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Regional Air Quality Program

Visual Opacity Assessment of Diesel Powered Heavy Duty Vehicles in the Okanagan Region

October 2001

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Project Funding Provided by:
The Okanagan Science and Technology Council and ICBC

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1.0 ACKNOWLEDGEMENTS

The Central Okanagan Regional District and the City of Kelowna sincerely thank the Okanagan Science and Technology Council and the Insurance Corporation of British Columbia's AirCare ON-ROAD Program for funding this project.

2.0 INTRODUCTION

From July 9th to July 13th, 2001 the Insurance Corporation of British Columbia's AirCare ON-ROAD Program in conjunction with the Central Okanagan Regional Air Quality Program conducted a visual study to assess the level of emissions related to the current diesel truck and bus fleet travelling within the Okanagan Valley. The survey identified diesel-fueled buses and trucks with licensed gross vehicle weights in excess of 5,000 kilograms that release large amounts of smoke. The darker the smoke the more likely it is that the vehicle is operating poorly and causing excess air pollution. This study is part of an overall look into the impact vehicles have on the Okanagan's air quality and will provide baseline data that can be used in making air quality management decisions.

Results from this study will be compared to earlier surveys conducted in 1995 and 1998 within the Greater Vancouver Regional District.

3.0 AirCare ON ROAD PROGRAM (BACKGROUND)

Currently, BC's heavy vehicle smoke prevention program is called AirCare ON-ROAD. The program provides two mobile teams to test diesel-fueled vehicles operating in BC's Lower Mainland. In the period from May 1, 1999 to May 1, 2001, there were 865 vehicles that failed the heavy-duty tests. After these vehicles were fixed, there was an average smoke opacity reduction of 51.4% upon re-inspection.

Diesel smoke consists of "particles, including aerosols, suspended in the exhaust stream of a diesel engine which absorb, reflect, or refract light." Although the particles are too small to be seen individually, collectively they can be visible as black smoke.

Black smoke is often an indicator that a diesel engine is in need of repair. Unlike the light-duty inspection programs, which test for nitrous oxides, hydrocarbons, and carbon monoxide, heavy duty diesel vehicles (HDDV) are tested to determine only whether they are emitting excessive amounts of visible smoke; i.e., the targets of the HDDV inspection programs are the gross emitters of visible smoke. These tests are conducted under controlled conditions and use standardized procedures, at the roadside or at an off-road facility, depending on the nature of the program and the test method being used. As with light-duty inspection programs, if an HDDV is found to be producing excessive emissions (in this case, Smoke), the HDDV inspection program requires that the defect causing the emissions be repaired, or penalties imposed, or both.

British Columbia's AirCare ON-ROAD program features a roadside-administered test of the opacity of the visible emissions (i.e., of the smoke) from the exhaust stack. This test is usually administered only on those vehicles showing visible signs of excessive smoke. AirCare ON-ROAD inspectors use the standardized SAE J1667 Snap Acceleration Test to measure the opacity of diesel emissions. This test is also used in air quality programs in Ontario and the United States.

Opacity is a measurement, on a percentage scale, of how much light is blocked by the exhaust plume. Light smoke has a lower opacity than dark smoke. A low opacity reading is good for your vehicle and good for the environment.

4.0 DATA COLLECTION

A representative from the AirCare ON-ROAD Program collected data from 16 locations throughout the Central, North and Okanagan-Similkameen Regional Districts from July 9th to July 13th, 2001. The AirCare surveyor, using EPA Method 9 Visual Determination, observed and assessed the approximate opacity (smokiness) levels of truck exhaust during acceleration and at cruising speeds, using 10%, 20%, 50% and 80%+ opacity ranges. 10% opacity is considered least polluting while 80% opacity is considered most polluting.

The maximum legal opacity limits in BC are:

- 40 per cent for vehicles with 1991 or newer engines
- 55 percent for vehicles with 1990 or older engines

Stationary locations listed in table 1 were established throughout the Okanagan Valley where a survey member visually assessed the vehicles as they drove by. Survey locations were decided upon with input from the AirCare ON-ROAD Program and local government officials in each area.

