

# Air Pollutant Briefing Note

## Particulate Matter

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### 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 health and environmental impact. For this reason, PM is classified into several categories including:

Size Fraction	Description
PM <sub>10</sub>	<ul style="list-style-type: none"><li>• Airborne particulate matter with a median diameter less than 10 µm</li><li>• Also known as coarse or inhalable PM</li><li>• About 1/5 the width of a human hair</li></ul>
PM <sub>2.5</sub>	<ul style="list-style-type: none"><li>• Airborne particulate matter with a median diameter less than 2.5 µm</li><li>• Also known as fine or respirable PM</li><li>• About 1/20 the width of a human hair</li></ul>
PM <sub>0.1</sub>	<ul style="list-style-type: none"><li>• Airborne particulate matter with a median diameter less than 0.1 µm</li><li>• Also known as ultrafine PM</li><li>• About 1/500 the width of a human hair</li></ul>

Larger fractions of PM are also measured as total suspended particulate matter (TSP) and dust fall.

### Effects on Human Health and the Environment

- Smaller particles are able to enter deeper into the respiratory system than larger particles, causing respiratory and cardiovascular damage. PM<sub>2.5</sub> and PM<sub>0.1</sub> can enter deep into the lungs, even to the gas exchange region (alveoli) and can cross into the bloodstream. From there, particles can translocate to different organs in the body, including the brain.<sup>1</sup>

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<sup>1</sup> Oberdurstner G, Sharp Z, Atudorei V, Elder A, Gelein R, Kreyling W, et al. Translocation of Inhaled Ultrafine Particles to the Brain. *Inhal.Toxicol.* 2004;16(6-7):437–45.

- People with respiratory and cardiovascular diseases, as well as children and the elderly, are considered to be the most sensitive to the effects of fine PM.<sup>2</sup>

**Table 1. Human Health and Environmental Impacts<sup>3,4</sup>**

Human Health Impacts	Environmental Impacts
Airway irritation, coughing, wheezing	Damage to vegetation (crops, forests etc.) and ecosystems overall
Reduced lung function/difficulty breathing	Acid deposition (widespread impacts on infrastructure and ecosystems)
Increased emergency room visits, hospital admissions, medication usage for respiratory and cardiovascular illness	Nutrient balance changes in waterways and soils
Aggravation of pre-existing medical conditions, such as asthma, bronchitis, emphysema	Impaired visual air quality (reduced visibility/regional haze), widespread impacts on safety, tourism, recreation, real estate
Compromised lung development and onset of chronic respiratory diseases in children	
Nervous system impairment	
Blood pressure and blood clotting changes; increased susceptibility to heart attacks	
Many forms of heart and lung disease	
Premature mortality (death)	

- It is estimated that air pollution in BC (based on PM<sub>2.5</sub> and ozone) annually accounts for:<sup>5</sup>
  - 375 premature deaths
  - 2.7 million minor illnesses
  - \$110 million dollars in human damages (healthcare costs, lost productivity, loss of life, etc.)
- Proximity to PM emission sources largely determines short- and long-term health impacts for individuals.

<sup>2</sup> Environment Canada. Air Quality Health Index. 2014. Available from: <http://www.ec.gc.ca/cas-aqhi/default.asp?lang=en&n=065be995-1>

<sup>3</sup> United States Environmental Protection Association. Particulate Matter (PM). 2013. Available from: <http://www.epa.gov/airscience/air-particulatematter.htm>

<sup>4</sup> R ckerl R, Schneider A, Breitner S, Cyrus J, Peters A. Health effects of particulate air pollution: A review of epidemiological evidence. *Inhal Toxicol.* 2011;23(10):555–92.

