide Standards and Provincial air quality objectives for particulate matter, and striving for continuous improvement of air quality.</b>	<i>The Boundary Airshed has been identified by the Ministry of the Environment as a degraded airshed due to exceedances of BC Air Quality Objectives for particulate matter. The concept of continuous improvement recognizes that standards and objectives are not "pollute up to" limits, and further recognizes that where pollutant concentrations are near those limits that efforts to take remedial and preventative actions to reduce emissions from anthropogenic sources should be encouraged to the extent practicable. The Boundary Airshed may wish to consider adopting the province's proposed 8 µg/m<sup>3</sup> annual average for PM<sub>2.5</sub> as a strategic goal for air quality in 2009 and beyond.</i>
<b>HUMAN HEALTH</b>	<b>Ensure that citizens and visitors in the Boundary Airshed have healthy air to breathe.</b>	<i>Protecting human health is a key driver for improving air quality, as adverse health impacts can be experienced even when levels of air pollution are below provincial and national standards. Health effects can include eye and throat irritation, breathing difficulties, aggravation of existing heart and lung conditions, and, in some cases, premature death. The elderly, children and those with existing conditions are at highest risk.</i>
<b>EDUCATION AND AWARENESS</b>	<b>Educate and inform the community and surrounding areas on air quality issues, especially the</b>	<i>As communities and individuals become more aware of the connection between air quality and health, positive actions to reduce harmful air emissions follow. The choices people make can have a significant impact on</i>

Value	Goal Statement	Description
	<b>connection between air quality and health.</b>	<i>local air quality, whether they are daily choices around local modes of transportation, more significant choices like purchasing a new wood stove, or getting involved in local air quality management planning.</i>
<b>POLICY INTEGRATION</b>	<b>Integrate the Boundary Airshed's air quality goals into local and regional policies and planning mechanisms.</b>	<i>Air quality can be influenced significantly by local &amp; regional planning and decision making in several key areas, including land use planning, transportation planning, waste management, greenhouse gas management and energy management. Factoring air quality needs and impacts into decision making in these areas will help ensure protection of the Boundary Airshed and reduce the likelihood of unintended consequences. In turn, air quality actions should not result in adverse consequences to other parts of the environment, e.g. land, water, vegetation or wildlife. Policy integration supports the principles of Smart Growth and community sustainability.</i>
<b>SUSTAINABLE DEVELOPMENT</b>	<b>Ensure a strong and sustainable local economy that has a positive impact on air quality.</b>	<i>The mandate of the BAQC is developing an air quality management plan that improves the quality of life and health in the Boundary Airshed while sustaining a viable economic base. This extends to attracting businesses and industry that have minimal impacts on the local airshed, while balancing the needs of existing industry. Adoption of a Sustainable Community Plan by the City of Grand Forks provides significant support for this goal.</i>

## 4.0 A Plan for Action

The following table sets out the main emission categories and categories of actions to improve air quality in the Boundary Airshed. To provide this composite overview, each BAQC stakeholder was asked to identify air quality actions they are taking, have recently taken, or are planning to take in the near future. To ensure some consistency in estimates around potential to improve air quality, stakeholders were given the following guideline:

Low encompasses actions that will not create any noticeable numerical change in monitored air quality, although may result in local, neighbourhood level improvements (ie. creating a no-idling zone),  
Medium encompasses actions that may show some minor improvement in monitored air quality and potentially significant improvement at a local/neighbourhood level, and  
High means that significant volumes of smoke/dust/emissions are being reduced and is strongly expected to result in statistically significant improvement of monitored air quality for the area.

**Table 3: Air Quality Actions for Boundary Region**

CATEGORY	ACTION	COST	POTENTIAL TO IMPROVE AIR QUALITY (LOW/MED / HIGH)	YEAR OF IMPLEMENTATION	CHAMPION(S)/ COMMENTS
<b>Industrial Emissions</b>	1. New Works	Industry Funding \$13million	High	2008	Roxul Inc.
	2. PM emissions assessment	Industry Funding	No impact	2009	Interfor
	3. Stack emissions regulated through Permitting Process by MoE	Industry Funding	High	2009	Ministry of Environment (MoE) and Company with input from City of Grand Forks

CATEGORY	ACTION	COST	POTENTIAL TO IMPROVE AIR QUALITY (LOW/MED / HIGH)	YEAR OF IMPLEMENTATION	CHAMPION(S)/ COMMENTS
	4. Install an afterburner on the melting furnace discharge to reduce organic odours from that source	Industry Funding	Medium	2008	Roxul Inc.
<b>Smoke from Residential Sources</b>	1. Wood stove exchange	\$45,000	Medium	2008/09	City of Grand Forks, RDKB Area "D", Ministry of Environment
	2. Implement Open Burning Bylaw	\$1,000	Medium	2009	City of Grand Forks to urge adoption of a bylaw by RDKB. Requires consultation with MoE & Ministry of Forests and Range (MoF) to ensure conformity with Wildfire Regulation
	3. Enforcement of bylaw to reduce domestic smoke	\$10,000	Low	2009	City of Grand Forks
	4. Ban backyard burning in residential areas	\$1,000	Low	2009	City of Grand Forks to urge adoption of a bylaw by RDKB.
	5. Education and awareness on proper burning and use of wood stoves	\$5,000 & In-Kind	Medium	2008-2010	City of Grand Forks, BAQC, BC Lung Association, Local Physicians, RDKB Area "D"
	6. Implement Wood Stove Bylaw requiring US EPA or CSA approved stoves to be installed	\$1,000	Low-Medium	2009	City of Grand Forks to adopt a bylaw and urge RDKB to adopt a similar bylaw.
	7. Implement Outdoor Wood-Fired Hydronic Boiler Bylaw	\$2,000	Low-Medium	2009	City of Grand Forks to adopt a bylaw and urge RDKB to adopt a similar bylaw.

CATEGORY	ACTION	COST	POTENTIAL TO IMPROVE AIR QUALITY (Low/MED / High)	YEAR OF IMPLEMENTATION	CHAMPION(S)/ COMMENTS
<b>Smoke from Controlled &amp; Open burning</b>	1. Education of farmers to burn only when air quality and wind direction is favourable.	\$1,000	Low	2009	City of Grand Forks and RDKB Area "D" to seek collaboration and support of Ministry of Agriculture and Foods (MoA) to address agricultural burning.
	2. Implement bylaw for controlled burning with fines and penalties for non-compliance.	\$2,000	Medium	2010	City of Grand Forks to seek support of RDKB Area "D" in favour of bylaw, and MoA to help address agricultural burning.
	3. US and Canada Cooperation - counties of Washington State and RDKB collaborate on education on burning - focus Forestry and Farming	\$5,000	Medium	2011	City of Grand Forks to seek support and collaboration of Ministry of Forests and Lands to address this issue.
	4. Roll-out new Open Burning Smoke Control Regulation	0	High	2009	Ministry of Environment
<b>Vehicle &amp; Engine emissions</b>	1. Idle Free Ambassador	\$40,000	Low-Med	2008	City of Grand Forks and BC Youth Climate Leadership Alliance
	2. Anti – Idling policy for company, employee and visitor vehicles	Industry Funding	Low	2008-09	Roxul Inc., EmCon, Pacific Abrasives
	3. Municipal Bylaw on Idling	\$2,000	Low-Med	2007	City of Grand Forks
	4. Upgrade fleet to more fuel efficient vehicles	Industry Funding	Low	On-going	EmCon

CATEGORY	ACTION	COST	POTENTIAL TO IMPROVE AIR QUALITY (LOW/MED / HIGH)	YEAR OF IMPLEMENTATION	CHAMPION(S)/ COMMENTS
	5. "Smart Vehicles" pilot	Industry Funding	Low	2008	EmCon
	6. Education and awareness on idling and vehicle emissions for general public and truckers	\$2,000	Low-Med	On-going	City of Grand Forks, BAQC, Local Physicians, Ministry of Environment, Trucking Fleet managers, Ministry of Transportation and Infrastructure (MoT), YCLA Climate Action Facilitator
	7. Signage for idle-free zones	\$1,500	Low	2008	City of Grand Forks, Interior Health
	8. Create electrified truck stops to reduce idling by tractor-trailers	Unknown	Low	2009-2010	Ministry of Environment
	9. Retrofits for all commercial on-road heavy-duty diesel vehicles, transit buses and school buses	Unknown	Low-Medium	2009	BC Government (see BC Air Action Plan, Actions #5, 6 & 7)
	10. Assess feasibility of establishing a truck by-pass route using existing roads	Unknown	Low-Med if by-pass created	2010	City of Grand Forks
	11. Increase use of videoconferencing to reduce vehicle travel	Industry Funding	Low	2008	EmCon
	12. Implement a public transportation system	\$150,000	Medium	2009	BC Transit, City of Grand Forks, and RDKB

