



NZ TRANSPORT AGENCY  
WAKA KOTAHI

emission:  
**impossible** Ltd

# VEPM versus RSD Comparisons

NAQWG Meeting – Transport Session  
28 November 2013

**Gerda Kuschel – Senior Air Quality Specialist\***  
Emission Impossible Ltd

**Jeff Bluett – Team Leader - Air Quality**  
Golder Associates Ltd

# Outline

- ❖ **Trends** – validate trends predicted by VEPM with real-world (RSD) measurements
- ❖ **Emission factors** – verify the factors used in emission inventories for light duty vehicles

# Trends Report

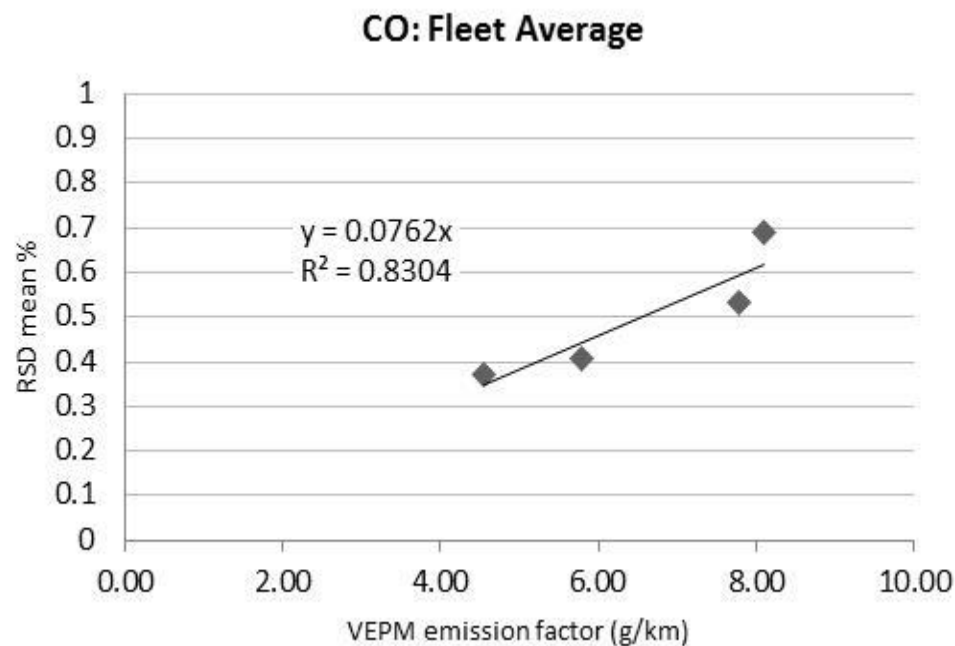
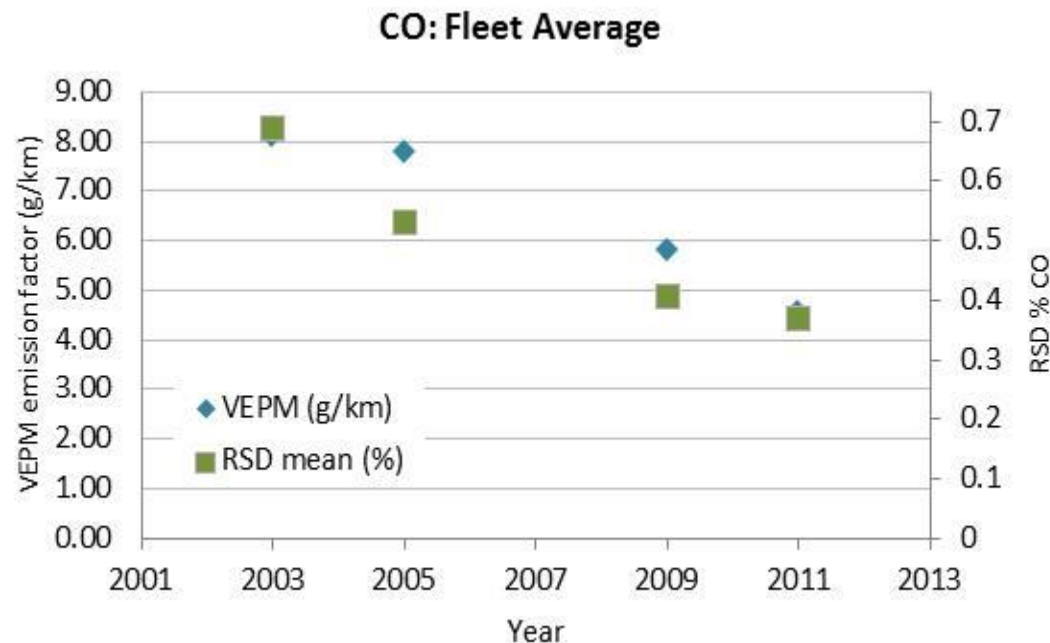
**Are the trends in on-road (RSD) vehicle emissions measurements between 2003 and 2011 comparable to trends in the light duty vehicle factors from VEPM?**

