Green Fleet Guide
Central Okanagan

Regional Air Quality Program

City of Kelowna

Lake Country
Life. The Okanagan Way.

Peachland
On the Lake

RDCO
Regional District of Central Okanagan

West Kelowna

Westbank First Nation

Contents

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Overview

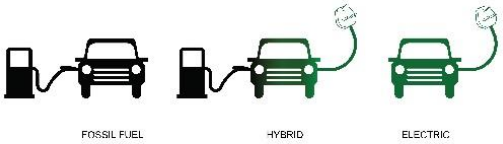
Vehicle fleets represent a significant investment for local governments and businesses both in terms of financial and natural resources. Local governments in the Central Okanagan have undertaken numerous initiatives to promote and develop sustainable forms of fleet management that increase operational efficiency, reduce costs, minimize emissions and support more sustainable economic development. The Central Okanagan Clean Air Strategy (Pinna Sustainabilty Inc, 2015) identified the necessity to incorporate clean fleet principles into regional partners' procurement policies and promote clean fleet principles with businesses and other regional organizations.

The proposed Green Fleet Guide could serve to local governments and corporations to implement or update their own policy. A Green Fleet Policy could support local governments and business in the region to better reflect a comprehensive approach to fleet management, strengthening the fleet initiatives and emission reduction strategies they already have in place.

Background

Current practices

Over the past several years, a number of programs and initiatives have been undertaken by local governments to reduce impacts of operating their corporate fleet; implementing initiatives for vehicles and fuels, promoting sustainable fleet-related choices and green maintenance and management practices, among others.



City of Kelowna has a Corporate Fleet Sustainability Procurement Policy, and it has a Fleet Management System since 2008. Reductions initiated from vehicle fleets are also part of the Climate Change Action Plan 2018 (City of Kelowna, 2018) Also, the City of Kelowna is partnering with Okanagan Car Share Co-op (MODO) to reduce its fleet services costs. The District of Peachland implemented a Fleet Management System for all fleet vehicles in the Spring of 2015; some of the key statistics the district is monitoring include idling, speeding, fuel use, and aggressive driving.

The City of West Kelowna tracks fuel and energy uses for its fleet including facilities and operations and calculates the amount of greenhouse gas emissions (GHGs) that result from this usage (City of West Kelowna). To achieve optimum cost savings, the vehicles and equipment are purchased and not leased. The City of West Kelowna maintains the vehicles in house to save on servicing costs and to ensure the longevity of the equipment purchased to maximize the value of the purchase to the municipality. The Regional District of Central Okanagan (RDCO) is working towards implementing policies described in the Regional Growth Strategy Bylaw No. 1336, section 3.2.4 Our Health, to contribute to the improvement of community health, safety, and social well-being. The RDCO plans to develop and implement fleet reviews for renewal planning, research engine and tire technologies to improve fuel efficiency, identify the most fuel efficient engine technologies based on class and application of vehicles and incorporate it into the fleet renewal plan (RDCO, 2016)[1] The District of Lake Country has also implemented a Fleet Management Program and has executed an anti-idling policy, purchased hybrids and is following the recommendations regarding fleet replacement (District of Lake Country, 2017).

Several companies in the Central Okanagan, have been working towards greenhouse gas reductions and fuel consumption. The following are just a few examples of some business's green fleet initiatives:

