

Sharing the Air

State of the Howe Sound/Sea-to-Sky Airshed

2009 Annual Report



November 3, 2010

Prepared for the:
Sea-to-Sky Air Quality Coordinating Committee

Prepared by:
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Executive Summary

An Air Quality Management Plan (AQMP) was developed for the Sea-to-Sky/Howe Sound airshed between 2002 and 2005 as a proactive measure to ensure clean air is maintained throughout the airshed, in particular due to the projected high levels of growth and development for the region. The AQMP identifies actions that help maintain healthy air through an integrated planning approach that addresses area, point and mobile sources in the airshed.

This report focuses on two aspects for the 2009 calendar year: the quality of the air in the airshed and the AQMP implementation process.

The quality of the air throughout the airshed was generally good in 2009, shown by data collected and analysed for six air quality indicators. There were, however, two air quality advisories issued, and several hours where the air quality was considered poor in Whistler and Squamish. One advisory was related to forest fire smoke, and the other was related to ground level ozone (smog). For comparison, there were no advisories issued in 2008.

Although the air quality is generally good at present, it is important to continue implementation of the AQMP because:

- Continued increases in population and visitors that lead to increases in transportation and space heating would result in deteriorating air quality without action to keep the air clean;
- There are no safe levels of certain pollutants, and research suggests human health impacts are occurring in sensitive individuals at levels that are currently being measured in the airshed;
- Typical summer air quality conditions measured in the airshed approach, and at times reach, levels that warrant the issuance of an air quality advisory; and
- The region is known for outdoor recreational opportunities, which are important to the local economy. When air quality is considered poor, air quality advisories are issued that recommend refraining from such activities. Poor air quality conditions may therefore have an impact on the local economy.

Highlights from the Second Year of Implementation

Actions in progress: Five actions are currently in progress at the airshed-wide scale and are regularly discussed at AQCC meetings. These include:

- *Action #1: Integrate Transit Systems*
- *Action #3: Promote opportunities to access public transportation & other transportation alternatives*
- *Action #4: Reduce vehicle idling through education & bylaws*
- *Action #8: Develop airshed-wide smoke control strategy*
- *Action #14: Share successes and information via the Sea-to-Sky Air Quality website*

There are nine other high-priority actions, and each of these have related initiatives that are in progress at the community level, where communities are working independently and providing updates at AQCC meetings.

AQCC Meetings: Three AQCC meetings were held in 2009, with each meeting hosted by a different AQCC member: Squamish First Nations (February), Squamish-Lillooet Regional District (June), and Village of Lions Bay (December). The meetings continued to serve as an excellent opportunity to exchange ideas, share lessons learned about programs underway in each community, and raise concerns with the rest of the members. They also served as an opportunity to discuss and define the direction for the AQCC as implementation progresses.

Indicators for the Sea-to-Sky AQMP

Ten indicators have been identified to gauge whether air quality is improving or deteriorating in the airshed. Two of these indicators provide context by measuring population and tourism growth in communities throughout the airshed. The remaining eight indicators look at air quality conditions by analysing data from ambient air quality monitoring stations in the airshed and other sources. Data was not reported for two of the air quality indicators (AQ-2: Economic Impacts and AQ-4: Visibility) because the data and methodology for reporting these indicators are not currently available. Although analysis is not yet available, images taken by the visibility camera in Lions Bay from one good and one poor visibility day in 2009 are included for information. These indicators will be reported as soon as data, methodology and analyses are available.

In addition, four performance measures were developed to track the implementation of actions across the region. Data for one of the performance measures was not reported (PFM-4: Website Usage). This indicator will be reported beginning in 2011.

The following summarizes the baseline measures for each of the indicators. For a more detailed review of the indicators, please refer to the main report.

Context Indicators

Resident Population: CTX-1

Purpose: A significant proportion of air quality and greenhouse gas emissions in the Sea-to-Sky/Howe Sound airshed can be attributed to transportation and space heating. Both of these are directly dependent on the size of the resident population.

Results: The population in the airshed grew by 3.2% in 2009. Since 2005, the population has grown approximately 8%.

Visitor Population: CTX-2

Purpose: Tourism is a vital part of the economy in the airshed, and the level of tourism has a strong impact on energy demand and air quality in the airshed – both with respect to transportation and space heating for accommodations.

Results: Visitor centre records indicate a significant increase in visitor population during 2009 compared to 2008. Overall, the number of visits in the airshed has increased approximately 25% since 2005.

Air Quality Indicators

Health Reference Levels (HRL): AQ-1

Purpose: The HRL is a measure of particulate matter (PM), which is the term for particles found in the air, including dust, dirt, soot, smoke, and liquid droplets. PM contributes to poor air quality which can negatively affect human health.

Results: Based on a rolling 24-hour average from continuous monitoring, there were: (a) 54 days on which the HRL for PM₁₀ was exceeded in 2009, 10 days less than in 2008; and (b) 19 days on which the HRL for PM_{2.5} was exceeded in 2009, 16 days more than in 2008.

Using a 24-hour or “daily” average, considering all PM monitoring in the airshed, there were: (a) 32 exceedances of the PM₁₀ HRL in 2009, a decrease of 11 from 2008; and (b) 12 exceedances of the PM_{2.5} HRL in 2009, an increase of 7 from 2008.

Greenhouse Gases (GHGs): AQ-3

Purpose: The use of natural gas, gasoline, diesel and other fuels along with landfill gas emissions result in greenhouse gases being emitted to the atmosphere. Monitoring GHG emissions provides a measure of regional energy efficiency and contributions to global climate change.

Results: In 2007 (the most recent year that data is available), estimated on-road transportation emissions were the largest contributors to greenhouse gas emissions in the airshed (60% of the emissions). Emissions from energy used in buildings accounted for 30% and emissions from solid waste decomposition accounted for 10%.

Odour: AQ-5

Purpose: Clean, fresh-smelling air is a vital component of the fresh-air experience boasted by the Sea-to-Sky/Howe Sound airshed for both its residents and guests.

Results: Howe Sound Pulp and Paper reported receiving five odour complaints in 2009, which is a slight decrease from the eight complaints received in 2008. There were 16 exceedances of the Odour Index in 2009, which is an increase from three exceedances in 2008.

Canada-wide Standards (CWS): AQ-6

Purpose: Air pollution has been shown to have detrimental effects on human health – particularly to at risk persons such as those with respiratory and cardiovascular ailments, children and the elderly. The CWS standard has set thresholds for particulate matter and ground-level ozone because they are the pollutants of most concern.

Results: Fine particulate matter (PM_{2.5}) – No exceedances. The 3-year average for 2009 at the Whistler ambient air monitoring station was 16.8 µg/ m³, an increase of 70% from the 3-year average calculated for 2008.

Ground-level ozone (O₃) – No exceedances. The 3-year averages of the 4th highest annual 8-hour period for 2009 were 49.8 ppb at the Squamish station and 54.9 ppb at the Whistler station, which are both very similar to 2008 levels.

Air Quality Index (AQI): AQ-7

Purpose: The main purpose of the AQI is to inform the public, on a daily basis, about the present state of air quality.

Results: In 2009, the AQI exceeded 50 and was rated POOR for 3 hours at the monitoring station in Squamish, and for 49 hours in Whistler. For comparison, in 2008 there were no occasions on which the AQI was POOR. Two air quality advisories were issued in the airshed in 2009, one due to smog (ground-level ozone), and one due to smoke from wildfires (particulate matter).

Continuous Improvement: AQ-8

Purpose: Most measures used to describe air quality describe whether pollutant levels are high over short periods of time. However, it is also important to track long term trends of air quality in the region since long term exposure may also affect health.

Results: There are only three data points currently available for each contaminant, making it difficult to identify a clear trend. However, increases were measured at the Whistler station for NO₂ (40% increase relative to 2007) and PM_{2.5} (60% increase relative to 2006). Decreases were measured at the Squamish station for ozone (11% decrease relative to 2005) and NO₂ (7% decrease relative to 2007). Decreases were also measured at the Langdale station for NO₂ (14% decrease relative to 2004) and PM₁₀ (5% decrease relative to 2005). Other contaminants measured showed minimal change.

Performance Measures

Action Plan Implementation Progress: PFM-1 and PFM-2

Purpose: Tracking the completed actions provides an indication of progress in implementing the AQMP. This measure will help the AQCC determine whether the approach to implementation and structure of the organization is effective in carrying out the identified actions.

Results: Implementation of the AQMP started in 2008 and several actions were initiated during the first two years, but no actions have been completed at this early stage in the process. Five actions are being pursued at the airshed-wide scale. All other high-priority actions have related initiatives that are in progress at the community level, where communities are working independently and providing updates at AQCC meetings.

AQCC Involvement: PFM-3

Purpose: This measure provides an indication of the level of involvement of identified stakeholders in the process.

Results: For 2009, 80% of funding members were represented at all three meetings held throughout the year, and 100% of funding members participated in at least one of the three meetings. For 2009, 50% of other (non-funding) members participated in at least one of the three meetings held throughout the year.

Next Steps

- 2010 will be a transition for the AQCC with the hiring of a locally-based coordinator, and with taking the initial steps towards setting up a non-profit organization for continued implementation of the AQMP.
- The AQCC expects to meet twice in 2010 after hiring the local coordinator.
- An annual report will continue to be produced to track changes in the identified context indicators, air quality indicators, and implementation performance measures.
- The first five-year report is scheduled for 2013. The five-year report will provide the AQCC with an opportunity to revise actions or add new ones in order to achieve the vision and goals of the AQMP by 2025.

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1 Introduction

1.1. Background

The Sea-to-Sky/Howe Sound airshed encompasses the region from Bowen Island to just north of Pemberton. It includes the following communities along the eastern and western shores of Howe Sound: parts of West Vancouver, Bowen Island, Gibsons, Langdale, Lions Bay, Squamish, Whistler and Pemberton. The Squamish-Lillooet Regional District (SLRD), the Sunshine Coast Regional District (SCRD) and Metro Vancouver all have residents in the airshed. See Figure 1 for a map that outlines the airshed boundaries. The airshed boundaries are defined by a combination of topography, meteorology and climate considerations that contain a shared air mass. All activities that emit pollutants anywhere in the airshed mix into to the air being breathed by everyone that lives in or visits the region.

The B.C. Ministry of Environment (MoE) monitors ambient air quality, provides data and technical expertise, and carries out regulatory activity throughout the province. In the late 1990s and early 2000s, MoE identified that certain pollutants in the airshed (e.g. particulate matter and ground-level ozone) were approaching levels of concern to human health¹ and the impacts were expected to grow as population and tourism increase. A significant portion of these emissions were from mobile sources (e.g. transportation) and area sources (e.g. space heating and wood burning)² which are beyond the traditional regulatory role of MoE.

The Sea-to-Sky Air Quality Management Plan (AQMP) was developed between 2002 and 2005 using a community-based approach to form a comprehensive plan to protect air quality by addressing these area and mobile sources as well as point sources in the airshed. Through the AQMP, with the involvement of all stakeholders in the airshed, emissions could be addressed through actions that could be carried out by municipalities, non-governmental organizations, industry, members of the public and other relevant agencies and organizations.

1.2. How was the AQMP developed?

The Sea-to-Sky AQMP was created in a series of four phases.

Phase 1 involved the evaluation of the opportunities to build an AQMP by supporting existing community-based initiatives. Specifically, this phase identified stakeholders, evaluated potential benefits of existing programs, and led to the development of a community-based process for creating the AQMP. The report titled "Sharing the Air: A Community-based Approach to Airshed Management in the Sea-to-Sky Corridor"³ details the results of this phase.

Phase 2 continued the stakeholder engagement process and established the Air Quality Coordinating Committee (AQCC), the group responsible for developing and implementing the AQMP.

¹ Ambient Air Quality Monitoring Report for Whistler, B.C.; B.C. Ministry of Water, Land and Air Protection (now MoE) November 2002.

² 1995 Sea-to-Sky Airshed Emissions Inventory of Common Air Contaminants, B.C. Ministry of Water, Land and Air Protection (now MoE).

³ Report prepared by The Sheltair Group for the B.C. Ministry of Water, Land and Air Protection (now MoE), March 2004.

