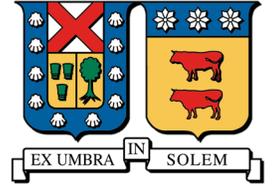




**FONDEF**  
Fondo de Fomento al Desarrollo  
Científico y Tecnológico

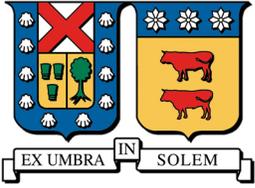


# EVALUATION OF TDI ENGINE NITROGEN OXIDE EMISSIONS IN CHILE MEASURED WITH PEMS

**FONDEF ID18I10297**

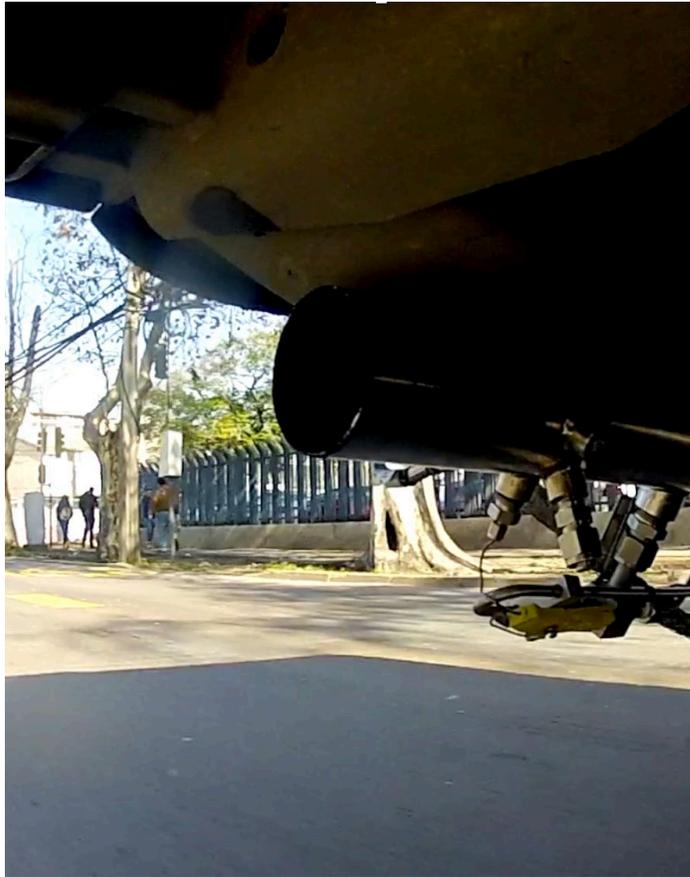
**Sebastian Tolvett C.**  
Mechanical Engineering Department  
Universidad Tecnológica Metropolitana

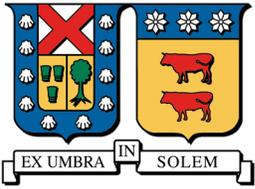
**03-11-2021**



# Content

- Motivation and Background
- PEMS - CHILE
- Experimental Methodology
- Results and Discussion
- Conclusion





# Motivation and Background



- Air quality is one of the most important environmental problems in Megacities and Santiago, Chile is not the exception.
- Market in South America is small but with great variety of products.
- Vehicles sold in Chile must comply with national emission standards, currently the regulations required is Euro 5 for light duty vehicles.
- Chile is advancing to upgrade the national emissions standard to Euro 6.