CATEGORY	ACTION	COST	POTENTIAL TO IMPROVE AIR QUALITY (LOW/MED / HIGH)	YEAR OF IMPLEMENTATION	CHAMPION(S)/ COMMENTS
	13. Develop trails and walkways	\$500,000	Medium	2009-2012	City of Grand Forks. Seek support from Ministry of Transportation and Infrastructure.
	14. Provide cycle network	\$500,000	Medium	2009-2012	City of Grand Forks. Seek support from Ministry of Transportation and Infrastructure.
	15. Conduct assessment of traffic volumes/trends on Highway 3	Unknown	N/a	2009/10	BAQC
<b>Road Dust</b>	1. Removal of sand early in the spring using pickup sweeper in local municipalities	\$15,000 (City)	Low-Medium	2008	City of Grand Forks and EmCon
	2. Reduce amount of sand on roads	Cost saving	Low-Medium	2008	City of Grand Forks
	3. Educate public on winter driving and alternate transportation	\$1,000	Low	2008	City of Grand Forks
	4. Where feasible and appropriate, reduce dust on selected road shoulders by planting grass to the edge of pavement	\$500,000	Medium	2009-15	City of Grand Forks and Residents
	5. Install a storm drainage system and pave	\$2 million	Medium	2009-20	City of Grand Forks
	6. Flushing and wetting areas,	\$52,000	Medium	2009	City of Grand Forks

CATEGORY	ACTION	COST	POTENTIAL TO IMPROVE AIR QUALITY (LOW/MED / HIGH)	YEAR OF IMPLEMENTATION	CHAMPION(S)/ COMMENTS
	application of dust suppressants in lanes in residential areas				
	7. Pave downtown lanes and parking lots	\$500,000	Medium	2009-15	City of Grand Forks
	8. Sweep and flush parking lots and downtown streets on a regular schedule	\$20,000	Low-Medium	2009	City of Grand Forks
<b>Dust from industrial sites</b>	1. Establish Development Permit Area regulating separation barriers to contain dust within the industrial operating area and require a dust management plan.	Industry Funding	Low-Medium	2009	City of Grand Forks
	2. Regular sweeping of the industrial area streets and the surrounding neighbourhood	Property Tax-City \$5,000	Low-Medium	2009	City of Grand Forks
	3. Reduction of dust from the unpaved areas in the industrial plant via berming and regravelling of the log yard	Industry	Low-Medium	2008	Interfor
	4. Wet down unpaved areas on a sustainable basis and on schedule	Industry	Low-Medium	2008	Interfor and the City
	5. Hire city sweeper to pick up dust and flush paved areas	Industry	Low-Medium	2008	Pacific Abrasives, Interfor, City of Grand Forks

CATEGORY	ACTION	COST	POTENTIAL TO IMPROVE AIR QUALITY (Low/MED / High)	YEAR OF IMPLEMENTATION	CHAMPION(S)/ COMMENTS
	6. Require trucks to do regular wash to remove muds, dirt and dust	Industry	Low-Medium	2009	Truck Owners, Roxul Inc., Pacific Abrasives, EmCon and City of Grand Forks
	7. Pave industrial yard on a sustainable basis	Industry	Low-Medium	2009	Interfor
	8. Install cattle guard grate at the entry and exit gate of plant to help prevent truck traffic from dragging slag onto the street	Industry	Low	2009	Pacific Abrasives
	9. Purchase and use a wet brush attachment for the company front end loader to reduce fugitive dust generated by vehicle traffic on company property	Industry	Low-Medium	2008	Roxul Inc.
	10. Fabricate a road watering device to reduce dust generated by vehicular traffic on unpaved segments of the Roxul industrial site.	Industry	Low	2008	Roxul Inc.
	11. Install a filter system on the product cooling equipment to reduce particulate matter released to atmosphere	Industry	Medium	2008	Roxul Inc.

CATEGORY	ACTION	COST	POTENTIAL TO IMPROVE AIR QUALITY (LOW/MED / HIGH)	YEAR OF IMPLEMENTATION	CHAMPION(S)/ COMMENTS
<b>Area Sources of Dust</b>	1. Encourage farmers to wet soil or plant as soon as possible to reduce dust from drying fields	Farmers	Medium	2009-15	City of Grand Forks to seek support and collaboration of Ministry of Agriculture and Lands and RDKB to address this issue.
	2. Plant grass and trees in open areas with moisture sustaining plants and grass	Property owners	Medium	2009-2020	City of Grand Forks to work with MoE and RDKB Area "D" to provide outreach to property owners.
	3. Require that construction sites be watered down and streets cleaned at construction sites.	Property owners	Medium	2009-	City of Grand Forks
	4. Wet down or apply dust suppressants to public gathering areas and have large parking lots of shopping centres flushed on a regular basis.	\$5,000 and Property owners	Medium	2008	Property owners and City of Grand Forks.
	5. Farm lands to plant tree wind barriers to reduce blowing soil	Property owners	Medium	2009-2020	City of Grand Forks to seek collaboration with Ministry of Agriculture, MoE and RDKB to conduct outreach to farmers.
	6. Plant grass and trees and use rock, gravels to reduce and eliminate erosion and dust.	Property owners	Medium	2009-2020	City of Grand Forks to seek collaboration with Ministry of Environment, RDKB, Ministry of Transportation and Infrastructure to conduct outreach to property owners

CATEGORY	ACTION	COST	POTENTIAL TO IMPROVE AIR QUALITY (LOW/MED / HIGH)	YEAR OF IMPLEMENTATION	CHAMPION(S)/ COMMENTS
	7. Educate residents and farmers on the adverse effects of erosion and dust and how to prevent both	\$5,000	High	2009-2010	City of Grand Forks to seek collaboration with Ministry of Agriculture, MoE and RDKB to conduct outreach to farmers.
<b>Air quality monitoring &amp; modeling</b>	1. Dispersion modeling	\$50,000	No impact	2009	BAQC and Ministry of Environment
	2. Implementation of modeling at the field level	\$50,000	Medium	2010	BAQC and Ministry of Environment
	3. Installation of 2 cameras to provide time lapsed photography of the City	\$20,000	No impact	2009	Ministry of Environment, City of Grand Forks
	4. Remote access capability of photography and data accessibility by MoE	\$1,200/p/yr	No impact	2009	City of Grand Forks and Ministry of Environment
	5. PM Data Trends and Analysis	In-kind	No impact	2008	Ministry of Environment
	6. Fundraising for additional air quality monitoring stations and modeling with the goal of installing a PM <sub>2.5</sub> Partisol monitor and PM <sub>10</sub> TEOM monitor.	To be determined	No impact	2008-2012	BAQC to lead fundraising efforts, with some support from MoE. Goal is for PM <sub>2.5</sub> Partisol monitor in place for 2009/10 and a PM <sub>10</sub> TEOM monitor for 2012.
	7. Develop strategy and fundraising for installation of additional meteorological stations	To be determined	No impact	2008-2012	BAQC. Goal is to add up to 3 more stations in the area.