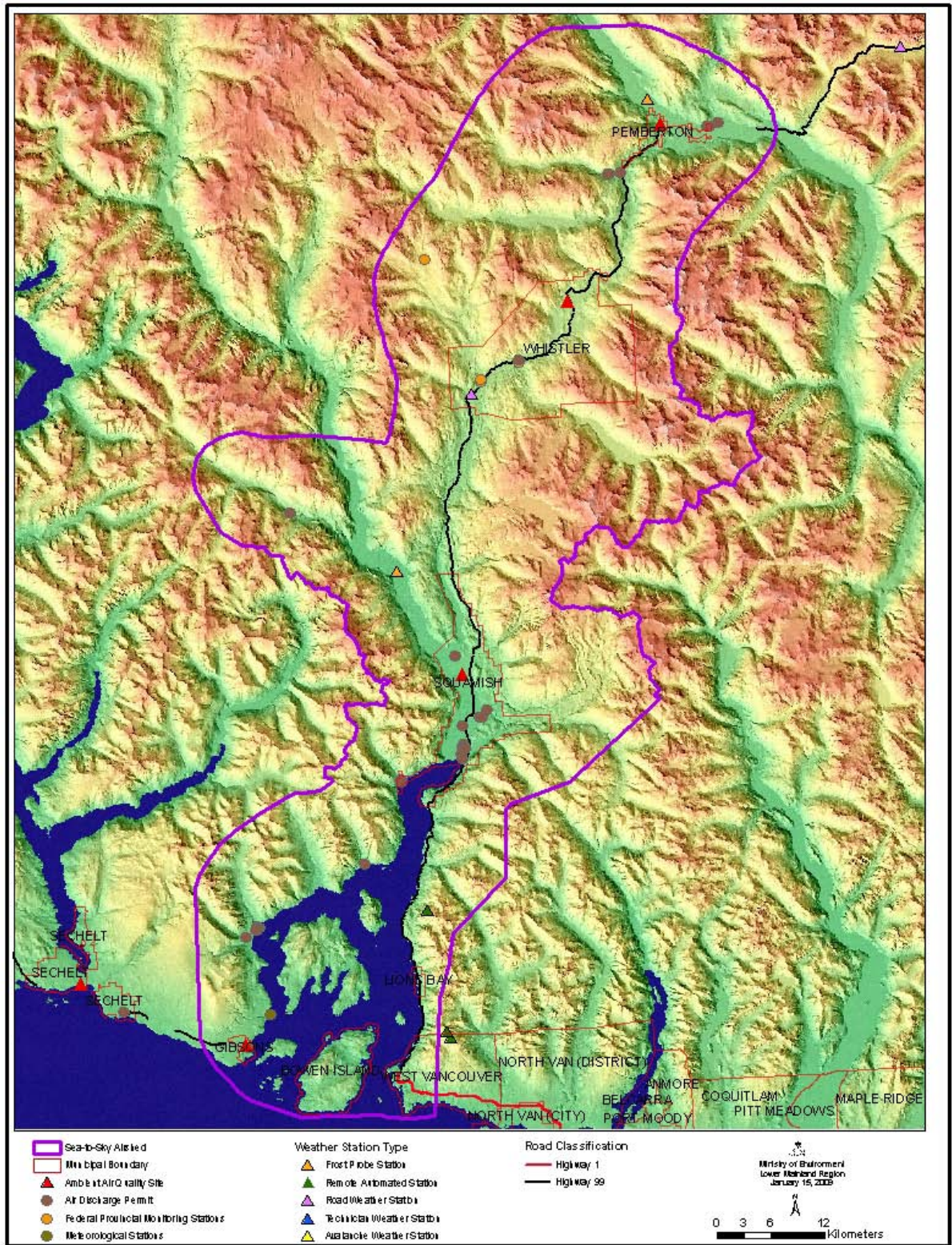


Figure 1: The Sea-to-Sky/Howe Sound Airshed

During **Phase 3**, the AQCC collectively built the AQMP through a series of meetings. The planning framework developed in Phase 1 was provided to the group to help them organize their work. The AQMP underwent public consultation in the winter of 2006-2007 and the revised plan was presented to councils and boards in April and May 2007.

Phase 4 involves the development of an AQMP implementation strategy and ongoing monitoring and reporting. The AQCC monitors progress toward the goals outlined in this plan through annual and five-year reports. MoE will continue to support to the AQMP by providing technical expertise in air quality monitoring and reporting, communication and outreach about pollution sources and management strategies, and regulatory activities.

1.3. Report Objectives

Annual and five-year reporting is important to keep both the AQMP and the actions relevant to the current situation in the airshed. The annual report focuses on the status of the actions and the air quality in the airshed. Reporting is based on the calendar year. This allows nationally accepted air quality calculations to be used in reporting but it should be noted that the budget and meeting schedule are currently organised on an April to March financial year basis.

The five year update report provides an opportunity to re-evaluate the AQMP and its actions, updating or adding actions where necessary. The annual reports will help to inform the five-year update report by identifying which actions have been completed and reporting on the progress towards the vision and goals (see Figure 2).

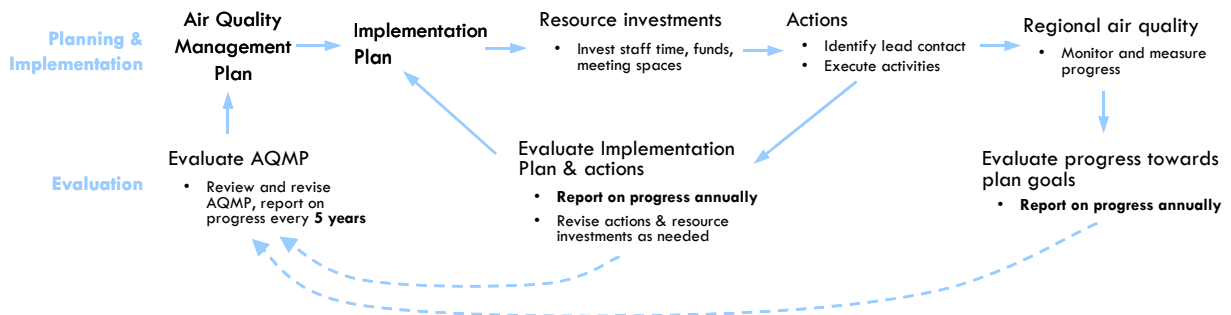


Figure 2: Reporting and Evaluation

The development and approval of the AQMP has proceeded as outlined in the timeline in Figure 3. The current phase (2009 and beyond) involves the implementation of early and high priority actions and monitoring and reporting on progress made to date. Mid and longer term actions are expected to begin in 2010 and beyond.

This document represents the second Annual AQMP Progress Report and was prepared by Stantec Consulting (previously The Sheltair Group). It is expected that the AQCC will take on this responsibility in future years.

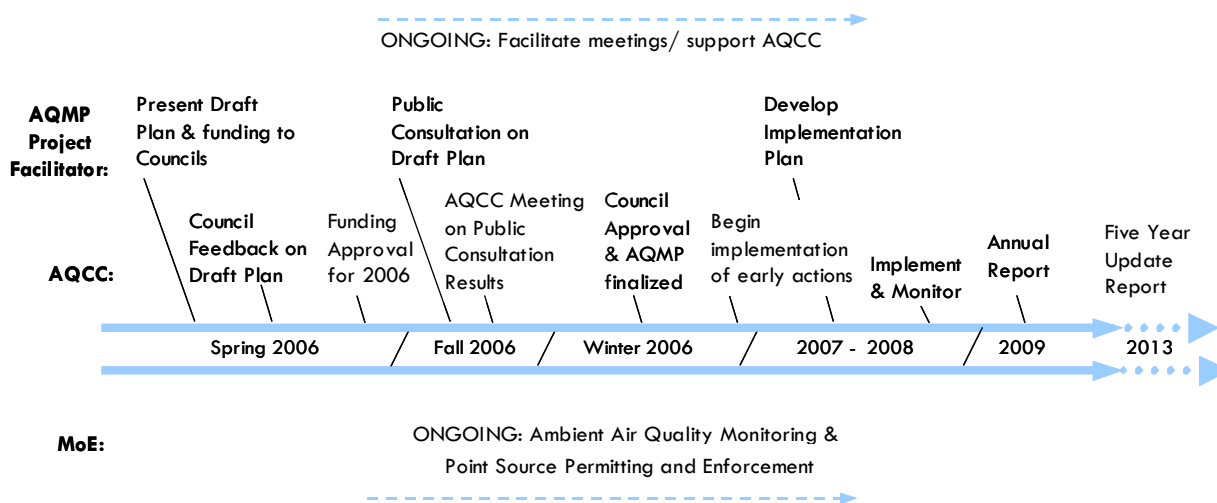


Figure 3: AQMP Implementation Timeline

1.4. About the AQCC

The Air Quality Coordinating Committee (AQCC) was established to guide the development of the AQMP for the Sea-to-Sky/Howe Sound airshed. Since the publication of the AQMP, the AQCC has continued to meet throughout development of an implementation plan and now the implementation of this plan. The AQCC is an integrated committee of representatives from local and regional government, First Nations, utilities, transit providers and the B.C. Ministry of Environment and other agencies. There are currently eight funding members of the AQCC: Town of Gibsons, Bowen Island Municipality, Village of Lions Bay, District of Squamish, Resort Municipality of Whistler, Village of Pemberton, Squamish-Lillooet Regional District, and MoE. In 2009 a Terms of Reference was adopted by consensus for the administration, roles and responsibilities of the AQCC members. The Sheltair Group (now Stantec) facilitated the process until 2010 when the AQCC hired a local coordinator to take over this facilitation and coordination role.

1.5. Provincial Role

MoE is responsible for monitoring and reporting on ambient air quality and regulatory activities associated with point sources, some area sources and some motor vehicle related emissions under the Environmental Management Act. Recognizing that air quality is an issue with many contributing factors, MoE proposed the development of airshed based planning to address unregulated emission sources, including transportation (mobile sources) and area sources (electricity use, space heating, agriculture, etc.) at the local level.

The development and implementation of the Sea-to-Sky AQMP has enabled the provincial government to work with local and regional level governments, First Nations and other stakeholders to address air quality issues. A regional approach is important since air quality should be managed across the entire airshed to be most effective.

2 AQMP Vision & Goals

The AQMP vision and goals were developed by the AQCC and are provided here for reference purposes. The AQCC is collectively responsible for ensuring that progress is made on actions outlined in the plan. The full version of the AQMP can be found at <http://seatoskyairquality.ca/reading-room/r-quality-planning-reading-room/>. The plan provides a framework and initial direction for achieving the identified vision and goals. Specific actions may change over time to align with other processes and initiatives occurring in the region, as long as the activities align with the vision and goals developed in the AQMP process. These initiatives may include SmartGrowth activities, municipal and regional district energy planning, the Howe Sound Community Forum, and others as they are identified.

2.1. Vision

The AQCC envisions that in 2025:

Communities in the Sea-to-Sky/Howe Sound airshed will enjoy clean air that sustains and contributes to the health of our residents and guests, our economy, and our environment and wildlife.

In 2025, residents and guests throughout the Sea-to-Sky/Howe Sound airshed will enjoy clean mountain air, crisp scents of ocean and forest, crystal clear views and vistas, and abundant, diverse wildlife. Clean air will contribute to our residents' and guests' enjoyment of the natural surroundings and help them to maintain a healthy lifestyle. Due to the cleaner air, everyone will benefit from improved quality of life and visitors will come here to breathe our fresh air and enjoy our panoramic views.

Despite continued growth in the airshed, air quality will improve beyond 2005 through the use of good planning principles such as Smart Growth, new technologies, and clean energy sources. We will continue to consider air quality and its contributions towards our goals in all planning processes, such as climate change initiatives. All residents and businesses will recognize that the quality of air is connected to all aspects of communities' activities.

Exceptional air quality and visibility in the airshed will continue to generate many economic opportunities for local businesses and will, in part, build on our multi-season outdoor tourism opportunities. We will develop new technologies and industries that contribute to healthy air as well as to our diverse and sustainable economy.

We will continue to identify and develop innovative best practices for air quality management. We will share results of actions we have already implemented and those that will be implemented through the AQMP, nationally and internationally. In 2010, at the sustainable Winter Olympics, and beyond we will be internationally recognized for our clean air, crystal clear views, our leading edge initiatives, and progressive management of air quality.

2.2. Goals

We will strive towards our vision by meeting these goals by 2025:

To address **Human Health**, we have improved regional air quality so there are substantially fewer incidences of respiratory related medical visits and health care costs.

To address **Ecosystem Health**, we have continued to maximize green space and vegetation in community planning and land development to help maintain healthy air.

To address **Economic Health**, we have a strong and sustainable local economy having a positive impact on air quality.

