Report of the AirCare Review Committee
July, 2010

Evaluation of the Costs and Benefits of Continuing the AirCare Vehicle Emissions Inspection and Maintenance Program Beyond 2011

Glen Okrainetz (MHL&S), (Chair)
Roger Quan, Ali Ergudenler, Derek Jennejohn (Metro Vancouver)
Bob Smith (FVRD)
Mark Francis (ICBC)
Richard Holt (Environment Canada)
David Gourley, Stephen Stewart (AirCare Program)
Brian Mills, Maria Su (TransLink)

Table of Contents

Introduction

In order to keep pace with changes in vehicle technology and to remain effective and relevant, the AirCare program has been reviewed and updated at intervals over its 18-year history. At the conclusion of the last review in 2005, the Solicitor General called for another review prior to any extension of the program beyond December 31, 2011. In response to this direction, an AirCare Review Committee (ARC) was established, chaired by Glen Okrainetz of the Ministry of Healthy Living and Sport, and consisting of members from TransLink, Metro Vancouver, Fraser Valley Regional District, ICBC, and Environment Canada. Under the direction of the ARC, a qualified consultant was engaged and a study performed, the results of which are summarized in this report. The committee has thoroughly reviewed the work of the consultant and is satisfied that the analysis and conclusions in the final report are both sound and supportable. The ARC therefore supports the recommendation to proceed with the development of specifications for a renewed AirCare program after 2011 for reasons specified in detail in the Recommendations portion of this report.

AirCare History

The AirCare program is a vehicle emissions inspection and maintenance (I/M) program administered by the South Coast British Columbia Transportation Authority (TransLink) as required by the *Motor Vehicle Act* and the *South Coast British Columbia Transportation Authority (SCBCTA) Act*. Inspection services are delivered by a private contractor (Envirotest Canada) under terms of a contractual agreement with TransLink. AirCare is a "centralized" type program with 10 inspection facilities in total, two of which are located outside of the SCBCTA service delivery area. Through a letter of Agreement, TransLink operates the Abbotsford and Chilliwack AirCare inspection centres on behalf of the Insurance Corporation of British Columbia (ICBC). ICBC's other responsibilities with respect to the AirCare program include:

- administration and certification of AirCare repair centres and technicians
- notifying vehicle owners of their AirCare eligibility through their Notice to Renew document; and
- denying a license for a motor vehicle if a required AirCare inspection has not been performed.

The program has operated since September 1992. There have been three service contracts issued with terms of seven, seven, and five years, respectively, with the current contract set to expire on December 31, 2011. AirCare is funded entirely through the collection of test fees and is required by legislation to collect no more than the revenue sufficient to recover the full costs of the program.

AirCare inspections are intended to identify light duty vehicles with excess emissions caused by emissions control component failure or lack of maintenance. Correcting these defects reduces the overall release of vehicle-generated pollutants, leading to improved ambient air quality and reduced health risk. Although vehicle manufacturers have made great strides over the years in reducing emissions from new vehicles and making vehicle engines and emission control systems more durable, the probability of an emissions-related defect developing in *any* vehicle increases with age and mileage. The typical lifespan of a vehicle has now grown to approximately 14 years and more than 250,000 km of use, well beyond the durability requirements required by Environment Canada.

Due to its centralized design, advanced test procedures and emphasis on training, monitoring and supporting the local repair industry, AirCare has established a reputation as one of the most effective I/M programs in existence. Previous program reviews and regular operational reports have confirmed the benefits of AirCare-related repairs and the effect of the program in accelerating the retirement of end-of-life vehicles. (see www.aircare.ca/newspubs-reports.php)

AirCare Review Process

The AirCare program is enforced by provincial legislation under Sections 48, 49 and 50 of the *Motor Vehicle Act* and Division 40 of the *Motor Vehicle Act Regulations*. Significant program changes or enhancements must therefore have provincial approval prior to implementation. The Ministry of Public Safety and Solicitor General is responsible for the provincial AirCare legislation, with policy advice concerning the program's effect on ambient air quality and human health coming from the Ministry of Healthy Living and Sport.