[1] Excluding emissions from fire services emergency fleet apparatus & equipment

Company	Green Initiatives
Canadian Freightways	"To reduce greenhouse gas emissions and fuel consumption our nationwide initiatives include: ○ Instituted anti-idling policy ○ Installation of engine management systems programmed for a maximum speed of 100km ○ Auxiliary heaters in new sleeper equipment ○ Maximized use of extended vehicle lengths (Rocky Mountain doubles, turnpike doubles and triple trailers) Conversion of all power units to extended life coolant removes the requirement to replace engine coolant. Bio-diesel demonstration project participant – Climate Change Central. Power unit tires are recapped and then used on trailing equipment. Friction reducing lubricants are now used in line haul power units, which have extended the life of oil and other lubricant maintenance. Scrap tires casing are returned to manufacturer dealers for product recycling… etc.".
Clark Freightways	Speed restrictions, zero idling, and equipping the majority of our line haul fleet with aero-dynamic trailer skirts that significantly reduce drag. Tires with a lower resistance rate also reduce fuel consumption.
Sysco(Lake Country)	Our fleet includes 180 low emission liquid natural gas trucks, and we have built LNG fuel stations at some operations. We also own 4,335 EPA-approved diesel trucks with low emission engines. Our entire fleet is equipped with auto-idle shut-off timers.
Costco	Our transportation team always works on ways to reduce empty miles involving trucks returning to our depots from the warehouses. One such practice is to pick up truckloads of merchandise that are destined for a Costco depot for distribution to a regional group of warehouses. Another practice is to load trailers with returned goods that are headed to salvagers or need to be returned to the supplier, and consolidate all of those shipments into truckloads
Home Depot	https://corporate.homedepot.com/sites/default/files/THD_0039_2015_Sustainability_Report_Online_Nov_10.pdf
Walmart	In October 2016, we were the first retailer to set an emissions-reduction plan approved by the Science Based Targets initiative, in alignment with the Paris Climate Agreement. Under this plan, we aim to: • Reduce emissions in our own operations by 18 percent by 2025 (from 2015 levels), through a combination of measures such as increased energy efficiency, sourcing of renewable energy and improvements in refrigeration systems and fleet efficiency
Canadian Tire	http://corp.canadiantire.ca/EN/CorporateCitizenship/EnvironmentalSustainability/Documents/2016%20Environmental%20Performance%20Update_Final_En.pdf
Safeway	Improving fuel efficiency in our trucks. Improving fuel efficiency in our trucks. •Switching to LEDs that use less electricity. •Creating new ways to manage our energy use. •Investing in energy efficient technologies to reduce the electricity usage in our stores, distribution centres, manufacturing plants and offices. Investing in better refrigerant systems to lower our environmental impact.
Gorman Brothers Lumber	https://www.gormanbros.com/social-responsibility/energy/
Tolko Industries,	http://tolko.com/responsibility/environmental-social
Sun Rype Products	https://www.sunrype.ca/content/contact-us-0
Coca Cola Bottling Plant	"As part of our work to reduce our carbon footprint, we aim to reduce the greenhouse emissions of our distribution trucking fleet, the source of about 4 percent of our value chain emissions. Our global system's fleet, which includes trucks operated by our Company and bottling partners, emitted an estimated 2.2 million metric tons of greenhouse gases in 2016, and we are making steady progress in reducing the emissions of our fleet"
School District 23	Policies - Central Okanagan Public Schools (sd23.bc.ca)
Interior Health	AQ1101 - Responsibility Code for Use of Interior Health Fleet Vehicles
BC Transit	In 2020, as part of the Low Carbon Fleet Program, 95 diesel buses were replaced with quieter, greener Compressed Natural Gas (CNG) buses. BC Transit - Sustainability | BC Transit

Vehicle Impacts

An operating vehicle emits a range of gases from its tailpipe into the atmosphere, one of which is carbon dioxide (CO_2), the principal greenhouse gas that contributes to climate change. **Each litre of gasoline used produces** about **2.4 kg of CO_2 and each litre of diesel used produces about 2.6 kg of CO_2** (Natural Resources Canada, 2016)**.** Vehicles produce other emissions, such as volatile organic compounds (VOCs), carbon monoxide (CO) and oxides of nitrogen (NO_X). All these emissions are known to contribute toward air pollution and smog. Smog forming pollutants seriously affect human health, causing cardiovascular disease, cardiovascular mortality, respiratory disease and lung cancer, and have negative impacts on our local environment, the economy and climate change.

Total smog-forming pollutants emitted in 2006 in the Central Okanagan were estimated to be 26,000 tonnes in which cars and trucks are responsible for 32%. (RWDI, 2010)

GHGs emitted from community activities in the Central Okanagan in 2010 are estimated to be 1.2 million tonnes (BC Ministry of Environment, 2010)[2]; personal vehicles are responsible for 46% and commercial vehicles for 15%. The CO_2e contribution from all local government's fleets in 2016 is shown in Table 1.

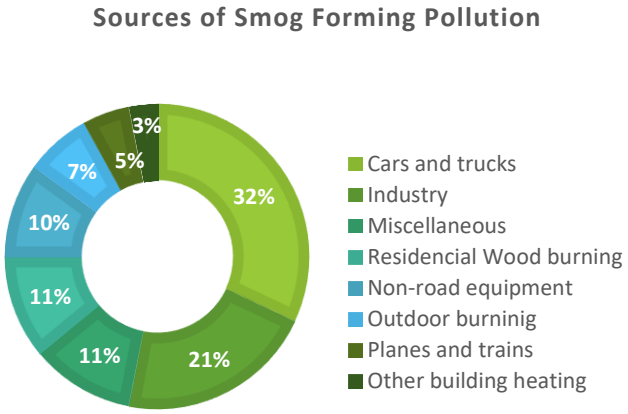


Table 1. CO_2 equivalent from Fleet operations

Partner	Number of vehicles		CO_2e from fleet 2016*	Percentage of Corporate emissions 2016
	Trucks, SUV's, cars	Heavy-duty and emergency		
City of Kelowna[3]	177	94	2,040.00	34%
City of West Kelowna[4]	51	68	701.58	33
RDCO	42	34	236.80	28
District of Lake Country	39	17	751.64	48
District of Peachland[5]	24	NA	187.78	76
Westbank First Nation	23	9	NA	NA