Table 1
Data Collection Sites

Date of Survey	City	Location	Weather Conditions
July 9, 2001	Kelowna	Hwy 97 @ Water Street	Sunny, clear and hot
July 9, 2001	Kelowna	Hwy 97 @ Pandosy Street	Sunny, clear and hot
July 9, 2001	Kelowna	Hwy 97 @ Gordon Street,	Sunny, clear and hot
July 12, 2001	Kelowna	Hwy 97 @ College Way	Sunny, clear and hot
July 12, 2001	Kelowna	Hwy 97 @ Sexsmith Road	Sunny, clear and hot
July 12, 2001	Kelowna	Hwy 97 @ Westlake Road	Overcast and hot
July 12, 2001	Kelowna	Gordon Drive @ Clement Avenue	Overcast and hot
July 10, 2001	Penticton	Main Street @ Industrial Ave	Sunny, clear and hot
July 10, 2001	Penticton	Main Street @ Warren Avenue	Sunny, clear and hot
July 10, 2001	Penticton	Skaha Lake Road @ Channel Parkway	Sunny, clear and hot
July 10, 2001	Penticton	Hwy 97 Kaleden Weigh Scale Northbound Only	Sunny, clear and hot
July 11, 2001	Vernon	Hwy 97 @ Hwy 6	Sunny, clear and hot
July 11, 2001	Vernon	Hwy 97 @ Vernon Weigh Scale	Sunny, clear and hot
July 11, 2001	Vernon	Hwy 6 @ 25 Avenue	Sunny, clear and hot
July 11, 2001	Vernon	Hwy 6 @ 27 Street	Sunny, clear and hot
July 11, 2001	Vernon	27 Street @ 30 Avenue	Sunny, clear and hot

The vehicle sample criteria consisted of vehicles under load, bobtailing, accelerating from a stop, at cruising speeds and on inclines. The vehicle types sampled included loaded and unloaded tractor-trailer combinations, dump trucks, vanbody and flatdeck style delivery trucks, cement mixers, tankers, garbage trucks and urban buses.

The vehicle type and opacity levels were then recorded for each observation.

5.0 DATA ANALYSIS

A breakdown of the Okanagan Visual Opacity Survey data is shown in table 2. The visual opacity assessments were recorded for 1325 sample vehicles during the 2001 Okanagan study (755 - Central Okanagan, 416 – Vernon area, 154 – Penticton area). These samples were collected from 16 different sites throughout the Kelowna, Penticton and Vernon areas. The 2001 Okanagan study found 40 (3.0%) vehicles in excess of 80% opacity, 81 (6.1%) vehicles in excess of 50% opacity, 219 (16.5%) vehicles in excess of 20% opacity, and 985 (74.3%) vehicles were approximately 10% opacity. The results from this survey reveal that 9.1% of the vehicles observed have the potential to fail roadside inspection with current standards at 40% and 55% opacity.

Table 2
Observation Summary for all Okanagan Sampling Sites
July 9 –13, 2001

Type of Truck	10% Opacity		20% Opacity		50% Opacity		80% Opacity		Total Observed	
Cement Mixer	15	1.1%	27	2.0%	11	0.8%	6	0.5%	59	4.5%
Truck (Tank, Flatdeck, etc.)	293	22.1%	59	4.5%	16	1.2%	5	0.4%	373	28.2%
Dump Truck	109	8.2%	40	3.0%	18	1.4%	20	1.5%	187	14.1%
Tractor Trailer	518	39.1%	88	6.6%	36	2.7%	9	0.7%	651	49.1%
Bus	50	3.8%	5	0.4%	0	0.0%	0	0.0%	55	4.2%
TOTAL	985	74.3%	219	16.5%	81	6.1%	40	3.0%	1325	100.0%

Chart 1 below compares opacity levels observed for Kelowna, Vernon and Penticton. Results show that the percentage of trucks observed in each opacity range for each region is reasonably similar.

