Speciation Monitoring and Source Apportionment in Golden, BC (2004 – 2007)

BC Ministry of Water, Land and Air Protection (WLAP)

Environment Canada / Environnement Canada

Background

• Provincial interest in using source apportionment to support local Air Quality Management Plans (AQMPs) has risen over the past decade.

•Currently, there is speciation monitoring in 3 BC communities under Environment Canada's NAPS speciation monitoring program (Vancouver, Abbotsford and Golden).

•Two new projects are scheduled for Prince George and Quesnel over the next 5 years.

•The Golden study is envisioned to help BC communities and air quality planners design source apportionment studies for their airshed (i.e. required instrumentation, operational support, data analysis and data management).

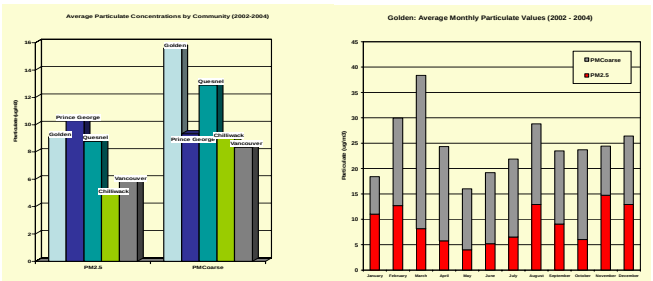
Golden's Air Quality

•Highest coarse fraction levels in BC

•Above average provincial $PM_{2.5}$ levels

•Coarse fraction highest in Spring/Winter

•$PM_{2.5}$ highest in November/December



Emission Sources

•Residential Wood Heating

•Trains (switch yard & traffic)

•Heavy Duty Trucks (truck stop & traffic)

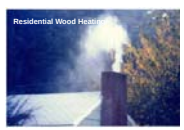
•Light Duty Vehicles

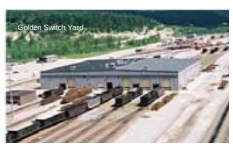
•Road Dust

•Wood products (sawmills, veneer/plywood plant)

•Prescribed Burning

•Forest Fires





Topographic Influences

•Deep valley bottom ('contained' airshed)

•Northwesterly/southeasterly winds

•Subject to persistent temperature inversions (particularly in winter) which correspond with highest $PM_{2.5}$ levels.

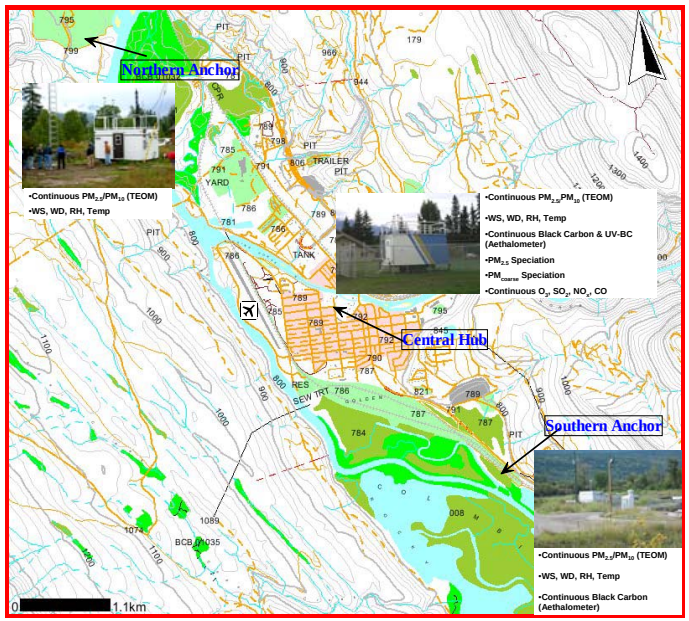
Golden Monitoring Network

•Golden is one of the most robust PM speciation sites in BC.

•The network is designed specifically to test equipment and modeling scenarios for future source apportionment work in other BC communities.

•The network is comprised of three stations: The Central Hub (Downtown), the Northern Anchor (Golf Course) and the Southern Anchor (CPR site).