# CO

*Good agreement*  
between *trends* in  
fleet average

- Mean RSD CO (%)
- and
- VEPM CO (g/km)

Assuming *same*  
fleet profile

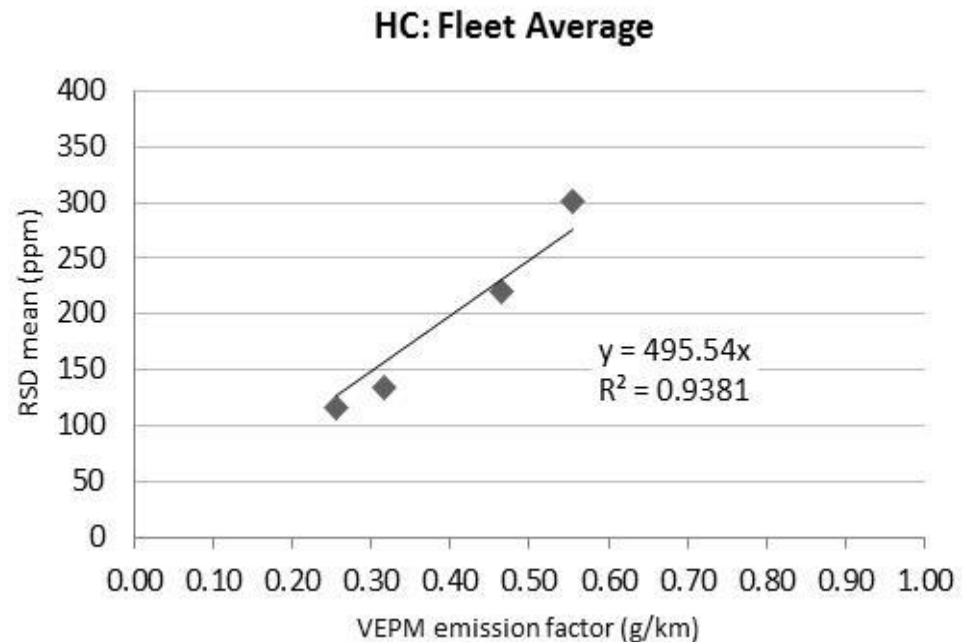
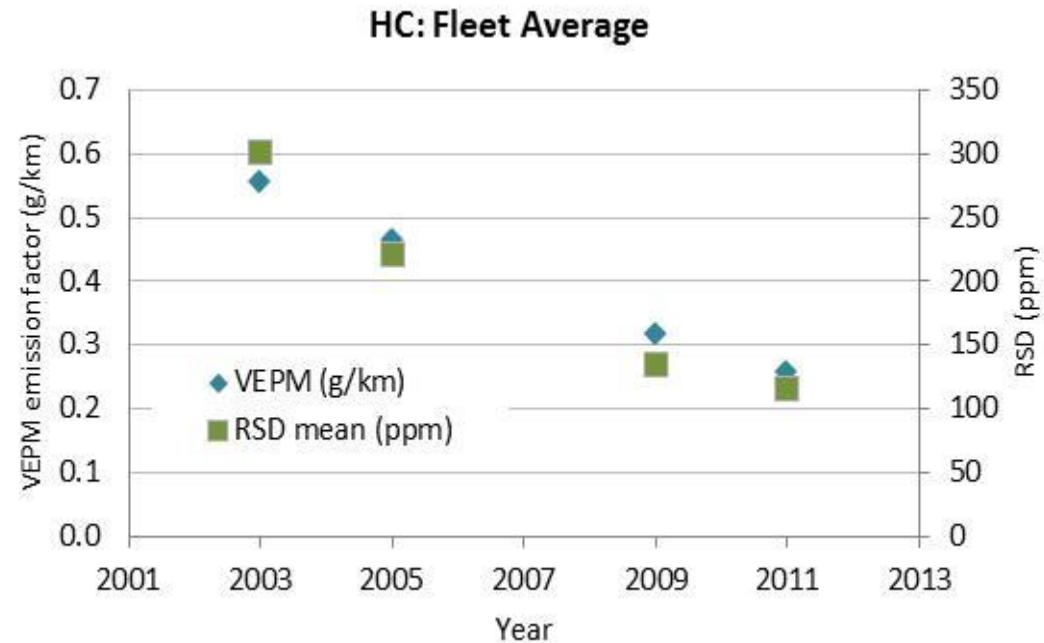