*Not included emissions for airports, police or solid waste NA- Not available

CO_2e- CO_2 equivalent, is the standard unit for measuring and comparing emissions across GHGs of varying potency in the atmosphere

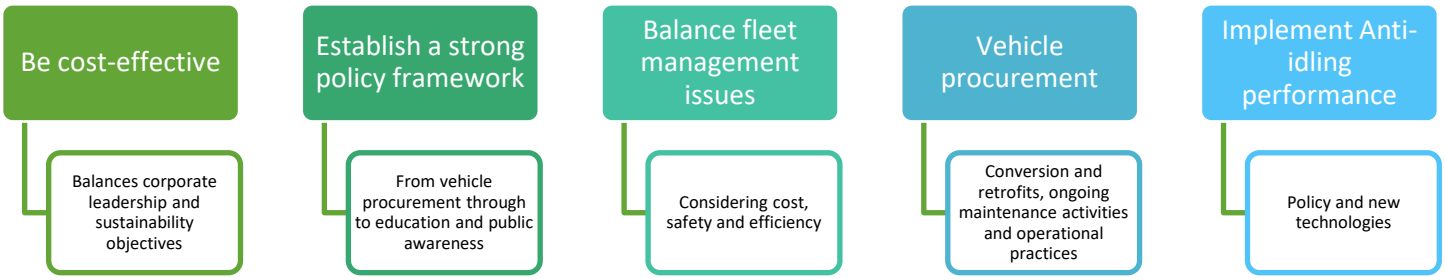
All municipalities have GHGs reductions targets to meet and this Green Fleet policy could provide an improved framework to achieve significant GHGs reductions. The GHG contribution from businesses will depend on the type of vehicle and amount of fuel used. GHG emissions can be calculated with the emission factors included in Appendix F.

A Fleet Inventory Template is available in Appendix G.

[2] Released February 2014. GHG emissions exclude large industrial processes and electricity use, off-road vehicles, aircraft and rail.
[3] (City of Kelowna, 2016)
[4] 2016 Climate Actions-City of West Kelowna
[5] (District of Peachland, 2016) Fleet

Objective

The objective of implementing a Green Fleet Policy is not only to reduce emissions but also operating and insurance costs, fuel consumption and enhance public image. This policy aims to (City of Richmond, 2016):



Financial Impacts

The green fleet policy provides a comprehensive decision-making framework for managing fleets. Certain initiatives will result in instant cost savings (i.e., vehicle downsizing, anti-idling policy), while others will result in higher up-front costs (i.e., anti-idling technology, low emission vehicles, etc.) with the prospect of longer-term cost savings in fuel consumption. Attention will be given to life-cycle costs, better use of resources, social health benefits and best economic value. The environmental impact in the region will depend on the ability to adopt effective green technologies and practices to reduce emissions (Department for Transport, UK).

Recommendation

To achieve the vision of clean and healthy air for current and future generations, local governments have responsibilities for several areas that can have an impact in our local air quality; Fleet Management is only one of those areas. Businesses also have a shared responsibility to achieve the regional vision and are encouraged to update or implement fleet management practices and sustainable procurement policies; a green fleet policy is a step forward to demonstrate corporate citizenship.

The objective of the Green Fleet Policy is to achieve the highest, most cost-effective fleet performance. The policy integrates all initiatives under a single corporate policy and provides a flexible framework by which staff can evaluate best practices and make decisions for the future. The policy considers life cycle and cost benefit analyses and identifies a monitoring and reporting mechanism for measuring progress. The following Green Fleet Policy is a compilation of other policies in the province and other countries, it can serve as a starting point for local governments or corporations to update or develop and implement their own Green Fleet Policy. The following appendices contain emission factors, a fleet inventory template, and several links to other useful resources to support their continuing efforts to keep our air clean.

Appendix A- Green Fleet Policy for the District of /City of __ /Corporation

Section 1. Basis[6]

1. The total energy bill in ____ for The District of/Corporation _____ was $____ million and is projected to increase by ___ percent to about $____ million by ____.

2. Public departments in The District of/Corporation _____ operate vehicle fleets that account for about ___ percent of the District's/Corporation's total energy bill.

3. The District of/Corporation ____ recognizes that energy use associated with the operation of its motor vehicle fleets exacerbates local air quality problems and results in greenhouse gas emissions that contribute to global climate change.

4. The District of/Corporation ____ recognizes that its departments have a significant role to play in improving local air quality and reducing greenhouse gas emissions by improving the energy efficiency of its fleets and reducing emissions from fleet operations.

5. The District of/Corporation ____ recognizes that by improving the energy efficiency of its fleets significant monetary savings will result in the long term.

6. The District of/Corporation _____ wishes to exercise its power as a participant in the marketplace to ensure that purchases and expenditures of public monies are made in a manner consistent with the policy of improving local air quality and reducing greenhouse gas emissions.

