



# Air Monitoring and Assessment Strategy for Williams Lake BC, 2001 - 2006

Earle Plain, Air Quality Meteorologist  
Norm Zirnhelt, Head, Environmental Section  
Ministry of Environment, Lands & Parks, Cariboo Region  
January 2001.

---

## 1.0 INTRODUCTION

Air quality in Williams Lake needs improvement. In fact, in 1999 and 2000, Williams Lake recorded the fourth highest level of fine particulate air pollution (PM<sub>10</sub>) in the province out of 27 communities where continuous monitoring is conducted (residential monitoring sites compared). The PM<sub>10</sub> levels recorded in Williams Lake are a concern from a public health perspective. While air quality is considerably better in Williams Lake as a result of the phase-out of the wood waste burners, there is room for improvement. Good planning now will help maintain and improve our air quality in the future.

In December of 2000 a community driven Airshed Management Planning (AMP) process was initiated to study the problem and make recommendations to improve air quality in the community (Zirnhelt and Plain, 1999; WLAQR, 2001). The goal of the air quality assessment is to better understand present air quality, and determine major contributing sources to poor air quality episodes.

A multi-stakeholder committee known as the Williams Lake Air Quality Roundtable oversees the Airshed Management Planning process. The City of Williams Lake chairs the committee which includes representation from the following organizations:

Williams Lake Environmental Society  
Ministry of Environment, Lands and Parks – Cariboo Region  
City of Williams Lake  
Cariboo Regional District  
Cariboo Community Health Services Society  
Weldwood of Canada Ltd.  
Riverside Forest Products  
Williams Lake Construction Association  
Ministry of Forests  
Williams Lake & District Chamber of Commerce  
West Fraser Mills Ltd.  
Caribou Road Services Ltd.

A number of objectives have been identified in order to meet the overall study goals. The objectives of the monitoring program (ambient and source) in Williams Lake are to collect meaningful data that will accomplish the following:

1. Refine the existing emissions inventory for fine particulates in the Williams Lake Airshed.
2. Determine the concentrations of fine particulates (PM<sub>10</sub> and PM<sub>2.5</sub>) in different areas of the Williams Lake Airshed.
3. Make links between elevated concentrations of fine particulates (PM<sub>10</sub> and PM<sub>2.5</sub>) and emission sources in various parts of the community using local knowledge of meteorological processes and pollution source characteristics (pollution rose, dispersion modelling).
4. Assess other parameters of interest such as TRS (odour from lagoons), O<sub>3</sub>, NO<sub>x</sub>, CO and link to major sources.
5. If necessary, estimate the amount of fine particulate that is due to natural and anthropogenic (man-made) sources. Group these sources by category such as soils, vehicle types, specific industrial sources and activities using tools such as particle speciation.

## 2.0 STUDY RATIONALE

Air pollutants such as Ground-level Ozone (O<sub>3</sub>) Oxides of Nitrogen (NO<sub>x</sub>), Carbon Monoxide (CO), and to some extent Total Reduced Sulphur (TRS) also require monitoring and assessment in Williams Lake. However, the main focus of this assessment will be on fine particulates due to ongoing elevated levels and the potential impacts on health and visibility (CEPA/FPAC, 1999).

In order to improve air quality in the Williams Lake Airshed it is necessary to obtain information about the nature and the sources of fine particulates. With this critical information, it will be possible to develop strategies with a sound technical basis to manage those sources which are the largest contributors to the air quality problem. However, sources of fine particulates in the Williams Lake Airshed are many and varied. Particulate matter is emitted by anthropogenic (man-made) and natural sources, and by large industrial and small residential sources such as wood stoves (primary particles). Fine particles can also form as a result of chemical and physical transformation of gaseous precursors in the atmosphere (secondary particles). As a result, source apportionment of fine particulates in the Williams Lake Airshed is a complex matter.