Chart 1

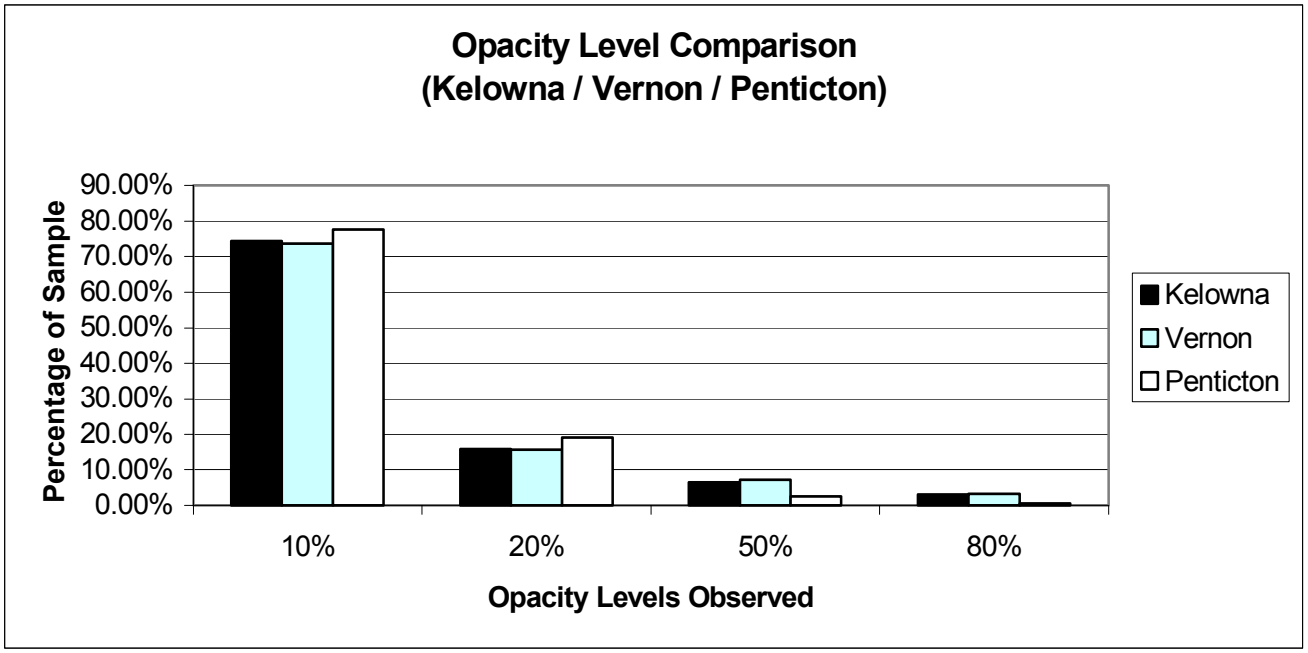


Chart 2 shows the types of trucks that were observed to be above the 50% opacity range in the Okanagan study. Trucks in this range have the potential to fail the roadside opacity test. Tractor-trailer combinations comprise the largest sector of trucks in this opacity range.