To address **Climate Change**, we have managed the airshed's air emission contributions to climate change and its effects.

To address **Visibility**, we have maintained, protected and are improving aesthetic viewscapes and vistas through management of the emissions contributing to poor visibility events.

To address **Odour**, we have controlled the emission of odour causing substances that negatively impact on human, economic and ecosystem health.

To demonstrate **Leadership**, we have showcased our AQMP, partnerships and resulting successes regionally, nationally and internationally, and have maintained the perception of clean, healthy air for which we are recognized.

3 Highlights from the Second Year of Implementation

The AQMP was adopted in principle by the funding members of the AQCC by the fall of 2007. At the same time, an implementation framework was developed to determine priorities and timelines for implementing the 18 actions identified in the AQMP. The implementation of the AQMP began in spring 2008 when this framework was finalized.

3.1. AQCC Meetings

Three AQCC meetings were held in 2009, with each meeting hosted by a different AQCC member: Squamish First Nations (February), Squamish-Lillooet Regional District (June), and Village of Lions Bay (December).

AQCC Budget

The 2009 budget was determined at the meeting held in December 2008. The total budget for the year was \$27,835, including a \$20,000 contribution from MoE. The 2009 budget included:

- Facilitation and food costs for two meetings (June and December). Note that the February 2009 meeting was held using the 2008 budget.
- Consulting fees for liaison between AQCC members.
- Website maintenance and development of support materials for initiatives and meetings.
- Performance monitoring and an annual report on AQMP progress for 2009 (this report).
- NOTE: MoE also provided an estimated in-kind contribution of \$25,000.

Committee Structure

For the year of 2009, the AQCC continued to operate as it had since its formation. However, a subcommittee formed following the February 2009 meeting to develop Terms of Reference for the AQCC to formalize the structure. After review and amendments requested by AQCC members, the Terms of Reference were adopted by consensus in the December 2009 meeting. The terms are included as Appendix A to this report. Additionally, the AQCC decided to hire a local coordinator for the next budget year, and to pursue the option to transform the AQCC into a non-profit society.

3.2. Funding from MoE for Implementation

Additional funding from MoE for implementation of the AQMP was made available to communities in the airshed in 2009. Three projects resulted from this funding:

1. Research and implementation of smoke control measures and information sharing with airshed municipalities – led by Bowen Island Municipality.
2. Project to address air quality in the energy and climate action plan development – led by SLRD.
3. Reduction of vehicle and equipment emissions through fleet rating, education and equipment upgrades – led by Resort Municipality of Whistler.

3.3. Actions in Progress in 2009

Five high priority actions were in progress during 2009.

Action #1: Integrate Transit Systems

Action #3: Promote opportunities to access public transportation & other transportation alternatives

During 2009 efforts to coordinate on these transportation actions were continued, with a particular focus on increasing availability and/or access to transit between communities from YVR to Whistler. Some initiatives include:

- District of Squamish conducted a study regarding potential for implementing a commuter bus to downtown Vancouver.
- Potential to display messages on screens at BC Ferries terminals; or providing links to transit schedules on the BC Ferries website.
- Individual communities planning to update websites and add links to applicable transit schedules.
- Opportunity to develop website regarding all transportation options for the region? Could be considered as part of TWG activities.

Action #4: Reduce vehicle idling through education & bylaws

Communities across the airshed continue to promote a reduction in vehicle idling with the installation of “Idle-Free BC” signs in several locations, idle-free messages at BC Ferries terminals, and education campaigns in schools and at various idling “hot spots”.

Action #8: Develop airshed-wide smoke control strategy

A few initiatives occurred in 2009 to move this action forward. First, funding was provided by the MoE to Bowen Island Municipality to conduct a study on alternative methods of managing wood waste on the island. Currently there is a practice of burning the wood waste; the study was initiated to identify technologies for more efficiently disposing of the waste. Second, MoE prepared a research paper about alternatives to burning that includes bylaws, disposal and composting facilities in the airshed. Third, Metro Vancouver launched the woodstove exchange program which is available for Metro municipalities to participate in.

Action #14: Share successes and information via the Sea-to-Sky Air Quality website

The website was updated with new information about implementation activities and the 2008 annual report. It continues to provide a broad spectrum of information on air quality issues relevant to the airshed.

3.4. Community Initiatives Related to Other High Priority Actions

In addition to the “actions in progress” listed above, communities in the airshed also had several local initiatives underway in 2009 that relate to the other high priority actions in the plan. A listing of these initiatives is available in Appendix B.

3.5. Changes to the Air Quality Monitoring Network

There are three monitoring stations for air quality (Langdale, Squamish, Whistler) and visibility cameras in Lions Bay. During 2009, the Squamish station received new continuous particulate matter (PM) monitoring, and new visibility equipment in Lions Bay was installed. Furthermore, a new indicator called "Air Quality Health Indicator (AQHI)" is now reported for the Whistler station (see http://www.weatheroffice.gc.ca/airquality/pages/bcaq-016_e.html).

4 Indicators and Targets

4.1. The Importance of Using Indicators to Monitor Progress

An indicator is a measure that reveals a condition, a trend, or an emerging issue. Its purpose is to reveal the direction the community is moving in. More specifically, indicators can show if the community is moving towards meeting the air quality goal or away from it. Indicators are tools that help track changes over time and are a yardstick for measuring future change relative to a baseline.

Indicators also provide an opportunity to identify and address policy gaps, shortfalls in implementation, or trends that may affect air quality. The presentation of indicators and trends helps decision makers, businesses, and residents see where changes are needed and desired.

Monitoring is a critical activity as it shows changes over time and identifies things that are working (what we should celebrate and protect) and areas where we are not making progress (where we need to direct more resources). Indicators provide feedback on how the community is doing through ongoing monitoring and feedback. Feedback in itself does not facilitate change as it merely indicates past performance. Learning from the feedback is required to allow the community to “correct its course” by modifying and adjusting its actions as it goes forward.

Three types of indicators have been developed for this airshed: context, air quality and performance measures. Context and air quality indicators are used to evaluate the progress towards or away from the air quality goals whereas the performance measures allow us to evaluate progress on plan implementation. These are described in more detail below.

“What gets measured tends to get done. If you don’t measure results, you can’t tell success from failure. If you can’t recognize success, you can’t reward it. If you can’t recognize failure, you can’t learn from it.”

David Osborne and Ted Gaebler (Reinventing Government, 1992) suggesting why indicators are important for making progress.

- Context indicators are important indicators that provide context for the other indicators, but in themselves are outside the sphere of influence of local government or other organizations.
- Air quality indicators directly measure the state of air quality in the airshed and are important for tracking trends and monitoring progress.
- Performance measures track the actions that are being implemented across the region. Performance monitoring is different from the indicators and targets outlined in the AQMP.

Limitations of Indicators

There are limitations to the use of indicators. A community or region comprises many subsystems with complex relationships and interdependencies. Indicators can only show one thing within an individual system and therefore are simplified. They do not explain the workings of a system, causality or the reasons for a particular condition or trend. Many of the indicators are too crude to capture any type of site-specific condition or qualitative condition. They also rely on “after-the-fact” information. As such, they are useful for basic information provision, but should be supplemented by observation, studies, survey research, and more detailed assessment and analysis.

4.2. Indicators for the Sea-to-Sky AQMP

Overview

To gauge the direction of air quality in the Sea-to-Sky/Howe Sound airshed, ten indicators were identified to be tracked on an ongoing basis. Two indicators provide context, by measuring population and tourism growth in communities throughout the airshed. The remaining eight indicators look at air quality conditions, by analysing data from ambient air quality monitoring stations in the airshed and other sources.

Each indicator is discussed by answering the following questions:

- What is being measured?
- Why is this indicator important?
- What is happening?

Baseline Year

The baseline year for monitoring air quality in the Sea-to-Sky airshed is 2008; however, baseline data for greenhouse gases (AQ-3) is only available for 2007⁴ and data for continuous improvement (AQ-8) is reported for 2005 and 2008. The baseline year for the performance measures is 2008, the first year of implementation.

Context Indicators

This section presents the two context indicators outlined in Table 1.

Table 1: Context Indicators (CTX)

	Context Indicators	Units	Rationale	Targets
1	Resident Population: (a) Total population of airshed by community (b) % total population growth change	# of people, % change	Measure of population growth	Not applicable
2	Visitor Population: (a) Total visitor population of airshed by community (b) % visitor population growth	# of people, % change	Measure of tourism growth	Not applicable

⁴ MoE, as part of the Community Energy and Emissions Inventory (CEEI) initiative, has recently begun preparing an inventory of community energy consumption and greenhouse gas (GHG) emissions for each community in BC. This initiative will provide each community in the province with standardized greenhouse gas inventories. The CEEI initiative does not include certain contributors to greenhouse gases, such as agricultural activities and, in many cases, industrial activities.

CTX-1: Resident-Population

What is being measured?

There are two components to this context indicator:

- a) The number of people residing in each community, according to B.C. Stats population estimates. These estimates are derived from Statistics Canada Census data and are updated annually.
- b) The percentage change in population in the entire airshed over time.

Why is this indicator important?

A significant proportion of air quality and greenhouse gas emissions in the Sea-to-Sky airshed can be attributed to transportation and space heating. Both of these are directly dependent on the size of the resident population. As the population continues to grow, there will be increased demand for energy and transportation.

What is happening?

The population of the airshed has increased approximately eight percent between 2005 and 2009, as shown in Figure 4. There was a 3.2% increase in population between 2008 and 2009, with the majority of growth occurring in Whistler, Squamish, Pemberton and Gibsons.

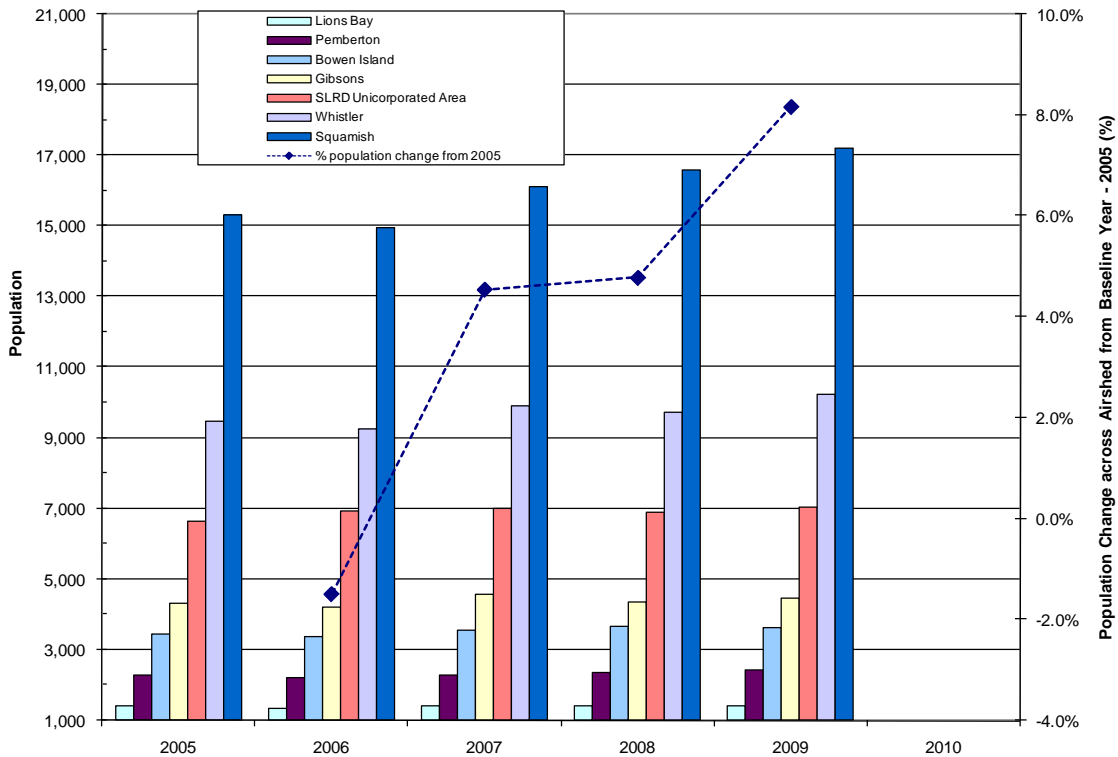


Figure 4: Population by Community and Total Population Change in the Airshed (2005 to 2009)

CTX-2: Visitor Population

What is being measured?

