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Management of the Shared Lower Fraser Valley Airshed

Border Policy Research Institute

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Introduction. This article discusses issues involved in the management of the Lower Fraser Valley (LFV) airshed, which straddles the border of Washington State and British Columbia. Many factors influence the management of the airshed, including geography, asymmetric patterns of growth, and differing regulatory contexts. There have been episodes of controversy associated with airshed management, with the greatest recent controversy centered around a 1999 proposal to build an electric generation facility in Sumas, Washington. The so-called "SE2" facility (Sumas Energy 2) received construction permits from Washington State, but died when Canada's National Energy Board denied a power-line permit that was needed to deliver power from the facility to the regional grid.

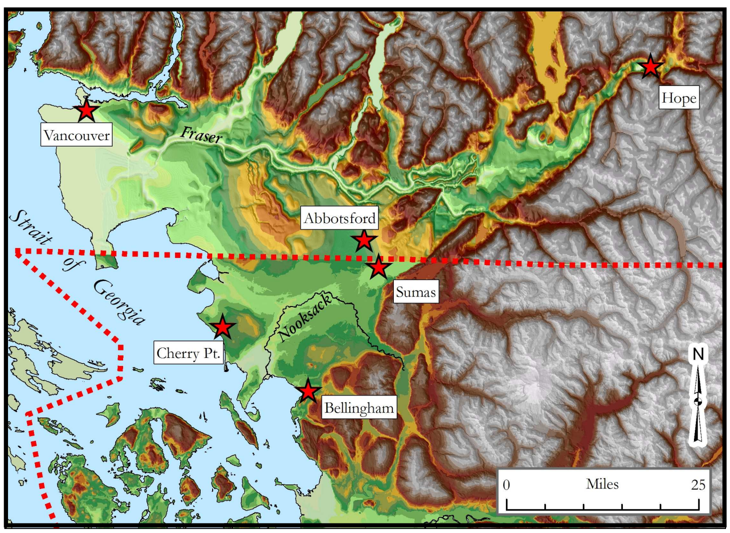


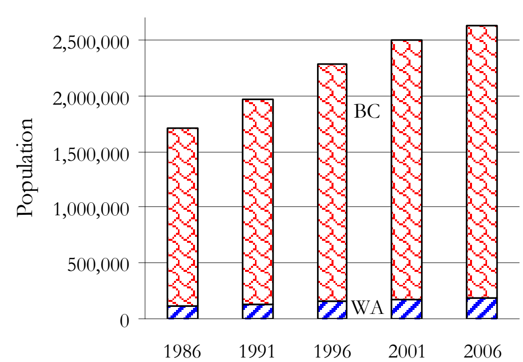
Figure 1. Topography of Lower Fraser Valley (LFV)

Geography. Figure 1 is a shaded-relief map of the LFV airshed, with key political features noted. The LFV is generally triangular in shape, bounded on the southeast by the Cascade Mountains, on the north by the Canadian Coastal Range, and on the west by the Strait of Georgia. The LFV is flat and low-lying, comprising the deltaic region of two rivers: the Fraser River, which drains much of B.C.'s coastal mountainous region, and the Nooksack River, which drains a relatively small corner of Washington. From Hope southwest to Abbotsford (a distance of 45 miles), the Fraser River valley is relatively narrow, averaging perhaps 7 miles in width. The valley widens greatly after emerging from mountainous terrain at Abbotsford, and it is 48 miles as the crow flies from Bellingham to Vancouver along the shore of the Strait of Georgia.

Initial European settlement of the region was confined to the coast, but inland growth has since occurred, with the lion's share occurring in B.C. Figure 2 shows recent trends in regional population growth. The population of the B.C portion of the LFV is now 13 times greater than that of the Washington portion, and this growth has been accommodated by urbanization that extends well inland. In B.C. there is substantial urban development in a continuous swathe from Abbotsford to Vancouver, whereas urban development across the border is still located primarily in and near Bellingham. Three major industrial facilities (two refineries and a smelter) are located at Cherry Point, 14 miles northwest of Bellingham.