CATEGORY	ACTION	COST	POTENTIAL TO IMPROVE AIR QUALITY (LOW/MED / HIGH)	YEAR OF IMPLEMENTATION	CHAMPION(S)/ COMMENTS
<b>Education and Awareness</b>	1. Ongoing public education in a variety of media/formats about key air quality issues in Grand Forks, including keeping the BAQC website current	In-kind	Low-Medium	On-going	BAQC, BC Lung Association, Local Physicians, City of Grand Forks, YCLA Climate Action Facilitator
	2. Clean Air Day	\$2,000	Low	On-going	City of Grand Forks, BC Lung Association
	3. Promote Healthy Built Environment and Active Living	IHA	Low	2008 -	Interior Health Authority
	4. Community air quality survey	City of Grand Forks	No Impact	2010	City of Grand Forks, RDKB Area "D"
<b>Energy Efficiency</b>	1. Energy Assessment of Local Yards – improved weatherization of buildings	Industry Funding	Low	2008	EmCon
	2. Use geothermal heating in new construction where feasible	Industry Funding	Low	2008 -	Emcon
<b>Coordination</b>	1. Explore feasibility of creating part-time air quality coordination role for City of Grand Forks	None	No impact	2008	City of Grand Forks
<b>Policy Integration</b>	1. Identify opportunities for integration of air quality management goals and actions with land use planning, climate	City of Grand Forks	No Impact	2008	City of Grand Forks, RDKB

CATEGORY	ACTION	COST	POTENTIAL TO IMPROVE AIR QUALITY (LOW/MED / HIGH)	YEAR OF IMPLEMENTATION	CHAMPION(S)/ COMMENTS
	action, transportation planning, and waste management at the local and regional level				
	2. Review proposed air quality actions, especially those related to dust control, to ensure that they do not create unreasonable adverse impacts on area water quality.	City of Grand Forks	No impact	2008	City of Grand Forks, BAQC
	3. Prepare a Memorandum of Understanding that outlines goals and processes for interagency consultation on significant permits, research projects, etc.	In Kind	No Impact	2009	City of Grand Forks, RDKB, Ministry of Environment, Interior Health Authority, Ministry of Forests and BAQC.

## 5.0 Monitoring and Reporting on Progress

The BAQC (or its successor) will review and communicate progress on air quality actions and activities on an annual basis to Grand Forks City Council, updating the Action Plan as needed with any new actions or modifications to existing actions, and providing a report on progress indicators in Table 4. The BAQC will keep its website up to date and use opportunities such as city newsletters to report on progress to residents in the airshed. At the same time, citizens with air quality complaints, concerns or wishing to participate in the plan may continue to address those concerns to City Council, the BAQC or its successor.

The vision of the BAQC is that this is a “living” plan that gets updated annually at minimum, with the BAQC as caretaker of the plan. Key information on the plan and achievement of its milestones will be provided and updated on the City’s website.

**Table 4: Key Progress Indicators**

<b>Indicator</b>	<b>Frequency of Measurement</b>
Air quality data and trends in PM <sub>10</sub> and PM <sub>2.5</sub> as measured by local monitoring station	Annual
Number of air quality complaints/concerns received by City of Grand Forks	Annual
Analysis of air quality-based timelapse photography of Grand Forks	Annual
Number of air quality days that are “Fair” or “Poor”	Annual
Number of air quality days that meet proposed BC 24-hour air quality objective for PM <sub>2.5</sub> (8 µg/m <sup>3</sup> )	Annual
Number of actions in AQMP that are “complete”	Annual
Number of actions in AQMP that are “In progress”	Annual
Number of actions in AQMP that have been “tabled”	Annual
Number of new actions initiated not previously listed in AQMP	Annual
Number of wood stoves exchanged	Annual
Number of hits to BAQC website	Annual
Number of media spots on local air quality (print, radio, TV)	Annual
Changes in responses to community survey	Every 4 years

## 6.0 Review of Plan

This plan has been prepared as a five year plan, and shall be substantively reviewed for progress and continued applicability after two years.

## 7.0 Signatories to Plan

We, the undersigned, agree to work together in good faith to achieve the goals and actions of the Boundary Air Quality Management Plan to the fullest extent possible.

Signed:

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_
4. \_\_\_\_\_
5. \_\_\_\_\_
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8. \_\_\_\_\_
9. \_\_\_\_\_
10. \_\_\_\_\_
11. \_\_\_\_\_
12. \_\_\_\_\_
13. \_\_\_\_\_
14. \_\_\_\_\_
15. \_\_\_\_\_
16. \_\_\_\_\_

Per:

- City of Grand Forks  
Area "C", RDKB\*\*  
Area "D", RDKB  
Roxul  
Interfor  
Selkirk Paving\*\*  
Pacific Abrasives\*\*  
EmCon  
Ministry of Environment  
Ministry of Forests  
and Lands\*\*  
Interior Health Authority  
Ministry of Transportation  
and Infrastructure\*\*  
Ministry of Agriculture  
and Lands\*\*  
BC Lung Association  
Chamber of Commerce\*\*  
Rob Chornenki,  
BAQC Member

This plan will be signed and becomes effective on adoption by resolution of the City Council of Grand Forks.

**Note: \*\* denotes that the signatory has not been confirmed as of 20/10/08.**

## Appendix 1: Additional Information on Air Quality in the Boundary Airshed

According to the Willis Report, PM<sub>10</sub> levels have been relatively consistent since measurement commenced in 1993, showing neither significant degradation nor improvement. There is some indication that PM<sub>10</sub> levels may be trending downward since 2006, however, it is premature to state this with any statistical certainty.

**Table 5: Grand Forks PM<sub>10</sub> Readings 1993-2005**

Grand Forks PM <sub>10</sub> Readings – 1993 to 2005											
Year	25 <sup>th</sup> Percentile ( $\mu\text{g m}^{-3}$ )	Median ( $\mu\text{g m}^{-3}$ )	98 <sup>th</sup> Percentile ( $\mu\text{g m}^{-3}$ )	Standard deviation ( $\mu\text{g m}^{-3}$ )	Number of samples	Data Capture Rate (%)	Frequency of <b>GOOD</b> AQ (%)	Frequency of <b>FAIR</b> AQ (%)	Frequency of <b>POOR</b> AQ (%)	Frequency of <b>VERY POOR</b> AQ (%)	Health Increments ( $\mu\text{g m}^{-3}$ day year <sup>-1</sup> )
1993	19	26	55	13.6	41	68	49	44	7	0	267
1994	14	18	70	15.0	44	72	64	30	7	0	199
1995	14	22	59	11.4	52	85	60	37	4	0	140
1996	14	19	51	10.3	68	93	72	25	3	0	108
1997	15	23	67	14.2	91	77	57	39	4	0	205
1998	18	25	60	13.6	45	72	51	44	4	0	260
1999	13	22	64	14.7	57	92	60	33	7	0	218
2000	15	23	60	13.3	58	95	62	33	5	0	170
2001	14	21	62	12.8	61	100	62	34	3	0	156
2002	15	22	60	13.1	57	90	63	32	5	0	166
2003	15	24	66	16.0	30	49	53	40	7	0	256
2004	12	21	50	11.1	58	95	67	31	2	0	126
2005	13	22	75	19.1	45	92	57	37	4	2	237

Seasonal biases are evident in Boundary air quality. With the exception of major 'wildfire years', the season that sees the highest PM<sub>10</sub> loading is winter. This is in keeping with a fairly typical interior BC pattern which suggests the higher winter PM levels are a combination of increased emissions from various sectors (e.g., road dust, woodstoves, slash burning) coupled with stagnant dispersion conditions. February and March experience particularly high PM levels because roads begin to thaw in February/March and large amounts of road dust are released in these months through vehicular action.

June is a month of relatively low PM. At this time of year the temperature is warm enough that temperature inversions are broken up during the days, allowing PM to disperse. In addition, June occurs prior to the summer wildfire season and before the summer tourism season.

Sunday PM levels are statistically different and lower than most weekdays, which may be explained by lower commuter and local traffic levels on that day.

### **2006 Air Quality Community Survey**

As part of the BAQC's community engagement program, an air quality survey was mailed to 3100 households in the Boundary airshed area in late 2006. With a view to creating a baseline assessment on public attitudes and behaviour around air quality, the survey presented 13 agreement statements to which respondents were asked to rate their support on a scale of 1 (strong disagreement) through 4 (strong agreement).

More than 360 surveys were returned and tabulated, identifying five areas of strong agreement among airshed residents:

- Air quality is a very important issue to me (3.74/4)
- I feel that poor air quality affects the health of my family as well as myself (3.51/4)
- Industry is responsible for poor air quality (3.45/4)
- Burning clippings and other yard wastes can badly affect local air quality (3.11/4)
- Municipal bylaws restricting outside burning can help improve air quality (3.05/4)

Additional information on the survey can be obtained at [www.city.grandforks.bc.ca/air](http://www.city.grandforks.bc.ca/air).