7. The District of/Corporation ____ wishes to establish a "Green Fleet" policy addressing the management, operation, and procurement of fleet vehicles under the control of The District of/Corporation _____ in order to improve the energy efficiency of its fleets and reduce emissions from its fleets.

Section 2. Definitions

1. "Passenger Vehicle"; any motor vehicle designed primarily for the transportation of persons and having a design capacity of twelve persons or less.

2. "Light Duty Truck"; any motor vehicle, with a manufacturer's gross vehicle weight rating of 2,722 kg (6,000 lb) or less, which is designed primarily for purposes of transportation of property or is a derivative of such a vehicle or is available with special features enabling off-street or off-highway operation and use.

3. "Heavy Duty Vehicle"; any motor vehicle, licensed for use on roadways, having a manufacturer's gross vehicle weight rating greater than 6,350 kg (14,000 lb).

4. "Full zero-emission vehicle"[7] or "full ZEV"; a motor vehicle that, under the regulations, is deemed to have no emissions of

[6] Green Fleet Policy Ordinance_(Lebanon County, Pennsylvania, U.S)
[7] (BC Governemnet, 2018)

(a) prescribed greenhouse gases, or
(b) other prescribed substances
(c) under prescribed operating conditions.

5. "partial zero-emission vehicle" or "partial ZEV"; a motor vehicle that, under the regulations, is deemed to have emissions of
   (a) prescribed greenhouse gases, or
   (b) other prescribed substances.
   (c) Under prescribed operating conditions that are greater than those of a full ZEV but less than the prescribed level;

6. "ZEV"**;** a motor vehicle that is a full ZEV or a partial ZEV.

7. "Bi-Fuel Vehicle";any motor vehicle designed to operate on two (2) fuels, one of which is an alternative fuel, but not on a mixture of fuels.

Section 3. Fleet Inventory

1. In order to establish a baseline of data[8] so that the "Green Fleet" policy can be established, implemented, and monitored, the fleet manager shall develop an inventory and analysis of the fleet vehicles as of the close of fiscal year ____. This inventory shall include:

a) Number of vehicles classified by the model year, make, model, engine size, vehicle identification number (VIN), and drivetrain type (2-wheel drive, 4- wheel drive), and the rated vehicle weight and classification (light-duty, medium-duty, heavy-duty) ZEV or partial ZEV;
b) Kilometers per litre per vehicle;
c) Type of fuel (or power source, e.g., electricity) used;
d) Average cost per litre of fuel;
e) Average fuel cost per kilometer;
f) Annual kilometers driven per vehicle;
g) Total fuel (or power) consumption per vehicle;
h) Vehicle function (i.e. the tasks associated with the vehicle's use);
i) Estimated emissions per kilometer[9] [10] [11] for each pollutant by vehicle type/class based on EPA tailpipe standards for the following: Carbon Monoxide (CO), Nitrogen Oxides (NOx), and Particulate Matter ($PM_{2.5}$).
j) Carbon Dioxide (CO_2) calculations based on litres[12] [13] of fuel consumed.

2. Fleet manager from the District's/Corporation's departments shall be responsible for providing these baseline data in a reliable and verifiable manner.

[8] Fleet Efficiency Tool (Natural Resorces Canada, 2015)
[9] Average In-Use Emissions from Heavy-Duty Trucks - Emission Facts (EPA)
[10] Average In-Use Emissions from Urban Buses and School Buses - Emission Facts (EPA)
[11] Average Annual Emissions and Fuel Consumption for Gasoline-Fueled Passenger Cars and Light Trucks Emission Facts (EPA)
[12] Carbon Footprint Calculator (Fleet News, UK, n.d.)
[13] Greenhouse Gas Emissions from a Typical Passenger Vehicle (EPA, n.d.)

Section 4. "Green Fleet" Policy

1. It shall be the policy of The District of/Corporation _____ to purchase, lease, or otherwise obtain the most fuel-efficient vehicles possible that meet the operational needs of the department for which the vehicles are intended, while considering lifecycle cost of the vehicle.

2. It shall be the policy of The District of/Corporation _____ to manage and operate its fleets in a manner that is energy efficient and minimizes emissions.

3. The District of/Corporation _____ shall decrease energy expenditures for its vehicle fleets by a total of ____ percent by the year ____, adjusting for inflation and relative to the baseline data established for year ____ through the fleet inventory taken in compliance with Section 3 above.

4. The District of/Corporation _____ shall reduce the emission of carbon dioxide (CO_2) from its fleet by a total of _____ percent by the year ____, relative to the baseline data established for year _____ in the fleet inventory taken in compliance with Section 3 above.

5. The District of/Corporation ___ will seek to be a leader in incorporating and leading edge technology in the management of its fleet.

