

Appendix B:

Air Pollutants Briefing Notes



Particulate Matter

Subject: Pollutant Briefing Note
Location: Prince George, BC

Particulate Matter Pollution Description

- Particulate matter (PM) refers to solid particles and liquid droplets suspended in the air. It includes aerosols, smoke, fumes, dust, ash and pollen.
- PM can be emitted directly from an emissions source (Primary PM) or can be formed from chemical and physical reactions of gases in the air (Secondary PM)
- The size of the particles largely determines the extent of environmental and health damage caused. For this reason, PM is classified into several categories including:

PM ₁₀	Airborne particulate matter with a mass median diameter less than 10 µm (“coarse PM”; 1/5 th the diameter of a human hair)
PM _{2.5}	Airborne particulate matter with a mass median diameter less than 2.5 µm (“fine PM”)
PM _{0.1}	Airborne particulate matter with a mass median diameter less than 0.1 µm (“ultrafine PM”)

Effects on Human Health and the Environment

- The greatest human health impacts are caused by the finer PM_{2.5} (including the PM_{0.1} fraction), because they become lodged deep in the lungs, and the finest of these can cross into the bloodstream.
- Numerous health studies have associated particle pollution with a variety of health and environmental effects^{1,2,3,4}, including:

¹ <http://www.epa.gov/pm/health.html>

² <http://www.epa.gov/region7/air/quality/pmhealth>

³ <https://northernhealth.ca/YourHealth/EnvironmentalHealth/AirQuality>

⁴ <http://www.hc-sc.gc.ca/ewh-semt/air>

Human Health	Various forms of heart and lung disease
	Premature death in people with heart or lung disease
	Reduced lung development, and development of chronic respiratory diseases in children
	Aggravated asthma, bronchitis, and emphysema
	Increased emergency room visits and hospital admissions for respiratory and cardiovascular illnesses
	Increased respiratory symptoms, such as irritation of the airways, coughing or difficulty breathing
Environmental Health	Contribution to ground-level ozone formation (damaging to people, vegetation, and ecosystems)
	Acid deposition (widespread effects on structures and ecosystems)
	Regional haze (widespread effects on safety, tourism, and recreation)

- People with respiratory diseases, as well as children and elderly people, are considered to be the most sensitive to the effects of fine particulate matter.
- It is estimated that anthropogenic PM_{2.5} levels in BC (those above natural background levels) account for 74 deaths/year in the Northern and Interior Health Areas⁵. Of the communities studied, Prince George has the highest annual average concentration of PM_{2.5}.
- Proximity to PM emissions sources largely determines short- and long-term health impacts for individuals

Emissions Sources

- Industrial emissions (mainly pulp and paper manufacturing) and mobile sources (mainly road dust) contribute the majority of PM₁₀ and PM_{2.5} emissions to the Airshed as a whole. (Table 1)
- Mobile sources (mainly on-road dust and locomotives) are predicted to contribute the most to PM₁₀ and PM_{2.5} levels in the Downtown. (Table 1)

⁵ Elliot, T.C., Copes, R. (2011) Burden of Mortality Due to Ambient Fine Particulate Air Pollution (PM_{2.5}) in Interior and Northern BC. *Can. J. Public Health*. 102(5):390-93.

Table 1 – PM emissions sources and their respective contribution to PM levels in the airshed as a whole (left) versus their contribution to PM levels in the Downtown (right) ⁶

Category	Sub-Category	Percent Contribution to Total Airshed Emissions Rates (2005 Inventory)		Percent contribution to Downtown Concentrations (2005 model prediction)	
		PM10	PM2.5	PM10	PM2.5
Permitted Industrial	Includes Sawmill and planing mill; Pulp and paper; Other wood products; Softwood veneer and plywood; Industrial inorganic chemical: Refined petroleum products; Others	28.5%	54.0%	-	-
	Subtotal Permitted Industrial	28.5%	54.0%	13.5%	18.4%
Commercial	Heating	0.1%	0.2%	0.4%	0.9%
	Misc.	0.5%	1.3%	0.8%	1.7%
	Dust	5.6%	1.7%	2.9%	1.3%
	Restaurants	2.6%	6.2%	6.0%	11.8%
	Subtotal Commercial	8.8%	9.4%	10.1%	15.6%
Residential	Heating	2.2%	5.6%	4.4%	9.2%
	Other	0.2%	0.6%	0.4%	0.9%
	Subtotal Residential	2.4%	6.2%	4.8%	10.1%
Mobile	On-road dust	56.3%	21.0%	30.4%	14.0%
	On-road mobile	0.4%	0.8%	2.5%	3.8%
	Locomotive	2.2%	5.6%	5.4%	10.7%
	Subtotal Mobile	58.9%	27.4%	38.2%	28.5%
Other Sources	City open burning	0.4%	1.0%		
	Province open burning	0.9%	2.0%		
	Subtotal Other Sources	1.3%	3.0%	1.6%	3.2%
Background		*	*	27.20%	14.67%
Secondary Formation		*	*	4.53%	9.58%
Total		100.0%	100.0%	100.0%	100.0%
Total Annual Tonnes Emitted (all sources)		8772	3549		