### **Emissions Inventory**

To help understand emissions by source and source category, SENES Consultants Limited (SENES) was commissioned by the City of Grand Forks to complete a comprehensive emissions inventory of all significant emission sources in and surrounding the City in 2006. The inventory tracked both Common Air Contaminants (CACs) and Greenhouse Gases (GHGs) for 135 individual sources.

The inventory is organized into three main source groups:

1. **Point sources** refer to fixed location large industrial sources that operate under a discharge permit from the Province. There are five point sources in the inventory.
2. **Mobile sources** include all modes of motorized transportation, including motor vehicles, aircraft, rail, and non-road engines (lawnmowers, chainsaws, tractors, etc)
3. **Area sources** include all remaining emission sources which, in many cases, tend to be widely distributed throughout a community. An example of an area source is space heating due to combustion of wood.

Particulate matter from area dust and industry sources comprise the most significant volume of air emissions for Grand Forks, with winter-time emissions from woodstoves also contributing significantly to particulate emissions in the winter months only. An overview of major sources and emissions can be found in Table 6.

**Table 6: SENES Emissions Inventory – Major Sources<sup>11</sup>**

Source Type	Category	CACs (tonnes)								GHGs (tonnes)		
		CO	NOx	SOx	VOC	NH3	TSP	PM10	PM25	CO2	CH4	N2O
AREA	Area_Agriculture	39.79	1.37	0.00	16.51	8.22	17.94	13.52	8.50	0.00	53.11	0.99
	Area_Dust	0.00	0.00	0.00	0.00	0.00	615.10	309.24	74.94	0.00	0.00	0.00
	Area_Energy	179.47	12.66	0.61	39.51	0.70	28.03	26.46	26.46	34,092.93	28.39	1.01
	Area_Other	32.91	31.39	0.24	1,973.70	0.19	5.38	5.04	4.94	1,214.10	446.34	7.78
	<b>AREA TOTAL</b>	<b>252.2</b>	<b>45.4</b>	<b>0.9</b>	<b>2,029.7</b>	<b>9.1</b>	<b>666.5</b>	<b>354.3</b>	<b>114.8</b>	<b>35,307.0</b>	<b>527.8</b>	<b>9.8</b>
MOBILE	Mobile_Highway	1,031.96	98.71	0.88	90.10	3.24	2.48	2.48	1.74	20,586.35	4.47	5.42
	Mobile_Local	614.64	49.95	0.38	52.74	2.07	1.28	1.28	0.89	10,591.60	2.75	2.83
	NonRoad_Agriculture	68.55	12.98	1.04	4.84	0.05	0.84	0.84	0.81	1,261.49	0.41	0.40
	NonRoad_Commercial	156.95	13.43	0.40	19.77	0.01	1.29	1.29	1.21	1,041.43	0.57	0.24
	NonRoad_Construction	25.85	4.49	0.46	1.66	0.01	0.38	0.38	0.37	445.75	0.11	0.15
	NonRoad_Industry	43.44	18.43	1.75	3.13	0.03	0.98	0.98	0.95	1,786.97	0.29	0.56
	NonRoad_Recreational	67.92	0.27	0.01	31.63	0.01	0.87	0.87	0.80	380.73	0.44	0.01
	NonRoad_Residential	412.67	2.51	0.02	41.90	0.01	1.18	1.18	1.09	770.12	0.88	0.02
<b>MOBILE TOTAL</b>	<b>2,422.0</b>	<b>200.8</b>	<b>4.9</b>	<b>245.8</b>	<b>5.4</b>	<b>9.3</b>	<b>9.3</b>	<b>7.8</b>	<b>36,864.5</b>	<b>9.9</b>	<b>9.6</b>	
POINT	CanPar	116.40	81.66	1.14	269.13	0.50	420.00	87.00	66.00	0.00	0.00	0.00
	Pacific Abrasives	0.00	0.00	0.00	0.00	0.00	17.00	3.60	3.60	0.00	0.00	0.00
	Pope & Talbot	14.50	72.70	0.43	50.00	0.00	62.00	54.00	34.00	0.00	0.00	0.00
	Roxul	1.31	2.18	0.03	26.04	3.31	84.20	78.20	74.20	0.00	0.00	0.00
	Selkirk Paving	1.00	0.20	0.03	0.25	0.00	0.25	0.18	0.17	0.00	0.00	0.00
	<b>POINT TOTAL</b>	<b>133.2</b>	<b>156.7</b>	<b>1.6</b>	<b>345.4</b>	<b>3.8</b>	<b>583.5</b>	<b>223.0</b>	<b>178.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>
<b>Grand Total</b>		<b>2,807.4</b>	<b>402.9</b>	<b>7.4</b>	<b>2,620.9</b>	<b>18.4</b>	<b>1,259.2</b>	<b>586.6</b>	<b>300.7</b>	<b>72,171.5</b>	<b>537.7</b>	<b>19.4</b>

<sup>11</sup> Canpar permanently closed its doors in December 2007.

Historic trends for PM<sub>10</sub> and PM<sub>2.5</sub> in Boundary Airshed<sup>12</sup>

Figure 7: Annual 98<sup>th</sup> Percentile and Means for PM<sub>10</sub>

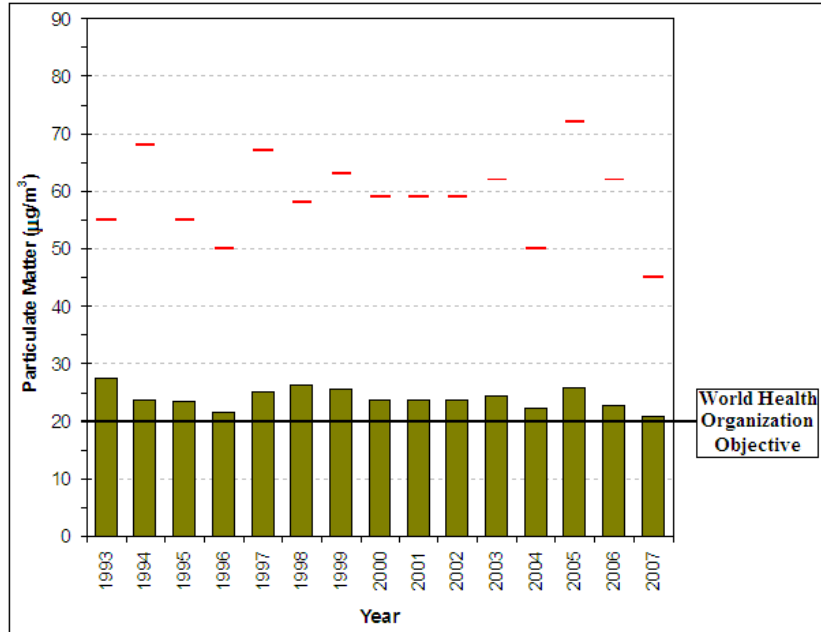
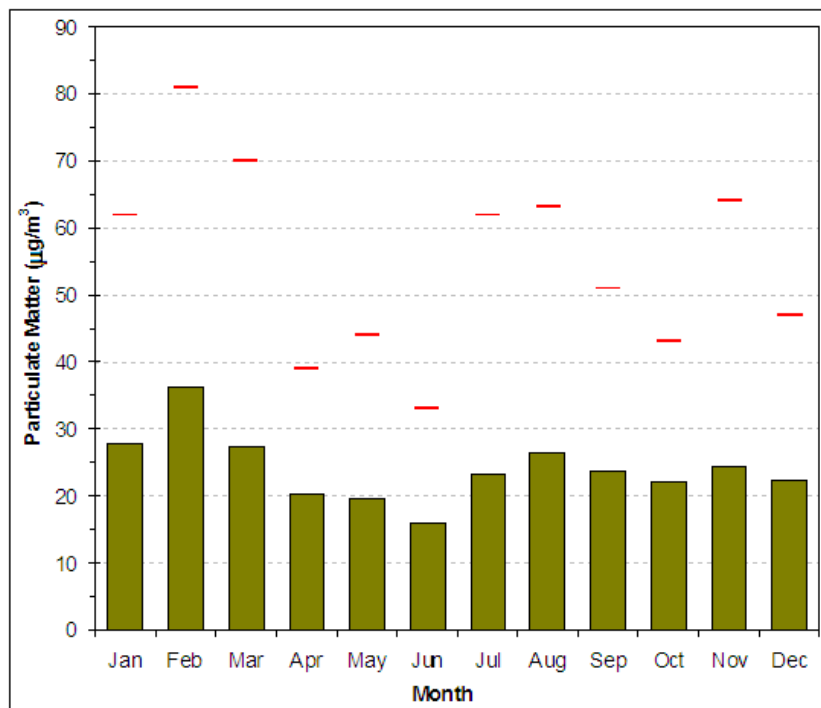


Figure 8: Monthly 98<sup>th</sup> Percentile and Means for PM<sub>10</sub>



<sup>12</sup> The figures in this section have been provided by Ministry of the Environment.