At the time of communicating approval of the most recent extension of the AirCare program in 2006, the Solicitor General expressed interest in the province leading a thorough review of the AirCare program prior to any consideration of continuing the program beyond December 31, 2011. Recognizing the length of time needed to coordinate and carry out such a review, the then-CEO of TransLink, Thomas Prendergast, wrote to Dana Hayden, Deputy Minister, Ministry of Public Safety and Solicitor General on April 30, 2009, referencing the government's request and asking him to identify a lead for the review process. The response came back that the Ministry of Healthy Living and Sport would be the responsible agency and that Glen Okrainetz, Director of Air Quality, would be the provincial lead for the review. Subsequently, a multi-stakeholder committee, named the AirCare Review Committee (ARC) and chaired by Mr. Okrainetz, was established on June 23, 2009. Committee members included:

- Ali Ergudenler, Metro Vancouver
- Mark Francis, ICBC
- Dave Gourley, Pacific Vehicle Testing Technologies (administrators of the AirCare program)
- Richard Holt, Environment Canada
- Brian Mills, TransLink
- Glen Okrainetz, Ministry Healthy Living and Sport, (Committee Chair)
- Roger Quan, Metro Vancouver
- Bob Smith, Fraser Valley Regional District

The ARC developed the technical and scientific specifications for the review which was to be conducted by qualified air quality management and vehicle emission testing experts. The resulting Request for Proposals (RFP) was approved by the ARC membership and was issued through TransLink. It sought the following analyses and policy considerations to determine if continuation of the program was supportable:

- the magnitude of emission reductions attainable from a light-duty vehicle I/M program in the 2012-2020 time period
- the health benefits expected from these reductions
- the cost of achieving these reductions
- the monetary value of the health benefits
- the potential to achieve similar or greater emissions reductions from other initiatives
- the goals and objectives of Metro Vancouver's and the Fraser Valley Regional District's Air Quality Management Plans
- the stated goals and policies contained in the BC Air Action Plan, June 2008 and
- the objectives outlined in TransLink's Transport 2040 Plan

Four submissions were received in response to the *Request for Proposal for the AirCare Review – Phase 1*, issued on October 14, 2009. Of the four respondents, the ARC selected the proposal by Sierra Research (Sacramento, California) as the most comprehensive. Sierra's sub-contractor, SENES Consultants Ltd. is a Canadian company with an office in Vancouver. Through their involvement with other projects, the Vancouver-based staff has acquired significant expertise in local air quality modeling and analysis. Selection of the consultant was conducted at a meeting of the ARC on November 26, 2009.

The consultants began work on the project in early December, 2009 and submitted a draft report on February 22, 2010, strongly endorsing the continuation of a modified AirCare program. After review of the first draft by the ARC and a meeting with the consultant on April 8, 2010, the ARC concluded that additional analysis was needed to support the consultant's

recommendations and that the costs and benefits contained in the report should be expressed as a range, with the lower estimate for emission reductions based on the existing, accepted vehicle emissions inventory model, MOBILE 6.2C, and the estimated costs based on the existing AirCare program structure and fees. This stipulation was made to ensure that a suitable base case was established and that the effect of the modifications to the MOBILE model made by the consultants was clearly evident.

The ARC also requested that the consultants estimate the health benefits from reducing the precursor emissions for secondary organic aerosols (SOA) and ozone as well as primary pollutants such as carbon monoxide and air toxics. The initial draft considered only nitrogen dioxide, and the ARC felt that it was reasonable to assume that a continued AirCare program would have a beneficial effect on secondary particle formation (SOA) and in reduced public exposure to carcinogens such as benzene which occur in volatile organic compounds. The ARC met on June 22, 2010 to review and discuss the second draft. It was agreed that the content of the report was sound and defensible and that only minor revisions were needed to create the final report. The consultant incorporated the requested changes and a final draft was received on June 30, 2010.

Highlights of the Consultants' Review

Emission Reductions

Standard emission inventory models such as the U.S. EPA's MOBILE6.2 and the Environment Canada version, MOBILE6.2C, underestimate the rate of degradation of emissions performance by 1996-and-later model year vehicles because in-use data have not been used to update the models since they were originally developed. Roadside testing carried out by the California Bureau of Automotive Repair from 2003 through 2009 (vehicles selected at random from passing traffic by CARB staff are required by the California Highway Patrol to submit to testing at a portable, roadside dynamometer emission testing facility) has shown that, contrary to EPA's initial assumptions for MOBILE, 1996-1999 model year vehicles that were approximately 10 years old at the time of roadside testing, failed emission tests 34.9% of the time. According to MOBILE, the expected failure rate should have been only 10.9%. Sierra has therefore altered the assumptions in the MOBILE model to more closely reflect the California roadside inspection data by increasing the deterioration rate for newer vehicles and assuming a higher incidence of emission control system failure and averted repairs in the absence of an AirCare program. The resulting "Revised" model was used to derive estimates for both the "No-AirCare" and "With-AirCare" scenarios from 2010 through 2020. At the request of the ARC, the standard

MOBILE6.2C model was also applied in this analysis, primarily to establish the lower end of the range of predicted benefits.