Our knowledge of particulate matter in the Williams Lake Airshed is mostly limited to mass measurements of PM<sub>10</sub>. Little is known about size distribution and chemical composition and how this varies throughout the year, which is a reflection of contributing sources. Emission inventory estimates are available for the Cariboo Region but are not airshed-specific. Although traditional emission inventories provide a starting point for determining source contributions, they have a number of limitations related to the fact that:

- a. British Columbia inventories for point sources may be based on permitted emission levels which are generally higher than the actual emission rates, or on emission factors that are often based on limited source measurements made primarily on facilities in the United States.
- b. Emission factors are based on empirical relationships that may not adequately reflect the real world (e.g. road dust factors) and are subject to frequent change.
- c.  $PM_{10}$  and  $PM_{2.5}$  emission factors are often derived from Total Suspended Particulate (TSP) emission factors based on a splitting factor. For instance, an approach used to estimate  $PM_{10}$  from a particular source where TSP emissions are under permit might be to assume that 60% of TSP is  $PM_{10}$  and that 40% of  $PM_{10}$  is  $PM_{2.5}$ .
- d. Traditional inventories do not adequately capture biogenic (natural) emissions or fugitive dust emissions, nor do they include secondary particles, which may be significant.

As a result, other techniques must be used in conjunction with traditional emission inventories to determine the best estimates for source contributions. These techniques may include receptor modelling (Lowenthal et. al.; 1994), in which detailed information collected at a receptor is used to ascertain something about the source emissions, and dispersion modelling, in which detailed information at the source is used in conjunction with meteorological and terrain information to determine where and to what degree pollutants will disperse in the atmosphere. Other tools that can be used include such things as continuous fine particulate monitoring (both the coarse and fine fraction of  $PM_{10}$ ) in different areas of the community, fine particle speciation monitoring (ARB, 1994; Plain and Carmichael, 1998; Chow and Watson, 1998; USEPA, 1999), field observations, remote photography (ARB, 1994), and pollution rose development (combining meteorological information with continuous fine particulate data).

Each technique may have unique requirements for data collection, monitor location, and level of expertise. Several techniques may have to be combined to provide the level of certainty required in meeting the study objectives. A scoping exercise was conducted at the beginning of the Quesnel Airshed Management Planning process (Plain and Zirnhelt, 2000) in 2000. Due to the similarities between the two communities, we have drawn on the results of this exercise to determine the most efficient means of meeting the study objectives to the level of certainty required.

### **3.0 REACHING THE AIR QUALITY MANAGEMENT GOAL**

In order to achieve improved air quality in the community a number of things must be accomplished. The recommended steps are listed below in point form. Ongoing re-evaluation of priorities and management requirements is expected as the process evolves.

- A. Based on existing knowledge and on initial results of new continuous  $PM_{2.5}$  monitors, prepare and implement preliminary interim steps that can be taken immediately to improve air quality in Williams Lake (e.g. road dust control/suppression).
- B. A preliminary scoping exercise was completed to identify the questions that need answering, the level of acceptable certainty, and the potential tools that could be used to provide the answers.