Figure 9: Annual 98<sup>th</sup> Percentile and Means for PM<sub>2.5</sub>

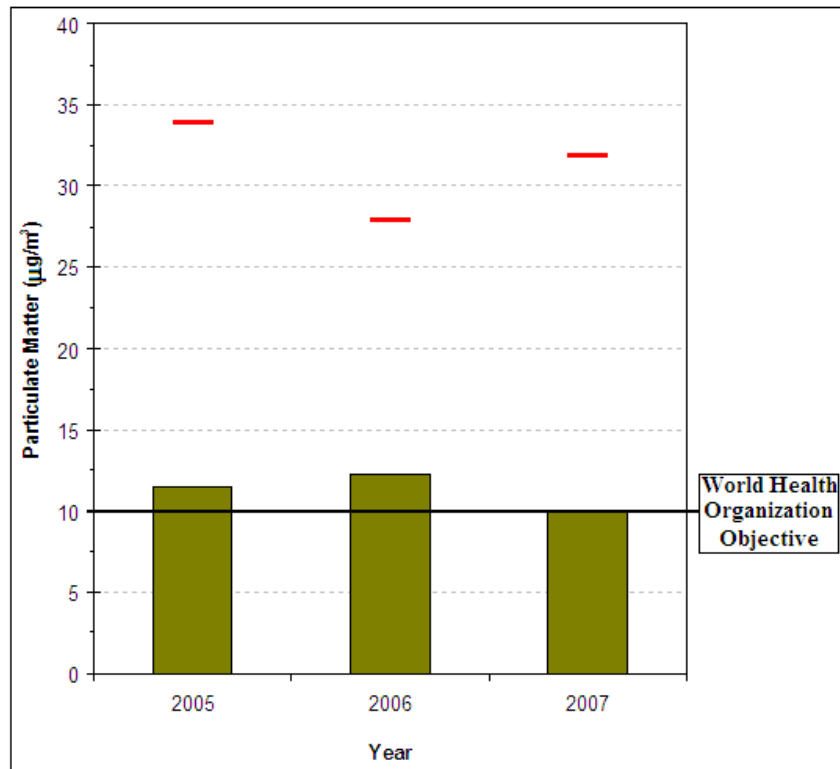
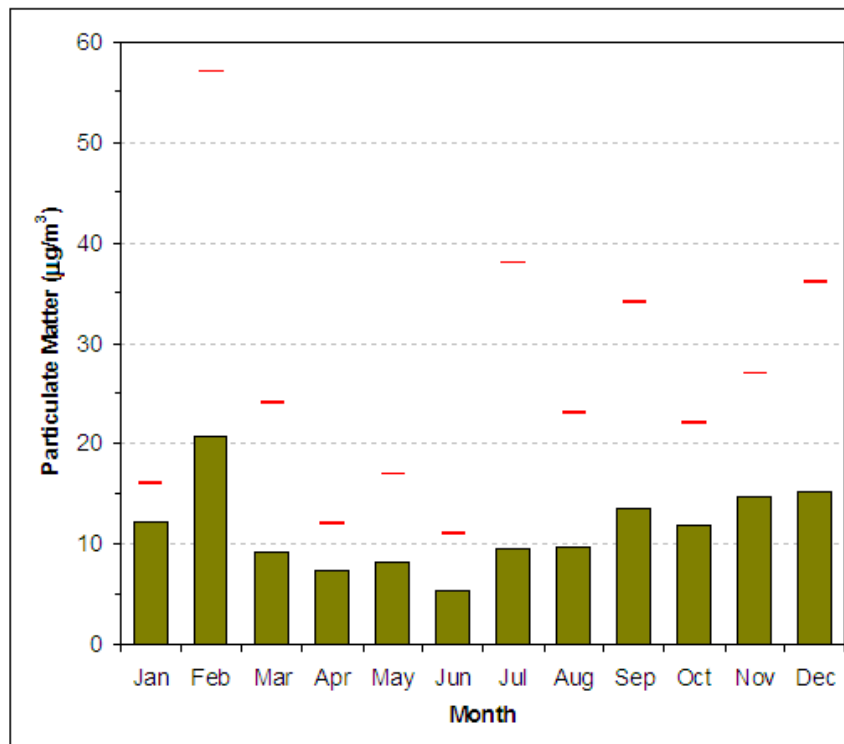


Figure 10: Monthly 98<sup>th</sup> Percentile and Means for PM<sub>2.5</sub>



## Comparison of Boundary Airshed Data with Vernon & Golden

**Table 7: PM<sub>10</sub> Airshed Comparison with Calibrated TEOM Data**

PM <sub>10</sub> Readings in three locations in 2005											
Station	25 <sup>th</sup> Percentile ( $\mu\text{g m}^{-3}$ )	Median ( $\mu\text{g m}^{-3}$ )	98 <sup>th</sup> Percentile ( $\mu\text{g m}^{-3}$ )	Standard deviation ( $\mu\text{g m}^{-3}$ )	Number of samples	Data Capture Rate (%)	Frequency of <b>GOOD</b> AQ (%)	Frequency of <b>FAIR</b> AQ (%)	Frequency of <b>POOR</b> AQ (%)	Frequency of <b>VERY</b> <b>POOR</b> AQ (%)	Health Increments ( $\mu\text{g m}^{-3}$ day year <sup>-1</sup> )
Golden	18	25	104	21.3	304	97	49	37	11	2	375
Vernon	15	23	98	21.5	365	100	55	33	10	2	338
Grand Forks	13	22	75	19.1	45	93	57	37	4	2	237

**Table 8: PM<sub>2.5</sub> Airshed Comparison with Calibrated TEOM Data**

PM <sub>2.5</sub> Readings in three locations in 2005											
Station	25 <sup>th</sup> Percentile ( $\mu\text{g m}^{-3}$ )	Median ( $\mu\text{g m}^{-3}$ )	98 <sup>th</sup> Percentile ( $\mu\text{g m}^{-3}$ )	Standard deviation ( $\mu\text{g m}^{-3}$ )	Number of samples	Data Capture Rate (%)	Frequency of <b>GOOD</b> AQ (%)	Frequency of <b>FAIR</b> AQ (%)	Frequency of <b>POOR</b> AQ (%)	Frequency of <b>VERY</b> <b>POOR</b> AQ (%)	Health Increments ( $\mu\text{g m}^{-3}$ day year <sup>-1</sup> )
Golden	5	8	29	7.2	304	97	78	17	5	0	N/A
Vernon	4	7	22	5.3	365	100	89	11	1	0	N/A
Grand Forks	5	10	34	9.1	40	86	80	15	4	2	N/A

## **Appendix 2: BAQC Stakeholders**

Michele Caskey, BC Lung Association  
Ingo Frankfurt, Interior Health  
Dale Bonke, Ministry of the Environment  
Paul Willis, Ministry of the Environment  
Mike Reiner, Ministry of the Environment  
Julia Beatty, Ministry of the Environment  
Grace McGregor, Director Area C, Regional District of Kootenay Boundary  
Tony Lodder, Director Area D, Regional District of Kootenay Boundary  
Peter Regenber, Roxul  
Mike Van Ek, Interfor  
Mr. Bent Jorgensen, Roxul  
John Ketrenos, Pacific Abrasives  
Cher Wyers, Chamber of Commerce  
Joe Mottishaw, Emcon Services  
Alvin Boyer, Ministry of Forests  
Gary Smith, Gaia Principles  
Karin Kilpatrick, Medical Staff  
Lyle Olsen, Selkirk College  
Rob Chornenki, resident  
Victor Kumar, CAO, City of Grand Forks  
Chris Moslin, Councillor City of Grand Forks