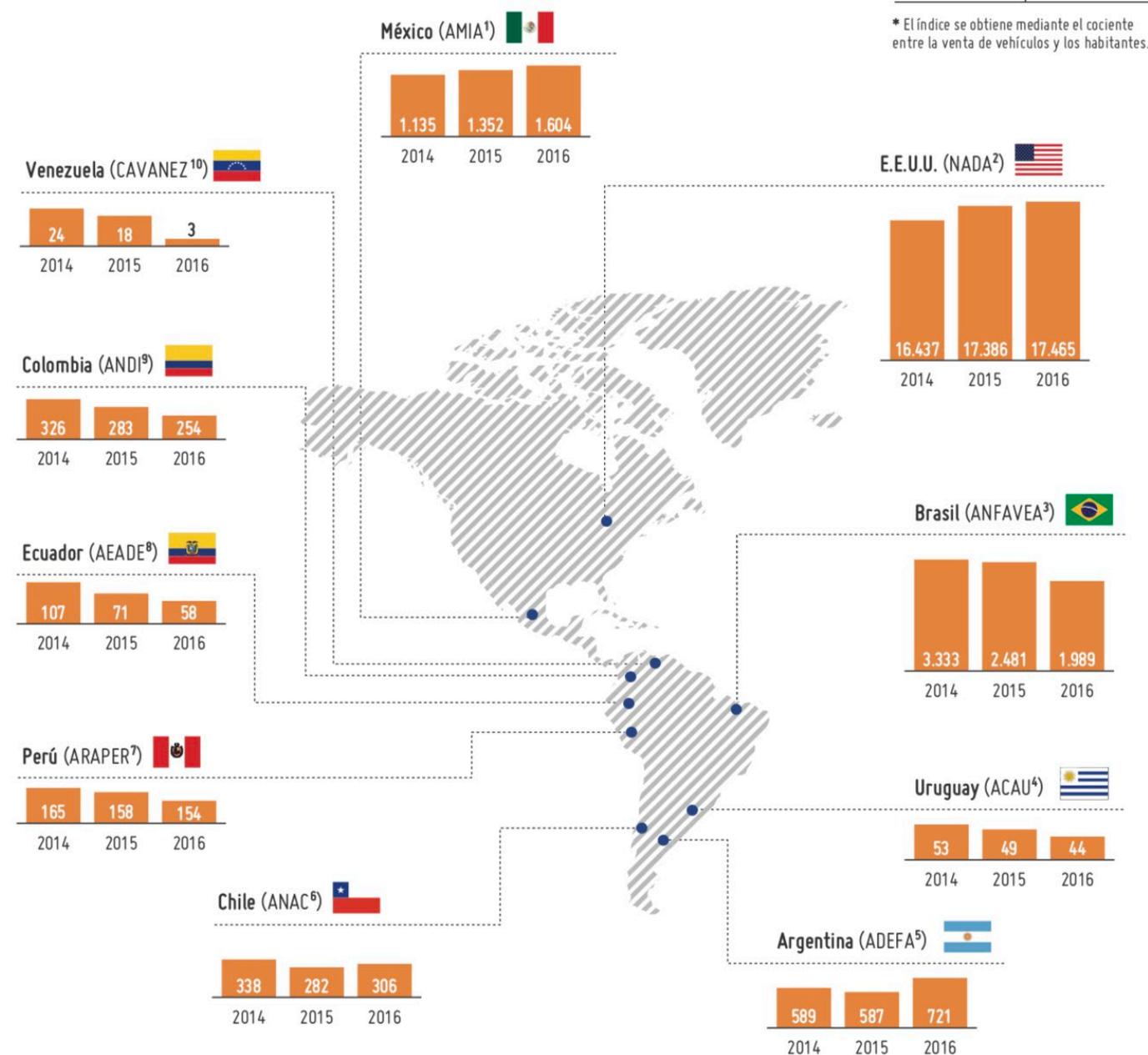
# Chile será el primer país de Sudamérica en exigir la norma de emisiones Euro 6

## 6

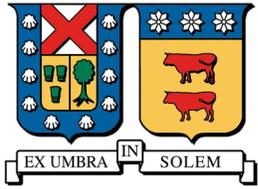
Mauricio Monroy  
30 SEP 2020 06:06 PM



Hoy se publicó en el Diario Oficial la obligatoriedad que tendrá a partir de 24 meses la normativa que fortalece la lucha contra el cambio climático.



(Miles de Unidades)



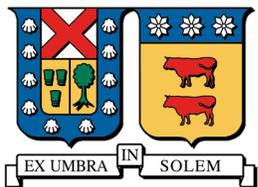
# PEMS - CHILE



- An initiative from 2 Chilean Universities to address real world emissions.
- Universidad Tecnológica Metropolitana and Universidad Técnica Federica Santa María supported by FONDEF.
- Our main objective is to generate local knowledge regarding emissions testing in On Road and Off-Road vehicles.