*Background and Secondary Formation sub-categories cannot be expressed as emissions rates
 Note: Major source contributions are highlighted in red

⁶ Prince George Air Quality Dispersion Modelling Study - Final Report. Prepared by Stantec. October 8, 2010.

Long-term Trend (1995 to 2012)

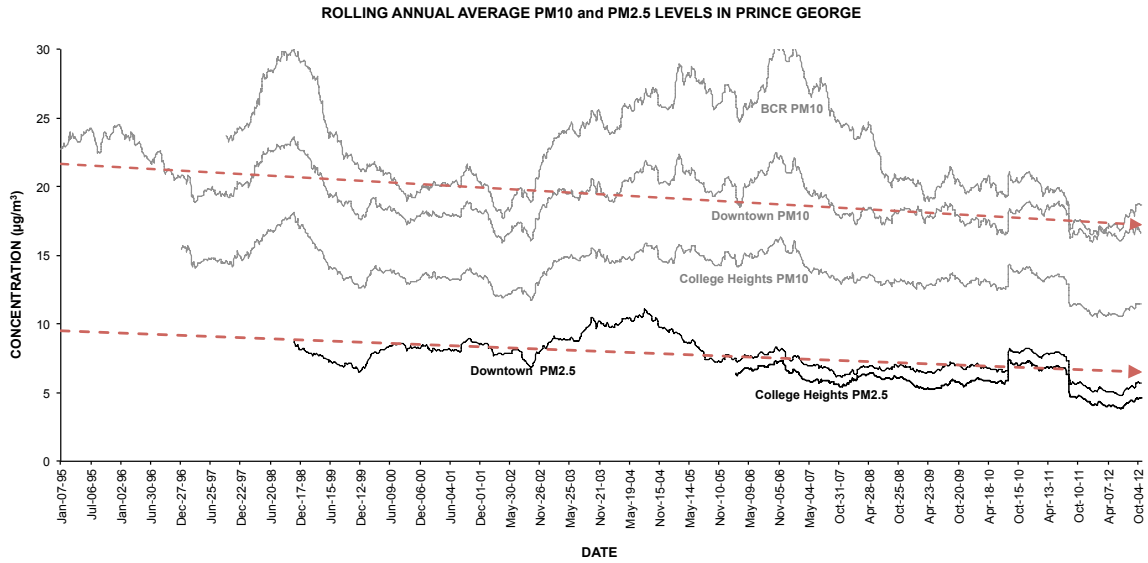


Figure 1 – Long-term trend in PM10 and PM2.5 concentration ($\mu\text{g}/\text{m}^3$) at the Prince George continuous monitoring stations. The red trendlines for the downtown monitoring station indicate a gradual 20% decrease in PM10 [$R^2=0.4$] and 25% decrease in PM2.5 [$R^2=0.3$] since the late 1990's.

7-Year Trend (2005 to 2012)