6. The District of/Corporation ___will manage its corporate fleet according to the following Green Fleet strategies and performance standards:

Section 5. "Green Fleet" Policy Strategies

1. In order to accomplish the goals stated in Section 4 above, The District of/Corporation _____ shall modify procurement procedures, implement policies, conduct reviews, and take other actions as outlined in sub-sections (2) through (30) below.

Acquisition

Purchases of new vehicles will be conducted in accordance with this Green Fleet Policy which is specifically aimed at:

2. Minimize overall fleet.
3. Use the smallest size vehicles available to meet assessed need.
4. Use vehicles with the highest fuel efficiency and cost effectiveness based on consideration of life cycle costing and financial investment requirements.[14]
5. Maximize the use of alternative fuels and technologies.
6. Include a minimum efficiency standard in kilometers per litre for each vehicle class for which The District of /Corporation has a procurement specification for and include such a standard in any new vehicle procurement specification.
7. Ensure that a minimum of ____ percent of the passenger vehicles purchase, leased, or otherwise obtained within a fiscal year by The District of/Corporation ___ are full-zero emission vehicles and ____ percent are partial zero-emission vehicles. Zero-emission vehicles purchased, leased, or otherwise obtained that quantify in another vehicle weight class may, for the purposes of this requirement, qualify as a passenger vehicle ZEV on a one vehicle for one vehicle basis.

[14] Fuel Economy- Find a Car-(U.S. Department of Energy, n.d.)

8. Review all vehicle procurement specifications and modify them as necessary to ensure that the specifications are written in a manner flexible enough to allow the purchase or lease of alternatively fueled or ZEV vehicles.
9. Review every new vehicle purchase request and modify them as necessary to ensure that the vehicle class to which the requesting vehicle belongs is appropriate for the duty requirements that the vehicle will be called upon to perform.
10. Determine the practicality of leasing vs. purchasing of vehicles or equipment.

Operational Safety and Efficiency

The District's/Corporation's Fleet will be operated in a manner which:

11. Maintains high safety standards.
12. Maximizes manufacturer recommended performance standards.
13. Supports, implements, and complies with current operations and emissions standards.
14. Incorporate technologies to accurately measure individual vehicle emissions.
15. Ensure optimal vehicle operations, by minimizing emissions and fuel consumption.
16. Adopts new technologies, including retrofits aimed at improving fuel efficiency and reducing emissions wherever practicable and cost effective.[15]
17. Support alternative transportation programs for District of/Corporation employees.
18. Implement an anti-idling policy prohibiting the District of/Corporation __ employees from idling District of/Corporation owned or operated vehicles for no more than one minute[16]
19. Promote fleet sharing among all user departments to achieve best utilization, cost recovery and reduced capital purchases.
20. Prohibit the use of non-alternative fuels in bi-fuel vehicles for more than ___ percent of the time that they are operated within the District of/Corporation.
21. Maintain vehicle at optimal efficiency by reviewing current maintenance schedule for all fleet vehicles and increasing maintenance wherever cost-effective benefits will accrue as a result.
22. Purchase route optimization computer software and train District of/Corporation employees to use the software to utilize District of/Corporation vehicles in the most efficient manner possible.
23. Develop procedures for safe disposal of hazardous waste such as used oil, batteries, damaged and used tires, vehicle parts, engine parts etc. as well as non-hazardous materials such as packaging materials. This section will also include: Spill Response – procedures in the event of a fuel spill etc. Wastewater – truck washing arrangements – to protect waterways, among other best practices or any applicable regulatory requirements for safe waste disposal.

Education and Awareness

24. The District of/Corporation will work with other agencies to support community wide green fleet initiatives, wherever practicable and cost effective.
25. The District of/Corporation will enhance operational efficiency and driver/operator education. Training programs will include education on:
    - Operational practices for maximizing fuel efficiency and reducing emissions (e.g. Minimizing travel distances, anti-idling, routine checks on tire pressure and wear, etc.)
    - Increasing safety
    - Encouraging acceptance of alternate technologies and approaches

[15] Smartway Technologies (EPA, n.d.) & Verified List
[16] Idling Technical Report- Appendix 2- Model Idle Free Policy

Monitoring and reporting

26. Corporate fleet practices, including annual fuel consumption and CO_2 e, will be monitored and reported through the annual Climate Action Revenue Incentive (CARIP) Public Report or the annual District's report.
27. Establish internal equipment rates based on the projected life cycle Vehicle Replacement Guidelines (Appendix E), projected annual utilization (Appendix D), actual operating costs and Fleet Services' overhead costs.
28. Evaluate all new and replacement vehicles/equipment requests using the Vehicle Use and Justification Form (Appendix B) to ensure that the requested vehicle/equipment meets the best environmental and operational performance. Fleet Services will also use the Vehicle Replacement Guidelines (Appendix E) and consider asset depreciation, condition, equipment suitability, technological advancement, exhaust emissions testing, operational needs and economic climate.
29. Review the fleet inventory taken in Section 3 above to identify older vehicles that are used infrequently (or not at all), as well as those vehicles that are disproportionately inefficient, and schedule their elimination or replacement.
30. Monitor vehicles/equipment utilization to determine if re-allocation is necessary to optimize utilization and costs recovery. Fleet utilization will be tracked by actual vehicle/equipment kilometer and hour meters. A Low Utilization Notification (Appendix C) will be sent to a user group when projected or actual utilization is less than the Annual Utilization Targets (Appendix D). Continued low usage may result in cost recovery from the user branch for the shortfall of the expected utilization (Appendix D) as deemed appropriate by the Fleet Services Supervisor.