There are two components to this context indicator:

- a) The visitor population by community is reported using visitor counts from Tourism BC visitor centres. These visitor counts are tracked and reported annually. There are visitor centres located in Bowen Island, Gibsons, Pemberton, Squamish and Whistler.
- b) The percent change in visitor population over time is also reported. Although visitor centre data does not provide a full estimate for the number of visitors in the airshed, looking at the change in numbers of visitors over time may provide insight into the changing pressure due to tourism. These counts can provide a very general guideline only, as there are several factors that may influence the counts beyond the number of tourists visiting the area.⁵

Why is this indicator important?

Tourism is a vital part of the economy in the airshed, and the level of tourism has a strong impact on energy demand in the airshed – both with respect to transportation and space heating for accommodations. Tracking visitor population in addition to resident population will provide a more complete picture of the demand for energy in the airshed, and the potential additional pressure placed on the region's air quality.

What is happening?

Visitor centre records indicate a significant increase in visitor population during 2009 compared to 2008, in particular at the Whistler visitor centre. All centres had more visits except Pemberton, which did not change from 2008, but is still high relative to previous years (see Figure 5). The increase in tourism is likely related to the lead-up to the 2010 Winter Olympic Games. Overall, there is almost 25% increase in visits in the airshed since 2005, which may have a negative impact on local air quality during peak travel times.

⁵ BC Stats regional data was also examined for this indicator. The hotel room revenue recorded in 2006 and 2007 showed slight increases from 2005, as opposed to slight decreases shown in visitor centre counts.

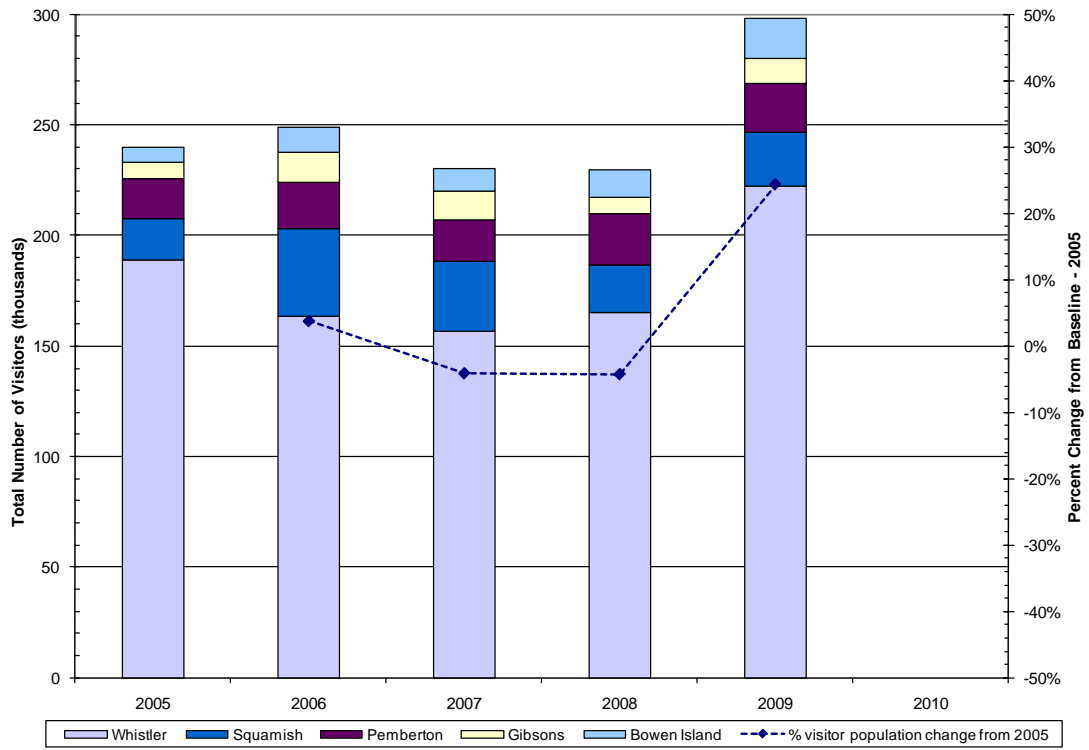


Figure 5: Number of Visitors (thousands) and Percent Change from 2005

Air Quality Indicators and Targets

This section presents the eight air quality indicators outlined in Table 2. At this time, two indicators are not reported: economic impacts of air quality in this airshed (AQ-2) and visibility (AQ-4). There is currently no method available for quantifying these; ideally these indicators will be reported in the future.

Table 2: Air Quality Indicators (AQ)

	Air Quality Indicators	Units	Rationale	Targets
1	Health Reference Levels (HRL) Number of 24-hour periods per year in which the Health Reference Level ⁶ for: (a) PM ₁₀ is greater than 25 µg/m ³ (b) PM _{2.5} is greater than 15 µg/m ³	# of 24-hour periods	Indication of health risk	Annual reduction in the number of 24-hour periods exceeding the HRL
2	Economic Impacts (an ideal indicator to be measured in the future) ⁷ Economic cost of air quality impacts (health & business) per capita	Cost (\$); \$/capita	Influence of air quality on economic health of the region	Reduction in costs
3	Greenhouse Gases (a) Total GHG emissions by sector/source, and (b) Per capita GHG emissions, by municipality	Tonnes, and tonnes per person	Indicator of regional energy efficiency and contribution to global climate change	Decreasing trend from baseline year (2007)
4	Visibility ⁸ Number of poor or compromised visibility events per year	# of poor visibility days	Visual measure of compromised air quality which can effect tourism, recreational activities (site-seeing) and public perception	Zero poor visibility events in a year
5	Odour (a) Number of odour complaints per year by municipality, and (b) Number of hours per year where Odour Index is above 25	#	B.C. Odour Index is an indicator of sulphurous odours (mainly a result of pulp mill operations). Odour complaints may give an indication of municipal type odours (wastewater treatment, composting operations, municipal solid waste treatment).	(a) Zero odour complaints per year (b) Zero exceedances of B.C. Odour Index level of 25

⁶ The HRL is the level of pollutant at which there is a demonstrated statistical effect on health. MoE guidelines are based on rolling 24-hour averages.

⁷ The calculation of this indicator is challenging, as it requires labour intensive full cost accounting methods.

⁸ Method to assess visibility as related to air quality is still under development.

	Air Quality Indicators	Units	Rationale	Targets
6	Canada-wide Standards (CWS) Number of occurrences of: (a) PM _{2.5} exceeding the CWS exposure limit (30 µg/m ³), or (b) Ground-level ozone (O ₃) exceeding the CWS exposure limit (65 parts per billion)	3-year average in µg/m ³ or ppb	All communities in Canada must aim to meet CWS by 2010, and those already below CWS levels must demonstrate commitment to continuous improvement and keeping clean areas clean. This indicator allows for national comparison of PM _{2.5} and ground-level ozone levels.	Zero exceedances of standard
7	Air Quality Index (AQI)⁹ Number of hours per year in a community when the AQI is greater than 50.	hours	An AQI of 50 is equivalent to the National "maximum acceptable" level for all CACs. An air quality advisory is issued whenever the AQI>50. AQI is useful in analysing short-term air quality episodes.	Zero hours per year
8	Continuous Improvement¹⁰ Trends for 3-year annual average of (a) 8-hour maximum daily level for O ₃ (b) Annual 24-hour average level for PM ₁₀ (c) Annual 24-hour average level for PM _{2.5} (d) 8-hour maximum daily level for NO ₂	3-year average in µg/m ³	Long term average which has a smoothing effect on short-term air quality episodes. Useful in determining the long term trends of air quality in the region.	Decreasing trend from baseline year (2005)

⁹ The AQI is a dimensionless index in which air contaminant concentrations are used to define the level of air quality. The AQI scale range is: Good: 0-25; Fair: 26-50; Poor: 51-100; and Very Poor: >100. The Air Quality Health Index (AQHI) may replace the AQI. The AQHI is a new index that correlates ambient air quality with health effects. The AQHI is based on a combination of factors. The older AQI from any given station is based on the value of the single highest air contaminant at that particular station. The AQHI has been implemented at one station in the airshed (Whistler) but the AQI also remains in place at Whistler, Squamish and Langdale.

¹⁰ This measurement is currently recommended in the CWS draft guidelines for Keeping Clean Areas Clean/Continuous Improvement. SO₂ is not included in the continuous improvement metrics since current levels of this pollutant in the Sea-to-Sky Airshed have decreased and are now extremely low. Levels are expected to continue to decrease and it is unlikely that in the future there will be any significant new sources of SO₂ in the airshed. CWS is not an exposure limit; it is a standard. There are still health effects below the CWS levels.

Health Reference Levels (HRL): AQ-1

Target

Annual reduction in the number of 24-hour periods exceeding the HRL.

Trend

Several years of data collection are required to infer the direction of a trend. This is the second year data is being reported, which is too soon to identify a trend. Future reports will be able to indicate the trend over time.

What is being measured?

Particulate matter with an aerodynamic diameter of 2.5 micrometres or smaller (called PM_{2.5}) and particulate matter with an aerodynamic diameter of 10 micrometres or smaller (called PM₁₀) are measured at various monitoring stations in the Sea-to-Sky/Howe Sound airshed.

This indicator measures exceedance of the Health References Levels (HRL) for PM_{2.5} and PM₁₀ as recommended in the National Ambient Air Quality Objectives for Particulate Matter published in 1998.

The HRLs that trigger an exceedance are:

- a) PM₁₀ concentration greater than 25 µg/ m³
- b) PM_{2.5} concentration greater than 15 µg/ m³

Air quality monitoring stations in the Sea-to-Sky sky airshed use two different methods to monitor HRLs: 1) using a rolling 24 hour average, and 2) using a midnight to midnight 24 hour or “daily” average. Although “rolling” averages are capable of capturing additional exceedances that are not captured in “daily” averages, certain locations only have non-continuous samplers, and therefore are only included in the “daily” totals. Although MoE guidelines are based on rolling averages (1-hour intervals), both methods are reported here in an effort to represent HRLs across the airshed.

Why is this indicator important?

Particulate matter (PM) is the term for particles found in the air, including dust, dirt, soot, smoke, and liquid droplets. It contributes to poor air quality which can negatively affect human health. The Canada-wide Standard is often used to assess air quality (see AQ-6).

Current research shows that there is no safe level (threshold level below which there are no effects) for particulate matter.¹¹ Despite this, reference levels are established for measurement and comparison purposes.

What is happening?

Based on a rolling 24-hour average from continuous monitoring, there were (shown in Figure 6):

- a) 54 days on which the HRL for PM₁₀ was exceeded in 2009, 10 days less than in 2008
- b) 19 days on which the HRL for PM_{2.5} was exceeded in 2009, 16 days more than in 2008

The increase in PM_{2.5} exceedances is related to the extensive forest fires in the airshed in 2009.