<https://pemschile.usm.cl>

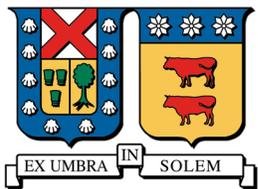




# Emissions evaluation of TDI vehicles

5 Turbo Diesel Injection (TDI) vehicles were tested, basic technical specifications are shown on the table with there emissions obtained at the certification process.

Vehicle	Model	Certification Date	Standard	NOx (gr/km)
1	Amarok 2,0 Lts. TDI DOHC 4Motion Pick Up Double Cab 4P. 4x4, Motor CDC Diesel	08-04-2010	IV	0.277
2	Rapid Spaceback 1,6 Lts. TDI DOHC Hatch Back, Motor CAYB Diesel	26-08-2014	V	0.138
3	Amarok 2,0 Lts. TDI Trendline DOHC Pick Up 4P. 4x4 T/M Motor CNEA Diesel	13-05-2013	V	0.147
4	Tiguan 2,0 Lts. Station Wagon, 4x4 Diesel	16-11-2017	V	0.161
5	Yeti 2,0 Lts. Station Wagon 4x4 T/A	16-06-2016	V	0.118

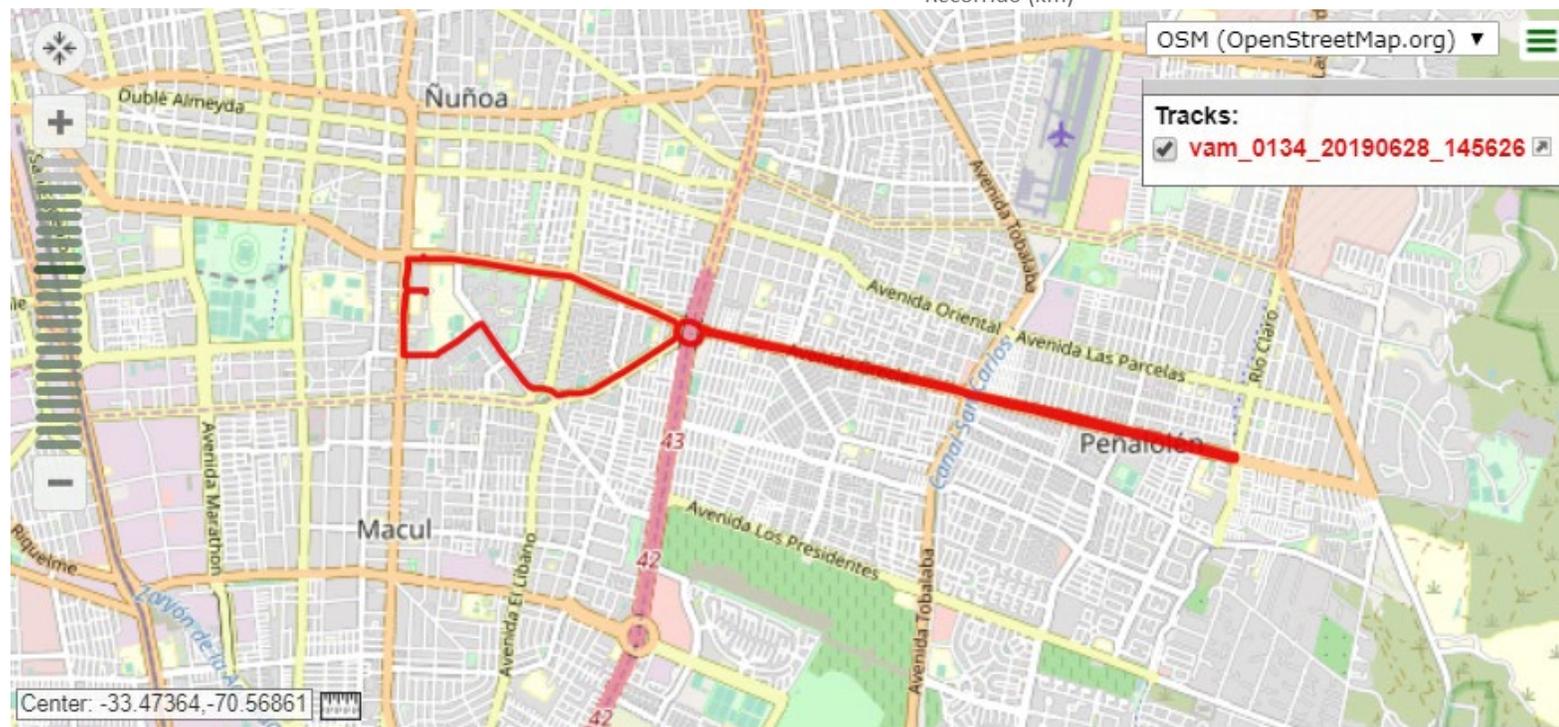
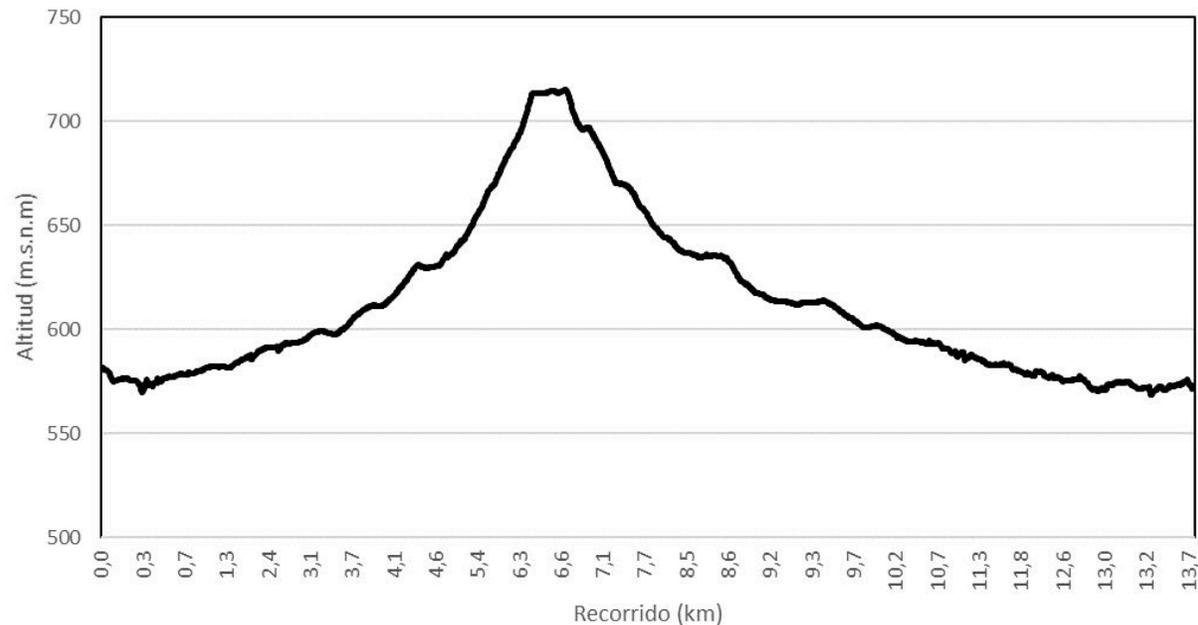


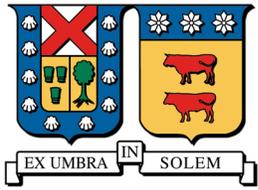
# Route

The route is shown in the figure with its respective altitude profile.

An approximate distance of 14 km.

Test duration around 40 minutes.