Effective Date	**Revised Date**	**Authorized by**	**Approved by**
Month, 202_			

Appendix B – Vehicle Use Justification

Vehicle Use Justification

Replacement: ◯ New: ◯

Department: Supervisor: Date:

Unit #: Vehicle Type: Year:

Assigned Operator, If Known:

Description of Vehicle Use:

Is Replacement Vehicle Still Required: Yes ◯ No ◯

Replacement Vehicle Type Requested: Same: ◯ Down Size: ◯ Upsize: ◯

If you are requesting downsizing or upsizing vehicle please explain?

Carbon Footprint: Same: ◯ Decrease: ◯ Increase: ◯

Percentage of Time Vehicle Will Be At Full Passenger Capacity	20 ◯	40 ◯	60 ◯	80 ◯	100 ◯
Percentage of Time Vehicle Will Be At Driver Only Capacity	20 ◯	40 ◯	60 ◯	80 ◯	100 ◯
Percentage of Time Vehicle Will Be At Full Cargo Capacity	20 ◯	40 ◯	60 ◯	80 ◯	100 ◯
Percentage of Time Vehicle Will Be At Half Cargo Capacity	20 ◯	40 ◯	60 ◯	80 ◯	100 ◯
Percentage of Time Vehicle Will Be At No Cargo Capacity	20 ◯	40 ◯	60 ◯	80 ◯	100 ◯

What types of cargo will be transported in this vehicle?

In an attempt to reduce your vehicle greenhouse gases are there other alternatives? Please explain.

Vehicle Replacement Can Be Downsized If:	Trailers Are Available	Yes ◯	No ◯
	More Vehicles Made Available	Yes ◯	No ◯
	Cargo Racks Installed	Yes ◯	No ◯
	Hook Lift Cargo Boxes Utilized	Yes ◯	No ◯

Other (explain)

Equipment Required:	Two Way Radio	Yes ◯	No ◯
	Strobe Light	Yes ◯	No ◯
	Box Liner	Yes ◯	No ◯
	Tool Box/Cabinets	Yes ◯	No ◯
	Automatic Vehicle Locater	Yes ◯	No ◯

Other (explain)

Effective Date	Revised Date	Authorized by	Approved by
Month, 202_			

Appendix C – Low Utilization Notification

FLEET SERVICES USE ONLY

UNIT _____
ASSIGNED DEPARTMENT: _____
ASSIGNED SUPERVISOR: _____
PROJECTED ANNUAL UTILIZATION: _____ KILOMETER/HOURS
PROJECTED REPORTING PERIOD UTILIZATION: _____ KILOMETER/HOURS
ACTUAL REPORTING PERIOD UTILIZATION: _____ KILOMETER/HOURS
% OF PROJECTED REPORTING PERIOD UTILIZATION: _____
TRM HOUR'S UTILIZATION: _____
REASON FOR CURRENT UTILIZATION RATE:
DEPARTMENT SUPERVISOR SIGN OFF: _____
DEPARTMENT MANAGER SIGN OFF: _____

Effective Date	Revised Date	Authorized by	Approved by
Month, 202_			

Appendix D – Annual Utilization Targets

DESCRIPTION		KILOMETER	HOUR
CAR	ECONOMY	10,000	
CAR	MIDSIZE	10,000	
VAN	ECONOMY	10,000	
VAN	LIGHT DUTY	10,000	
PICKUP	ECONOMY	10,000	
PICKUP	LIGHT DUTY	10,000	
PICKUP	1-4 TON	20,000	
TRUCK	SINGE AXLE HD	20,000	
TRUCK	SINGE AXLE HD (CRANE)		750
TRUCK	SINGE AXLE HD (AERIAL)		750
TRUCK	TANDEM AXLE HD	20,000	
TRUCK	TANDEM AXLE HD (ATTACHMENT)		750
TRUCK	TANDEM HD (SEWER RODDER)		750
EQUIPMENT	LIGHT		750
EQUIPMENT	LIGHT, SEASONAL		375
EQUIPMENT	MEDIUM		750
EQUIPMENT	MEDIUM, SEASONAL		750
EQUIPMENT	LIGHT, TREE CHIPPERS		300
EQUIPMENT	HEAVY DUTY		1,000
EQUIPMENT	HEAVY DUTY (ELECTRIC DRIVE)		1,500
EQUIPMENT	FORKLIFT		500
EQUIPMENT	ICE RESURFACER		750
EQUIPMENT	SPECIALTY		750
TRAILERS	LIGHT DUTY		N/A
TRAILERS	HEAVY DUTY	20,000	