Regulatory Context. The regulation of air quality differs substantially on either side of the border. In the U.S., the process began in 1963, with the enactment of the federal Clean Air Act. The Act has been amended and extended several times (i.e., 1967, 1970, 1977, 1990), but a basic framework has persisted. The Act establishes National Ambient Air Quality Standards (NAAQS) for various pollutants, as well as a framework for issuance of permits. The Act identifies six pollutants that are broadly indicative of air quality and that are the most prevalent hazardous byproducts of anthropogenic activity: carbon monoxide (CO), nitrogen oxides (NO_X), ozone (O_3), sulfur dioxide (SO_2), lead, and particulate matter (PM). These six are collectively known as the "criteria pollutants," and the NAAQS designate the maximum concentration of each that is allowable within the air during various averaging periods (i.e., a certain concentration is allowable when considering a brief "8 hour" averaging period, but the allowable concentration is lower on an annual average basis). Table 1 shows a subset of the current NAAQS for some of the criteria pollutants. In recent years, emphasis has centered upon the smallest sizes of PM, which are those particles with a diameter of less than 2.5 microns. Such particles, referred to as $PM_{2.5}$, are inhaled deeply into the lungs and are considered most threatening to human health. In this article we omit discussion of larger sizes of PM.

Figure 2. Population Growth in LFV 1986 — 2006



Source: Statistics Canada (B.C. Regional Districts 9 and 15 pop.) and Washington State Office of Financial Management (Whatcom County pop.)

Table 1. Most Stringent Pollutant Concentration Limits Established in Entities' Regulations, Together with Actual Peak Values Measured in 2004 — (ug/m³)

		"Standards" of U.S. entities			"Objectives" of Canadian entities				Peak measured values (2004)[6]		
		NAAQS[1]	WAAQS[2]	NWCAA[3]	CWS[4]	Canada[4]	BC[4]	GVRD[5]	Van. (T2)	Abb. (T33)	Hope (T29)
$PM_{2.5}$	Annual	15	-	15	-	-	-	12	6	# 5	5
	24 hour	35	-	65	30	-	-	* 25	24	# 19	20
O_3	8 hour	157	-	157	126	-	-	* 126	112	141	149
CO	8 hour	10,000	10,000	10,000	-	6,000	5,500	10,000	2,379	2,039	1,020
	1 hour	40,000	40,000	40,000	-	15,000	14,300	30,000	-	-	-
NO_x	Annual	100	100	100	-	60	-	40	37	24	17
SO_2	Annual	78	53	53	-	30	25	30	5	3	-
	24 hour	363	260	260	-	150	160	125	23	8	-

* The GVRD objectives for $PM_{2.5}$ (24 hr) and O_3 are calculated using an averaging method more stringent than that of other entities.
\# No $PM_{2.5}$ values for Abbotsford station T33 are available, so values for Abbotsford station T34 are instead shown.

Within the context of the Act, airsheds are assigned to one of two categories: "attainment" areas are those that comply with all NAAQS, and "nonattainment" areas are those that do not. The U.S. portion of the LFV is an attainment area, and within such an area, the thrust of the permitting regime is the "prevention of significant deterioration." When new facilities (or substantial retrofits of existing facilities) are proposed, the proponent must install reasonably cost-effective emission control technology, but the total amount of pollution emitted within the airshed is permitted to creep upward. By contrast, a proponent seeking to emit new pollution into a nonattainment area needs to secure an emission "offset" elsewhere, so that the airshed-wide pollutant load does not increase.

The specific value of each NAAQS is derived through analysis that is primarily focused upon human health effects, but which also may consider economic and environmental factors. There is thus some controversy associated with the establishment of a NAAQS, with some stakeholders advocating for the adoption of a standard that is completely protective of human health, and other stakeholders arguing that the economic costs of achieving compliance are disproportionately large relative to the health benefits.