Chart 2

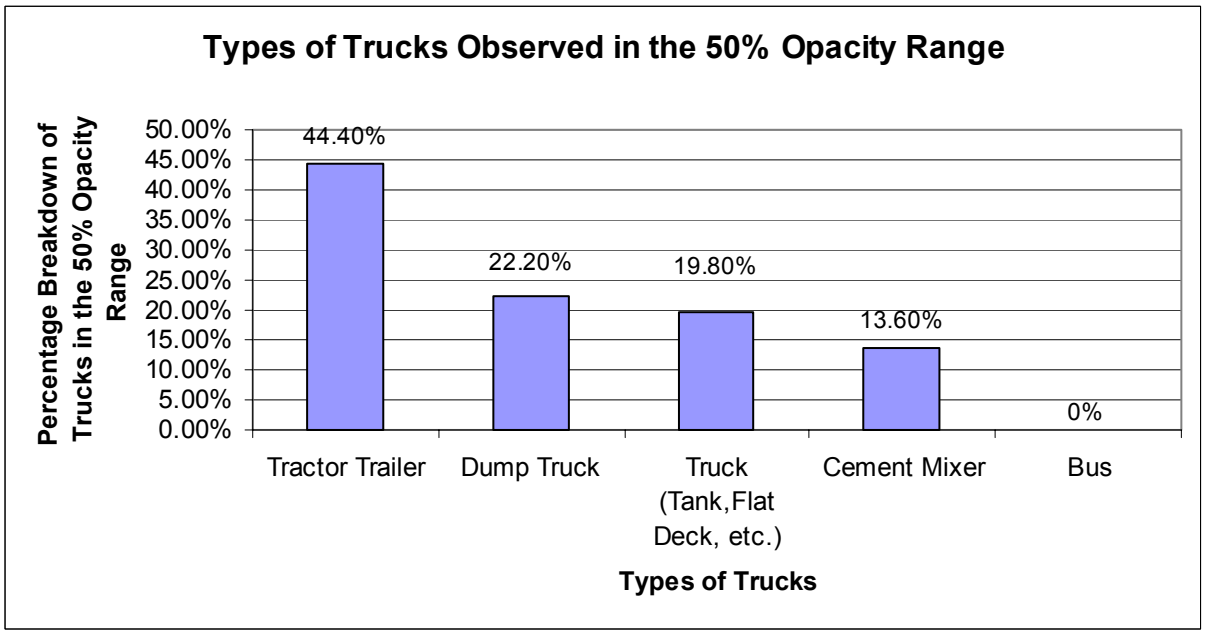


Chart 3 below shows the types of trucks that were observed to be in the 80% opacity range. Trucks in this range are considered grossly