Effective Date	Revised Date	Authorized by	Approved by
Month, 202_			

Appendix E – Vehicle Replacement Guidelines

DESCRIPTION		YEARS	KILOMETER	HOUR
CAR	ECONOMY	10	150,000	
CAR	MIDSIZE	10	150,000	
VAN	ECONOMY	10	150,000	
VAN	LIGHT DUTY	10	150,000	
PICKUP	ECONOMY	10	150,000	
PICKUP	LIGHT DUTY	10	150,000	
PICKUP	1-4 TON	10	200,000	
TRUCK	SINGE AXLE HD	10	200,000	7,500
TRUCK	SINGE AXLE HD (CRANE)	10		7,500
TRUCK	SINGE AXLE HD (AERIAL)	10	200,000	
TRUCK	TANDEM AXLE HD	10		7,500
TRUCK	TANDEM AXLE HD (ATTACHMENT)	10		7,500
TRUCK	TANDEM HD (SEWER RODDER)	10	N/A	
SANDER	ATTACHMENT	8		5,00
EQUIPMENT	LIGHT	10	N/A	
EQUIPMENT	LIGHT, SEASONAL	15		2,500
EQUIPMENT	LIGHT, TREE CHIPPER	7		7,500
EQUIPMENT	MEDIUM	10		7,500
EQUIPMENT	MEDIUM, SEASONAL	15		10,000
EQUIPMENT	HEAVY DUTY	10		15,000
EQUIPMENT	HEAVY DUTY (ELECTRIC DRIVE)	15		5,000
EQUIPMENT	SWEEPERS	5		7,500
EQUIPMENT	FORKLIFT	15		7,500
EQUIPMENT	ICE RESURFACER	10		7,500
EQUIPMENT	SPECIALTY	10	N/A	
TRAILERS	LIGHT DUTY	15	200,000	
TRAILERS	HEAVY DUTY	15		7,500

Effective Date	Revised Date	Authorized by	Approved by
Month, 202_			

Appendix F- Average Emission Factors for Passenger Cars, Light and Heavy-Duty Trucks

Average emission factors[17], [18],

Emission Facts

Average Emissions and Fuel Consumption for Light-Duty Trucks*
(most pick-uptrucks, SUVs, etc.)

Pollutant/Fuel	Emission & Fuel Consumption Rates (per mile driven)	Calculation	Annual Emission & Fuel Consumption
VOC	1.224 grams (g)	(1.224 g/mi) x (15,000 mi/yr) x (1 lb/454 g)	32.35 lb
THC	1.289 g	(1.289 g/mi) x (15,000 mi/yr) x (1 lb/454 g)	34.07 lb
CO	11.84 g	(11.84 g/mi) x (15,000 mi/yr) x (1 lb/454 g)	312.95 lb
NOx	0.95 g	(0.95 g/mi) x (15,000 mi/yr) x (1 lb/454 g)	25.11 lb
PM_{10}	0.0049 g	(0.0049 g/mi) x (15,000 mi/yr) x (1 lb/454 g)	0.13 lb
$PM_{2.5}$	0.0045 g	(0.0045 g/mi) x (15,000 mi/yr) x (1 lb/454 g)	0.12 lb
CO_2	513.5 g	(513.5 g/mi) x (15,000 mi/yr) x (1 lb/454 g)	13,572.69 lb
Gasoline Consumption	0.05780 gallons (gal)	(15,000 mi/yr) / (17.3 mi/gal)	693.64 gal

*See Endnotes

For More Information

The other fact sheets in this series and additional information are available on the Office of Transportation and Air Quality's Web site at:

Emission factor fact sheets:	www.epa.gov/otaq/consumer.htm
Modeling and estimating vehicle emissions:	www.epa.gov/otaq/models.htm
Fuel economy:	www.epa.gov/fueleconomy www.fueleconomy.gov
Improving fuel economy and reducing emissions:	www.epa.gov/epahome/trans.htm www.fueleconomy.gov/feg/drive.shtml
Finding the "greenest" vehicle:	www.epa.gov/greenvehicles

[17] Average Annual Emissions and Fuel Consumption for Gasoline-Fueled Passenger Cars and Light Trucks Emission Facts
[18] Average In-Use Emissions from Heavy-Duty Trucks - Emission Facts

