To: Environment and Parks Committee

From: Eve Hou, Air Quality Planner, Planning, Policy and Environment Department

Date: March 8, 2013   Meeting Date: April 11, 2013

Subject: On-Road Heavy-Duty Diesel Vehicle Program – Update and 2013 Work Plan

RECOMMENDATION
That the Board direct staff to forward the report dated March 8, 2013, titled “On-Road Heavy-Duty Diesel Vehicle Program – Update and 2013 Work Plan” to the Provincial Minister of Environment with the request that the Province work with Metro Vancouver and other agencies in the development and evaluation of policy and program options to address air emissions from on-road heavy-duty diesel vehicles supported by the findings of the 2012 remote sensing device study.

PURPOSE
To highlight key findings from the 2012 heavy-duty diesel vehicle remote sensing device (RSD) study and chart a path for program development in 2013.

BACKGROUND
The 2013 work plan for the Environment and Parks Committee contains an item to “establish scope of work for a program to reduce emissions from on-road heavy-duty diesel vehicles”. This item builds upon a number of actions within the Integrated Air Quality and Greenhouse Gas Management Plan that aim to reduce emissions from on-road diesel and heavy-duty vehicles. The Metro Vancouver 2013 Action Plan also contains an action to: “With partners, develop a program to reduce emissions from on-road heavy-duty diesel vehicles”.

DISCUSSION
In 2012, Metro Vancouver in collaboration with the BC Ministry of Environment, the BC Ministry of Transportation and Infrastructure, the Fraser Valley Regional District, AirCare and Port Metro Vancouver, conducted a study to help characterize and compare emissions from different vehicle types. During a 55 day period from July to October 2012, emissions from over 11,700 semi-trailer trucks, dump trucks, buses and other heavy-duty vehicles were tested as they drove past specialized testing equipment. Emissions data from 6,012 unique vehicles were captured in this study, which amounts to 17% of all class 8 (heaviest) trucks registered in the region.

This specialized equipment, known as a “remote sensing device”, or RSD, directs infrared and ultraviolet beams from a testing trailer on one side of a road across roadways at the height of a heavy-duty truck’s engine exhaust pipe. The beams go through the vehicle’s exhaust plume to a
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“detector,” allowing for analysis of the vehicle’s emissions. The RSD testing captured information on emissions of hydrocarbons (HC), carbon monoxide (CO), nitrogen oxides (NOx) and particulate matter (PM). For one week, RSD testing was supplemented by an experimental “Tunnel” test which recorded emissions as they passed through an open-ended tent.

Testing was performed at 24 diverse locations throughout Metro Vancouver and the Fraser Valley Regional District (see Figure 1).

![Figure 1: Emission testing locations for 2012 RSD project.](image)

**Impact of Improved Emission Standards**

The results of the study confirmed that national engine emissions standards have been successful in reducing air emissions from heavy-duty vehicles, with newer vehicles on average producing significantly lower emissions than older models. Note that the RSD and Tunnel results shown in Figures 2 and 3 are a “snapshot” of emissions at the time of testing, and care needs to be taken when comparing test values to the emission standards shown, since the emission standards represent emissions over a range of operating conditions.

**Particulate Matter**

This benefit of improved emission standards was particularly evident with PM emissions. Test results found clear reductions in measured emission levels for vehicle model years when a new or more stringent emission standard took effect (see Figure 2). For example, 1991 and newer vehicles emit significantly less PM than 1990 and older vehicles. Another perceptible drop in PM emissions occurs after 2007 when another round of tighter standards kicks in.
Nitrogen Oxides

For NOx, emission standards have also contributed to improvements, although the reduction in measured emissions levels was not as abrupt as for PM. While NOx emissions appear to have steadily decreased over time, in recent years (2007-2012) reductions in the measured emissions appear to lag somewhat behind the standards (see Figure 3).

Vehicle Age

The study estimated that the 75% of vehicles built in 2007 and earlier contributed 90% of the NOx and 98% of the measured diesel soot emissions. Retiring or retrofitting older vehicles may be one strategy for reducing emissions from this sector.