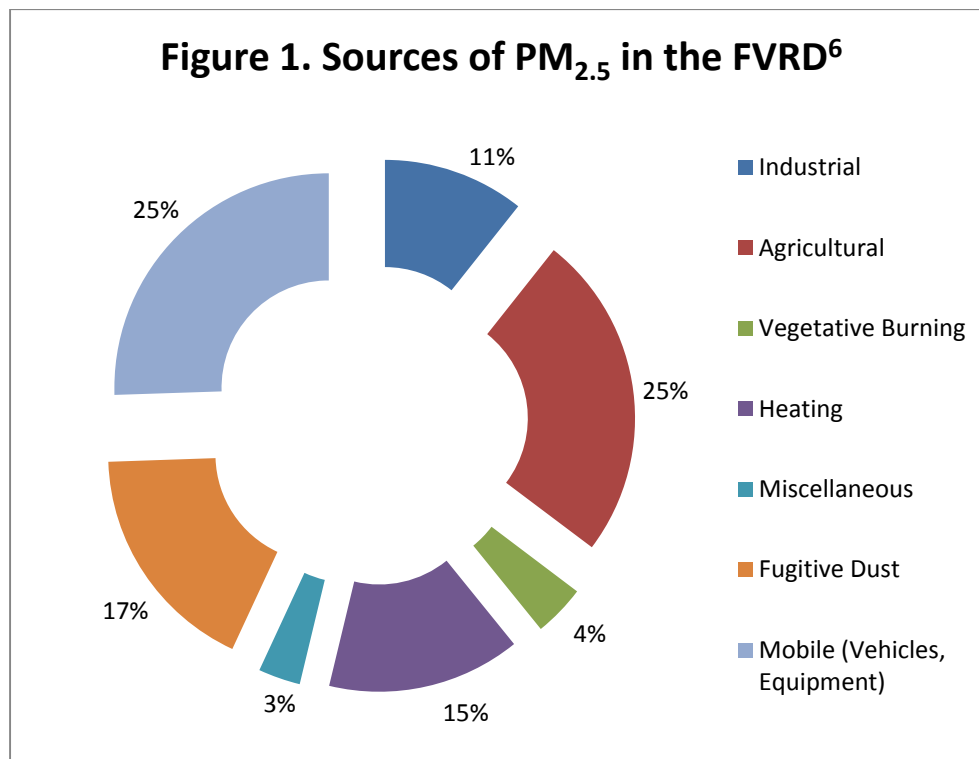
<sup>5</sup> Canadian Medical Association. No Breathing Room: National Illness Costs of Air Pollution. 2008. Available from: [http://www.prowind.ca/downloads/Resources/CMA\\_ICAP\\_sum\\_e.pdf](http://www.prowind.ca/downloads/Resources/CMA_ICAP_sum_e.pdf)