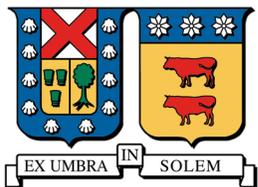




# Instruments

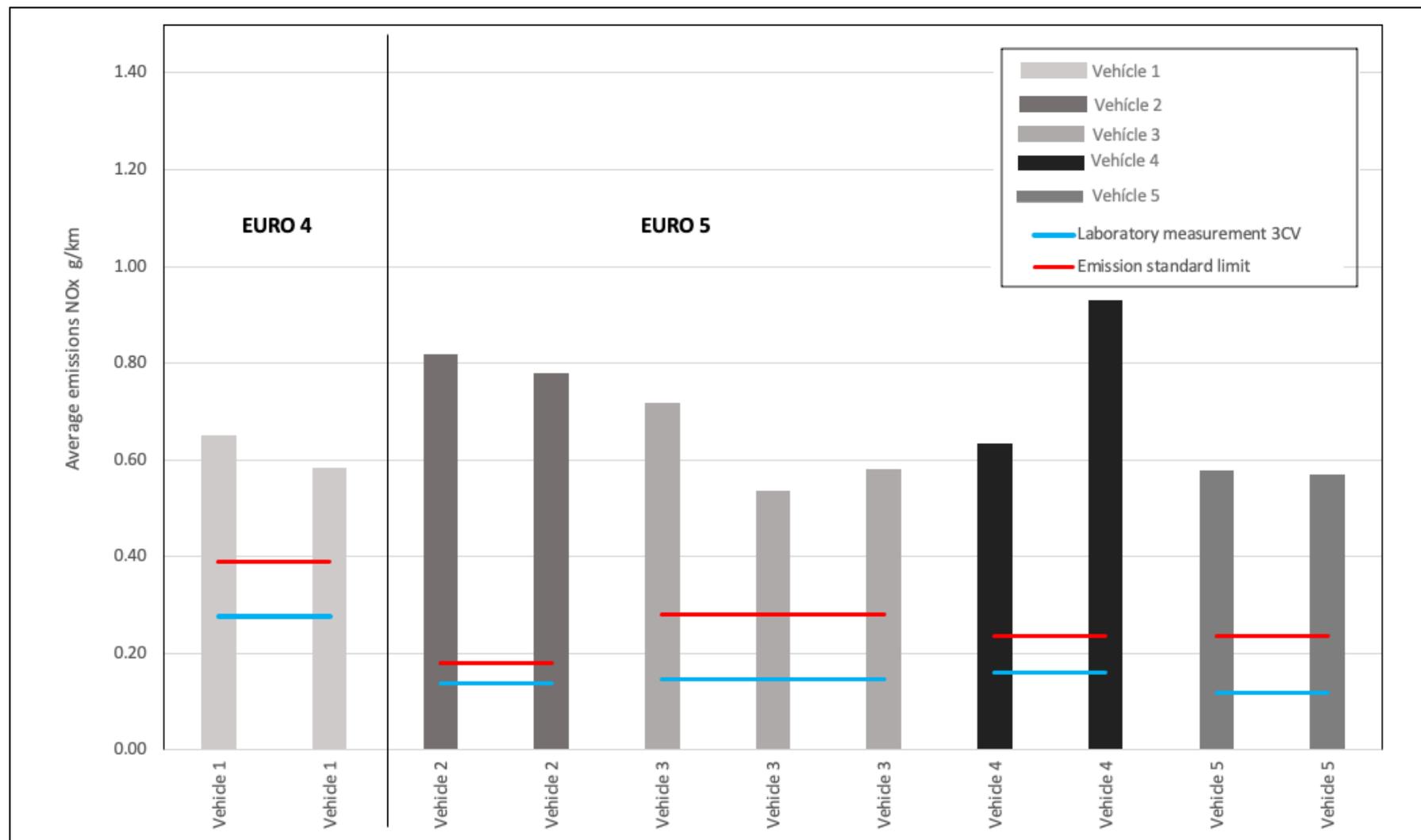
Vehicle exhaust gases were measured with a Portable Emission Measurement System.