The Act establishes a framework in which authority and responsibility for compliance are delegated to the states, and in Washington, state legislation has resulted in sub-delegation to regional air authorities. The Northwest Clean Air Agency (NWCAA) is the regional air authority with responsibility for the U.S. portion of the LFV. Both a state and a regional air authority have the ability to enact regulations and/or standards that are more stringent than found in the Act, but given the controversy associated with the establishment of standards, the promulgation of distinct local standards is not widespread. Table 1 also shows certain ambient air quality standards adopted by Washington State (labeled "WAAQS") and by the NWCAA. In general, the standards adopted by junior entities are either identical to or more stringent than those of the federal government. In some cases an entity will simply refrain from adopting its own standard (e.g., no 8-hour O_3 standard exists within the WAAQS), relying instead upon the standard promulgated by senior entities. The adoption of a *less* stringent standard by a junior entity is legally indefensible, but this situation can briefly exist as regulations evolve (e.g., the EPA recently lowered the NAAQS for $PM_{2.5}$ (24-hour) from 65 to 35 ug/m³, and the NWCAA has not yet reacted to the change).

A much different regulatory regime exists in Canada. There is no over-arching federal legislation equivalent to the Clean Air Act, and the federal government directly regulates only a few of the commonplace emission sources, mostly related to transportation (e.g., railroad, marine shipping, motor fuels, vehicle emission control equipment). The provinces have authority for most point sources (e.g., commercial, industrial, and governmental facilities, solid-fuel burning applicances, vehicles) and have devised individual regulatory frameworks. In B.C., the Environmental Management Act (EMA) is the primary regulation pertaining to air, and it establishes the basic requirement that the air not be polluted. Pursuant to the EMA, the provincial government implements a permitting mechanism applicable to point sources and also establishes standards applicable to some other sources (e.g., wood stoves).

Sub-provincial entities typically have relatively little authority with respect to air emissions, but in the LFV a special situation exists — the B.C. government has delegated authority to the Greater Vancouver Regional District (GVRD) in a region encompassing 21 municipalities in the Vancouver metro area.

At all governmental levels, Canadians have refrained from promulgating legally binding air-quality "standards," instead establishing "objectives" that agencies strive to meet through their various programs and permit mechanisms. As with American standards, the objectives are derived from rigorous health-based analyses conducted by federal and provincial agencies. Table 1 contains some of the objectives currently established at various levels of Canadian government. Note that Canadian objectives are more stringent than American standards across the board. Given that the objectives are not as rigidly binding within the Canadian regulatory scheme as are the standards within the American scheme, Canadians have been inclined to specify values that are more protective of human health. Note also that the objectives are most stringent at the smallest scale of government, the GVRD.

Very recently, two Canada Wide Standards (CWS) have been established, as shown in Table 1. The CWS were established by the Canadian Council of Ministers of the Environment (a forum consisting of the federal and provincial environment ministers), and the provinces have agreed to strive for compliance with the CWS by 2010.

On a final note, cross-border management of the LFV airshed is ongoing in two separate forums. One is a regional construct known as the Lower Fraser Valley Air Quality Coordinating Committee (LFVAQCC), which is comprised of officials from the regulatory agencies on either side of the border. The LFVAQCC is a forum through which data can be shared and at which communication and coordinated planning can occur. The second forum, known as the Georgia Basin/Puget Sound International Airshed Strategy, is a formal pilot project initiated at the federal level pursuant to the 1991 U.S. – Canada Air Quality Agreement.

Emission Trends in the LFV. Figures 3 through 6 show trends in the total amount of various air pollutants emitted within the LFV, separated by geographic origin.[7] Please note that the vertical scales differ from one figure to the next. The most striking trend is the dramatic reduction since 1990 in overall volumes of pollution. This trend is mainly attributable to three factors: closure of some industrial facilities, mandatory changes in vehicle emission control technology and fuel standards (e.g., gasoline oxygenation, reduced sulfur content), and AirCare — a tailpipe emission monitoring program in B.C. Before a vehicle can be relicensed and insured, it must pass an emission test. Test failure leads to repair of the car, and a companion program has led to the removal of the oldest and most-polluting cars from the road.