¹¹ Environment Canada, Clean Air Online, Pacific and Yukon Region. www.ec.gc.ca/cleanair-airpur/Clean_Air_Picture-WSE59D691A-1_En.htm

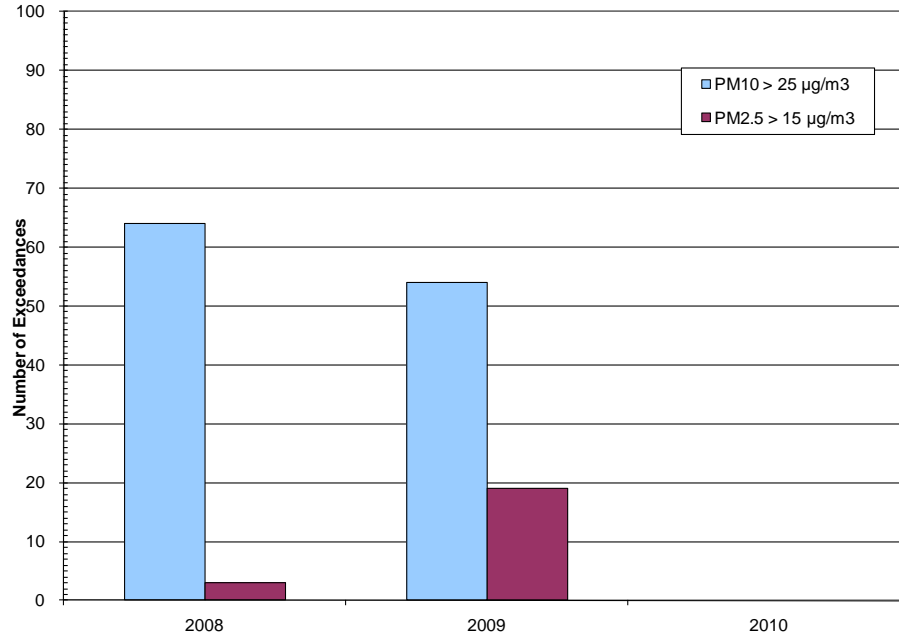


Figure 6: Number of 24-hour periods per year in which the HRL are exceeded over a rolling 24-hour average
 Note: includes only continuous monitor results

Using a midnight to midnight 24-hour or “daily” average, considering all PM monitoring in the airshed, there were (shown in Figure 7):

- (a) 32 exceedances of the PM₁₀ HRL in 2009, a decrease of 11 from 2008
- (b) 12 exceedances of the PM_{2.5} HRL in 2009, an increase of 7 from 2008

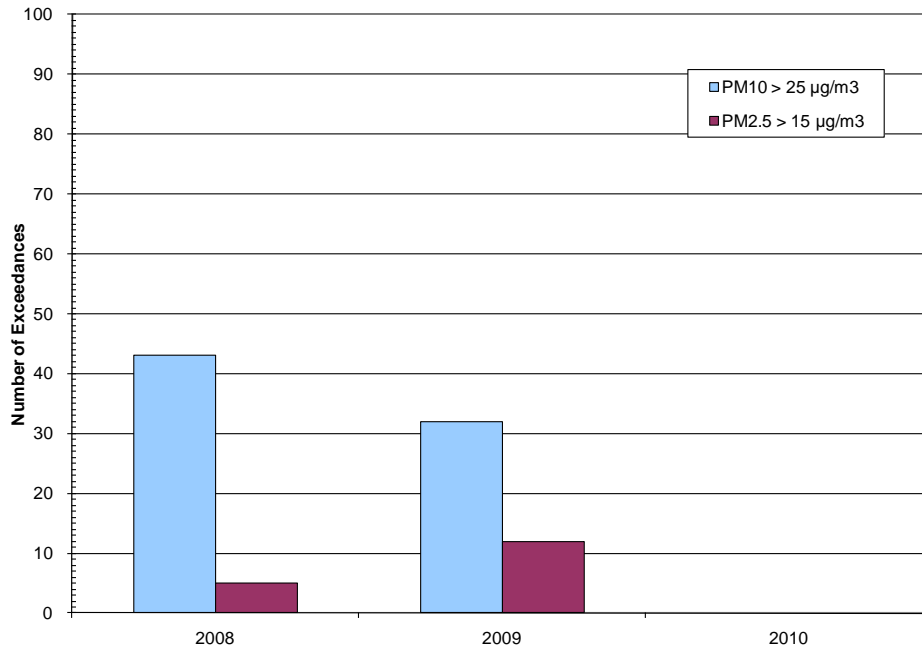


Figure 7: Number of 24-hour periods per year in which the HRL are exceeded over a “daily” average
 Note: includes results from continuous and non-continuous monitors

Economic Impact: AQ-2

Target

Reduction in economic impacts (costs) from baseline year.

What is being measured?

This indicator is not currently measured for this airshed. To report this indicator, a methodology needs to be developed to associate air quality levels with costs for the Howe Sound/Sea-to-Sky airshed. For reference, studies for the Lower Fraser Valley airshed have measured cost impacts for health care, tourism revenue loss and crop damage associated with poor air quality in BC. Results of these studies include:

- Estimated health care savings of \$195 million annually with a 10% improvement in ozone and PM_{2.5} in the Lower Fraser Valley (*Health and Air Quality 2005. Phase 2: Valuation of Health Impacts from Air Quality in the Lower Fraser Valley Airshed*, RWDI).
- Estimated loss of \$9 million in future tourist revenue for a single extremely poor visibility event in the Lower Fraser Valley (*The Impact of Visual Air Quality on Tourism Revenues in Greater Vancouver and the Lower Fraser Valley*, R. McNeill and A. Roberge).
- Estimated loss due to crop / vegetation damage due to poor air quality (*Clean Air Benefits and Costs in the GVRD* by Bovar-Concord and *Review of Costs and Benefits of the Greater Vancouver Regional District (GVRD) Air Quality Management Plan: The Assessment of Injury to Vegetation (Crops and Forests)* by Vic Runeckles).

Why is this indicator important?

Poor air quality may have economic impacts such as reduced work attendance and participation in the labour force, an increase in health care costs, decreases in tourism, and potential impacts on the forest and agricultural industries due to reduced growth rates.

Status

This indicator will not be reported for 2009, as a methodology has not yet been developed to quantify the cost impacts associated with measured air pollutant levels in this airshed.

Greenhouse Gases (GHGs): AQ-3

Target

Decreasing trend from baseline year (2007).

Trend

Data is currently only available for the baseline year (2007). The data is expected to be reported for 2010, then every second year after that. The trend will be discussed in future reports when more data is available.

What is being measured?

The primary sources of greenhouse gas emissions are from burning fossil fuels for transportation, heating, cooling and using power in our buildings, and from the solid waste that is disposed of in our landfills. This indicator measures greenhouse gas emissions from each of these sources for the airshed as well as total per capita greenhouse emissions for each municipality in the airshed.

The greenhouse gas emissions indicator was calculated using data from the MoE's 2007 Community Energy and Emissions Inventory (CEEI). This is the baseline year for this data, and the data reported are based on the revised methodology and data released in September 2010¹². Note that draft CEEI inventories for 2007 were released in 2009, and these were included in the 2008 Annual Report. The revised CEEI reports have improved in accuracy with respect to geographic boundaries and vehicle kilometre estimates, and the revised data is reported below.

Why is this indicator important?

The United Nations Intergovernmental Panel on Climate Change (IPCC) report in November 2007 draws three key conclusions: that the Earth's climate is changing, that the change is being caused by human activities, and that its effects will worsen if no action is taken. The use of natural gas, gasoline, diesel and other fuels along with landfill gas emissions result in greenhouse gases being emitted to the atmosphere. Monitoring GHG emissions provides a measure of regional energy efficiency and contributions to global climate change. These measures can help us assess our efforts to reduce our emissions by monitoring our greenhouse gas emissions.

What is happening?

In 2007, approximately 316,000 tonnes of GHGs were emitted from community-based activities in the airshed. Estimated on-road transportation emissions were the largest contributors to greenhouse gas emissions in the airshed (60% of the emissions). Emissions from energy used in buildings accounted for 30% and emissions from solid waste decomposition accounted for 10%. This is illustrated in Figure 8.

¹² For details about the CEEI methodology, refer to the "Technical Methods and Guidance Document for 2007 CEEI Reports" at http://www.env.gov.bc.ca/cas/mitigation/ceei/CEEI_TechMethods_Guidance_final.pdf.

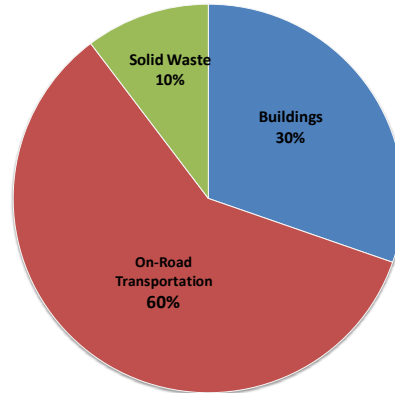


Figure 8: Greenhouse Gas Emissions, by sector (2007)

GHG emissions on a per capita basis are shown in Figure 9. Per capita GHG emissions were higher in Whistler than in other municipalities within the airshed. In Whistler, per capita emissions were almost 12 tonnes of CO₂eq per person. Building emissions account for the majority of Whistler’s emissions (48%). Bowen Island, Lions Bay and the unincorporated areas of the SLRD have the lowest GHG emissions, all emitting approximately 4 tonnes of CO₂eq per person¹³. On-road transportation emissions are the largest source of emissions for each of these areas. Per capita emissions for the entire airshed are 7 tonnes of CO₂eq per person.

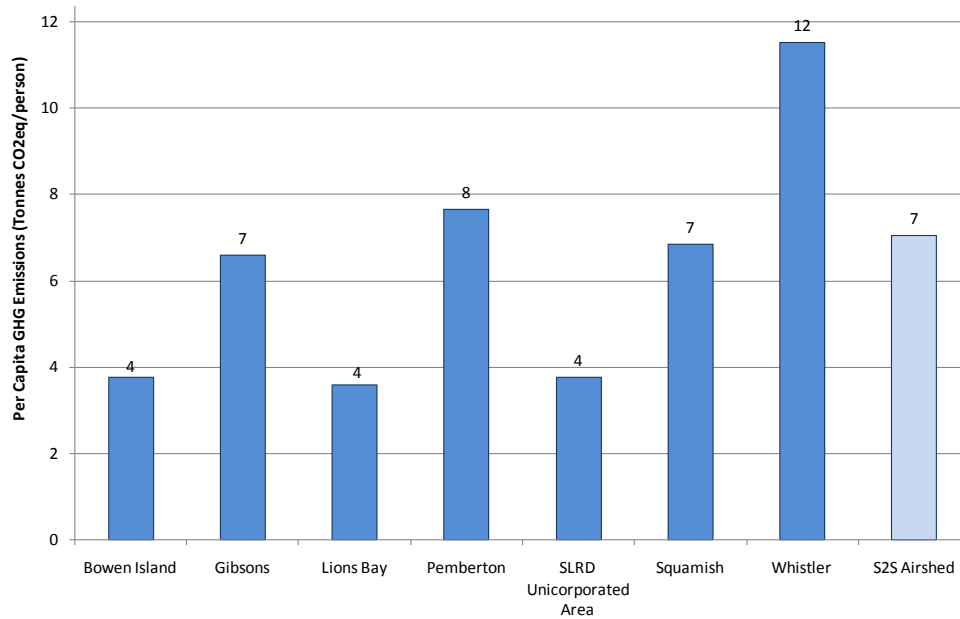


Figure 9: Greenhouse Gas Emissions per Capita in 2007, by municipality

¹³ The lower GHG emissions in these communities may be related to a higher use of wood-fired heating. Although wood-fired heating is considered GHG neutral, other emissions are released (e.g. Fine Particulate Matter) that have a negative impact local air quality.

Visibility: AQ-4

Target

Zero poor visibility events in a year.

Why is this indicator important?

Poor visibility events can impact tourism, recreational activities and public perception.

Status

This indicator will not be reported for 2009 as it is not currently evaluated. However, a visibility camera is installed in Lions Bay to record the quality of visibility on an hourly basis. Figure 10 and Figure 11 show photos taken in 2009 that represent good and poor visibility days taken from the Lions Bay camera.



Figure 10: Lions Bay photo showing high visibility (July 18, 2009, 3:30pm)
Source: Environment Canada



Figure 11: Lions Bay photo showing low visibility (June 6, 2009, 8:50am)
Source: Environment Canada

Odour: AQ-5

Target

- (a) Zero odour complaints per year.
- (b) Zero exceedances of B.C. Odour Index level of 25.

Trend

This is the second year data is being reported, an insufficient number of data points to infer a trend. Future reports will be able to indicate the trend over time.

What is being measured?

This air quality indicator has two components:

- a) The number of odour complaints, as reported by i) Howe Sound Pulp and Paper, and ii) the B.C. Ministry of Environment.
- b) Number of hours per year where Odour Index is above 25. This index is developed by the Ministry of Environment and is based on ambient monitoring station measurements of sulphurous odours.

Why is this indicator important?

Clean, fresh-smelling air is a vital component of the fresh-air experience boasted by the Sea-to-Sky airshed for both its residents and visitors.

What is happening?

- a) Howe Sound Pulp and Paper reported receiving five odour complaints in 2009, which is a slight decrease from the eight complaints received in 2008. The Ministry of Environment recorded zero recorded complaints in 2009.
- b) There were 16 exceedances of the Odour Index in 2009, which is an increase from three exceedances in 2008.

Canada-wide Standards (CWS): AQ-6

Target

Zero exceedances of standards for PM_{2.5} and ground level ozone.

Trend

This is the second year this indicator is being reported. Future reports will be able to indicate the trend over time.

What is being measured?

This indicator measures exceedances of the Canada-wide Standard (CWS) for either particulate matter with a diameter of 2.5 micrometres or smaller (PM_{2.5}) or ground-level ozone (O₃).