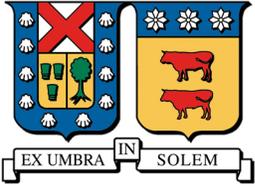




# Emissions results

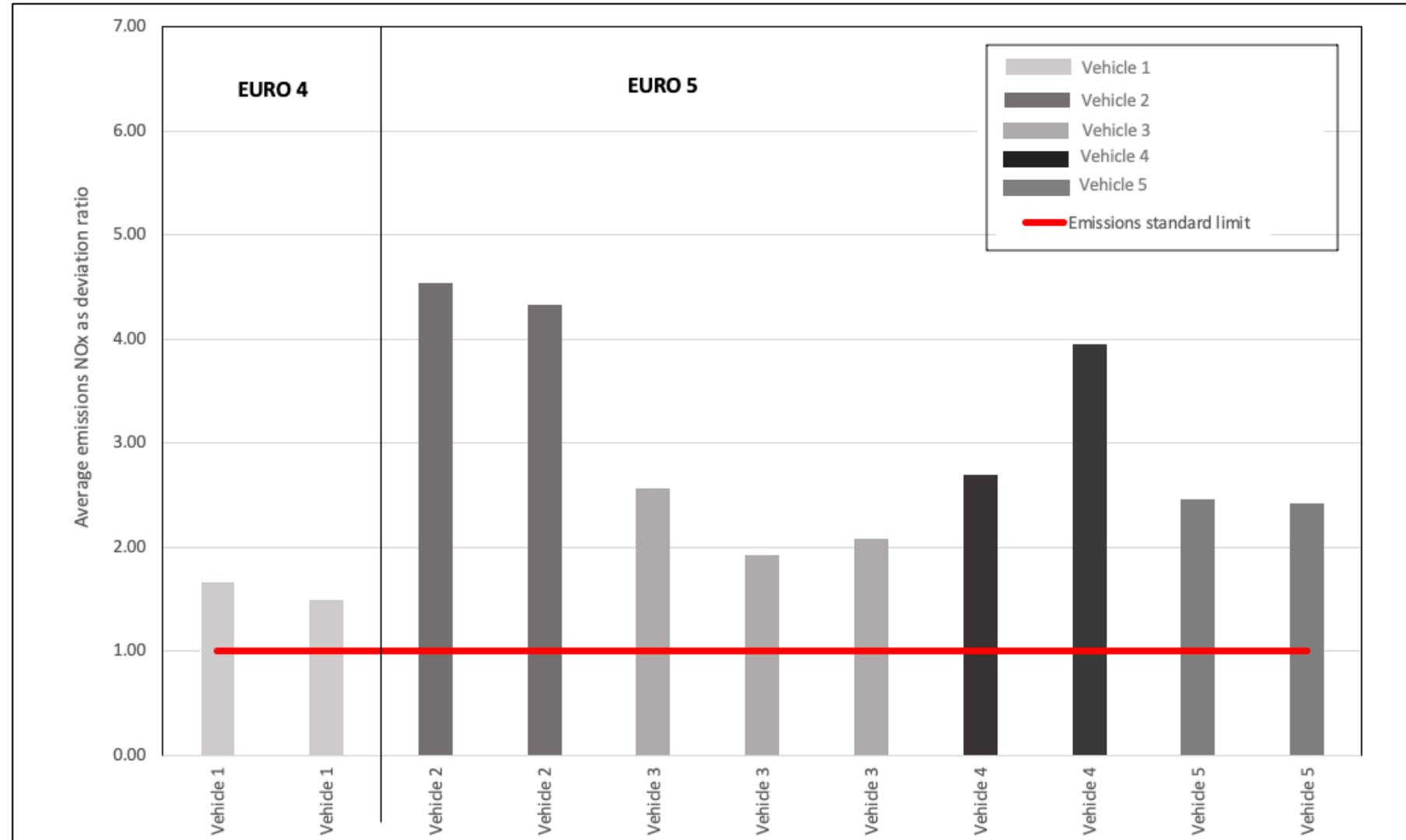
Emissions were compared with its emissions standard limit and its laboratory measurement at the *Centro de Control y Certificación Vehicular (3CV)* from the Ministry of Transport