- For the "With-AirCare" projections, Sierra assumed that the AirCare program would either continue in its current form or that its effectiveness could be augmented by making some modifications to the program rules and test regime. The resulting "Modified AirCare Program" projection to 2020 was calculated, predicting greater emission benefits, particularly for VOC's, compared to the "Current AirCare Program" value, which assumes no program changes.
- Using the standard MOBILE6.2C model, the difference in light-duty vehicle emissions, on a health-impact-weighted basis, between a "No AirCare" case and the "Current AirCare" projection in 2020 is calculated to be 8,109 tonnes, or 22.6%. "Health-Impact-Weighted" means that the carbon monoxide (CO) emissions have been discounted by a factor of 7, reflecting their reduced role in human health impacts relative to their emissions, while emissions of volatile organic compounds (VOC) and oxides of nitrogen (NOx) are included with weightings of 1.0. Table 1 shows the reductions for each individual pollutant in addition to the health-weighted value.

Table 1.

	Annual Light-Duty Vehicle Emissions in 2020 MOBILE 6.2C		
	No AirCare	With AirCare (Current)	Emission Reduction
VOC	6,995 tonnes	5,208 tonnes	1,787 tonnes
CO	157,183 tonnes	126,527 tonnes	30,657 tonnes
NOx	6,430 tonnes	4,489 tonnes	1,942 tonnes
Impact-Weighted	35,880 tonnes	27,772 tonnes	8,109 tonnes

- Incorporating Sierra's adjustments to MOBILE6.2C, the difference between the "Revised, No-AirCare" scenario and a "Modified, With-AirCare" scenario in 2020 increases to 17,440 tonnes on a health-impact-weighted basis, or an AirCare-attributable emission reduction of 39.8%. Table 2 shows the reductions estimated for each pollutant in addition to the health-impact-weighted value.

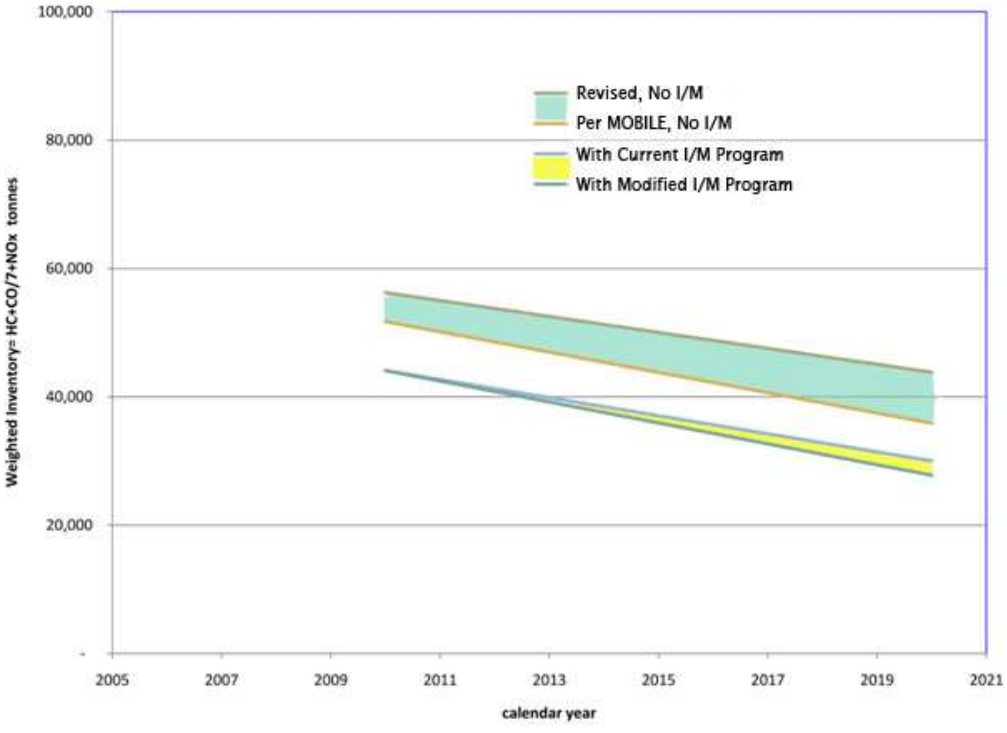
Table 2.