# HC

*Good agreement between trends in fleet average*

- Mean RSD HC (ppm) and
- VEPM HC (g/km)

Assuming *same* fleet profile



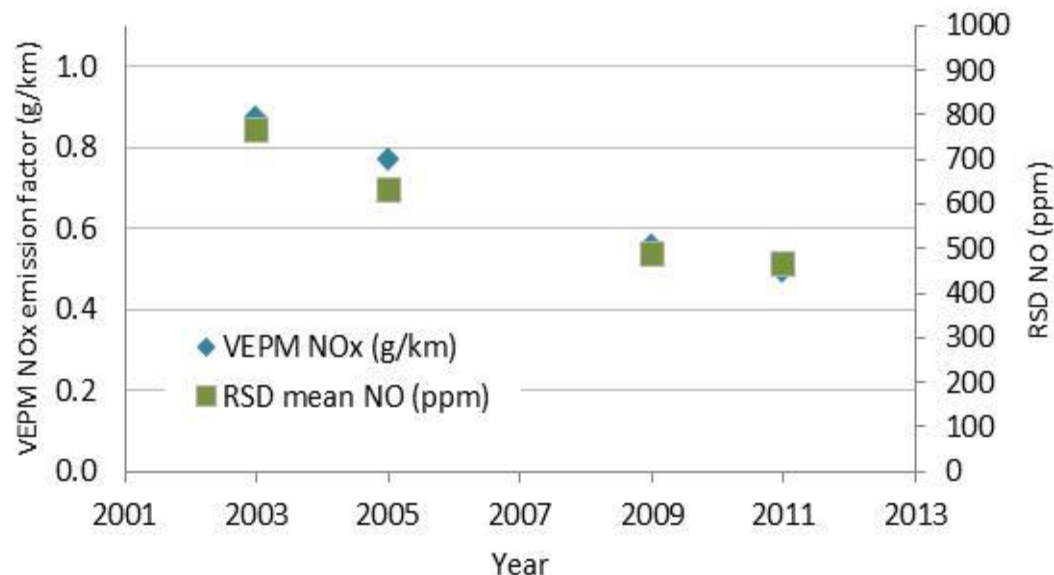
# NO/NOx

*Good agreement between trends in fleet average*

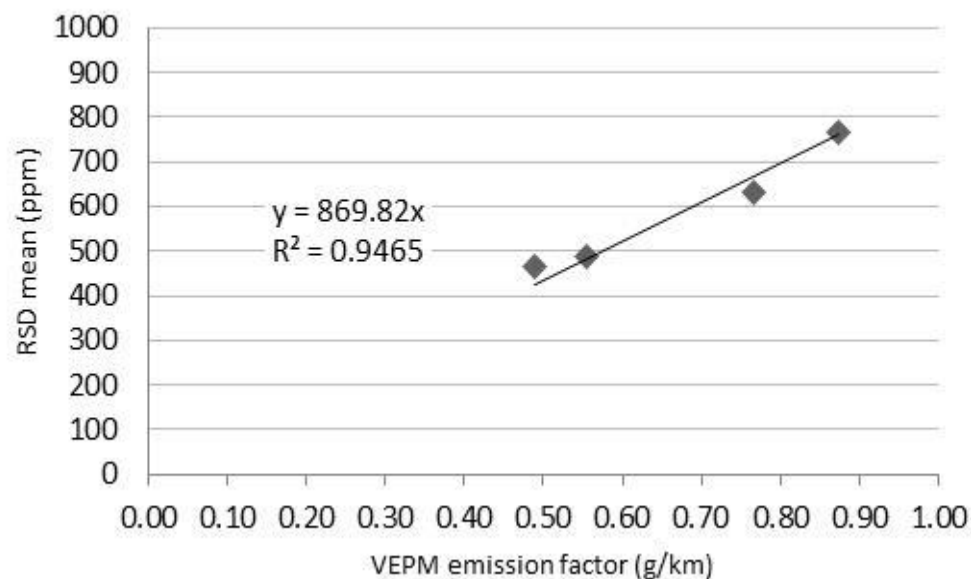
- Mean RSD NO (ppm) and
- VEPM NOx (g/km)