Gross Emitters

This study also examined the highest polluters in each age category – the “gross emitters”. These vehicles contribute a disproportionately high amount of emissions per amount of fuel burned compared to a properly operating vehicle of the same age, or other categories of vehicles. This could be due to emission control technology failure, or in some cases, tampering with emission controls. This study found that compared to the typical, properly-operating heavy-duty vehicle, the dirtiest ten percent of trucks emit approximately:

- Four to five times more NOx and PM;
- Eleven times more carbon monoxide; and
- Eight times more hydrocarbon.

Although more recent model years are significantly cleaner than older vehicles, gross emitters are present in every age-group of vehicle.

Vehicles from In and Out of Region

Twenty-one percent of the vehicles measured in this study were not registered in the Lower Mainland. Most of these vehicles had BC license plates, although a number had Alberta and United States plates. No clear difference in average emissions levels was recorded between vehicles registered in different jurisdictions.
Next Steps
These test results will inform policy and program development by the Province of British Columbia, Metro Vancouver and other partners over the next two years. The specialized testing technologies used in this project were demonstrated to be viable options for measuring emissions in a manner that minimizes inconvenience to drivers. Road-side vehicular emissions testing is one of several options which will be considered in the next phase of program development for on-road vehicles. One interesting finding was that vehicles can be categorized as high-emitters according to the RSD testing without showing a visible smoke plume. This has implications for the effectiveness of programs, such as the current AirCare ON-ROAD Program, that rely on visual inspection as a screening method. Other options to be considered include scrappage programs, required retrofits, incentives and fees. Costs, effectiveness and consistency with other objectives (for example, greenhouse gas emissions) will be key criteria in selecting an appropriate program to pursue.

ALTERNATIVES
1. That the Board direct staff to forward the report dated March 8, 2013, titled “On-Road Heavy-Duty Diesel Vehicle Program – Update and 2013 Work Plan” to the Provincial Minister of Environment with the request that the Province work with Metro Vancouver and other agencies in the development and evaluation of policy and program options to address air emissions from on-road heavy-duty diesel vehicles supported by the findings of the 2012 remote sensing device study.
2. That the Environment and Parks Committee receive this report for information and take no further action at this time.

FINANCIAL IMPLICATIONS
The 2012 remote sensing testing project was a collaborative effort guided by a steering committee with representation from federal, provincial and regional governments, including environment and transportation staff. Funding was provided by the BC Ministry of Environment, Metro Vancouver, Fraser Valley Regional District, AirCare and Port Metro Vancouver. Metro Vancouver resources required for continuing program development were included in the 2013 budget.

SUMMARY / CONCLUSION
The 2012 remote sensing device study helped to characterize the makeup of and emissions from the heavy-duty diesel vehicle fleet in our region. This data will provide a firm foundation to evaluate the potential impact of various programs and policy measures aimed at reducing emissions from the heavy-duty diesel vehicle fleet in an efficient and cost-effective manner. This work will proceed in 2013 in close collaboration with the Province of BC and other partners.

Attachment:
GREATER VANCOUVER REGIONAL DISTRICT

REMOTE SENSING DEVICE TRIAL FOR MONITORING HEAVY-DUTY VEHICLE EMISSIONS

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March 2013
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- AirCare

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- Commercial Vehicle Safety and Enforcement (CVSE)
- The cities of Surrey, Burnaby, Richmond, Delta, Burnaby, New Westminster
- Coast Mountain Bus Company
- CP Intermodal

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Special thanks to:

Disclaimer

This report has been reviewed by representatives of Metro Vancouver, Fraser Valley Regional District, BC Ministry of Environment, AirCare, Port Metro Vancouver, and BC Ministry of Transportation and Infrastructure, who commissioned the study, but the interpretation of the results of this study, as expressed in the report, is entirely the responsibility of the consultant authors and does not imply endorsement of specific points of view by Metro Vancouver, Fraser Valley Regional District, BC Ministry of Environment, AirCare, Port Metro Vancouver, or BC Ministry of Transportation and Infrastructure. The findings and conclusions expressed in the report are the opinion of the authors of the study and may not necessarily be supported by Metro Vancouver, Fraser Valley Regional District, BC Ministry of Environment, AirCare, Port Metro Vancouver, or BC Ministry of Transportation and Infrastructure.