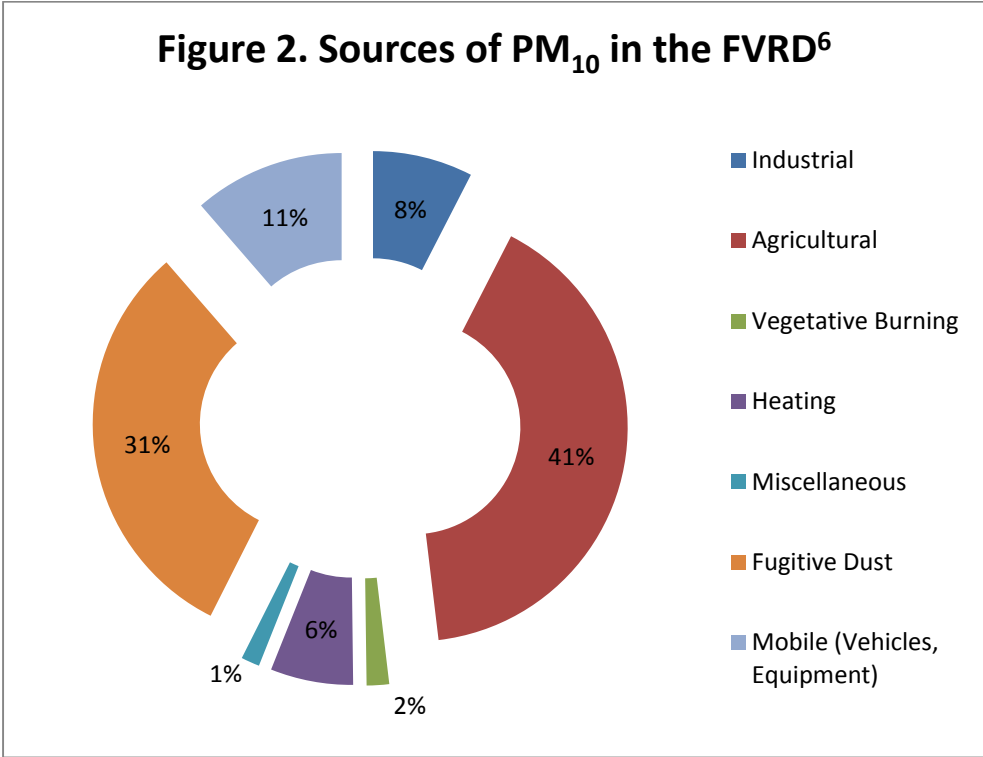
## Emissions Sources

Dominant sources of emissions of fine particulate matter in the FVRD include:

- On-road vehicles
- Off-road equipment
- Agriculture (especially from wind erosion)
- Fugitive dust (especially from unpaved roads)
- Residential wood burning
- Industry
- Vegetative burning

See Figures 1-2 and Table 2 for detailed emissions inventory information.





**Table 2. PM emissions sources in the FVRD<sup>6</sup>**

Sector	Sub-sector	PM <sub>10</sub> (t)	PM <sub>2.5</sub> (t)
Industrial	Non-metallic Mineral Processing Industries	14	6
	Petroleum Products	5	1
	Wood Products	90	52
	Miscellaneous Industrial Sources	64	45
	<b>Subtotal</b>	<b>173</b>	<b>104</b>
Agricultural	Wind Erosion	623	138
	Fugitive Dust from Tilling	93	19
	Fertilizer and Pesticide Application	44	12
	Cattle	3	0

<sup>6</sup> 2010 Lower Fraser Valley Air Emissions Inventory Forecast and Backcast. 2013. Available from: <http://www.metrovancouver.org/about/publications/Publications/2010LowerFraserValleyAirEmissionsInventoryandForecastandBackcast.pdf>