•Instruments and stations are transportable for future studies in other communities



Speciation Parameters

Sampler	Filter	Lab Analysis	Sampling Schedule	Compounds
Dichot Partisol #1	$PM_{2.5}$ Teflon	MASS EDXRF	1-in-3 days	Al, Fe, Zn, Si, Mn, Ni, Cr, Cd, Pb, As, V, Se, Cu, Ca…
	PM_{Coarse} Teflon	MASS EDXRF	1-in-3 days	Al, Fe, Zn, Si, Mn, Ni, Cr, Cd, Pb, As, V, Se, Cu, Ca…
Dichot Partisol #2	PM_{Coarse} Quartz	TOT/TOR IC	1-in-12 days	OC (1-4), EC SO_4, NO_3, Cl, Na^+, K^+…
Speciation Channel 1	$PM_{2.5}$ Teflon	IC	1-in-3 days	SO_4, NO_3, NH_4, Cl, Na^+, K^+…
	$PM_{2.5}$ Nylon (backup)	IC	1-in-3 days	NO_3
Speciation Channel 2	$PM_{2.5}$ Teflon	MASS	1-in-3 days	Archive
	$PM_{2.5}$ Quartz (backup)	TOT/TOR	1-in-3 days	OC(1-4), EC
Speciation Channel 3	$PM_{2.5}$ Quartz	TOT/TOR	1-in-3 days	OC(1-4), EC

Environment Canada's Short-Term CRUISER Monitoring in Golden

•3-week monitoring period in February 2005

•Objectives:

✓ To develop and test receptor modeling techniques

✓ To characterize emissions from selected sources

Continuous (~ 15 min) Measurements on Cruiser

Gases	Particles
CO	BC (Aethalometer)
NO	Ultrafine Particle Counts (GRIMM CPC)
NO_y	Size (aerosol mass spec.)
NO_2	Ion composition (aerosol mass spec.)
SO_2	MASS (TEOM)
O_3	
VOC	

Source Apportionment for $PM_{2.5}$ and PM_{Coarse}

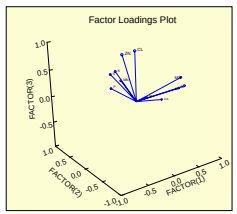
Tools used in Golden study:

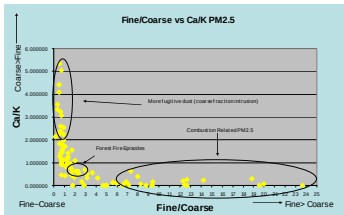
•Receptor Modeling (PCA, PMF)

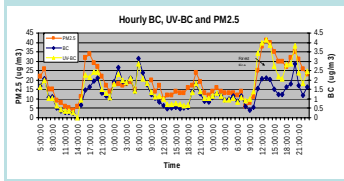
•Wind Sector Analysis

•Mass Reconstruction

•Time Series Analysis







Airshed Planning

•Airshed planning is the process of coordinating activities in an airshed, and ensuring that federal, provincial and local air quality goals are achieved.

•Source apportionment has proven useful in targeting sources for emission management plans.

•Information and knowledge gained from the source apportionment study will allow community planners to determine the most efficient and economically viable emission reduction options.

Budget

Agency	Operational $	Capital $	Data Analysis $	Total $
Environment Canada	$30,000[1]	$85,000	N/A	$115,000
WLAP	$325,000	$400,000[2]	$50,000	$775,000
City of Golden	$60,000[3]	N/A	N/A	$60,000
Total	**$415,000**	**$485,000**	**$50,000**	**$950,000**

[1] Lab Analysis performed by Environment Canada

[2] Includes pre-existing monitoring equipment

[3] Public Reports and Brochures

Timeline

	2004				2005			2005/ 2006 Fiscal[1]	2006/ 2007 Fiscal
Task	SEP	OCT	NOV	DEC	JAN	FEB	MAR		
Site Setup									
Monitoring									
Site Takedown									
CRUISER Study									

[1] April 1st to March 31st

Acknowledgements

•The Golden and District Air Quality Committee

•Environment Canada

•Louisiana Pacific Engineered Wood Products Ltd.

•The City of Golden

•Canadian Pacific Railway

•Golden District Golf and Country Club

•Interior Health

•Golden and District Hospital