According to the CWS:

- a) PM_{2.5} must not exceed 30µg/m³ in a 24-hour period; on the annual 98th percentile value, averaged over 3 consecutive years.
- b) O₃ must not exceed 65ppb based on 8-hour moving averages; on the 4th highest annual ambient measurement, averaged over 3 consecutive years.

Data for this indicator was available from two monitoring stations:

- PM_{2.5} is measured at a monitoring station in Whistler, and
- O₃ (ground-level ozone) is measured at monitoring stations in Whistler and Squamish.

Why is this indicator important?

Air pollution has been shown to have detrimental effects on human health – particularly to at risk persons such as those with respiratory and cardiovascular ailments, children and the elderly. The CWS standard has set thresholds for particulate matter and ground-level ozone because they are the pollutants of most concern from a human health perspective:

- Particulate matter can impair respiratory function. Natural processes contribute to increases in particulate matter (e.g., forest fires, volcanic ash and dust storms), but a particular concern arises from combustion-based particulate which is composed of extremely small particles that can travel deep into the lungs.
- Ground-level ozone (i.e. smog) can cause decreased lung function and inflammation in the lungs. Some at risk people may experience difficulty breathing. Smog is formed when NO_x and VOCs react in the atmosphere in the presence of sunlight. Concentrations are typically higher in the summer.

Monitoring long-term ambient air quality levels, especially ground-level ozone and particulate matter concentrations, helps to evaluate the overall exposure of the population to contaminants.

What is happening?

- a) PM_{2.5} – No exceedances. The 3-year average for 2009 at the Whistler station was 16.8 µg/m³, an increase of 70% from the 3-year average calculated for 2008 as shown in Figure 12.
- b) Ground-level ozone – No exceedances. The 3-year averages for 2009 were 49.8 ppb at the Squamish station and 54.9 ppb at the Whistler station, very similar to 2008 levels as shown in Figure 13.

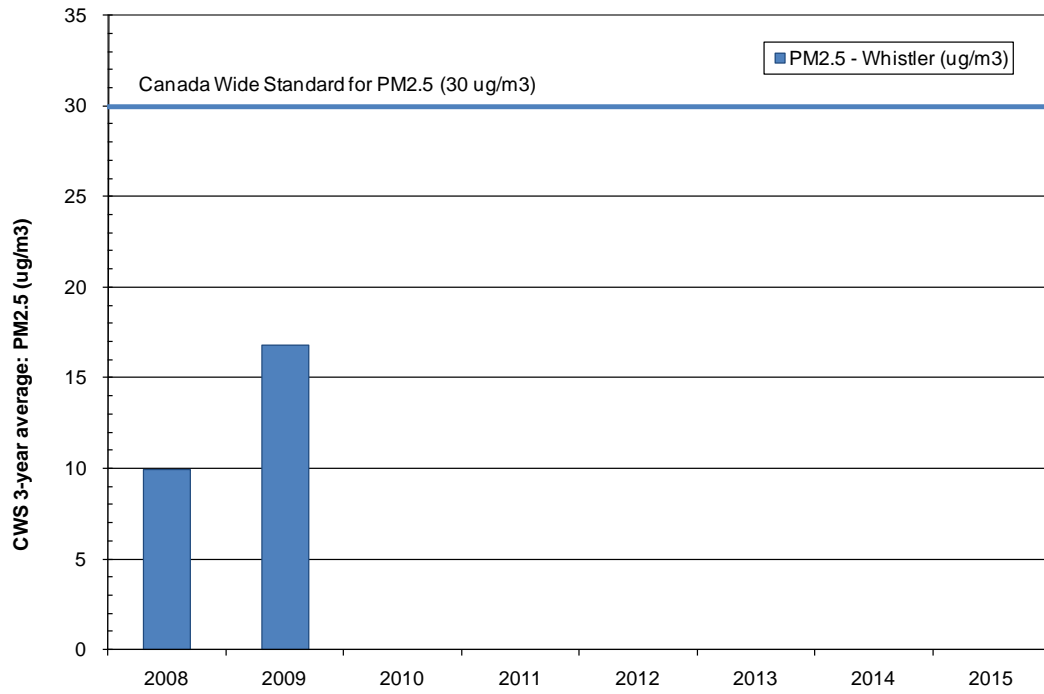


Figure 12: PM2.5 levels from Canada Wide Standard (CWS) calculations

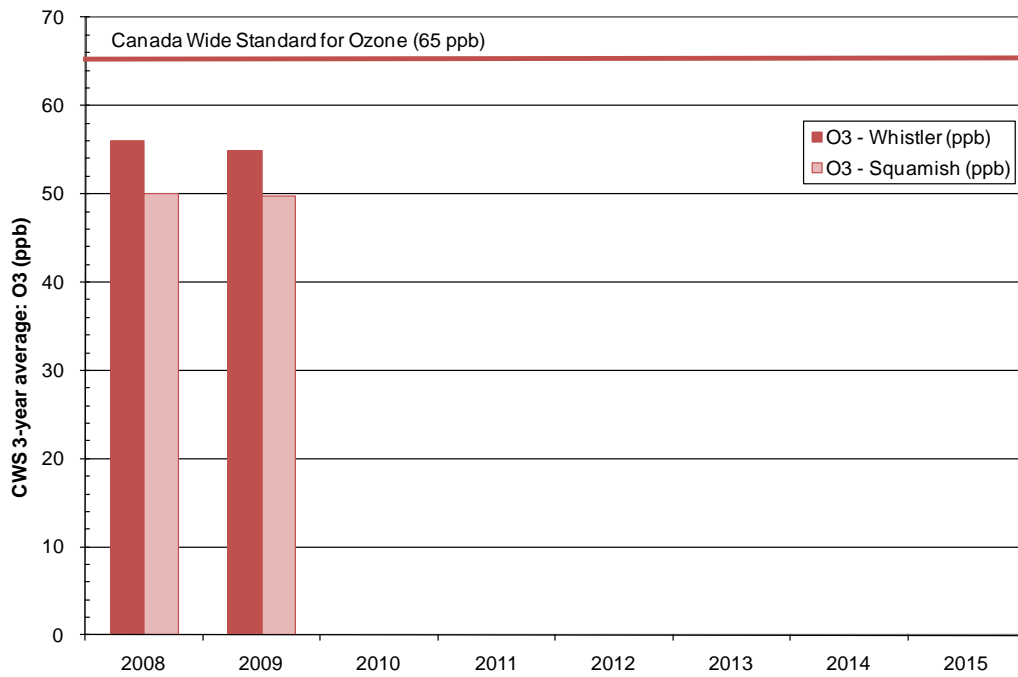


Figure 13: O3 levels from Canada Wide Standard (CWS) calculations

Air Quality Index (AQI): AQ-7

Target

Zero hours per year during which the AQI exceeds 50.

Trend

Trends emerge after several years of data collection. This is the second year data is being reported; therefore it is too early to infer a trend. Future reports will be able to indicate the trend over time.

What is being measured?

The AQI describes both the measured air quality and the publicly perceived air quality at any given time.¹⁴ The AQI values are sorted into 4 categories, Good, Fair, Poor and Very Poor, where:

- 0 to 25 is GOOD,
- 26 to 50 is FAIR,
- 51 to 100 is POOR, and
- 100+ is VERY POOR.

The AQI reaches 50 when the concentration of at least one air contaminant exceeds its ambient objective. There are objectives for particulate matter (PM₁₀ and PM_{2.5}), ground-level ozone, nitrogen dioxide and sulphur dioxide. An air quality advisory is issued when the AQI exceeds 50. This indicator measures the number of hours per year in a community where the AQI is greater than 50.

Why is this indicator important?

The main purpose of the AQI is to inform the public, on a daily basis, about the current state of air quality. It enables the public to draw comparisons between the measured air quality and what they directly sense. At risk people and other concerned residents can use this information to modify their behaviour as necessary. For example, in a situation where the AQI is high (above 50) those with respiratory problems may choose to refrain from strenuous exercise or temporarily avoid the polluted region. The AQI is useful in analysing short-term air quality episodes.

What is happening?

In 2009, the AQI exceeded 50 (a rating of POOR) for 3 hours at the monitoring station in Squamish, and for 49 hours in Whistler. For comparison, in 2008 there were no occasions on which the AQI was POOR. Two air quality advisories were issued in the airshed in 2009: one due to smog (ground level ozone) and one due to smoke from wildfires (particulate matter).

¹⁴ The Ministry of Environment has recently started using a new a new air quality measure called the Air Quality Health Index. The Air Quality Health Index (AQHI) is a new public information tool developed by Health Canada and Environment Canada, in collaboration with the provinces and key health and environment stakeholders. The AQHI is not being reported in this report because Whistler is currently the only location with AQHI reporting in the Sea-to-Sky/Howe Sound airshed.

Continuous Improvement: AQ-8

Target

Decreasing trend from baseline year (2005).

Trend

Trends emerge after several years of data collection. Currently, data is reported for 2005, 2008 and 2009. It is therefore too early to infer a trend. Future reports will be able to indicate the trend over time.

What is being measured?

Continuous Improvement measures the continual incremental reductions in both the higher and the everyday concentrations of ground-level ozone, PM_{2.5}, PM₁₀ and NO₂ over the long term. The continuous improvement indicator measures the 3-year annual average (in µg/ m³) of four different air contaminants:

- 1) 8-hour maximum daily level for O₃
- 2) Annual 24-hour average level for PM₁₀
- 3) Annual 24-hour average level for PM_{2.5}
- 4) 8-hour maximum daily level for NO₂

There are three monitoring stations in the airshed that collect the air quality data, however each station does not measure all the contaminants:

- O₃ is measured at the Squamish and Whistler monitoring stations,
- PM₁₀ is measured at the Squamish and Langdale stations,
- PM_{2.5} is measured at the Whistler station, and
- NO₂ is measured at all three stations.

The 3-year annual average uses the baseline year of 2005 to calculate the continuous improvement of the above air contaminants, however, not all parameters were available at each station for 2005. Where a 3-year average could not be calculated for 2005, the first year for which a 3-year value could be calculated is shown.¹⁵

Why is this indicator important?

Most measures used for air quality describe whether pollutant levels are high over short periods of time. These measures are important because high pollution levels over short periods of time, even less than a day, can result in adverse health effects. It is also important to track long term trends of air quality in the region since long term exposure may also affect health. Long term trends are also important to determine how effectively air quality is being managed in the airshed, and can provide direction for future AQMP activities.

¹⁵ Using the CWS calculation methodology, a 2-year average is permitted when 3 years of valid data is not available. It is noted when this alternative average has been used.

What is happening?

There are only three data points currently available for each contaminant, making it difficult to identify a clear trend (see Figure 14). However, increases were measured at the Whistler station for NO₂ (40% increase relative to 2007) and PM_{2.5} (60% increase relative to 2006). The increase in particulate matter is primarily attributed to high quantities of smoke from wildfires in the airshed during the summer of 2009.

Decreases were measured at the Squamish station for Ozone (11% decrease relative to 2005) and NO₂ (7% decrease relative to 2007). Decreases were also measured at the Langdale station for NO₂ (14% decrease relative to 2004) and PM₁₀ (5% decrease relative to 2005). Other contaminants measured showed minimal change.

Longer-term data is required to identify clear trends in each measured contaminant.