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I Executive summary

I-1 Background

Air pollution causes significant health risks, including death from respiratory and cardiovascular causes, inflammation of lung tissue in young, healthy adults and increased hospitalization for asthma among young children.

Environment Canada has declared particulate matter (PM), especially airborne particulate matter equal to or less than 10 microns (called PM10), toxic under the Canadian Environmental Protection Act (1999). California Air Resources Board (CARB) in 1998 also classified diesel exhaust as a toxic air contaminant, finding, “Diesel exhaust includes over 40 substances that are listed by the United States Environmental Protection Agency (USEPA) as hazardous air pollutants and by the CARB as toxic air contaminants. Fifteen of these substances are listed by the International Agency for Research on Cancer (IARC) as carcinogenic to humans, or as a probable or possible human carcinogen” and “Based on available scientific information, a level of diesel exhaust exposure below which no carcinogenic effects are anticipated has not been identified.” In 2012, IARC classified diesel engine exhaust as carcinogenic to humans based on evidence that exposure is associated with an increased risk for lung cancer.

Oxides of nitrogen (NOx) are a concern for their role in the formation of harmful low level ozone in the Lower Fraser Valley, which includes Metro Vancouver and the Lower Fraser Valley Regional District. In addition, in 2010 the USEPA announced a national air quality standard for nitrogen dioxide (NO2) to protect individuals from peak short-term exposures, which primarily occur near major roads. Short-term exposures to NO2 have been linked to impaired lung function and increased respiratory infections, especially in people with asthma. The USEPA set the new one-hour standard for NO2 at a level of 100 parts per billion (ppb). USEPA also retained the existing annual average standard of 53 ppb. Environment Canada established National Ambient Air Quality Objectives (NAAQO) for NOx of an annual maximum desirable level of 60 ppb and an hourly maximum acceptable level of 400 ppb.

On-road transportation is estimated to contribute approximately one quarter of ‘smog forming pollutants’ in the Lower Fraser Valley. Large, heavy-duty vehicles such as buses and trucks use diesel engines, a significant contributor to emissions of diesel exhaust containing particulate matter and nitrogen oxides that are hazardous to human health. Reductions in heavy-duty emissions have tended to lag behind those of light-duty vehicles. Heavy-duty vehicles, which are nearly all diesel fueled, produce greater quantities of PM and NOx emissions.
Metro Vancouver wished to obtain an assessment of heavy-duty vehicle emissions in the region and selected Envirotest to perform this study. Remote sensing device (RSD) 4600 series units were deployed to acquire on-road remote sensing emissions measurements of active heavy-duty vehicles. In addition a prototype heavy-duty emissions tunnel (HDET) was used to measure heavy-duty vehicle emissions at a weigh-station.

I-2 Goals

The primary objectives for this RSD Trial project were to:

1. **Understand Emissions from Heavy-Duty Vehicles in the Lower Fraser Valley:**
   - How many vehicles are higher emitters than their model year counterparts?
   - Which vehicles (age/class) have the worst / most offenders?
   - Does reality match public perception with respect to the emissions of heavy-duty vehicles?

2. **Understand the Impacts of Different Program / Policy Options:**
   - Help design effective programs to target the highest emitting vehicles;
   - How many vehicles would be affected by programs established at varying levels of stringency (e.g., opacity limits)?
   - What would be the estimated air quality benefit?

3. **Test the Feasibility of Integrating RSD into Program Options:**
   - Could RSD play a role in a “gross-emitter” or “clean screen” program?
   - Could it help identify vehicles eligible for scrappage incentives?

I-3 Findings

**I-3.1 Emissions from HDVs in the Metro Vancouver and the Fraser Valley Regional District**

During the 55 days of data collection, a net total of 6,012 individual heavy-duty vehicles were measured by RSD including 17% of all class 8 trucks registered in the region.