\*Industrial, commercial, institutional

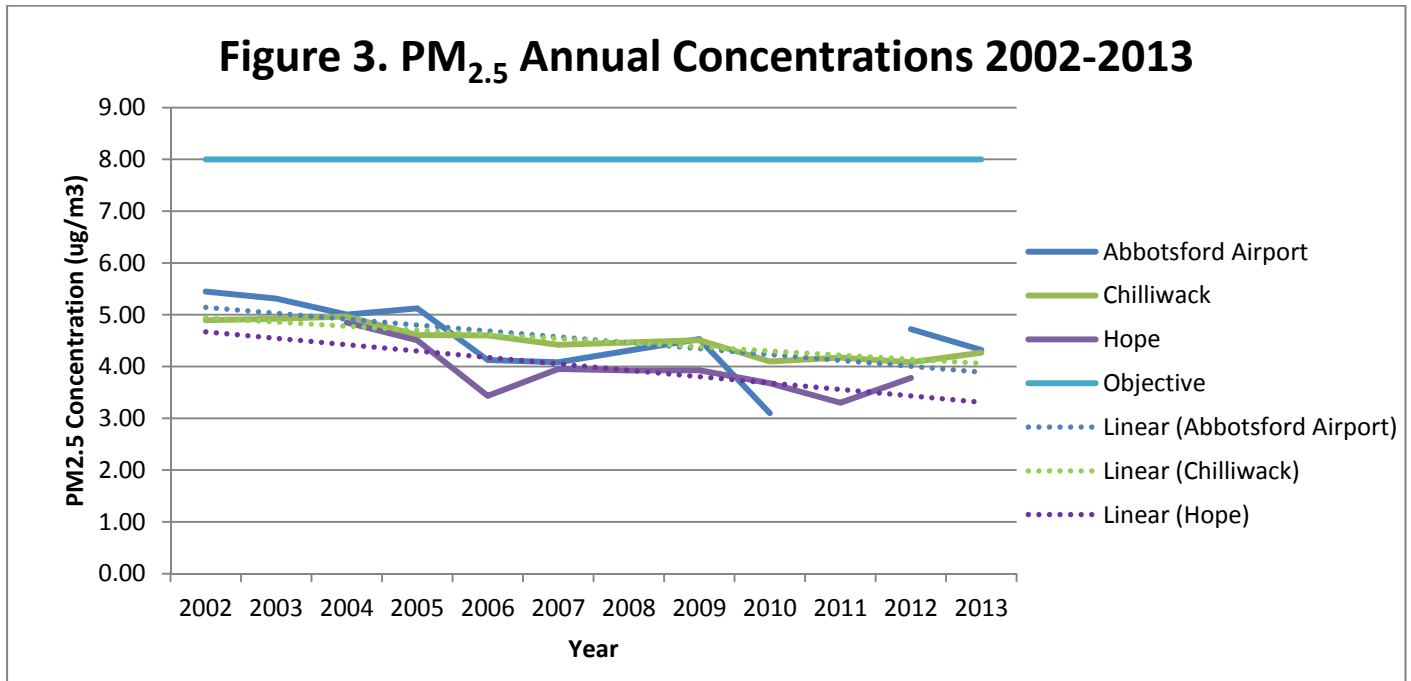
	Pigs	36	7
	Poultry	45	4
	Horses	1	0
	Agricultural Burning	8	8
	Greenhouses	77	51
	<b>Subtotal</b>	<b>930</b>	<b>240</b>
<b>Vegetative Burning</b>	Prescribed Burning	8	8
	Residential Open Burning	5	5
	Land Clearing	25	25
	<b>Subtotal</b>	<b>39</b>	<b>38</b>
<b>Heating</b>	Residential - Natural Gas	17	17
	Residential - Wood	110	109
	Light ICI* - Natural Gas	16	16
	<b>Subtotal</b>	<b>143</b>	<b>142</b>
<b>Miscellaneous sources</b>	Meat Cooking	25	25
	Bakeries	0	0
	Tobacco Smoke	3	3
	Vehicle Fires	2	2
	Structural Fires	2	2
	Crematoria	1	0
	<b>Subtotal</b>	<b>32</b>	<b>31</b>
<b>Fugitive Dust</b>	Construction and Demolition (dust)	112	22
	Coal Dust from Rail Locomotives	15	6
	Road Dust	588	142
	<b>Subtotal</b>	<b>715</b>	<b>171</b>
<b>Waste</b>	Landfills	4	1
	<b>Subtotal</b>	<b>4</b>	<b>1</b>
<b>Mobile</b>	Light-Duty Vehicles	48	45
	Heavy-Duty Vehicles	50	48
	Aircraft	3	3
	Rail Locomotives	26	24
	Marine Vessels	1	1
	Non-Road Engines and Equipment	133	128
	<b>Subtotal</b>	<b>261</b>	<b>249</b>
	<b>Grand Total</b>	<b>2295</b>	<b>977</b>