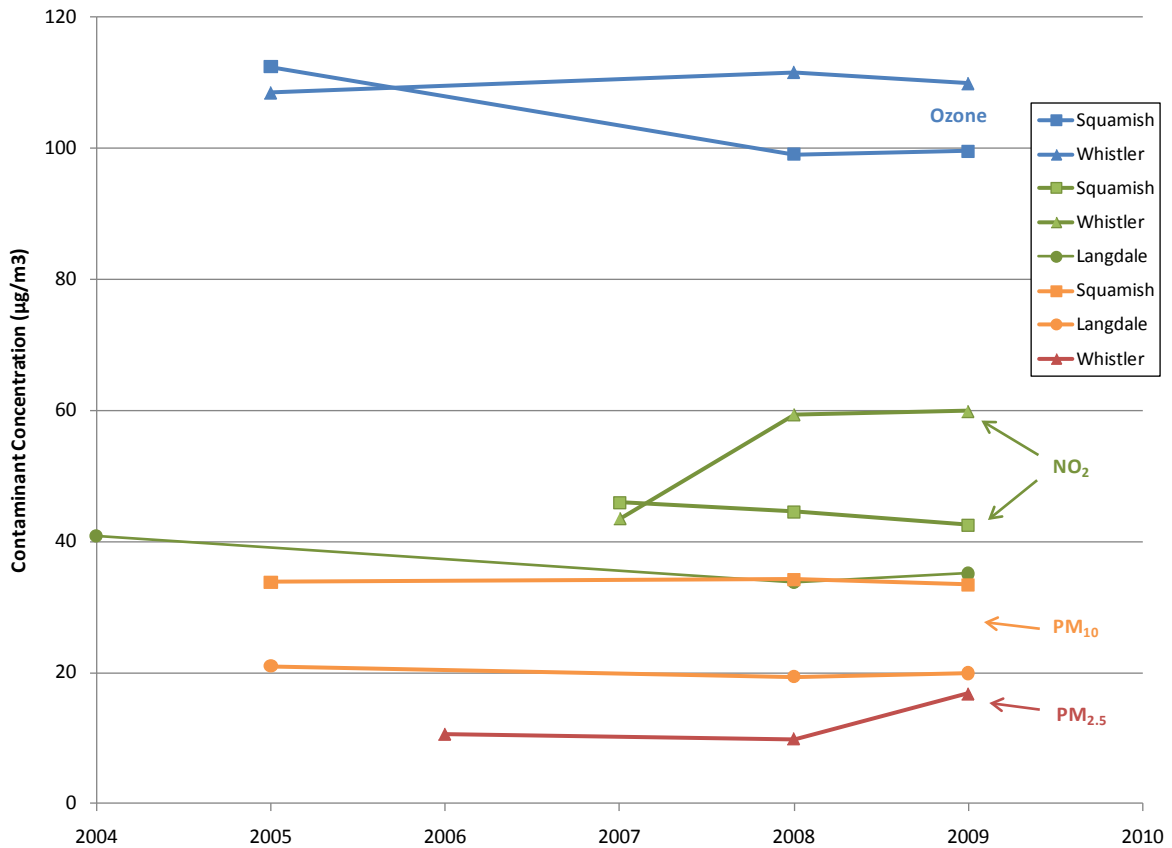


Figure 14: Continuous Improvement trends for 3-year average concentrations of Ground-level ozone, NO₂, PM₁₀ and PM_{2.5}

4.3. Performance Measures

As part of the monitoring and reporting process, four performance measures have been developed to enable the tracking of actions that are being implemented across the region.

Performance monitoring is different from the indicators and targets outlined in the AQMP. The indicators in the AQMP will be used to evaluate the progress towards or away from the air quality goals whereas the performance measures allow us to evaluate progress on plan implementation.

Table 3: Performance Measures (PFM)

	Performance Measure	Units	Rationale	Targets
1	Plan Progress Number of actions completed	# of actions; percent complete	Indicator of plan progress to date	Not applicable
2	Plan Progress Number of actions in progress	# of actions	Indicator of progression of plan	5 per year
3	AQCC Involvement Percentage of AQCC members participating in meetings (average of yearly meetings)	%	Indicator of level of engagement among core AQCC members	80%
4	Website Usage Number of website visitors annually	Number of visits; annual percent increase	Measure of website use and usefulness of information	5% annual increase in visitors

Plan Progress – Number of actions completed: PFM-1

What is being measured?

This indicator tracks the total number of actions from the AQMP that are considered complete for the airshed as a whole.

Why is this measure important?

Tracking the completed actions provides an indication of progress in implementing the AQMP. There is no target for this indicator.

What is happening?

Implementation of the AQMP started in 2008 and several actions were initiated (see indicator PFM-2) during the first two years. It is too early in the implementation process to have completed any actions.

Plan Progress – Number of actions in progress: PFM-2

Target

Five actions in progress per year.

What is being measured?

This performance measure reports on the number of actions that are in progress. Actions that are in progress typically have a clear champion leading them at the airshed or regional scale, and have been identified by the AQCC as a priority to implement.

Why is this measure important?

This measure identifies how many AQMP actions are being undertaken. This will help the AQCC determine whether the approach to implementation and structure of the organization is effective in carrying out the identified actions.

What is happening?

Fourteen high priority actions were identified to begin in the first year of implementation. Five of these are considered “actions in progress”, including:

- Action #1: Integrate Transit Systems
- Action #3: Promote opportunities to access public transportation & other transportation alternatives
- Action #4: Reduce vehicle idling through education & bylaws
- Action #8: Develop airshed-wide smoke control strategy
- Action #14: Share successes and information via the Sea-to-Sky Air Quality website

There are also a number of ongoing community initiatives that relate to other actions in the plan, however, these do not have a clear champion on the AQCC and are not being implemented at a regional scale. All of the high priority actions have some related community initiatives taking place, and in some cases all communities have related initiatives underway (see the list in Appendix B).

AQCC Involvement - Percentage of AQCC members participating in meetings: PFM-3

Target

80% of AQCC members participating in meetings.

What is being measured?

This performance measure indicates the level of involvement of the AQCC members in the implementation process. It measures the percentage of AQCC members that participate in AQCC meetings on an annual basis. Participation in meetings is defined by having had at least one representative of the organization attend (this individual may be staff, council, or other) an AQCC meeting. The measure is split into two categories: funding members of the AQCC and other members.

Why is this measure important?

This measure provides an indication of the level of involvement of identified stakeholders in the process.

What is happening?

For 2009, 80% of funding members were represented at all three meetings held throughout the year, and 100% of funding members participated in at least one of the three meetings. This shows a high level of commitment to the process. Some municipalities have very limited resources, and travel to meetings is time consuming, particularly if traveling by ferry.

For 2009, 50% of other (non-funding) members participated in at least one of the three meetings held throughout the year. Although several of the members that originally participated in the development of the AQMP have not been attending meetings, there are new stakeholders starting to get engaged as implementation progresses. It is anticipated that there will be more involvement of other stakeholders as partners in implementing actions. This may be reflected in involvement at AQCC meetings, or perhaps in working group meetings and other correspondence. Table 4 shows the non-funding members that attended at least one meeting, and the non-funding members that were invited but were not available to attend any meetings.

Table 4: Involvement of non-funding AQCC members at meetings in 2009

Attended at least one AQCC meeting	Invited but did not attend any AQCC meetings
Squamish First Nation	Sunshine Coast Regional District
Lil'wat First Nation	BC Transit
Metro Vancouver	B.C. Ministry of Transportation
District of West Vancouver	Howe Sound Pulp & Paper
BC Ferries	Terasen Gas
Vancouver Coastal Health-Coast Garibaldi Health Services	Squamish/Whistler Transit
VANOC	Translink
Squamish River Watersheds Society	Smart Growth BC
Squamish Environmental Conservation Society (SECS)	

Website Usage – Number of website visitors annually: PFM-4

Target

5% increase in visitors annually.

What is being measured?

The number of hits to the Sea-to-Sky air quality website (www.seatoskyairquality.ca) on an annual basis.

Why is this measure important?

This measure allows the AQCC to determine if the website is being well-used, either by the public for educational purposes, or by AQCC members to exchange information.

What is happening?

Visits to the website were not being tracked in 2009 or the beginning of 2010. The visits are now being tracked and will be reported starting in 2011.

5 Next Steps

5.1. 2010: Third Year of Implementation

The third year of implementation will be a transition for the AQCC with the hiring of a locally-based coordinator, and with taking the initial steps towards setting up a non-profit organization for continued implementation of the AQMP. The AQCC expects to meet twice in 2010 after hiring the local coordinator. The Terms of Reference that were developed for the committee in 2009 to clarify the roles, responsibilities and activities of the AQCC members will continue to describe the committee's operation until a non-profit organization is formed.

5.2. Annual Reporting

An annual report will continue to be produced to track changes in the identified context indicators, air quality indicators, and implementation performance measures.

5.3. Five-Year AQMP Update Report

The five-year report will provide a summary of past years and include a review of the actions completed, in progress and outstanding. The review of actions will provide the AQCC with an opportunity to revise actions or add new ones in order to achieve the vision and goals of the AQMP by 2025. The first five-year report is scheduled for 2013.

An outline of the five-year AQMP update report is provided here. Note that a template for this report has not been developed as it is anticipated that changes may be made over the next five years. The proposed outline is as follows.

State of the Sea-to-Sky Airshed: Five Year AQMP Update Report outline:

1. Introduction – background, about the AQCC and process to date
2. Where are we now?
 - a. Indicator results and progress towards targets
 - b. Review of Actions
 - i. Completed
 - ii. In Progress
3. Where are we headed?
 - a. Current and future airshed context (e.g. increased traffic, more future development, etc)
 - b. Proposed New Actions (if necessary)
4. Next steps
 - a. Results
 - b. Recommendations

6 Conclusions

This report focused on two aspects of the implementation of the Sea-to-Sky/Howe Sound airshed AQMP:

- a) the implementation process for the 2009 calendar year, and
- b) the quality of the air in the airshed throughout 2009.

The implementation of the AQMP began in spring of 2008 with the development of an implementation framework document. Through the first two years of implementation, several actions have been initiated and coordinated at an airshed scale. These activities are expected to continue through 2010 and are towards improved air quality in the airshed. In addition to the airshed-wide actions, each community in the airshed has several initiatives underway at the local level that address actions identified in the AQMP. The AQCC has continued to work effectively together to keep air quality concerns integrated into local government planning and priorities. It is currently too early in the process to determine how successful implementation activities have been in protecting air quality and addressing identified air quality issues in the airshed.

Trends in the quality of the air in the airshed are difficult to determine at this stage, given that 2009 is only the second year of reporting data. However, there are indications that:

- PM_{2.5} levels worsened in 2009 (measured in Whistler),
- PM₁₀ levels have improved slightly (measured in Squamish and Langdale),
- NO₂ levels have improved slightly in Squamish but worsened in Whistler,
- Ozone levels have improved in Squamish but not changed in Whistler, and
- Odour worsened in 2009.

Note that the most significant reductions in air quality were measured at Whistler, for NO₂ in 2008 and for NO₂, ozone and PM_{2.5} in 2009. There were also two Air Quality Advisories issued for the area due to POOR air quality ratings. While the number of Air Quality Advisories is still very small, the planned development within the airshed warrants continued vigilance in taking action to protect or improve air quality throughout the airshed.

Appendix A: AQCC Terms of Reference

Appendix B: Community Initiatives

The following table outlines the air quality and energy initiatives occurring in communities in the airshed as they relate to actions in the AQMP. Note that actions shaded in gray are considered “Mid-term” and “Longer-term” actions that are not expected to begin implementation until 2009 and beyond. The “Gaps” column lists activities that were identified in the AQMP implementation plan that are not currently being addressed.

	Action	Realm	Related Initiatives	Gaps
1	Integrate Transit Systems	Regional	<ul style="list-style-type: none"> Transportation Working Group began formation Squamish completed a Transportation Study to identify options for establishing a commuter service between Squamish and Metro Vancouver Lions Bay working to create a transit connection to Squamish Lions Bay formed a Transportation sub-group as part of Climate Action Task Force SLRD received a \$1million grant for transit initiatives in the region Pemberton in discussion with Whistler about extending Squamish-Whistler bus north 	<ul style="list-style-type: none"> Evaluate feasibility of direct link from YVR to Whistler (Note: study completed for Squamish to Metro Vancouver) Evaluate feasibility of integrating Bowen Island, Horseshoe Bay, and SCR D Transit (Note: initial discussions are occurring)
2	Lobby transit providers to reduce emissions from transit vehicles	Local	<ul style="list-style-type: none"> Whistler obtained a fleet of 20 hydrogen buses Bowen Island trying to increase efficiency of transit services – though challenging 	<ul style="list-style-type: none"> Review existing pilot programs re: hydrogen fleet and other emission reduction programs
		Regional		
3	Promote opportunities for resident and visitor access to public transportation & other transportation alternatives	Local	<ul style="list-style-type: none"> Squamish completed a Transportation Study to identify options for establishing a commuter service between Squamish and Metro Vancouver (as above) Lions Bay worked with Translink to increase transit frequency and to add a pick-up in town (not just at highway) Full trail way being completed with highway expansion (Squamish) Valley trail system from Function Junction to the village (Whistler) Biggest footprint is commuter travel to Whistler. Looking at ways to decrease this through transit link and increasing business opportunities locally. (Pemberton) Traffic calming master plan(Gibsons) Harbour master plan: walkway connecting water to village (Gibsons) 	<ul style="list-style-type: none"> Actively promote transportation alternatives and use events as public education tools (e.g. Car Free Day, Canadian Environment Week, Bike to Work Week, Clean Air Day)
4	Reduce vehicle idling through education & bylaws	Local	<ul style="list-style-type: none"> Launching an education program at location of idle-free signs: educating businesses with signs nearby to encourage / educate people not to idle. (Whistler) Also working with Whistler Secondary School to educate parents not to idle. (Whistler) Conducting a campaign at idling hotspots to educate around idling and to measure behaviour change over time. (Whistler) Recently introduced a by-law to allow use of ZEVs. (Gibsons) 	