Using RSD units deployed at road level and at four meters, Envirotest measured the emissions and captured the license plates of 40,000 heavy-duty and light-duty vehicles driving past the RSD systems at sites such as weigh stations. Over 35,000 of the passing vehicles were matched by license plate to British Columbia registration information and of these 11,700 were heavy-duty and 23,600 were light-duty. These included repeat measurements of the same vehicles at sites where RSD was deployed for several days. In addition, over 900 heavy-duty vehicles were measured as they drove through a tent tunnel designed to capture emissions.
The registration jurisdictions of the heavy-duty vehicles observed operating in the region are shown in Figure I-1. The vast majority were registered in the Lower Fraser Valley region (ICBC lower mainland territories DEH and Z and probably most of the unmatched). Vehicles registered elsewhere were found to have similar emissions.

Almost three-quarters of the heavy-duty vehicles observed were Class 8. Observations by weight class are possibly skewed towards Class 8 vehicles by the selection of sites including an emphasis on weigh stations. Figure I-2 shows the split of heavy-duty vehicle observations by weight class. There were not major differences in emissions per unit of fuel across the weight classes. Most of the emissions differences were related to fuel and vehicle age.
Emissions of heavy-duty vehicles were more homogeneous than those of light gasoline vehicles. Virtually all (99%) of heavy-duty vehicles were diesel fueled. From an emissions perspective these can be divided into three groups: 1) 2007 & older, 2) 2008-2010 and 3) 2011 and newer.

- The 2007 & older heavy-duty vehicles had PM and NOx emissions ten and six times higher respectively per kilogram of fuel consumed than those of 2007 and older light-duty gasoline vehicles. Trucks also use about four times more fuel per kilometer than light vehicles. Nearly all these heavy-duty vehicles had high NOx emissions but since emission standards were more relaxed for earlier models, it was among the 2004 to 2007 model years that most vehicles exceeded the Canadian adopted USEPA NOx emissions standards.
• With improved diesel particulate filter systems (DPFs), the **2008-2010 models** had dramatically lower emissions of PM and modest reductions in NO\textsubscript{x}. NO\textsubscript{x} standards were phased in for diesel engines between 2007 and 2010 on a percent-of-sales basis: 50% from 2007 to 2009 and 100% in 2010.

• The **2011 and newer** models had low emissions of PM and NO\textsubscript{x}.

Federal emission standards in the U.S. and adopted by Canada, have required the use of PM control technologies such as DPF’s from 2007, but appears effective on 2008 and later models. NO\textsubscript{x} aftertreatment, e.g. lean NO\textsubscript{x} catalysts (LNCs) or selective catalytic reduction (SCR) were required from 2010. These NO\textsubscript{x} controls appear to have been effectively applied on 2011 and later models. The current heavy-duty standards have effectively reduced NO\textsubscript{x} and PM emissions from the newest models to mere fractions of those from older models. Even at these technology levels, however, trucks have higher emissions than light-duty vehicles.

Overall, 24% of heavy-duty vehicles measured were 2008 and newer models.

The emissions of public transit buses were also measured at bus terminals. Many of the measured buses were older and had PM and NO\textsubscript{x} emissions consistent with the majority of trucks. This may be a particular concern because they operate in predominantly densely populated areas in close proximity to pedestrians and passengers. Compared to some other urban areas there were relatively few buses fueled by natural gas.

Anecdotally the public believes that most heavy-duty trucks emit smoke. In the study, however, relatively few trucks generated visible smoke as observed by the RSD operators.