	Annual Light-Duty Vehicle Emissions in 2020 Sierra's Revised MOBILE 6.2C		
	No AirCare	With AirCare (Modified)	Emission Reduction
VOC	8,600 tonnes	4,120 tonnes	4,481 tonnes
CO	187,791 tonnes	125,057 tonnes	62,734 tonnes
NOx	8,372 tonnes	4,375 tonnes	3,997 tonnes
Impact-Weighted	43,800 tonnes	26,360 tonnes	17,440 tonnes

- Relative to the emissions inventory for all emission sources in the Lower Fraser Valley (LFV) airshed (which includes Metro Vancouver, the Fraser Valley Regional District and Whatcom County in Washington State), Sierra's expected emission reductions in 2020 from a continued, modified AirCare program constitute a 4.7% reduction in VOC, a 15.8% reduction in CO and an 8.8% reduction in NOx.
- A continued, modified AirCare program is estimated to reduce Lower Fraser Valley greenhouse gas emissions from motor vehicles by 1.1% per year because repairing emission-related defects such as a defective oxygen sensor also improves fuel efficiency. A continued, modified program is also projected to reduce toxic air contaminants (e.g., benzene) by over 40% in 2020 by identifying and correcting vehicles with liquid leaks or excessive fuel evaporative emissions.
- Figure 1 illustrates the potential range of AirCare emission reductions, with the current MOBILE6.2C projections represented by the two inner lines and Sierra's adjusted "No-I/M" and "Modified I/M" assumptions representing the outer two lines. The graphic shows that emission reductions are projected to increase from 2010 to 2020 as most of the vehicle population by 2020 will comprise 2004-and-newer vehicles that will have a very large percentage difference in emission rates between normal and malfunctioning vehicles.

Figure 1

Range of Future Outcomes - with and without AirCare



Cost Effectiveness

- For the purpose of this analysis, the annual cost to the motoring public of the AirCare program was assumed to include initial inspection and re-inspection fees as well as pre- and post-inspection repairs. Under the current contract and fee structure, the cost of delivering the program (contract fees and program administration) is about $19 million/year. Based on the expected failure rate and an estimated rate of pre-inspection repairs to avoid failure, the average annual cost to the motoring public is estimated to range from $45 million (current program) to $47 million (modified program) over the 2010 to 2020 period.
- With the addition of two new test procedures to identify vehicles with liquid leaks and defective evaporative emission control systems, a modified AirCare program in 2020 will reduce impact-weighted emissions by 17,440 tonnes at a cost of $47 million which equates to a cost-effectiveness ratio of $2,695/tonne. Using only the base assumptions in MOBILE6.2C, the program cost drops to $45 million while the emission reductions decrease to 8,109 tonnes, for a cost effectiveness of $5,549/tonne.
- Due to the low incidence of health effects related to ambient CO concentrations, cost-effectiveness is often calculated based on only VOC and NOx emissions. To compare the cost-effectiveness of a continued AirCare program with other available emission reduction options, the consultants referenced studies by the California Air Resources Board and the U.S. Transportation Research Board to obtain the data shown in Table 3.

Table 3.

Cost-Effectiveness Estimates for Various Emission-Reduction Program Options Relative to Vehicle Emissions Inspection and Maintenance Programs	
Estimates for I/M	$/tonne (VOC+NOx)
1. AirCare Based on Standard MOBILE 6.2C and Current Program	$12,068
2. Sierra's Estimate for AirCare Based on Revised MOBILE 6.2C and Assuming a Modified AirCare Program (2010 to 2020)	$5898 - $7,729
3. U.S. Transportation Research Board Estimate for I/M	$5,373
Other Potential Emission Reduction Measures	
1. Park and Ride Lots at Transit Stations	$179,000
2. Pace (Chicago) transit van project	$92,000
3. Conventional transit service upgrades (general)	$77,000
4. Cleaner In-Use Heavy-Duty Trucks	$39,094
5. Ottawa TransitWay (bus)	$27,000
6. Cleaner In-Use Off-Road Equipment	$16,425
7. Old Vehicle Retirement	$14,051
8. Cleaner Line-Haul Locomotives	$12,399
9. Cleaner Ship Engines and Fuels	$9,952
10. Recreational Boat New Standards	$5,847

- From Table 3, it is clear that even with the most conservative estimate of AirCare benefits, the calculated cost-effectiveness of $12,068/tonne is better than most other potential emission reduction measures. Using Sierra's more correct estimates of AirCare benefits, the cost effectiveness comes in at a value lower than all but one of the alternatives.