- C. Prepare a report on the current status of air quality in the City of Williams Lake, including an airshed-specific emissions inventory based on current knowledge (Cheng and Dunlop, 1998). Identify priority contaminants, major sources and data gaps.
- D. Based on B & C, prepare and implement an ambient monitoring program to characterize fine particulate (begin with PM<sub>10</sub> vs. PM<sub>2.5</sub> in different areas of the city) and quantify concentrations of other priority air contaminants in the Williams Lake airshed. It is anticipated that monitoring program revisions may result in ambient monitoring requirements for industry.
- E. Where necessary, conduct a source monitoring program to 1) refine the emissions inventory and 2) provide accurate source emissions information to be used in a dispersion modeling study. Industry will be responsible for providing data on their emissions.
- F. Use dispersion modelling techniques (CALPUFF) to identify source contributions during PM<sub>10</sub> episodes. Sources to be modelled will be determined based on emissions inventory results (e.g. sources with largest particulate loading to airshed will be evaluated first).
- G. At this stage, if the level of certainty is acceptable, proceed to J. If further certainty is required, refine the scoping exercise and prepare and implement an ambient monitoring program to speciate fine particulate in the airshed. Continue with H.
- H. Prepare and implement a source monitoring program to provide source profiles (fingerprints) for source apportionment work. This is for point and non-point sources. Possibly retain a consulting firm to carry out sampling and to determine the applicability of existing source profiles to Williams Lake. Source profile refinement may be the responsibility of industry.
- I. Retain the services of a consultant to run the Chemical Mass Balance (CMB) receptor model and assess results.
- J. Based on the work above, identify priority contaminant sources for management action to answer the question of where we should concentrate our efforts to achieve the greatest reductions in contaminants. This may include episode management.
- K. Select management options (e.g. Pollution Prevention Planning for industrial sources, etc.).
- L. Prepare an Airshed Management Plan.
- M. Implement the Airshed Management Plan recommendations and monitor effectiveness through revisions in ambient/source monitoring program.
- N. Revise plan when new priorities are identified.

## References

- CEPA/FPAC. 1999. National Ambient Air Quality Objectives For Particulate Matter. Part 1: Science Assessment Document. A report by the Canadian Environmental Protection Act (CEPA)/Federal-Provincial Advisory Committee (FPAC) Working Group on Air Quality Objectives and Guidelines. Health Canada.
- Chow J. C. and J.G. Watson. 1998. *Guideline on Speciated Particulate Monitoring*. Desert Research Institute. Reno Nevada, USA.
- Cheng K. C. and R.J. Dunlop. 1998. *Review and Forecast/Backcast of 1995 British Columbia Point Source Emission Inventory (Outside the LFV)*. Levelton Engineering Ltd. Prepared for the BC Ministry of Environment Lands and Parks, Air Resources Branch, Victoria, BC.
- Lowenthal D.H., D. Wittorf and A.W. Gertler. 1994. *CMB Source Apportionment During REVEAL (Regional Visibility Experiment in the Lower Fraser Valley)*. Desert Research Institute. Prepared for the Ministry of Environment, Lands and Parks, Air Resources Branch, Victoria, BC.
- Plain E. and N. Zirnhelt. 2000. *Air Monitoring and Assessment Strategy for Quesnel BC, 2000-2005*. Ministry of Environment, Lands and Parks. Cariboo Region. Williams Lake, BC.
- Plain E. and V. Carmichael. 1998. *Inhalable Particle Characterization During a Late Winter Period in Quesnel, British Columbia*. Ministry of Environment, lands and Parks. Williams Lake, BC. [http://wlapwww.gov.bc.ca/car/p2/air\\_quality\\_reports/final.pdf](http://wlapwww.gov.bc.ca/car/p2/air_quality_reports/final.pdf)
- Williams Lake Air Quality Roundtable (WLAQR). 2001. *Airshed Management Planning – A community initiative to improve air quality*. An information brochure. Eight pages. [http://wlapwww.gov.bc.ca/car/p2/air\\_quality\\_reports/wlbrochure.pdf](http://wlapwww.gov.bc.ca/car/p2/air_quality_reports/wlbrochure.pdf)
- U.S. Environmental Protection Agency (USEPA). 1999. *Particulate Matter (PM<sub>2.5</sub>) Speciation Guidance Final Draft, Edition 1*. Monitoring and Quality Assurance Group. Emissions, Monitoring and Analysis Division. Office of Air Quality Planning and Standards. Research Triangle Park, NC 27711.
- Zirnhelt N. and E. Plain. 1999. *Framework Outline For Airshed Management Planning In Quesnel And Williams Lake*. Ministry of Environment, Lands and Parks. Pollution Prevention, Cariboo Region, Williams Lake, BC. Revised: November, 1999. [http://wlapwww.gov.bc.ca/car/p2/air\\_quality\\_reports/Framework4.pdf](http://wlapwww.gov.bc.ca/car/p2/air_quality_reports/Framework4.pdf)