Emission Facts

Average Emissions and Fuel Consumption for Passenger Cars*

Pollutant/Fuel	Emission & Fuel Consumption Rates (per mile driven)	Calculation	Annual Emission & Fuel Consumption
VOC	1.034 grams (g)	(1.034 g/mi) x (12,000 mi/yr) x (1 lb/454 g)	27.33 lb
THC	1.077 g	(1.077 g/mi) x (12,000 mi/yr) x (1 lb/454 g)	28.47 lb
CO	9.400 g	(9.400 g/mi) x (12,000 mi/yr) x (1 lb/454 g)	248.46 lb
NOx	0.693 g	(0.693 g/mi) x (12,000 mi/yr) x (1 lb/454 g)	18.32 lb
PM_{10}	0.0044 g	(0.0044 g/mi) x (12,000 mi/yr) x (1 lb/454 g)	0.12 lb
$PM_{2.5}$	0.0041 g	(0.0041 g/mi) x (12,000 mi/yr) x (1 lb/454 g)	0.11 lb
CO_2	368.4 g	(368.4 g/mi) x (12,000 mi/yr) x (1 lb/454 g)	9,737.44 lb
Gasoline Consumption	0.04149 gallons (gal)	(12,000 mi/yr) / (24.1 mi/gal)	497.93 gal

*See Endnotes

Emission Facts

Table 1: Average In-Use Emission Rates for Heavy-Duty Vehicles*
(in grams per mile)

Pollutant	HDGV (gasoline)	HDDV (diesel)
VOC	1.586	0.447
THC	1.635	0.453
CO	13.130	2.311
NOx	2.914	8.613
$PM_{2.5}$	0.044	0.202
PM_{10}	0.051	0.219

* See Endnotes

Table 2 presents average in-use emission rates for heavy-duty gasoline trucks and heavy-duty diesel trucks, separated by various weight classes. The GVW weight classes are:

Heavy-Duty Vehicle Classifications
(Gross Vehicle Weight Rating)

IIb: 8,501-10,000 lb (e.g., full-size pick-up trucks, very large passenger vans)
III: 10,001-14,000 lb (e.g., panel trucks, small enclosed delivery trucks)
IV: 14,001-16,000 lb (e.g., city delivery trucks, rental trucks)
V: 16,001-19,500 lb (e.g., bucket utility trucks, large walk-in delivery trucks)
VI: 19,501-26,000 lb (e.g., rack trucks, single axle vans)
VII: 26,001-33,000 lb (e.g., tow truck, garbage collection trucks)
VIIIa: 33,001-60,000 lb (e.g., long-haul semi-tractor trailer rigs)
VIIIb: > 60,000 lb (e.g., double long-haul semi-tractor trailer rigs)

Appendix G- Fleet Inventory Template

An excel file to complete the Fleet Inventory and estimates baseline emissions can be requested by sending an email to airquality@kelowna.ca

- CO, NOx, $PM_{2.5}$ and VOC emissions factors are given in grams per mile (Appendix F) and are estimated based on the Annual km driven
- CO_2 is calculated based on the total fuel of gasoline or diesel used (litres/year)
- CO_2 for Full ZEV is estimated from the energy used (kwh/year)
- CO_2 for Partial ZEV is estimated from the fuel used (gasoline) and the energy used (kwh/year)

Year	Make	Model	Wheel drive (2,4)	Vehicle function (emergency, crew, trailer, etc.)	Primary Use (department)	Vehicle class (light-duty, heavy-duty)	Vehicle type (full ZEV, partial ZEV)	Vehicle Identification number	Km/ litre	Type of fuel (gasoline, diesel, electrical)	Annual km driven	Total fuel/energy consumption per vehicle (year)	Total fuel costs ($/year)	Estimated emissions Kg per year				Estimate CO_2 Based on litres of fuel consumed
														CO	NOx	$PM_{2.5}$	VOC	CO_2

1 litre of gasoline used produces		2.39	Kg of CO_2
1 Litre of diesel used produces		2.62	Kg of CO_2
0.003	Kg CO2e/kwh[19]		
1 mile = 1.60934 Km			
Average price gas*		$1.154	dollars/litre
Average price diesel*		$1.163	dollars/litre

*Average price July 2017- prices should be updated

Example to estimate emissions:

Type of vehicle	Emission factors			Annual km driven	Emissions per year		
Passenger car	**CO**	**NOx**	**$PM_{2.5}$**	20,000 km	**CO**	**NOx**	**$PM_{2.5}$**
	9.4 g/mile	0.693g/mile	0.0041g/mile		[9.4 g/mile] x [1 mile/1.606934km] x [20,000km/year] x [1kg/1000g] = 116 kg/year	[0.693g/mile] x [1 mile/1.606934km] x [20,000km/year] x [1kg/1000g] = 8.61 kg/year	[0.0041 g/mile] x [1 mile/1.606934km] x [20,000km/year] x [1kg/1000g] = 0.050 kg/year

[19] Best practices methodology for quantifying greenhouse gas emissions

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