Health Benefits

- The consultants used available models to estimate the reductions in ambient concentrations of nitrogen dioxide (NO_2), ozone (O_3), secondary fine particulate matter ($PM_{2.5}$), carbon monoxide (CO) and air toxics (benzene, acetaldehyde, 1-3 butadiene, formaldehyde) that would result from AirCare-related emission reductions. Scenarios considered included the current AirCare program relative to the basic MOBILE6.2C, No-I/M scenario and a modified AirCare program relative to Sierra's revised estimate of the No-I/M trend line.
- The estimated ambient air quality improvements were entered into Health Canada's AQBAT model (Air Quality Benefits Assessment Tool) to estimate the public health benefits and to calculate a monetary valuation of those benefits. Benefits of improved air quality include a lower incidence of premature mortality, reduced hospital admissions, fewer emergency room visits, and fewer restricted activity days. The reduction of air toxics reduces lifetime cancer risk.
- Given the magnitude of the predicted changes in ozone precursor emissions (VOC – 4.7% and NOx – 8.8% in 2020) relative to all emissions sources in the air shed, the predicted effects of the AirCare-induced reductions on ambient concentrations of ozone and NO_2 are relatively small. Thus the consultant has cautioned that there is a high degree of uncertainty in the predicted health benefits. Nevertheless, the models used represent the only tools available for this purpose and, directionally, reduced exposure to harmful emissions can be reasonably expected to generate positive health care benefits.
- AQBAT's estimate of the monetary value of the health benefits attributable to the current AirCare program using the current version of MOBILE6.2C to generate the No-I/M baseline is about $30 million dollars per year, which is somewhat less than the estimated cost of the program at $45 million per year. However, using the estimated benefits from a modified program compared to Sierra's revised No-I/M baseline yields an estimate of $77 million dollars per year, considerably more than the annual cost of $47 million.

Additional Economic Benefits

- The consultants estimate that AirCare provides an estimated $35 million per year in revenue for the automotive repair industry.
- Because a significant number of failing vehicles are retired from service or sold outside of the area instead of being repaired, the program is also estimated to contribute to $21 million per year in new vehicle sales.

- In addition to reducing emissions, this accelerated fleet turnover contributes to increased vehicle safety and fuel economy.
- Economic impacts of the AirCare Program that have not been quantified include the reduced number of vehicles in operation with visibly smoking exhausts.

Consultants' Conclusions and Recommendations

- Given that the AirCare program will continue to generate meaningful emission reductions at an attractive cost-benefit ratio until at least 2020, the consultants recommend continuing the AirCare program with minor modifications beyond the current contract expiry date.

AirCare Review Committee Recommendations

Recommended Action: The AirCare Review Committee should proceed with the development of a modified program specification and request that TransLink re-negotiate the AirCare program service contract for an appropriate term of 5 to 7 years.

- The committee agrees with the consultant's recommendation to proceed with a continued, yet slightly modified, version of the AirCare program after 2011. After reviewing the consultants' work, the Committee is satisfied that this recommendation is based on sound and supportable technical data and analysis.
- Although the Committee required the consultant to calculate the costs and benefits of the program based on its current design and using the current version of MOBILE6.2C, the members agree with the consultants' assumption that MOBILE6.2C does not adequately take into account the effects of component failure, averted maintenance and possible tampering with emission controls that would take place in the absence of an effective emissions inspection program. Therefore, there is reasonable justification for assuming that if the AirCare program were to end in 2011, the amount of emissions produced by vehicles in 2020 would be much greater than what MOBILE 6.2C would predict.
- The Committee concurs that vehicles certified to EPA Tier 2 standards are very clean when operating normally, but *all* vehicles have the potential to become high emitters eventually and roadside data from California confirms that a significant fraction of late-model vehicles are likely to develop some form of emission-related defect over their lifetime. Until such time that gasoline and diesel-powered vehicles become immune to degradation or that a significant change in propulsion technology occurs, the justification for continuing a program such as AirCare remains.