Note *not the same species*

NO and NOx: Fleet Average



NO and NOx: Fleet Average



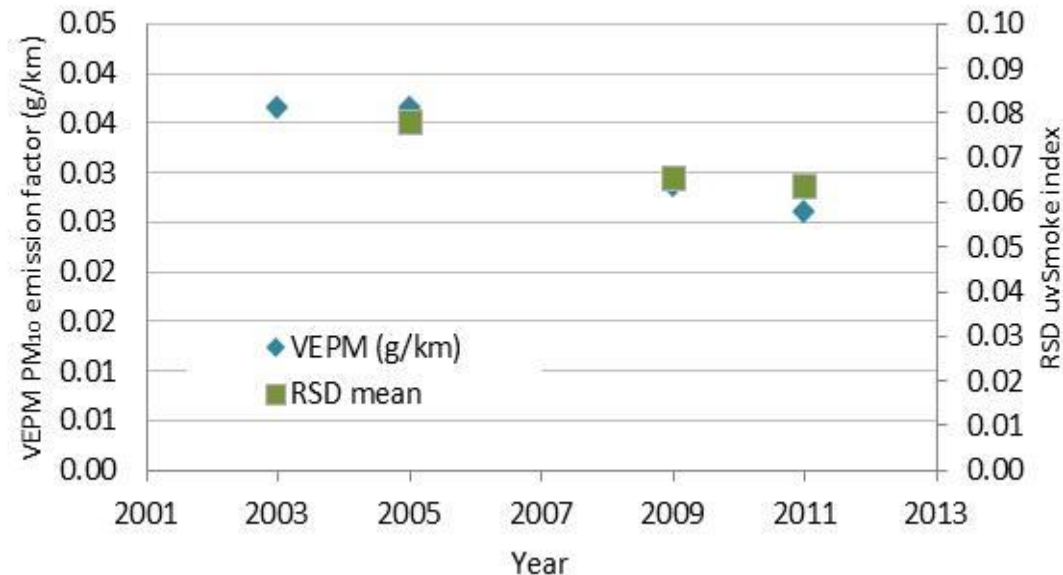
# uvSmoke/PM

*OK agreement*  
between *trends* in  
fleet average

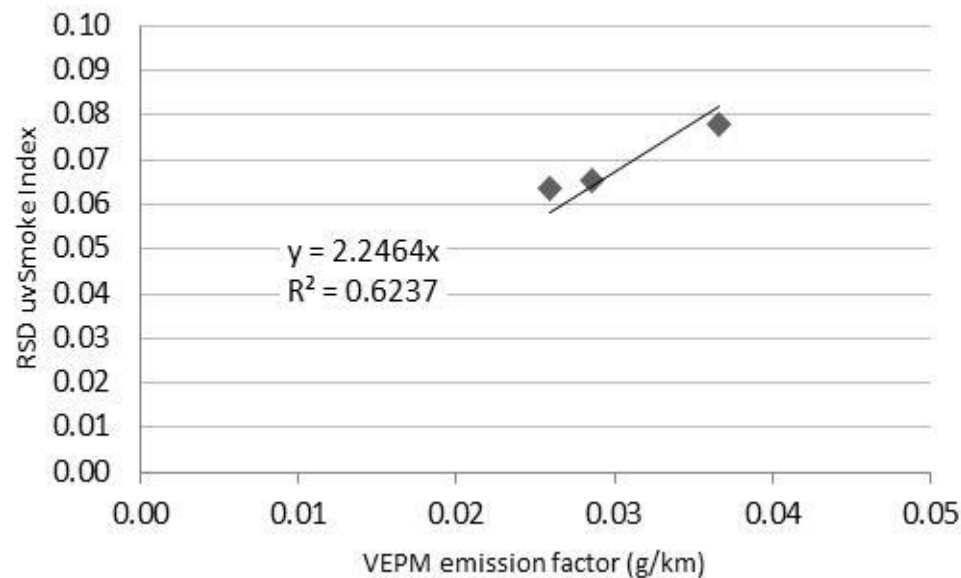
- Mean RSD  
uvSmoke (index)  
and
- VEPM PM (g/km)

Note *not the same*  
species

uvSmoke and PM<sub>10</sub>: Fleet Average



uvSmoke and PM<sub>10</sub>: Fleet Average



# More detailed fleet breakdowns

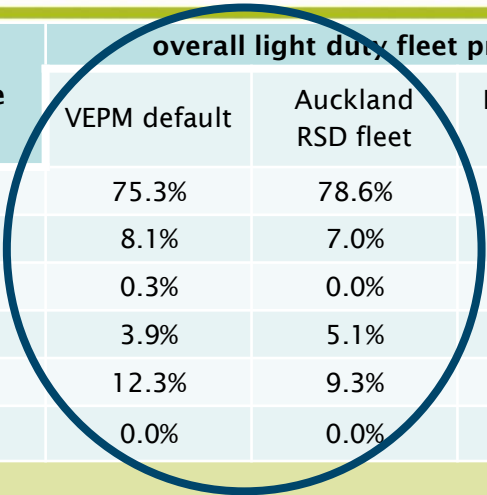
For the *overall light fleet*, the RSD results validate the rate of change in emissions predicted by VEPM

The good level of agreement generally retained for *specific sectors* of the light fleet, except for

- The trend in RSD NO (increasing) is *contrary* to the trend in VEPM NO<sub>x</sub> (reducing) from diesel vehicles
- The rate of reduction for RSD uvSmoke is *less than* the rate of reduction in VEPM PM<sub>10</sub>, especially for diesel vehicles



# Effect of local fleet profile



VEPM factors *not particularly sensitive to local variations* in light duty fleet composition but needs further checking

		overall light duty fleet profile		
Fuel type		VEPM default	Auckland RSD fleet	Rodney RSD fleet
Cars	petrol	75.3%	78.6%	78.4%
	diesel	8.1%	7.0%	8.2%
	hybrid	0.3%	0.0%	0.0%
Other light duty	petrol	3.9%	5.1%	3.7%
	diesel	12.3%	9.3%	9.7%
	hybrid	0.0%	0.0%	0.0%

		2011 light duty fleet average emission factors				
unit	species	VEPM default light duty fleet	Auckland RSD fleet	difference vs. VEPM default	Rodney RSD fleet	difference vs. VEPM default
g/km	CO	5.0	4.6	-10%	4.6	-8%
g/km	CO <sub>2</sub>	208.1	205.8	-1%	204.3	-2%
g/km	VOC	0.3	0.3	-1%	0.3	-2%
g/km	NOx	0.5	0.5	-4%	0.5	1%
g/km	PM <sub>2.5</sub> exhaust	0.03	0.03	-7%	0.03	7%
l/100km	FC	9.1	9.0	-1%	8.9	-2%