#### Long-term trends in PM concentrations in the FVRD

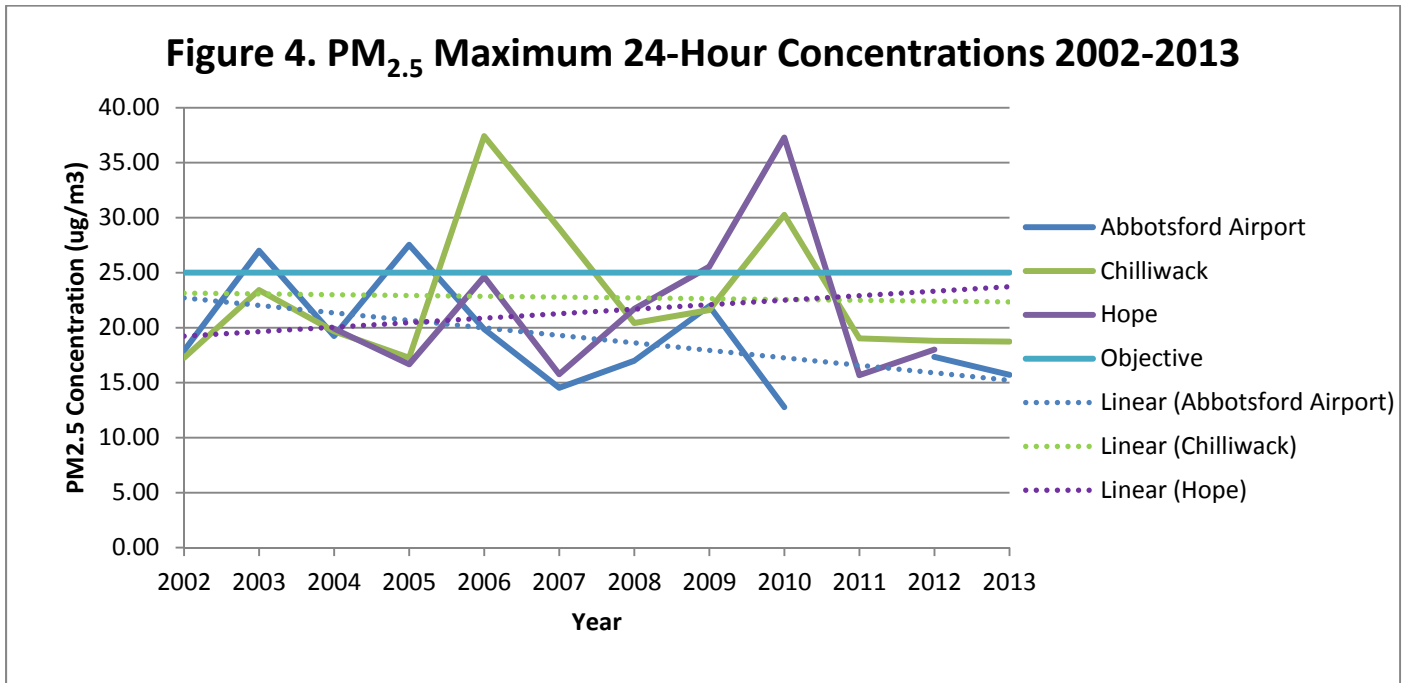
Long-term trends for PM<sub>2.5</sub> and PM<sub>10</sub> at FVRD air quality monitoring stations are shown in Figures 3-6 below. Annual concentrations reflect the annual average measurement for the pollutant, and represent

long-term exposure values. Maximum 24-hour concentrations are the highest 24-hour rolling average measured in the noted year, and represent peak values and short-term exposure.