Alternatives: Terminate the AirCare Program Effective January 1, 2012

This option is not recommended for the following reasons:

- Termination of the AirCare program would result in increased emissions that would cause negative health impacts on all residents of the Lower Fraser Valley. The cost of AirCare inspections impact only motorists with vehicles more than 7 years old, yet all citizens benefit from improved air quality.
- The cost of treating the health impacts that would result from the cancellation of the AirCare program are likely greater than the annual cost of the program.
- The AirCare program is a user-pay system so there is no saving to government or TransLink from terminating the program. Although there is a societal cost, motorists should be responsible for maintaining their vehicles and ensuring that they do not pollute excessively. In the absence of an emissions inspection program, there is no deterrent to neglecting the repair of emission-related defects or overt disabling of emission controls.
- There are 51 individual I/M programs currently in operation in North America. Ontario has recently announced its intention to continue its Drive Clean Program to 2019 and Washington State is expected to keep their program operating until 2019 as well. British Columbia has been a leader in implementing Canada's first inspection and maintenance program and a decision to end AirCare when other I/M programs are continuing, is inconsistent with established principles of continuous improvement and keeping clean areas clean.
- Termination of the program would slightly increase provincial GHG emissions, counter to provincial policy on Climate Change.
- In order to end the program on December 31, 2011, considerable work would need to be completed in a relatively short period to wrap up the program in a successful manner. Wind-down costs were not considered in the budget for the current program, so there would be a deficit remaining if the program were to end. Furthermore, should it become known ahead of time that the program is being terminated, some motorists would likely take steps to avoid going through the inspection process in the final year, leading to a shortfall in revenue and a potential further deficit of several million dollars.
- An exit strategy would need to be implemented to properly wind down the program and this would likely require an extension to the current inspection contract. A short term extension would be costly, especially given that the contractor would wish to include all of its wind-down costs in the contract extension.
- An orderly phase-out might best be accomplished by systematically exempting more vehicles until the program was effectively eliminated. However, this would take as many years as a program renewal and would leave no option to continue the program if it were determined that significant numbers of exempt vehicles were operating with emission-related defects.

Appendix A

Timeline

February 16, 2006 – Solicitor General, John Les writes to Mayor Malcolm Brodie, TranLink Board Chair to confirm the new contract of AirCare III and expresses interest in leading a review of the AirCare program prior to the expiry of the new contract.

April 20, 2009 – TransLink CEO, Tom Prendergast requests provincial direction on lead agency for the review of the AirCare program.

June 29, 2009 – Wes Shoemaker, Deputy Minister, Public Safety informs TransLink that the Ministry of Healthy Living and Sport, working together with the Ministry of Environment will take the lead for the AirCare Review.

June 23, 2009 – Inaugural meeting of the AirCare Review Committee with representation from Environment Canada, Ministry Healthy Living and Sport, ICBC, Metro Vancouver, the Fraser Valley Regional District and Pacific Vehicle Testing Technologies (administrators of the AirCare program).

July 9, 2009 – The AirCare Review Committee completes the Terms of Reference for the Review.

October 14, 2009 – TransLink issued a Request for Proposal (RFP) to review the AirCare program. The review will focus specifically on the emission contribution from transportation sources and the analysis of projected air quality and health benefits that could be obtained from a vehicle emissions inspection and maintenance program in the period 2012-2020.

November 12, 2009 – Four proponents express interest in the AirCare Review RFP:

- Eastern Research Group Inc.
- Levelton Consultants Ltd.
- RWDI Air Inc.
- Sierra Research

December 2, 2009 – The AirCare Review Committee evaluate the four proposals and select Sierra Research of Sacramento, California and SENES Consultants Limited of Vancouver, to analyze and evaluate the benefits of continuing the AirCare program post 2011. Sierra Research was determined to be best proponent of the four to effectively deliver Phase 1 of the AirCare Review based on the strength of both their I/M and air quality components.

June 4, 2010 – Sierra & SENES submit the final draft 2010 AirCare Program Review – Phase 1.

June 22, 2010 – AirCare Review Committee meets to review the final draft 2010 AirCare Program Review – Phase 1.

July 8, 2010 – Sierra Research completes and submits the 2010 AirCare Program Review, Phase 1 to the AirCare Review Committee.