The emission averages and trends are illustrated in Table I-1 and Figures I-3 and I-4 for both the RSD and the Tunnel. Both sets of equipment show similar trends and agreement between RSD NO and Tunnel total NO\textsubscript{x} was very good. Average RSD PM emissions were 0.4 g/kg higher than the Tunnel measurements across all model years, which may be a consequence of the operating mode of the vehicles. Heavy-duty vehicle PM emissions per unit of fuel were higher at idle than when engines were under load and those measured by RSD were often operating at a lower average power than those measured through the Tunnel. Vehicle operating mode needs to be carefully considered when screening heavy-duty vehicles using RSD.
Table I-1: Observations and Average Emissions by Vehicle Age Group

<table>
<thead>
<tr>
<th>Model Year</th>
<th>Observations</th>
<th>RSD NOx g/kg</th>
<th>Tunnel NOx g/kg</th>
<th>NOx Variance (RSD-Tunnel)</th>
<th>RSD PM g/kg</th>
<th>Tunnel PM g/kg</th>
<th>PM Variance (RSD-Tunnel)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000 &amp; older</td>
<td>6,989</td>
<td>30.5</td>
<td>29.3</td>
<td>1.1</td>
<td>1.2</td>
<td>0.8</td>
<td>0.4</td>
</tr>
<tr>
<td>2001-2007</td>
<td>12,768</td>
<td>19.9</td>
<td>20.9</td>
<td>-1.0</td>
<td>1.1</td>
<td>0.6</td>
<td>0.5</td>
</tr>
<tr>
<td>2008-2010</td>
<td>3,079</td>
<td>10.9</td>
<td>14.2</td>
<td>-3.3</td>
<td>0.5</td>
<td>0.1</td>
<td>0.4</td>
</tr>
<tr>
<td>2011 &amp; newer</td>
<td>2,969</td>
<td>3.6</td>
<td>4.2</td>
<td>-0.6</td>
<td>0.5</td>
<td>0.1</td>
<td>0.4</td>
</tr>
<tr>
<td>Total</td>
<td>25,805</td>
<td>19.8</td>
<td>20.5</td>
<td>-0.6</td>
<td>1.0</td>
<td>0.6</td>
<td>0.4</td>
</tr>
</tbody>
</table>

Figure I-3: Heavy-duty Vehicle PM Emissions: Tunnel and RSD
Figure I-4: Tunnel and RSD Heavy-duty Vehicle NOx Emissions

Table I-2 summarizes by four vehicle age groups the percentage of observations of vehicles and the percentage of total NOx and PM emitted by each age group. Seventy-six percent of heavy-duty vehicles observed were 2007 & older models. These emitted 90% of NOx and up to 98% of PM.

Table I-2: Percentage of Observations and Emissions by Vehicle Age Group

<table>
<thead>
<tr>
<th>Heavy-duty Model Year</th>
<th>% of Observations</th>
<th>% of RSD NO</th>
<th>% of Tunnel NOx</th>
<th>% of RSD PM</th>
<th>% of Tunnel PM</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000 &amp; older</td>
<td>27%</td>
<td>42%</td>
<td>39%</td>
<td>34%</td>
<td>41%</td>
</tr>
<tr>
<td>2001-2007</td>
<td>49%</td>
<td>50%</td>
<td>51%</td>
<td>55%</td>
<td>57%</td>
</tr>
<tr>
<td>2008-2010</td>
<td>12%</td>
<td>7%</td>
<td>8%</td>
<td>6%</td>
<td>1%</td>
</tr>
<tr>
<td>2011 &amp; newer</td>
<td>12%</td>
<td>2%</td>
<td>2%</td>
<td>5%</td>
<td>1%</td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>
I-3.2 Impacts of Different Program / Policy Options

Heavy-duty vehicle inspection programs exist in several major metropolitan areas in Canada and the United States. These typically test for opacity only using the "Snap Acceleration Smoke Test Procedure for Heavy-Duty Diesel-powered Vehicles" (SAE J1667)" and may use decentralized facilities or fleet self-testing in combination with limited roadside programs and other audit/enforcement elements.

Canada does little at the federal level with regard to in-use vehicle emissions enforcement because federal jurisdiction stops at the point of first retail sale. Thus, it is up to the provinces to deal with in-use trucks. Diesel trucks and buses in Ontario more than three model years old are required to pass an annual opacity snap acceleration test. Quebec operates an on-road pullover inspection program using the snap acceleration smoke test.