The figures also reveal that the above-mentioned trend has now waned. The greatest pollutant reductions were achieved from 1990 to 2000, as vehicles became cleaner in response to mandates. Little incremental benefit remains to be achieved, as is most evident in Figures 3 and 6.

Through comparison of these figures with Figure 2, it is evident that Washingtonians emit more pollution per-capita than do their British Columbian neighbors. This imbalance is attributable to the differing proportional impact of industrial facilities on either side of the border. In the U.S. portion of the LFV, the emissions associated with industrial activity at Cherry Point are sizable in relation to vehicular emissions. In contrast, although B.C. contains similarly large industrial facilities, vehicles, by dint of sheer numbers, are the dominant emission source.

Following are brief comments regarding specific pollutants:

- $PM_{2.5}$. The largest current contributors to $PM_{2.5}$ pollution are: mobile sources (35%), space heating (22%), outdoor burning (7%), and agriculture (7%). Of the pollution associated with mobile sources, only 6% is associated with cars and light trucks — the remainder is emitted by sources that burn dirtier fuels (marine vessels, heavy trucks) or by nonroad equipment (recreational, agricultural, construction, lawn/garden) that is not optimized for emission reduction.
- CO. Mobile sources are the overwhelming contributor to CO pollution (87%), with cars and light trucks largely responsible (56%). The largest point source is the smelter located at Cherry Point (7%).
- NOx. Mobile sources are again the predominant pollution source (82%), with marine vessels (27%), nonroad equipment (18%), and cars and light trucks (17%) at greatest fault.
- SO_2. The industries at Cherry Point are the predominant source of SO_2 pollution (51%), followed by marine vessels (35%). In Figure 6, a distinct pattern is used to show the magnitude of the contribution from Cherry Point.