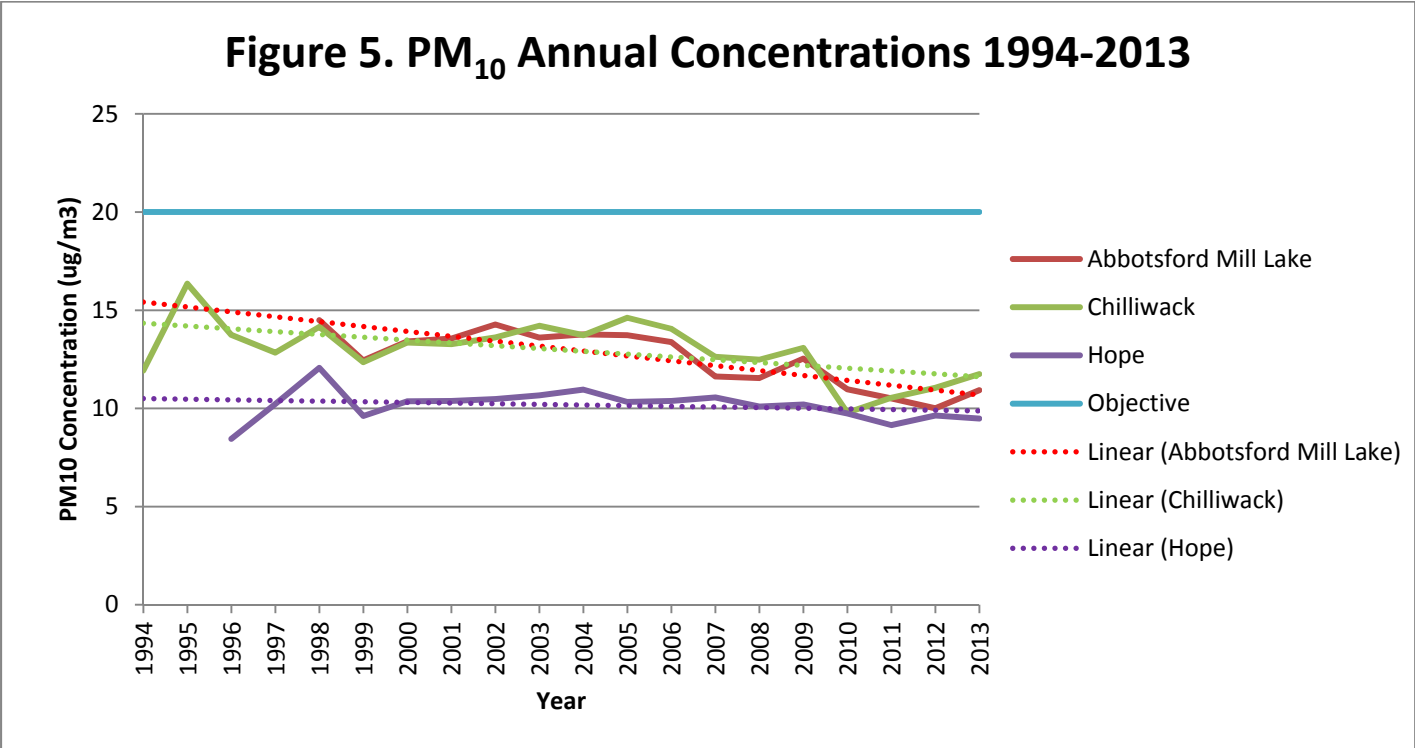
Note: PM<sub>10</sub> has been monitored longer than PM<sub>2.5</sub>, hence the difference in date range. Linear = trend.



Annual PM<sub>2.5</sub> concentrations have been decreasing at Abbotsford Airport, Chilliwack, and Hope stations from 2002 to 2013. All years have been below the annual average objective.