In British Columbia, the AirCare On-Road (ACOR) program tests a small number of trucks each year using the snap acceleration smoke test. Port Metro Vancouver (PMV) licenses trucks using the port with the goal of bringing the fleet up to 2007 standards. Pre-2007 trucks over ten years old are required to pass a 20% opacity test standard.

Limitations of the current snap acceleration test include: insensitivity to fine PM generated by modern diesel engine systems, standards that are very loose compared to modern truck standards, measurement during unloaded engine operation rather than under load, and no evaluation of NOx emissions. Tuning for PM by making the fuel-air mixture leaner can increase NOx emissions. Therefore, an inspection program that controls for opacity but not for NOx may raise NOx levels.

In addition to inspections, the USA has made a major investment using public funds to both modernize and retrofit HDVs to reduce their emissions. In 2004, California Air Resources Board adopted a regulation requiring diagnostic systems on all 2007 and subsequent model year heavy-duty engines and vehicles (i.e., vehicles with a gross vehicle weight rating greater than 14,000 lbs.) in California. USEPA and California Air Resources Board subsequently adopted a comprehensive OBD regulation for 2010 and subsequent model year HDVs. In October 2011 similar Canadian regulatory amendments for heavy-duty OBD were proposed. The proposed Amendments only apply to heavy-duty engines of the 2013 and later model years.

Such investments in diesel vehicle retrofits and modernization should be monitored to ensure the equipment is being adequately maintained.

In this context, Envirottest offers a number of suggestions for Metro Vancouver and the Lower Fraser Valley Regional District to consider:
1) A mandatory annual heavy-duty inspection program to protect the public from harmful excess emissions and protect the heavy investment in heavy-duty emission control systems by manufacturers and owners through retrofit/replacement programs.

2) The program should be implemented in a way that is effective but not overly onerous on heavy-duty vehicle operators.

3) The newest model vehicles and those with low mileage accumulation could be exempted.

4) Inspected vehicles should be tested for PM and NOx emissions. For applicable 2011-2012 models and all 2013 and newer models the inspection should include a scan of the OBD system. The program should collect odometer data.

5) An expanded database of heavy-duty vehicles should be established to record their characteristics including details of original or retrofit emissions control equipment, and inspection results.

Heavy-duty vehicles observed in the study were nearly all (87%) registered within the Lower Fraser Valley or as territory Z. There were approximately 50,000 vehicles registered in these regions with GVW greater than 5,000 kg and 13% of these were measured during the study.

Potential Air Quality Benefits of an RSD Program:

In looking at the statistics gathered in the study, and extrapolating to the entire fleet, Envirotest ran trials using two sets of RSD emissions cutpoints. One set was conservatively loose with the intent of identifying just the worst emitters and a second set was more directly linked to vehicle standards with an allowance for the variability in operating conditions associated with on-road measurements.

The first set of cutpoints identified 8% percent of vehicles measured as high emitters and these vehicles emitted 16% of the PM and 17% of the NOx from heavy-duty vehicles. If these vehicles were repaired to the average emissions level for their model year the emissions reductions would be 9% of PM and 9% of NOx from HDVs.

With the second set of trial RSD emissions cutpoints, 26% of heavy-duty vehicles were identified as high emitters and these vehicles emitted 42% of the PM and 38% of the NOx from heavy-duty vehicles. If the high emitting vehicles were repaired to the average emissions level for their model year, the emissions reductions would be 23% of PM and 16% of NOx from heavy-duty vehicles.

Greater emissions reductions could be achieved if these vehicles were replaced or retrofit with more effective emissions control systems.
To convert the percentage reductions into tonnes of emissions requires estimates of the kilometers travelled by the heavy-duty vehicles. For this reason, it would be important that the odometer readings be included in the data in any future program. As we have seen in the light-duty vehicle AirCare Program, it is possible to estimate the kilometers travelled from the odometer readings recorded and to make definitive estimates of program benefits.