# Emission Factor Report

**To verify that the VEPM is providing useful and realistic estimates of light duty vehicle emissions and**

**To increase stakeholder confidence in the emission data produced by VEPM**

# VEPM vs RSD emission factors

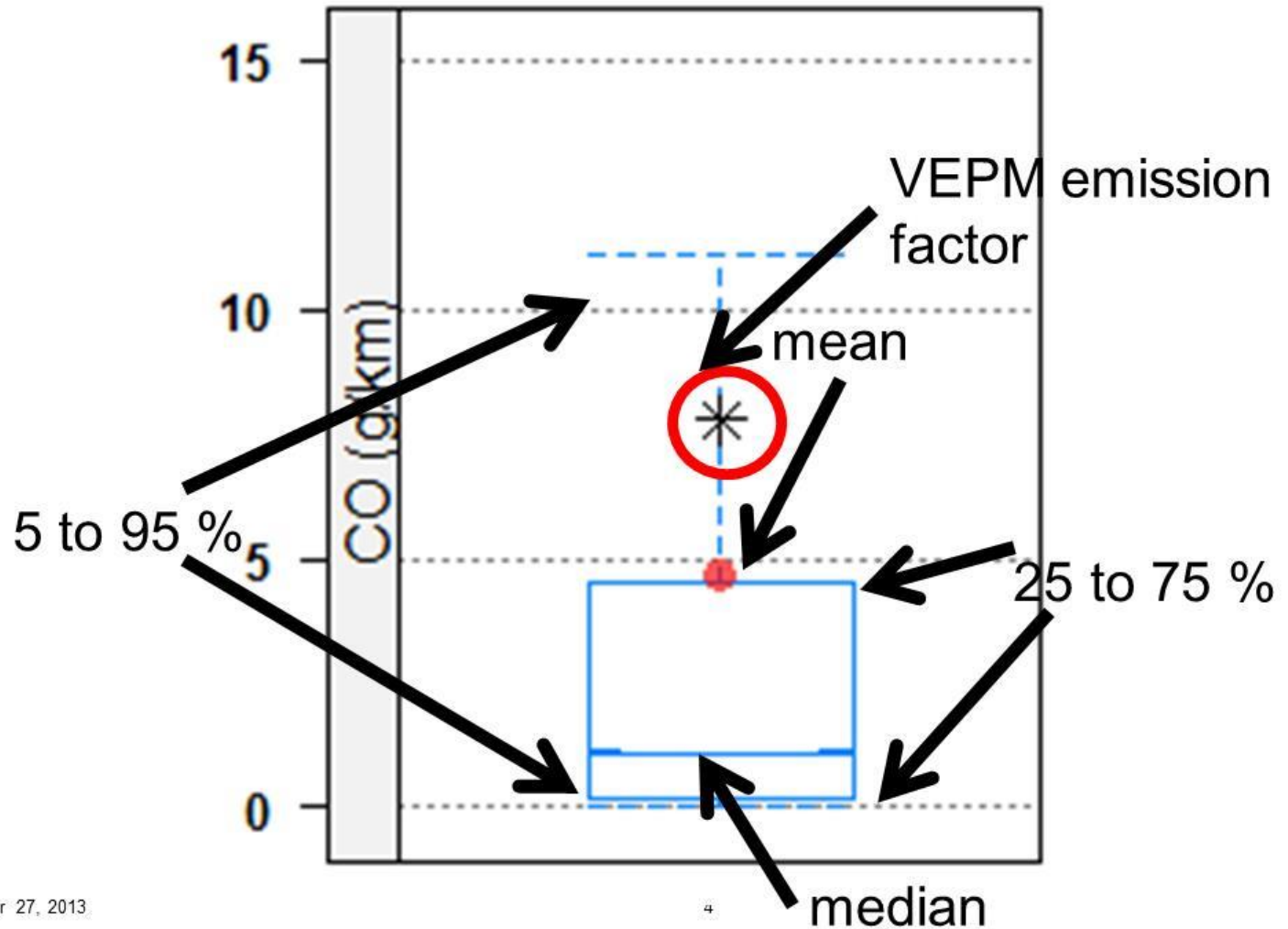
**VEPM** (AC 2005 inventory)