polluting vehicles. Fifty percent of the trucks observed in this opacity range were dump trucks.

Chart 3

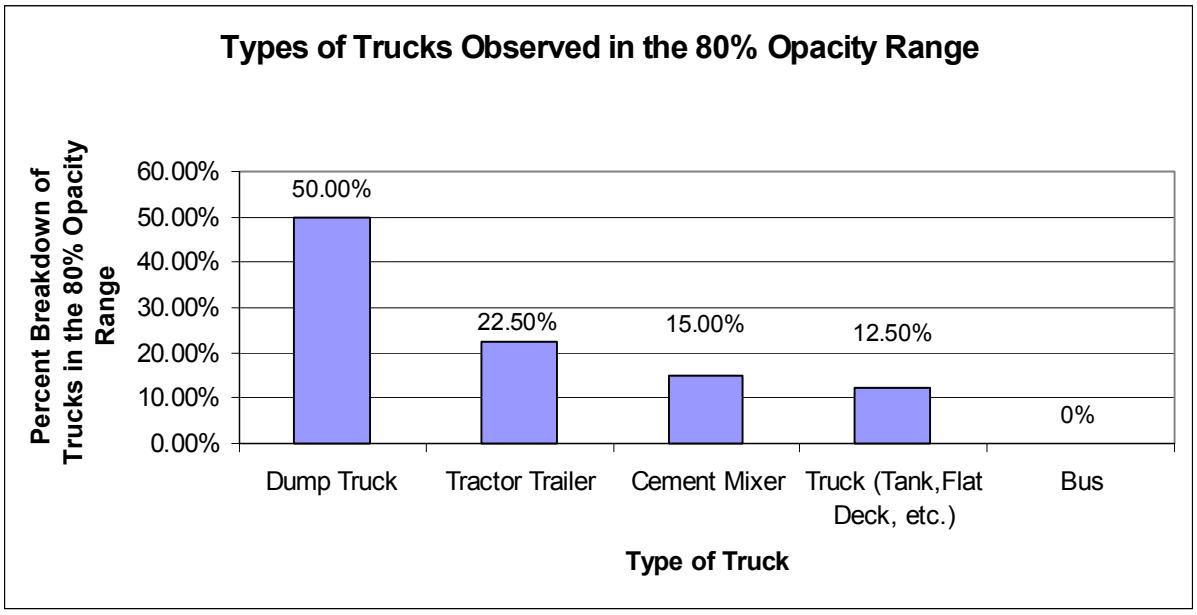
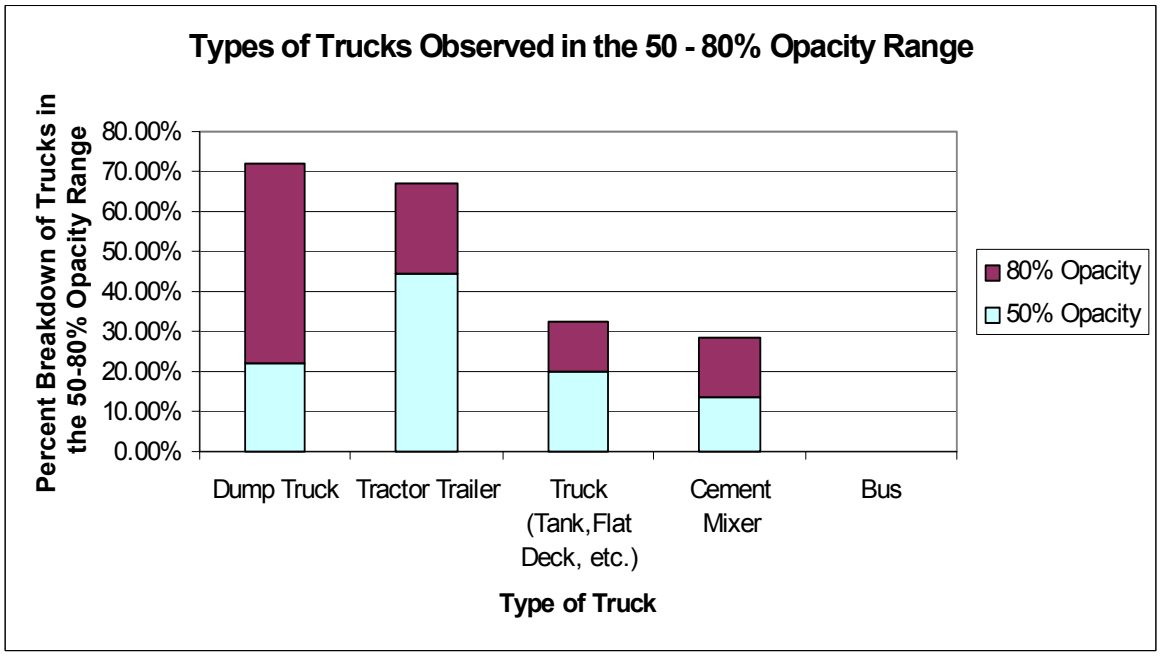