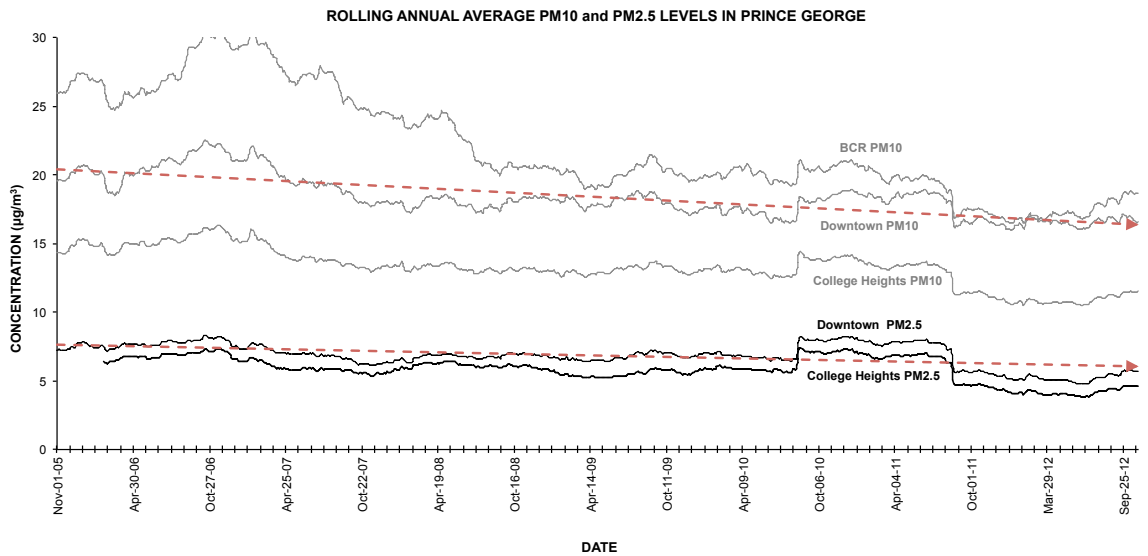


Figure 2 – 7-year trend in PM10 and PM2.5 concentration ($\mu\text{g}/\text{m}^3$) at the Prince George continuous monitoring stations. The red trend lines for the downtown monitoring station indicate a gradual 20% decrease in PM10 [$R^2=0.6$] and 21% decrease in PM2.5 [$R^2=0.3$] over the past 7 years.

Annual Air Quality Objective

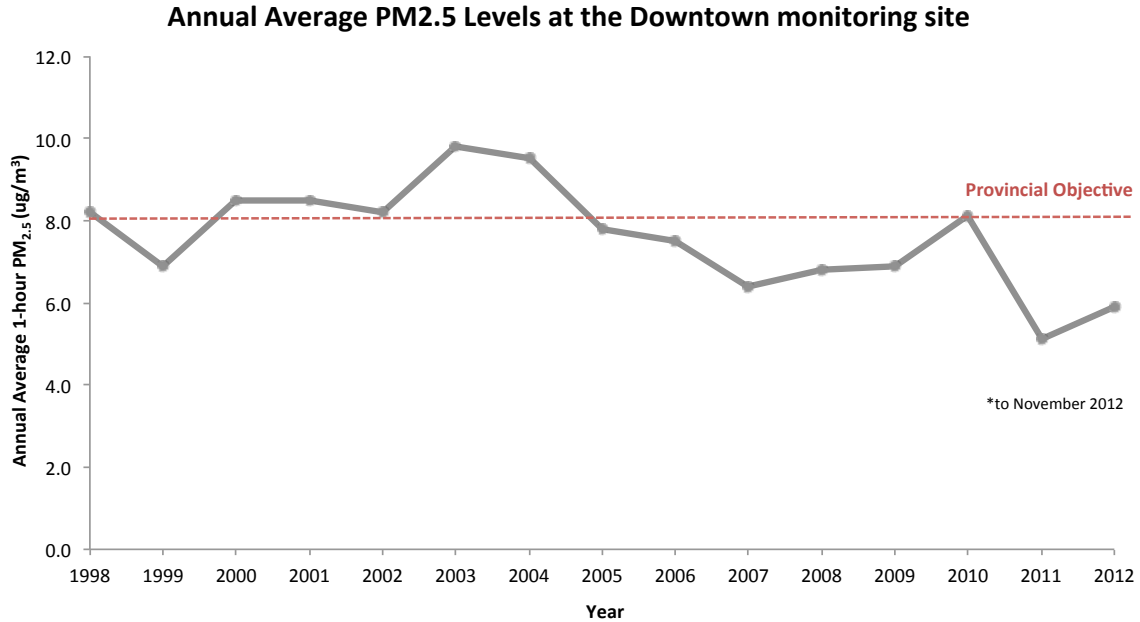


Figure 5 – Annual average PM_{2.5} concentration at the downtown-monitoring site from 1998-2012. The Provincial objective for the annual average is 8 ug/m³, indicated by the red line. Levels in downtown Prince George have been below the annual objective since 2005, with the exception of 2010, when high forest fire activity caused the annual average to slightly exceed the Provincial objective for the year.

Air Quality Advisories

There have been a total of eight air quality advisories issued to date in 2012 in Prince George –three in the spring due to dust, two in the summer due to wildfire smoke, and two in the fall and one in the winter due to high PM levels associated with wood burning and industrial emissions accumulating under stagnant atmospheric conditions.

For more information on air quality please visit: www.pgairquality.com