### Appendix 3: Summary of Main Pollutants and their Impacts

Pollutant	Description	Sources	Health Effects	Environmental				
<b>Particulate Matter (PM):</b> Dust, soot, and tiny bits of solid material.	PM <sub>10</sub> : Particles smaller than 10µm in diameter, also known as “coarse particulates” and/or “inhalable particulates”	Road dust, road and other construction dust	Coarse particles irritate the nose and throat, but do not normally penetrate deep into the lungs.	PM is the main source of haze that reduces visibility.  It takes hours to days for PM <sub>10</sub> to settle out of the air.  PM contributes to smog				
		Mixing and applying fertilizers/pesticides						
		Wind and other natural sources						
		See also sources of PM <sub>2.5</sub> below						
	PM <sub>2.5</sub> : Particles smaller than 2.5µm in diameter, also known as “fine particulates” and/or “respirable particulates”	Combustion (motor vehicles, woodstoves, yard waste and fireplaces)	Fine particles enter the lungs, making it difficult to breathe, and lead to diseases such as bronchitis. Depending on the source and chemical composition of the fine particles, effects can be severe enough to cause cancer and premature death.  PM <sub>2.5</sub> is the worst public health problem from air pollution in BC (Research indicates the number of hospital visits increases on days with increased PM levels).	Because they are so small, PM <sub>2.5</sub> stay in the air much longer than PM <sub>10</sub> , taking days to weeks to be removed.				
		Produced in reactions of gaseous pollutants						
		Industrial Activity						
		Garbage Incineration						
<b>Ground-Level Ozone (O<sub>3</sub>):</b> Bluish gas with a pungent odour	• At ground level, ozone is formed by chemical reactions between volatile organic compounds (VOCs) and nitrogen oxides (NOx) in the presence of sunlight.	VOCs and NOx are released by burning coal, gasoline, and other fuels; VOCs are also released naturally by vegetation (e.g., the smell from evergreen sap/needles).	Exposure for 6-7 hours, even at low concentrations, significantly reduces lung function and causes respiratory inflammation in healthy people during periods of moderate exercise. Can be accompanied by symptoms such as chest pain, coughing, nausea, and pulmonary congestion. Impacts on individuals with pre-existing heart or respiratory conditions can be very serious.  Ozone exposure can contribute to asthma, and reduced resistance to colds and other infections.	Ozone occurs naturally high above the Earth (in the stratosphere) where it protects us from harmful ultraviolet rays.				
				Ground level ozone contributes to smog				
				At ground level, ozone can damage plants and trees, leading to reduced yields.				
				At ground level, ozone leads to lung and respiratory damage in animals.				
				<b>Other Pollutants</b>	• SOx: sulphur oxides • CO: carbon monoxide • NOx: nitrogen oxides • TRS: total reduced sulphur • VOCs: volatile organic compounds • POPs: persistent organic pollutants • Pb: lead • Hydrocarbons	Most of these come from combustion, particularly from vehicles, and industrial processes or the evaporation of paints and common chemical products.	The health impacts of these pollutants are varied.	While some of these pollutants have a local impact on the environment (e.g., heavy metals such as lead) or are relatively short-lived (NO <sub>2</sub> ), some are long-lived (POPs), and can travel the world on wind currents in the upper atmosphere. NO <sub>x</sub> and SO <sub>2</sub> contribute to PM <sub>2.5</sub> formation.

## Appendix 4: Air Quality Standards and Objectives in BC

The Ambient Air Quality Objectives (AAQOs) in Table 6 reflect current knowledge about air quality and health science. AAQOs can be used to formulate air quality management programs comprised of, but not limited to, the following components:

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

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

**Table 9: Canada Wide Standards & Ambient Air Quality Objectives for PM**

Air Contaminant	Averaging Time	Standard	Ambient Air Quality Objectives [micrograms/m <sup>3</sup> (µg/m <sup>3</sup> )]
PM <sub>2.5</sub>	*24 hour	Canada Wide Standards	30
	24 hour (proposed)	Ambient Air Quality Objectives	25
	Annual (proposed)	Ambient Air Quality Objectives	8
	Planning Goal (proposed)	Ambient Air Quality Objectives	6
PM <sub>10</sub>	24 hour	Ambient Air Quality Objectives	50

\*based on annual 98th percentile value, averaged over 3 consecutive years;

### Canada Wide Standards (CWS) for PM<sub>2.5</sub> and Ozone

The Canada Wide Standards (CWS) for Particulate Matter (PM<sub>2.5</sub>) and Ground Level Ozone were endorsed by the Canadian Council of Ministers for the Environment (CCME) (including the BC Ministry of Environment, federal, provincial and territorial governments) in June 2000. In recognition of the lack of health threshold levels for both PM and Ozone, the CWS contained a stipulation for “keeping clean areas clean” and “continuous improvements” in areas that are already meeting the standards.

## **BC Objectives for PM<sub>10</sub>**

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

## **BC Objectives for PM<sub>2.5</sub>**

In January 2008, BC Ministry of Environment announced its intention to establish provincial ambient air quality criteria for particulate matter 2.5 micrometres (µm) or smaller (PM<sub>2.5</sub>) – addressing objectives for 24-hour and annual averages, and longer-term planning goals. It is expected that the new objectives will be in place by 2009. The proposed levels are as follows:

- 24-hour AQO        25 ug/m<sup>3</sup>
- Annual AQO        8 ug/m<sup>3</sup>
- Planning Goal     6 ug/m<sup>3</sup>

## **Air Quality Index (AQI)**

Air quality objectives for PM<sub>10</sub> and other common contaminants form the basis of the Air Quality Index (AQI). The AQI is a scale used in parts of the province and elsewhere to determine if air quality is "good", "fair", "poor" or "very poor". At sites where numerous contaminants are monitored, the AQI reflects the concentration of the contaminant that is highest compared to its respective air quality objective. Where PM<sub>10</sub> is the contaminant of concern, air quality can be described as shown in Table 7. Exceedances of the air quality objective for PM<sub>10</sub> indicate that air quality may be poor or very poor.

Because Grand Forks does not have a PM<sub>10</sub> monitor, it is likely that its actual AQI may be higher than what is reported. For example, Grand Forks often has the lowest AQI reading while other interior communities with the exact same PM<sub>2.5</sub> reading (Golden, for example) will have a higher AQI because they also have a PM<sub>10</sub> monitor in place.

Description of the air quality index, based on PM<sub>10</sub> measurements:

**Table 10: Air Quality Index**

<b>Air Quality Descriptor</b>	<b>Air Quality Index</b>	<b>PM<sub>10</sub> Concentration (24-hour average, µg/m<sup>3</sup>)</b>
<b>Good</b>	<b>&lt; or = 25</b>	<b>&lt; or = 25</b>
<b>Fair</b>	<b>26-50</b>	<b>26-50</b>
<b>Poor</b>	<b>51-100</b>	<b>51-100</b>
<b>Very Poor</b>	<b>&gt; 100</b>	<b>&gt; 100</b>

(Source: MoE, 2007)

### **Air Quality Health Index**

Canada has also created an Air Quality Health Index (AQHI) that directly ties air quality to health risk. This tool has been adopted by BC as a means of more effectively communicating health risk levels of air quality in real-time.

The AQHI is reported on a scale of 1-10+ based on concentrations of three different air pollutants that harm human health: ozone, particulate matter (PM<sub>10</sub> and PM<sub>2.5</sub>), and nitrogen dioxide. Levels 1-3 indicate a low health risk, levels 4-6 indicate a moderate health risk, levels 7-10 indicate a high health risk, and level 10+ indicates a very high health risk.

For participating communities, the AQHI report is updated hourly and provides a current measurement as well as a forecasted high level for the day and for the next day. For more information on the AQHI in BC and current levels, see [www.airhealthbc.ca](http://www.airhealthbc.ca).

## Appendix 5: Glossary of Terms Related to Air Quality Management

**Abatement** - Reducing the degree or intensity of, or eliminating, pollution.

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

**Air Contaminant** - Any particulate matter, gas, or combination thereof, other than water vapour. (See: air pollutant.)

**Air Quality Health Index (AQHI)** - The Air Quality Health Index or "AQHI" is a scale designed to help citizens understand what real-time air quality means for health. It is a health protection tool designed for individuals to make decisions to limit short-term exposure to air pollution and adjusting activity levels during increased levels of air pollution. The index pays particular attention to people who are sensitive to air pollution and provides them with advice on how to protect their health during air quality levels associated with low, moderate, high and very high health risks. See [www.airhealthbc.ca](http://www.airhealthbc.ca) for daily readings on air quality.