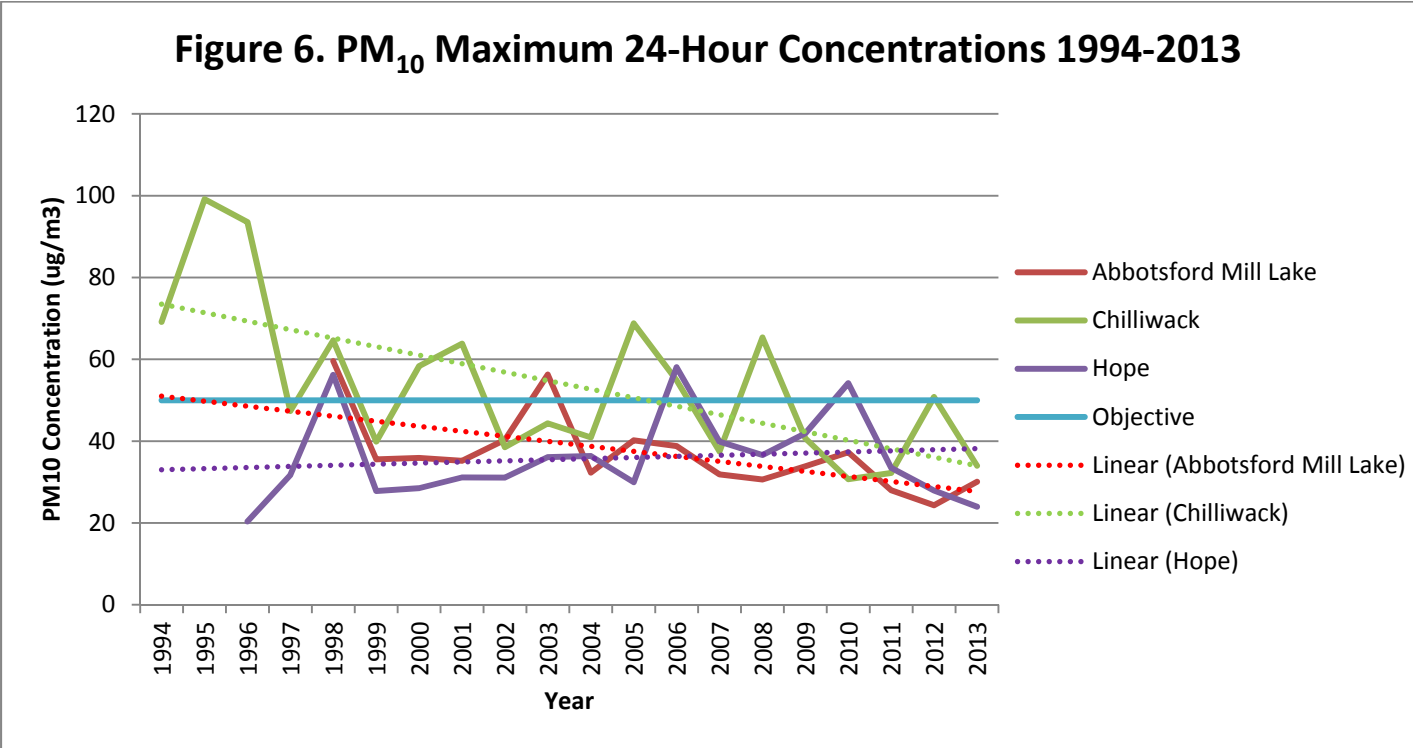


Maximum 24-hour PM<sub>2.5</sub> concentrations have generally been decreasing at Abbotsford Airport and Chilliwack monitoring stations. The Hope station trend line is being affected by a high 2010 value. There have been a number of exceedances of the 24-hour objective since 1994.



Annual PM<sub>10</sub> concentrations have been decreasing at Abbotsford Mill Lake, Chilliwack, and Hope stations from 1994 to 2013. All years have been below the annual average objective.





Maximum 24-hour PM<sub>10</sub> concentrations have generally been decreasing at Abbotsford Airport and Chilliwack monitoring stations. The Hope station has not exhibited the same trend. There have been a number of exceedances of the 24-hour objective since 1994.

**For more information**

FVRD Air Quality Webpage: [www.fvrd.ca/airquality](http://www.fvrd.ca/airquality)  
 BC Ministry of Environment Air Quality Website: [www.bcairquality.ca](http://www.bcairquality.ca)

For additional lessons and to complete and evaluation survey, visit: [www.fvrd.ca/airquality](http://www.fvrd.ca/airquality)  
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