	Action	Realm	Related Initiatives	Gaps
			<ul style="list-style-type: none"> • Anti-idling bylaw. (Pemberton) • Anti idling policy – hoping to turn into a by-law (Squamish) • Anti idling bylaw being discussed (Lions Bay) • Updating bylaw for idling to 1 min from 3 min after Olympics (Whistler) • Hiring anti-idling coordination for January (2010) – giving rewards for those not idling (Whistler) • Taxi idling reduction campaign to keep drivers warm (e.g. providing blankets) (Whistler) • \$844 in idling tickets collected - train bylaw officers (Whistler) • Anti-Idling campaign on ferries and new signs going up in terminals (BC Ferries) 	
5	Promote use of best available technology and practices for construction and related equipment	Local +		<ul style="list-style-type: none"> • Share VANOC's air quality specifications for construction to ensure continuity throughout the airshed • Seek partners (e.g. Metro Van) to lobby federal government for tighter emission standards. Bring action to HSCF.
6	<i>Investigate the impact of off-road vehicle emissions</i>		<ul style="list-style-type: none"> • <i>Replaced generators with Diesel Oxidation Catalysts (DOCs) – will reduce emissions up to 90%. (Whistler)</i> • <i>Replaced gas weed eaters with electric. Switched to propane weed eaters (electric didn't work out) (Whistler)</i> • <i>Diesel emission reduction program implemented in collaboration with Marine Group, air-care program and rail. (MetroVancouver)</i> • <i>Rail emissions reduction initiatives. (MetroVancouver)</i> • <i>Optimizing fuel economy of ship operation (BC Ferries)</i> 	
7	Promote improvement of vehicle emissions performance	Local +	<ul style="list-style-type: none"> • Fleet is undergoing a fleet review and conducted workshop for staff on good driving practices. Also invited fire, ambulance and fleet personnel and taxi drivers. (Whistler) • Looking to develop a Metro Vancouver anti-idling fleet policy – will unveil a fleet education program. (MetroVancouver) • Doing E3 Fleet rating E.g. find when to replace vehicles, Fleet optimization (Whistler) • Green Fleet Purchasing Policy. Replacing fleet (Squamish) • Fleet vehicle anti-idling policy (BC Ferries) • Switching vessels to plug-in at harbours overnight (currently run the ships all night to keep at dock) (BC Ferries) • Purchased 1st hybrid (Ford) for fleet (Gibsons) • Electric vehicle bylaw: hoping to take to Council by January (Squamish) 	<ul style="list-style-type: none"> • Compile a list of municipal and corporate vehicle emission best practices and programs most relevant to S2S airshed • Replace/retrofit fleet vehicles to reduce emissions (+ fleet smart training) • Petition Air Care On Road Program to do spot checks of heavy-duty vehicles on Sea-to-Sky highway

	Action	Realm	Related Initiatives	Gaps
8	Develop airshed-wide Smoke Control Strategy	Local	<ul style="list-style-type: none"> Looking into wood-stove exchange. (Pemberton) Interested in participating in woodstove exchange with MV (Lions Bay) Looking to control/reduce fires while balancing cultural values/requirements (Lil'Wat Nation). Looking into smoke control and how to efficiently dispose of wood waste (Bowen Island) MOE approved funding for Bowen Island to support alternative burning and wood disposal initiatives. (MOE) Defacto cessation of open burning (air curtain incinerator not operating) – do get annual permit for good burning days (Bowen Island) Burning: No longer issue any permits for backyard burning. People can drop off at bins during certain times – reduce trips to transport (Whistler) Banned backyard burning of yard waste; had problems with this failure in spring but have revised the program to feed local composter and expecting better results (Whistler) Green waste collection and disposal in Lions Bay – still adjusting to program (new trucking emissions, way more waste than anticipated, etc) Looking into program for managing garden waste and composting. (Pemberton) Changes to waste policies – reduced garbage pick-up; no more open burning (Squamish) 	
		Regional	<ul style="list-style-type: none"> Researched and wrote a paper about alternatives to burning – includes list of all bylaws, disposal and composting facilities in the corridor. Distributed draft to meeting attendees (not to be circulated further). (MOE) Wood-stove exchange program – have funding but been delayed because looking into a regulatory approach – details yet to be announced. (Metro Vancouver) Wood smoke reduction program. Implementing Woodstove Exchange program this fall. Considering Regulatory measures (e.g. ban on fireplaces) Metro Vancouver Working with MoFR to look at reducing air quality impacts from forestry related burning (MOE) Launched woodstove exchange program & Burn it Smart workshop with WET BC (Metro Vancouver) TFL 28 acquired from Interfor: 219,000 Ha of land. Reduced AAC from ~210,000 to ~160,000. Also working to reduce/eliminate burning. (Squamish Nation) 	<ul style="list-style-type: none"> Develop a formalized regional smoke control strategy (specify open burning management zones, tools, wood stove emissions management program) Educate AQCC & stakeholders about alternatives to open burning – presentations and consultation with regional stakeholders
9	Assist in the development of GHG emission reduction targets and plans		<ul style="list-style-type: none"> All municipalities and regional districts in the airshed signed the Climate Action Charter (CAC) and are aiming to be carbon neutral in operations by 2012 Completed a corporate GHG inventory and defined goals. (Gibsons) Tree planting and trails program (Pemberton) The SLRD Board approved a corporate energy and climate change action plan which 	[note – currently identified as longer-term action]

	Action	Realm	Related Initiatives	Gaps
			<p><i>will include energy audits and an oil vulnerability study/audit at the regional scale</i></p> <ul style="list-style-type: none"> • <i>Identifying energy vulnerabilities in corridor (SLRD)</i> • <i>Currently developing a Community Energy Action Plan: focus on reducing energy consumption in buildings – available in Fall (Squamish)</i> • <i>Developing GHG management plan (MetroVancouver)</i> • <i>Bowen recognized as a PowerSmart leader – BC Hydro hosted seminars on the island.</i> 	
10	Ensure power generation in the airshed supports the AQMP goals	Local	<ul style="list-style-type: none"> • Squamish Nation turned down several IPP requests due to concerns over location and impact on fish habitat. Have recently finished one IPP where the powerhouse is upstream of fish habitat. 5,000m of habitat compensation has led to 60,000m of connected habitat reach – has resulted in large increase in fish spawning (pinks) (Cheakamus, Upper Squamish area) • Bought some land and turned over to Land Conservancy Trust (rather than IPP where not appropriate) • IPP being initiated (Whistler) 	<ul style="list-style-type: none"> • Keep informed of local issues regarding power generation and upcoming potential projects
		Regional		<ul style="list-style-type: none"> • Consider developing a position or policy on preferred types of power generation • Maintain open dialogue (with BC Hydro, IPPs)
11	Work with the local pulp and paper industry to identify opportunities to reduce lifecycle emissions	Regional		<ul style="list-style-type: none"> • Continue efforts to decrease emissions from HSPP operations • HSPP: participate in AQCC meetings and provide regular progress reports
12	<i>Expand current community-based air quality initiatives within the airshed</i>		<ul style="list-style-type: none"> • <i>Squamish CAN non-profit: working to increase transit ridership, ongoing events</i> • <i>Hiring anti-idling coordination for January (2010) – giving rewards for those not idling (Whistler)</i> 	
13	Promote use of alternative energy sources and systems	Local	<ul style="list-style-type: none"> • Looking into creating a methane recovery system – innovative at this scale. (Gibsons) • Whistler is now a solar community. • New private greenhouses being built that will be heated by waste heat. New source of local food. Mass scale production. (Whistler) • Developing Neighbourhood Energy Utility (Squamish) • Geothermal heating system + solar in sports complex (Whistler) • Set up a Geothermal Energy Corporation – Fully funded by municipality, but evolving into a separate corporation. Options open to other energy sources – IPP; wind etc. (Gibsons) 	<ul style="list-style-type: none"> • Seek education opportunities for residents / businesses about alternative energy systems
		Regional / Committee		<ul style="list-style-type: none"> • Circulate relevant information and invite guest speakers to AQCC meetings re: alternative energy systems • Create a S2S airshed strategic plan for independent power producers

	Action	Realm	Related Initiatives	Gaps
14	Share successes and information via the Sea-to-Sky Air Quality Website	Committee	<ul style="list-style-type: none"> MOE worked to update some website content 	
15	Implement an airshed-wide public outreach and education campaign	Local	<ul style="list-style-type: none"> Held a green energy session to educate councillors and community. (Lions Bay) Started a Green Energy Task Force to investigate alternative energy options. (Lions Bay) Hired a summer student to engage people in Whistler face-to-face on 4 topics; one is idling reduction. Approach is to get commitments from people on the spot. Research indicates much better uptake with this approach. Will be going to schools to seek commitments from parents (Whistler) Organized Bike to Work Week (Squamish) UBCM CEA award for innovation for geothermal energy in greenfield housing development coming up. Brought to project to LivCom and received GOLD award for Best Livable Community (<20,000 population) and award for Best Planning for Future (all cities) (Gibsons) 	<ul style="list-style-type: none"> Promote energy saving devices at community events
		Regional	<ul style="list-style-type: none"> Sent out 1 Sea-to-Sky Air Quality E-Newsletter Developing a visibility campaign which will include a website with visibility pictures. (Metro Vancouver) Created a visibility survey on perceptions of visibility. (MOE) Clean Air Day – organized several activities (Metro Vancouver) 2nd hand smoke Bylaw – Ban on public smoking through whole coastal region for 2010 (Coastal Health) Visibility website for Lower Fraser Valley to be launched in June 2010 – add Lions Bay Camera (Metro Vancouver) Air Quality, Land Use, and Transportation Workshop held with Fraser Basin Council in late October - 130 people; FBC has posted PowerPoint presentations on website at www.fraserbasin.bc.ca/events/Land_use_workshop_2009.html (Metro Vancouver) Anti-Idling campaign on ferries and new signs going up in terminals (BC Ferries) 	<ul style="list-style-type: none"> Use S2S website as a tool to share information in the campaign Develop a cross-airshed community challenge Develop S2S specific education materials

	Action	Realm	Related Initiatives	Gaps
16	Coordinate air quality initiatives with other organizations	Regional	<ul style="list-style-type: none"> • Invited two non-profit organizations to participate in meetings – potential for partnering to implement future activities • VANOC attended AQCC meetings; VANOC interested in determining how to transfer lessons learned / “leverage” to AQCC • MoE representative maintained connections with other provincial staff working on airshed planning through Clean Air communications and the Clean Air Forums. • Request to conduct joint meeting between Metro Energy and Environment Committee and the AQCC to discuss airshed interfacing between the regions. • Negotiations on behalf on the Coast Salish on a Puget Sound/Georgia Basin Airshed Action Plan led to a signed agreement (January 2009). Agreement is entitled “Joint Statement of Cooperation on the Georgia Basin and Puget Sound Ecosystem; 2008-2010 Action Plan; Initiatives for the Salish Sea”. (Squamish Nation) • September 12-16, 2010: International Union of Air Protection and World Clean Air Congress to hold a conference for sharing lessons with the developing world (Metro Vancouver) • Encouraging BC Ferries to allow electric vehicles through vehicle line (Bowen Island) 	<ul style="list-style-type: none"> • Participate in other organizations’ air quality programs • Provide resources to complementary initiatives that promote AQMP goals
17	Develop business cases for air quality actions	Committee	<ul style="list-style-type: none"> • Initial discussions held at AQCC meeting – no action yet. 	<ul style="list-style-type: none"> • List actions that need business cases developed and develop each case through working groups of 2 to 3 AQCC members • Provide staff or funding to develop specific business cases
18	<i>Incorporate the AQMP vision into other planning processes</i>		<ul style="list-style-type: none"> • <i>OCP review will include language on climate change and will likely include air quality too. (Bowen Island)</i> • <i>OCP update will include Climate Change mandates. (Pemberton)</i> • <i>OCP will be adopted in the fall and will have targets and commitments for GHGs. (Squamish)</i> • <i>OCP Update to included GHG targets (Gibsons)</i> 	

Appendix C: Indicator Meta Data

Meta data for all indicators is included with the final report in electronic format.

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