versus

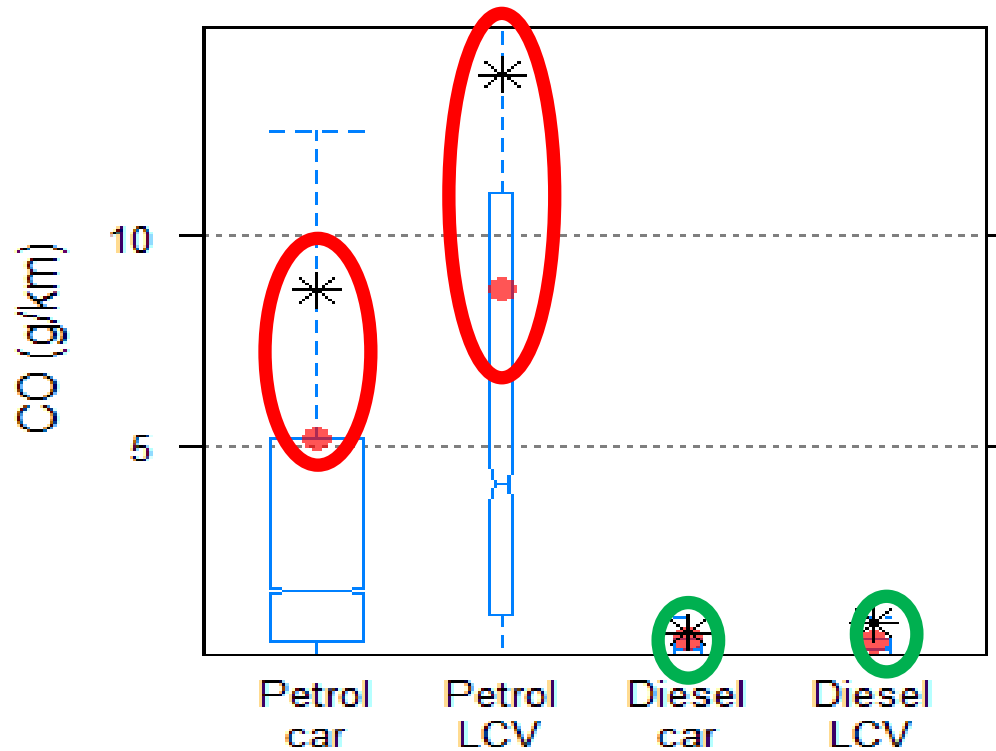
***RSD emission factors*** (2006 monitoring campaign)

- Petrol cars
- Petrol light commercial vehicles
- Hybrid and Electric vehicles (none in 2005 RSD)
- Diesel car vehicles
- Diesel light commercial vehicles

# RSD emission factors - petrol car example



# CO by vehicle type



Comparison of RSD and VEPM CO emission factor by vehicle type

# Traffic light criteria

Ratio VEPM/RSD	Colour
<b>&lt;0.50 or &gt;2.0</b> (more than 100% diff)	<b>Red</b>
<b>0.50-0.67 or 1.5-2.0</b> (between 50 and 100% diff)	<b>Orange</b>
<b>0.67-1.5</b> (less than 50% diff)	<b>Green</b>



# Summary of results – VEPM/RSD

	Petrol Car	Petrol LCV	Diesel Car	Diesel LCV
CO	1.7	1.6	1.5	2.4
HC	0.7	1.1	0.3	0.2
NO <sub>x</sub>	1.0	1.4	0.6	0.5
PM <sub>10</sub>	8.2	21.0	0.5	0.7

# Acknowledgements

- Jayne Metcalfe (EIL) – co-author on trends report
- Martin Unwin (NIWA) - data analysis
- Auckland Council and NZTA for funding
  - Various 2003 to 2011 RSD campaigns
  - On-going development of VEPM
  - Trends and emission factors investigations
- Rob Hannaby (NZTA), Shanju Xie (AC), Iain McGlinchy (MoT) & Janet Petersen (AC) for invaluable review comments



# When reports available & where from

- ❖ **Trends report** – to be uploaded to *air.nzta.govt.nz* website (due December 2013)
- ❖ **Emission factors report** – to be uploaded to *air.nzta.govt.nz* website (due December 2013) and possibly also on Auckland Council website

# Thank You and Any Questions?

**Gerda Kuschel**  
Senior Air Quality Specialist  
**Emission Impossible Ltd**

or

**Jeff Bluett**  
Team Leader – Air Quality  
**Golder Associates Ltd**



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