**Air Pollutant** - Any substance in air that could, in high enough concentrations, harm people, other animals, vegetation, or material. Pollutants may include almost any natural or artificial composition of airborne matter capable of being airborne. They may be in the form of solid particles, liquid droplets, gases, or in combination thereof. Generally, they fall into two main groups: (1) those emitted directly from identifiable sources and (2) those produced in the air by interaction between two or more primary pollutants, or by reaction with normal atmospheric constituents, with or without photoactivation. Air pollutants are often grouped in categories for ease in classification; some of the categories are: solids, sulfur compounds, volatile organic chemicals, particulate matter, nitrogen compounds, oxygen compounds, halogen compounds, radioactive compound, and odours. Common examples of pollutants include: dust, wood smoke, nitrogen dioxide, ground-level ozone, and particulate matter.

**Air Pollution Episode** - A period of abnormally high concentration of air pollutants, often due to low winds and temperature inversion, which can cause illness and death. (See: episode, pollution.)

**Air Quality Index (AQI)** - An AQI is a way of transforming complex air quality measurements into a single number or descriptive term. It describes the measured air quality and the publicly perceived air quality at any given time. AQI numbers are interpreted thus:

0 to 25 is GOOD  
26 to 50 is FAIR

51 to 100 is POOR  
100+ is VERY POOR

An AQI in excess of 50 represents the point at which BC Environment normally becomes concerned about the level of human health impact. The British Columbia AQI is directly comparable to the AQI's issued in all major Canadian cities as it follows the same Federal guidelines.

**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 (AQMP)** - 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.

**Airborne Particulates** - Total suspended particulate matter found in the atmosphere as solid particles or liquid droplets. Chemical composition of particulates varies widely, depending on location and time of year. Sources of airborne particulates include: dust, emissions from industrial processes, combustion products from the burning of wood and coal, combustion products associated with motor vehicle or non-road engine exhausts, and reactions to gases in the atmosphere.

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

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

**Ammonia (NH<sub>3</sub>)** - a compound containing nitrogen and hydrogen, and known for a sharp, pungent smell. It is emitted mostly from agricultural and animal husbandry activities. Other sources of ammonia are fuel and waste combustion, chemical industry and refrigeration facilities. It contributes to the formation of inhalable particulates and visibility-reducing particles.

**Area Source** - Any source of air pollution that is released over a relatively small area but which cannot be classified as a point source. Such sources may include vehicles and other small engines, small businesses and household activities, or biogenic sources such as a forest that releases hydrocarbons.

**Carbon Monoxide (CO)** - A colorless, odorless, poisonous gas produced by incomplete fossil fuel combustion.

**Carbon Dioxide (CO<sub>2</sub>)** is a colourless, odourless, noncombustible gas and a normal constituent of air. This gas is formed by certain natural processes, the burning of fuels and wastes containing carbon, and heating of minerals or products containing carbonate.

**Cogeneration** - The consecutive generation of useful thermal and electric energy from the same fuel source.

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

**Common air contaminants (CACs)** - CO, VOCs, NH<sub>3</sub>, NO<sub>x</sub>, SO<sub>x</sub> and PM

**Ecosystem** - The interacting system of a biological community and its non-living environmental surroundings.

**Emission** - Pollution discharged into the atmosphere from smokestacks, other vents, and surface areas of commercial or industrial facilities; from residential chimneys; and from motor vehicle, locomotive, or aircraft exhausts.

**Emission Inventory** - A listing, by source, of the amount of air pollutants discharged into the atmosphere of a community; used to establish emission standards.

**Emission Standard** - The maximum amount of air polluting discharge legally allowed from a single source, mobile or stationary.

**Episode (Pollution)** - An air pollution incident in a given area caused by a concentration of atmospheric pollutants under meteorological conditions that may result in a significant increase in illnesses or deaths. May also describe water pollution events or hazardous material spills.

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

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

**Fugitive Dust** - A particulate emission made airborne by forces of wind or people's activities. Unpaved roads, construction sites, and tilled land are examples of areas that originate fugitive dust. Fugitive dust is a type of fugitive emission.

**Fugitive Emissions** - Emissions not caught by a capture system.

**Fume** - Tiny particles trapped in vapor in a gas stream.

**Greenhouse Gas (GHG)** - A gas that, when in equilibrium, keeps our planet at a livable temperature. Since the industrial revolution a rapid increase in GHGs is believed to be contributing to global climate change. The major GHGs are carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>) and nitrous oxide (N<sub>2</sub>O).

**Ground Level Ozone** - A gas that occurs both in the Earth's upper atmosphere and at ground level. Ozone can be "good" or "bad" for your health and the environment, depending on its location in the atmosphere. The layer closest to the Earth's surface is the troposphere. Here, ground level or "bad" ozone is an air pollutant that is harmful to breathe and it damages crops, trees and other vegetation. Created by chemical reactions between oxides of nitrogen (NO<sub>x</sub>) and volatile organic compounds (VOC) in the presence of sunlight. Emissions from industrial facilities and electric utilities, motor vehicle exhaust, gasoline vapors, and chemical solvents are some of the major sources of NO<sub>x</sub> and VOCs.

**Hydrocarbons** - Hydrocarbons refer to the most important class of organic compounds. Hydrocarbons contain only the elements hydrogen and carbon. They occur in petroleum and natural gas. Commercial petroleum products such as gasoline, kerosene, airplane fuel, lubricating oils, and paraffin wax are mixtures of hydrocarbons. Some hydrocarbons are found in coal tar and coal gas. Many other Hydrocarbons are synthesized from hydrocarbons found in nature.

**Inhalable Particles** - All dust capable of entering the human respiratory tract, and typically refers to PM<sub>10</sub>.

**Inversion (a.k.a. Temperature Inversion)** - A layer of warm air that prevents the rise of cooling air and traps pollutants beneath it; can cause an air pollution episode.

**Irritant** - A substance that can cause irritation of the skin, eyes, or respiratory system. Effects may be acute from a single high-level exposure, or chronic from repeated low-level exposures to such compounds as chlorine, nitrogen dioxide, and nitric acid.

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

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

**Mitigation** - Measures taken to reduce adverse impacts on the environment.

**Mobile Source** - Any non-stationary source of air pollution such as cars, trucks, motorcycles, buses, airplanes, and locomotives.

**Monitoring** - Periodic or continuous surveillance or testing to determine the level of compliance with statutory requirements and/or pollutant levels in various media or in humans, plants, and animals.

**NH<sub>3</sub>** – Ammonia, see entry for Ammonia

**Nitrogen** - Nitrogen gas (N<sub>2</sub>) makes up 78.1% of the Earth's air, by volume. All organisms must have nitrogen to live. Nitrogen makes up an important part of protein molecules, which are found in protoplasm. Protoplasm is the living material in all plant and animal tissues. Human beings and animals get protein by eating animal products and plants. Most plants must manufacture protein from simple nitrogen compounds dissolved in the soil. Some of this dissolved nitrogen comes from the atmosphere in the form of nitric acid (HNO<sub>3</sub>). Lightning causes nitrogen and oxygen in the air to form compounds called nitrogen oxides. These oxides react with water to form nitric acid, which is carried to the earth dissolved in rainwater.

**Nitrogen dioxide (NO<sub>2</sub>)** is a gas consisting of one nitrogen and two oxygen atoms. It absorbs blue light and therefore has a reddish-brown color associated with it.

**Nitric oxide (NO)** is formed as a by-product in the combustion of gasoline in automobile engines. Sunlight causes the nitric oxide in the lower atmosphere to react with oxygen to form ozone, which can be a harmful pollutant.

**Nitrogen Oxides (NO<sub>x</sub>)** - The term used to describe the sum of nitric oxide (NO), nitric dioxide (NO<sub>2</sub>), and other oxides of nitrogen, which plays a major role in the formation of ozone. The major sources of man-made NO<sub>x</sub> emissions are high

temperature combustion processes, such as those occurring in automobiles and power plants.

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

**Non-Road Emissions** - Pollutants emitted by combustion engines on farm and construction equipment, gasoline-powered lawn and garden equipment, and powerboats and outboard motors.