Figure 3. Trend of $PM_{2.5}$ Emissions in LFV 1985 — 2005

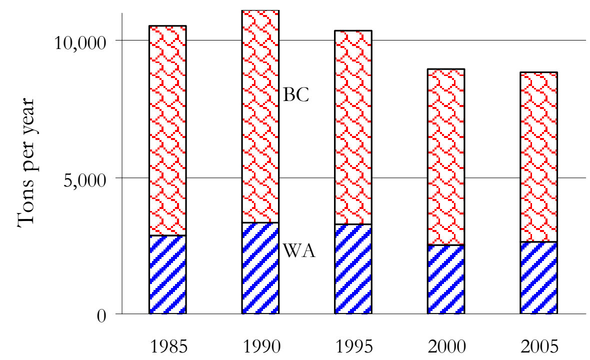


Figure 4. Trend of CO Emissions in LFV 1985 — 2005

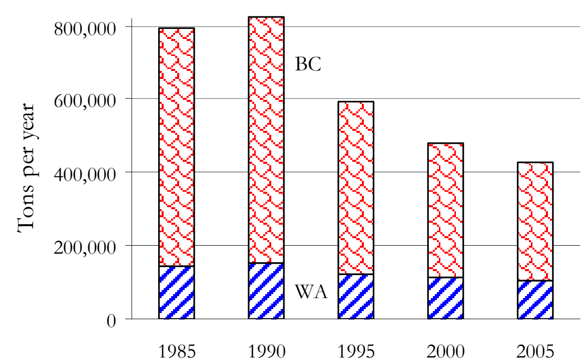


Figure 5. Trend of NOx Emissions in LFV 1985 — 2005

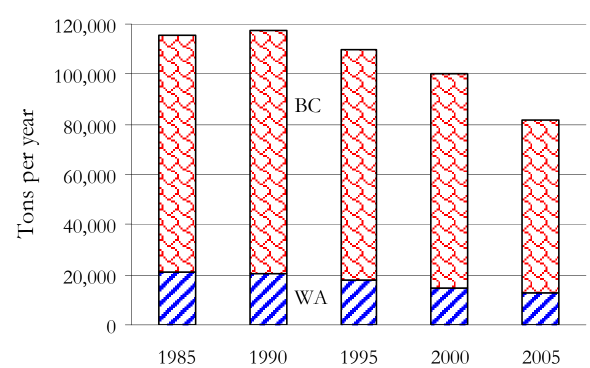
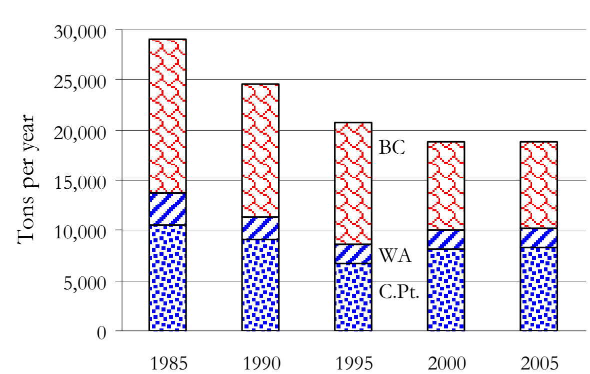


Figure 6. Trend of SO_2 Emissions in LFV 1985 — 2005



- O_3. This criteria pollutant is unique in that it is not directly emitted, but rather is a product of airborne chemical reactions between NO_x and a group of chemicals known as volatile organic compounds (VOC). VOC and NO_x are therefore identified as "precursors" to O_3 pollution. As with other pollutants, reductions in VOC pollution occurred in the LFV in response to AirCare. Currently, VOC is predominantly naturally occurring (36%), with mobile sources (29%) and solvent evaporation (15%) the largest man-made sources.

The rightmost columns in Table 1 show actual peak pollution concentrations measured in 2004 at three of the monitoring stations maintained by the GVRD: Vancouver, Abbotsford, and Hope. Comparing the data from those stations reveals how pollution is distributed along the length of the LFV. For most pollutants, the highest concentrations are found in the Vancouver metro area, and concentrations decline as one heads inland. The unique nature of O_3 formation leads to an equally unique pollution pattern, with the highest concentrations experienced in rural east-valley communities such as Hope. On a hot summer day, a gentle onshore breeze can funnel precursor chemicals from the coastal urban areas into the LFV, leading eventually to high O_3 concentrations distant from pollution sources.

In general, as shown in Table 1, pollution levels in the LFV are comfortably below the various objectives and standards, and air quality is generally considered good. Issues of concern are NO_x in the metro areas, O_3 in the eastern LFV, and rare episodes of elevated $PM_{2.5}$ throughout the LFV.

Managing the Future. Airshed management practices must be relevant to the pollution problem at hand, as well as workable within the pertaining regulatory and social context. In the LFV, the border complicates the situation. The intense controversy over the SE2 facility serves to illustrate some of the complications. In Washington, the facility was evaluated in relation to the air quality regulations and NAAQS applicable within an attainment area. Within that context the facility readily complied, and as a matter of regulatory equity, denial of a permit would therefore have been a legally difficult matter. The new pollution emitted by the facility was acceptable within the relatively rigid context existing in the U.S.

From the Canadian perspective, things looked different. In the eastern LFV, air quality already failed to meet O_3 and PM objectives on rare occasions (recall that the objectives are more stringent than the NAAQS), and the placement of a major new pollution source in Sumas could only exacerbate matters. In short, the controversy was stoked by the differing numeric limits within each country, together with the differing *legalistic meaning* of those limits.

In the airshed today, similar issues arise. The Cherry Point industries are significant polluters, particularly with respect to CO and SO_2. From a Canadian perspective, those emissions are an obvious target, given that significant reductions could be achieved at relatively little cost. From the U.S. perspective, the facilities comply with their permits, and there is no legal basis to require near-term installation of new emission controls. Likewise, a tailpipe emission effort in the U.S. would be beneficial, but such a program is mandatory in the U.S. only within nonattainment airsheds.