### I-3.3 Feasibility of Integrating RSD into Program Options

The information gathered in the study indicates that both the RSD and the Tunnel are effective tools in identifying the highest and the lowest emitting vehicles. By comparing the data from both methods, RSD indicated a higher level of PM than the same vehicle showed when it went through the tunnel. Other measurements were more closely aligned. It is important to note, however, that the same trends applied with both testing techniques on all measures as illustrated by Figures I-1 and I-2.

Although the weather during the RSD study performed over the summer of 2012 was outstanding (record-breaking dry weather) and it enabled a concentration of effort during the time available for the study, it is understood that this cannot always be expected.

We consider the tunnel test results to be very encouraging. The accuracy, the ability to measure more emissions parameters and the ability to perform testing in the rain makes it a very promising technology for the region. In addition, the control over the test process is reasonably high. If the truck doesn’t accelerate properly through the test, the inspector could require it to go through again thus allowing one reading to be used as the screen. We believe the Tunnel technique could be used to cost effectively and conveniently test or screen the HDV fleet.

One issue with the measurements completed in the study was the lower than expected traffic counts at sites. It was perhaps underestimated just how effective the truck driver’s communications network is and how much they would consciously avoid the testing locations. This behavior was confirmed by the Commercial Vehicle Safety and Enforcement (CVSE) staff who stated that when they performed surprise roadside safety inspections, a similar scenario exists and the number of trucks observed dropped dramatically and almost instantly. Therefore, screening or testing would have to be part of a mandatory program that required vehicles to be screened or tested annually.

The quick, drive-through nature of the test would be many times more convenient than a requirement for testing at a traditional inspection station. During the 55 days of on-road testing 17% of the class 8 trucks registered in ICBC areas D, E and H were measured. A large number of the vehicles also had repeats indicating that drivers who had “nothing to lose” (like fleet drivers) would not hesitate to go through the RSD or Tunnel.
We estimate that three tunnels (located on convenient sites in the region) would be sufficient to measure the Lower Fraser Valley and territory Z heavy-duty truck fleets annually. Sites could operate 60 hours per week with a throughput capacity of 15 trucks per hour. Three sites would provide the capacity to test or screen 50,000 vehicles annually at 37% utilization. Because the tunnel operation would require some operator interaction with the truck driver, it would only test BC registered trucks. The general population could also be monitored by RSD. If desired ACOR/CVSE teams could direct non-BC trucks to obtain a Tunnel measurement.

An effective use of RSD would be as a complement to the mandatory testing program. RSD can be used in three applications; clean screening, high emitter identification and on-road fleet monitoring. Trucks observed by RSD as being among the cleanest or having emissions well below the standards would not be required to undergo further testing. In the same way, the highest emitters could be flagged as requiring early testing and recruitment into incentivized repair, retrofit and replacement programs. Obtaining adequate funding for heavy-duty vehicle retrofit and replacement programs is a common challenge. Using activity and emissions data to prioritize the vehicles to be retrofit or replaced ensures the most effective use of the limited funds available. Fleet monitoring provides feedback on the effectiveness of the program and the progress made in reducing emissions.

Review of the on-road data could also be used to assess the effectiveness of the decentralized facilities certified for testing – if there are any. The RSD/Tunnel testing techniques would therefore be used to minimize the impact of any emissions testing program to the trucking community.

I-3.1 Next Steps

Suggested next steps are to:

- Integrate the emission results from this study with mileage data from CVSE to develop a more detailed breakdown of the heavy-duty vehicle emissions inventory and the relative contributions from heavy-duty and light-duty vehicles;

- Investigate the cost effectiveness of alternate approaches to reducing heavy-duty vehicle emissions, e.g. repairs, retrofit emissions control equipment, replacement engines or replacement vehicles;

- Establish a working group to consider what legal authority, regulations, equipment and resources would be needed to implement an effective heavy-duty vehicle emissions monitoring and control program.

In summary, we believe there is an opportunity to improve the air quality in the Lower Fraser Valley by monitoring and controlling emissions from heavy-duty vehicle. RSD and Tunnel testing could play a significant role in that effort while minimizing the impact of drivers and operators of these vehicles.