**Open Burning** - The combustion of material with or without control of the combustion air and without a stack or chimney to vent the emitted products of combustion to the atmosphere.

**Outdoor Wood-fired Hydronic Heaters (OWHH)** - also known as an "Outdoor Wood Heater," "Outdoor Wood Boiler," or "Outdoor Wood Furnace", these units burn wood to heat water that is piped underground to a nearby structure (usually a home) resulting in heat for the building. An OWHH resembles a small shed with a smokestack, typically located on the outside of the building to be heated. Outdoor wood-fired hydronic heaters can be substantially dirtier and less efficient than most other home heating technologies. With their smouldering fires and short smokestacks (usually no more than six to ten feet tall), OWHHs can create heavy smoke and release it close to the ground, where it may linger and expose people in the area to nuisance conditions and health risks.

**Oxygen (O<sub>2</sub>)** - Humans and the other animals obtain oxygen from the air, filtered into the bloodstream through the lungs. Blood then carries oxygen to the cells of the body, where it combines with other chemicals obtained from food to produce energy and to perform the functions of the individual cells. Carbon dioxide is produced in the cells as a waste product and is expelled from the body through the respiratory system. PM<sub>2.5</sub> pollution deposits itself right alongside the O<sub>2</sub> molecules in the alveoli of the lungs, obstructing the absorption of O<sub>2</sub> with the smallest components of PM<sub>2.5</sub> being absorbed into the bloodstream.

**Ozone (O<sub>3</sub>)** - Found in two layers of the atmosphere, the stratosphere and the troposphere. In the stratosphere (the atmospheric layer 7 to 10 miles or more above the earth's surface) ozone is a natural form of oxygen that provides a protective layer shielding the earth from ultraviolet radiation. In the troposphere (the layer extending up 7 to 10 miles from the earth's surface), ozone is a chemical oxidant and major component of photochemical smog. Ozone in the troposphere is produced through complex chemical reactions of nitrogen oxides, which are among the primary pollutants emitted by combustion sources;

hydrocarbons, released into the atmosphere through the combustion, handling and processing of petroleum products; and sunlight.

**PM (Particulate Matter)** - One of the major components of smog. PM include microscopic particles in the air. These particles, capable of being inhaled by humans, are divided into two size ranges: PM<sub>2.5</sub> and PM<sub>10</sub>. Between the two, "fine" particles less than 2.5 micrometers in size (PM<sub>2.5</sub>) are responsible for causing the greatest harm to human health.

**PM<sub>10</sub>** are particles in the atmosphere with a diameter of less than ten or equal to a nominal 10 micrometers, otherwise known as inhalable particulates and/or coarse fraction particulates.

**PM<sub>2.5</sub>** are particles in the atmosphere with a diameter of less than ten or equal to a nominal 2.5 micrometers, otherwise known as respirable particulates and/or fine fraction particulates.

**Point Source** - A stationary location or fixed facility from which pollutants are discharged; any single identifiable source of pollution; e.g. a pipe, ditch, ship, ore pit, factory smokestack. A point source is easy to regulate using an emission permit process.

**Pollutant** - Generally, any substance introduced into the environment that adversely affects the usefulness of a resource or the health of humans, animals, or ecosystems.

**Pollution** - Generally, the presence of a substance in the environment that because of its chemical composition or quantity prevents the functioning of natural processes and produces undesirable environmental and health effects. Under the Clean Water Act, for example, the term has been defined as the man-made or man-induced alteration of the physical, biological, chemical, and radiological integrity of water and other media.

**Precautionary Principle** - When information about potential risks is incomplete, basing decisions about the best ways to manage or reduce risks on a preference for avoiding unnecessary health risks instead of on unnecessary economic expenditures.

**Prescribed Burning** - controlled application of fire to wildland fuels in either their natural or modified state, under specified environmental conditions that allows the fire to be confined to a predetermined area, and produce the fire behavior and fire characteristics required to attain planned fire treatment and resource management objectives.

**Risk Assessment** - Qualitative and quantitative evaluation of the risk posed to human health and/or the environment by the actual or potential presence and/or use of specific pollutants.

**Smart Growth:** an initiative or plan that intends to improve ways in which human settlement occurs for the purpose of reducing impact on the environment, as well as improve quality of life. In particular, Smart Growth initiatives address urban sprawl; motor vehicle use; environmental integrity and food-system security; and affordable housing, among many other topics.

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

**Smoke Control Forecast** - Designed to predict the capability of the atmosphere to effectively disperse pollutants such as small particulate matter (smoke).

**Smoke Dispersion Factors** - Two factors control the spread or dispersion of small particles or gases. These factors are the wind speed (controls horizontal spread) and the height of the "mixed layer". The mixed layer is the portion of the atmosphere from the ground up to the level at which gases and small particles freely mix. For example, smoke from a smokestack will tend to rise to the top of the mixed layer and then level off.

**Sulphur Dioxide (SO<sub>2</sub>)** - Sulphur Dioxide is a colorless, poisonous gas with a sharp odour. Sulfur dioxide forms naturally from volcanic activity and from the decay of organic matter. It can be manufactured by burning sulfur dioxide or heating metallic sulfur compounds. Sulphur dioxide is also released into the atmosphere by oil refineries and by factories and electric power plants that burn coal or oil. In the air people breathe, sulfur dioxide can irritate the eyes and respiratory system. It will also dissolve in water droplets to form acid rain, which can harm or even kill wildlife and damage buildings. Acid rain also may form when sulfur dioxide in the air is converted into sulfur trioxide. Sulphur dioxide can convert to an aerosol that is a very efficient light scatterer.

**Sulphur Oxides (SO<sub>x</sub>)** - Oxides of sulphur, mostly sulphur dioxide (SO<sub>2</sub>)

**Ventilation Index** - The ventilation index is formed by multiplying the mixed layer height by the average wind speed in this mixed layer. Stronger wind speeds and thicker mixed layers will produce higher ventilation index values. For convenience, the actual numbers are converted to a scale of 0 to 100. A ventilation index of '0' implies no ability of the atmosphere to disperse pollutants while a value of '100' implies an excellent ability to disperse pollutants. The ventilation index in British Columbia is divided into the following categories:

0 -- 33 = POOR	Burning is not acceptable (or permitted by some by-laws)
34 – 54 = FAIR	Burning is not acceptable
55 – 100 = GOOD	Conditions are acceptable for burning

For most locations, ventilation index values are poor from sunset until late morning. For locations within valleys, the ventilation index should be lowered if the mixing height is less than the height of the surrounding hills.

**Volatile Organic Compound (VOC)** - Any organic compound that participates in atmospheric photochemical reactions.

**Wood-Burning-Stove Pollution** - Air pollution caused by emissions of particulate matter, carbon monoxide, total suspended particulates, and polycyclic organic matter from wood-burning stoves.

## Appendix 6: Glossary of Acronyms

**AAQO** - Ambient Air Quality Objectives  
**AQHI** - Air Quality Health Index  
**AQI** - Air Quality Index  
**AQMP** - Air Quality Management Plan  
**CET** – Community Engagement Team  
**CO** - Carbon Monoxide  
**CWS** - Canada Wide Standards  
**GHG** - Greenhouse Gas  
**MoA** – Ministry of Agriculture and Lands (BC)  
**MoE** - Ministry of Environment (BC)  
**MoF** – Ministry of Forests and Range (BC)  
**MoT** – Ministry of Transportation and Infrastructure (BC)  
**NO<sub>2</sub>** - Nitrogen Dioxide  
**NO<sub>x</sub>** - Nitrogen Oxides  
**O<sub>3</sub>** - Ozone  
**OBSCR** - Open Burning Smoke Control Regulation  
**OCP** - Official Community Plan  
**PM** - Particulate Matter  
**PM<sub>10</sub>** - Particulate Matter (diameter ≤ 10µm)  
**PM<sub>2.5</sub>** - Particulate Matter (diameter ≤ 2.5µm)  
**PSA** - Public Service Announcement  
**RDKB** - Regional District of Kootenay Boundary  
**SCP** – Sustainable Community Plan  
**SO<sub>2</sub>** - Sulphur Dioxide  
**SO<sub>x</sub>** - Sulphur Oxides  
**VOC** - Volatile Organic Compound  
**µg** - Microgram