The importance of marine vessel emissions has become evident, particularly with respect to SO_2, PM, and NO_x. This, however, is an instance in which federal involvement is key, given the inability of regional governments to regulate international maritime commerce.

Population growth within B.C. poses a daunting challenge, as the arrival of newcomers will result in more cars. Growth in the past decade within the B.C. portion of the LFV amounted to about 312,000 people, and data from the Insurance Corporation of British Columbia show a ratio of about 1 car per 1.9 people in B.C.[8] This means that about 164,000 cars were added to the airshed from 1996 to 2006. It is instructive to view the issue in relation to the SE2 proposal, which was so widely opposed. A study undertaken by Environment Canada concluded that SE2 would have produced emissions equivalent to 7,400 cars with respect to NO_x and 4,800 cars with respect to VOC.[9] We thus observe that with respect to the main O_3 precursor pollutants, and considering cars alone (i.e., ignoring other combustion that accompanies growth), a decade of growth in B.C. was roughly equal to 22 to 34 SE2s.

As noted earlier, the reductions in pollutant volumes that occurred over the past 15 years are at an end — initiatives of the early 1990s have achieved their goals, and new efforts are needed if mounting pollution is to be avoided. B.C and the GVRD are proposing various initiatives to deal with the issue of cars. Certain initiatives are within the ability of the region to implement unilaterally, such as improved public transit, tax incentives to promote purchase of gas-electric hybrid cars, and the gradual replacement of governmental vehicle fleets with hybrid vehicles. However, one vital initiative requires action in Ottawa and Washington, D.C. — the establishment of tougher fuel economy standards. For its part, Washington State has joined with Oregon and California to demand further emission reductions from automobile manufacturers.

For the regional governments that manage the LFV airshed, asymmetric growth and differing regulatory regimes may lead to more disputes, but policy-makers should not lose sight of the vital common ground — the airshed's future is very dependent upon emission sources that are regulated at the federal level, and cooperative advocacy can be a potent tool.

Endnotes

1. The NAAQS can be retrieved at http://www.epa.gov/air/criteria.html
2. The WAAQS are in Title 173, Ch. 470-475 of the Washington Administrative Code and can be retrieved at http://apps.leg.wa.gov/wac/default.aspx?cite=173
3. NWCAA standards can be retrieved at http://www.nwcleanair.org/formsRegs/regulations.htm
4. The cited federal and provincial objectives can be retrieved at http://www.env.gov.bc.ca/air/airquality/pdfs/aqotable.pdf
5. The GVRD objectives are found on pp. 8-19 of the *Lower Fraser Valley Ambient Air Quality Report: 2005*, which can be retrieved at http://www.gvrd.bc.ca/air/pdfs/AmbientAirQualityReport2005.pdf
6. Values are from the *Lower Fraser Valley Air Quality Monitoring Network Ambient Air Quality Report: Technical Appendix, Air Quality Data, 2004*, which can be retrieved at http://www.gvrd.bc.ca/air/pdfs/AmbientAirTechnicalAppendix2004.pdf
7. All data used to prepare Figures 3-6 and to summarize existing sources of individual pollutants is from the tables in Appendix 1 of the *Forecast and Backcast of the 2000 Emission Inventory for the Lower Fraser Valley Airshed: 1985-2025*, which can be retrieved at http://www.gvrd.bc.ca/air/pdfs/2000EmissionInventoryForecast.pdf
8. For 2001, Statistics Canada's estimate of B.C. population was compared to the automobile count published by ICBC on p. 4 of *Traffic Collision Statistics: Police-attended Injury and Fatal Collisions: British Columbia 2001*, which can be retrieved at http://www.icbc.com/library/research_papers/traffic/pdf/Traffic_Collision_Statistics_2001.pdf
9. See Table 1a of *A Numerical Simulation of Impacts on Ambient Ground-level Ozone Concentrations from the Proposed Sumas Energy 2, Inc. Power Generation Facility*, (unpublished manuscript), which can be retrieved at http://www.efsec.wa.gov/Sumas2/prefiled/Exhibit%20EH-3.pdf