Chart 4 shows the types of trucks that were observed in both the 50% and 80% opacity range in the Okanagan study. Vehicles in these opacity ranges have the potential to fail roadside inspection with current standards at 40% and 55% opacity. Dump trucks were the most observed type of truck most likely to fail the roadside opacity inspection.

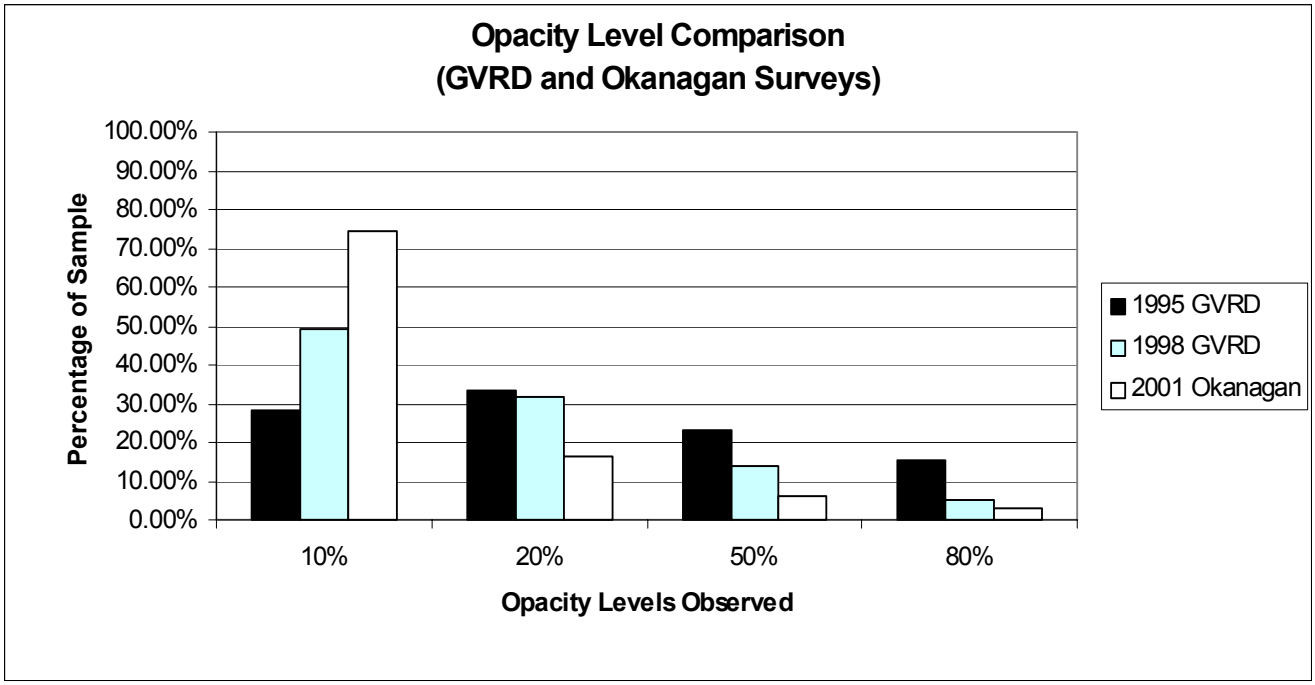
Chart 4



6.0 COMPARING THE OKANAGAN AND GVRD SURVEYS

Chart 5 below illustrates the comparisons between the 2001 Okanagan study to similar studies completed within the GVRD in 1995 and 1998. There were 901 vehicles sampled in the 1998 GVRD survey and 660 vehicles sampled in the 1995 GVRD survey. The 1998 study found 48 (5.3%) vehicles in excess of 80% opacity, 124 (13.8%) vehicles in excess of 50% opacity, 285 (31.6%) vehicles in excess of 20% opacity and 444 (49.3%) vehicles were approximately 10% opacity. The 1995 study found 101 (15.3%) vehicles in excess of 80% opacity, 151 (22.9%) vehicles in excess of 50% opacity, 221 (33.5%) vehicles in excess of 20% opacity and 187 (28.3%) vehicles were approximately 10% opacity.

Chart 5



By comparing the three surveys in chart 5, you can see a significant difference in the percentage of vehicles observed that had the potential to fail the roadside inspection. The 2001 Okanagan study showed 9.1% of vehicles observed had the potential to fail the roadside inspection with current standards at 40% and 55% opacity. The 1998 study shows 19.1% of the vehicles observed had the potential to fail roadside inspection and the 1995 study shows 38.2% of the vehicles observed had the potential to fail roadside inspection. The significant reduction of vehicles in the GVRD and the Okanagan over the 50% opacity range may be attributed to industry awareness, advanced technology, altered driving habits and the implementation of the AirCare ON-ROAD Program.

7.0 CONCLUSIONS

From July 9th to July 13th, 2001 the Insurance Corporation of British Columbia's AirCare ON-ROAD Program in conjunction with the Central Okanagan Regional Air Quality Program conducted a visual study to assess the level of emissions related to the current diesel truck and bus fleet travelling within the Okanagan Valley. 1325 vehicles were surveyed at 16 different sites during this five day study (755 - Central Okanagan, 416 – Vernon area, 154 – Penticton area).

The 2001 Okanagan Visual Opacity Assessment found 40 (3.0%) vehicles in excess of 80% opacity, 81 (6.1%) vehicles in excess of 50% opacity, 219 (16.5%) vehicles in excess of 20% opacity, and 985 (74.3%) vehicles were approximately 10% opacity. These results indicate that 9.1% of the vehicles observed have the potential to fail roadside inspection with current standards at 40% and 55% opacity.

If you compare results from the 2001 Okanagan survey to those conducted by the GVRD in 1995 and 1998 there is a significant difference in the percentage of vehicles in the 50% and 80%+ opacity ranges. The 2001 Okanagan survey shows 9.1% of vehicles observed had the potential to fail the roadside inspection compared to 19.1% of vehicles observed in a 1998 GVRD survey and 38.2% observed in a 1995 GVRD survey. The significant reduction of vehicles in the GVRD and the Okanagan over the 50% opacity range may be attributed to industry awareness, advanced technology, altered driving habits and the implementation of the AirCare On-Road Program.

Since the inception of the pilot phase of the AirCare ON-ROAD Program in the Lower Mainland in February 1996 there has been a significant decrease in the number of vehicles with the potential to fail roadside inspection. In this regard, the AirCare ON-ROAD Program has proven to be successful in reducing emissions related to the diesel truck and bus fleet travelling within the Lower Mainland. Results of the Okanagan Visual Opacity Survey show that there are a significant number of heavy-duty vehicles running poorly and causing excess smoke emissions within the Okanagan Valley. Expansion of the AirCare ON-ROAD Program to the Okanagan would certainly reduce the number of grossly polluting vehicles within the Okanagan and Southern Interior to the benefit of air quality and the health of the region's citizens.