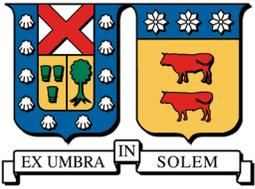




# Comparisons with Emissions Std

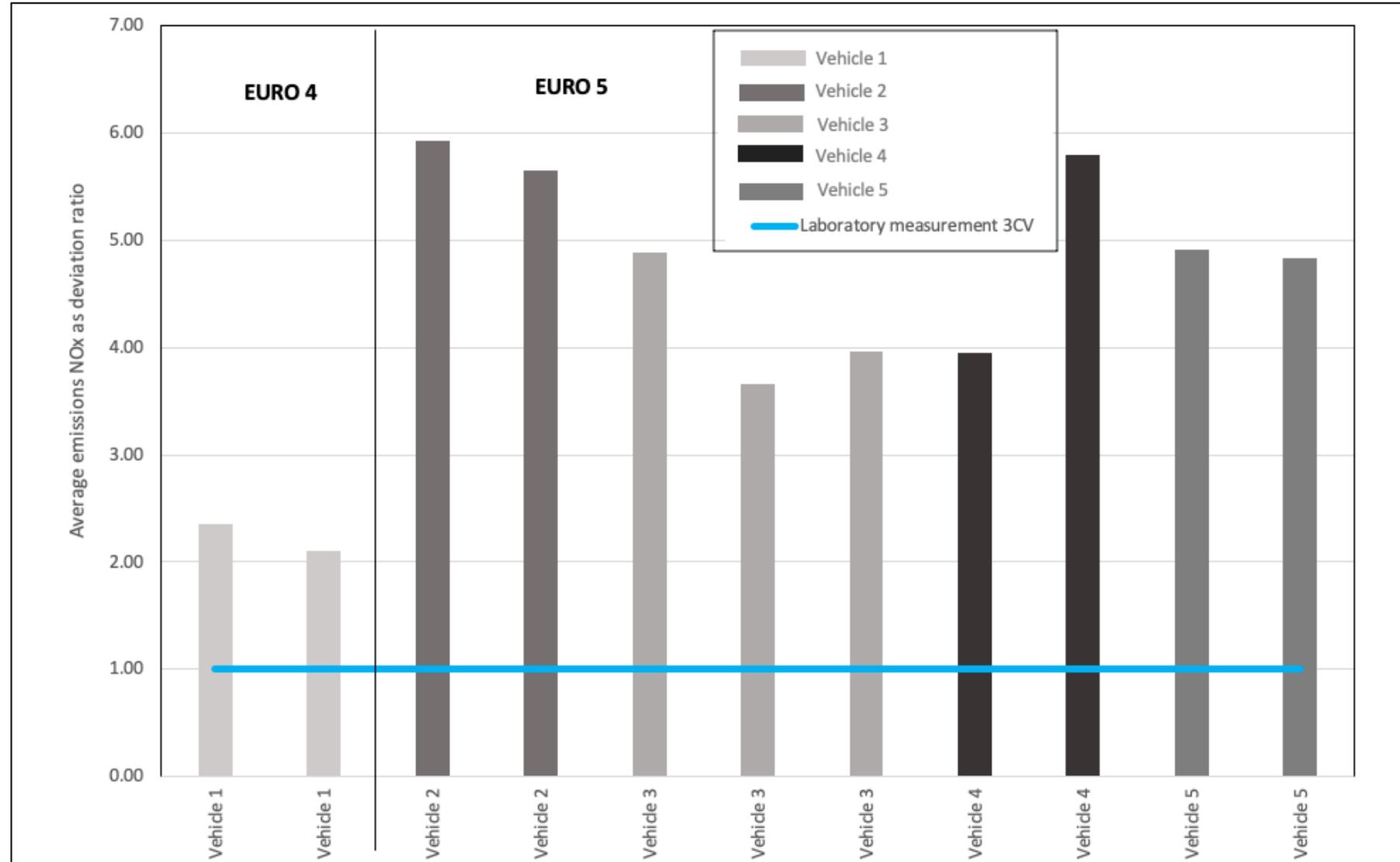
Emissions are higher than the emissions standard limit up to 4.5 times.

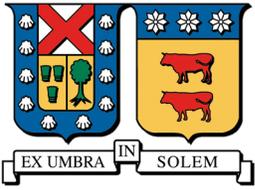




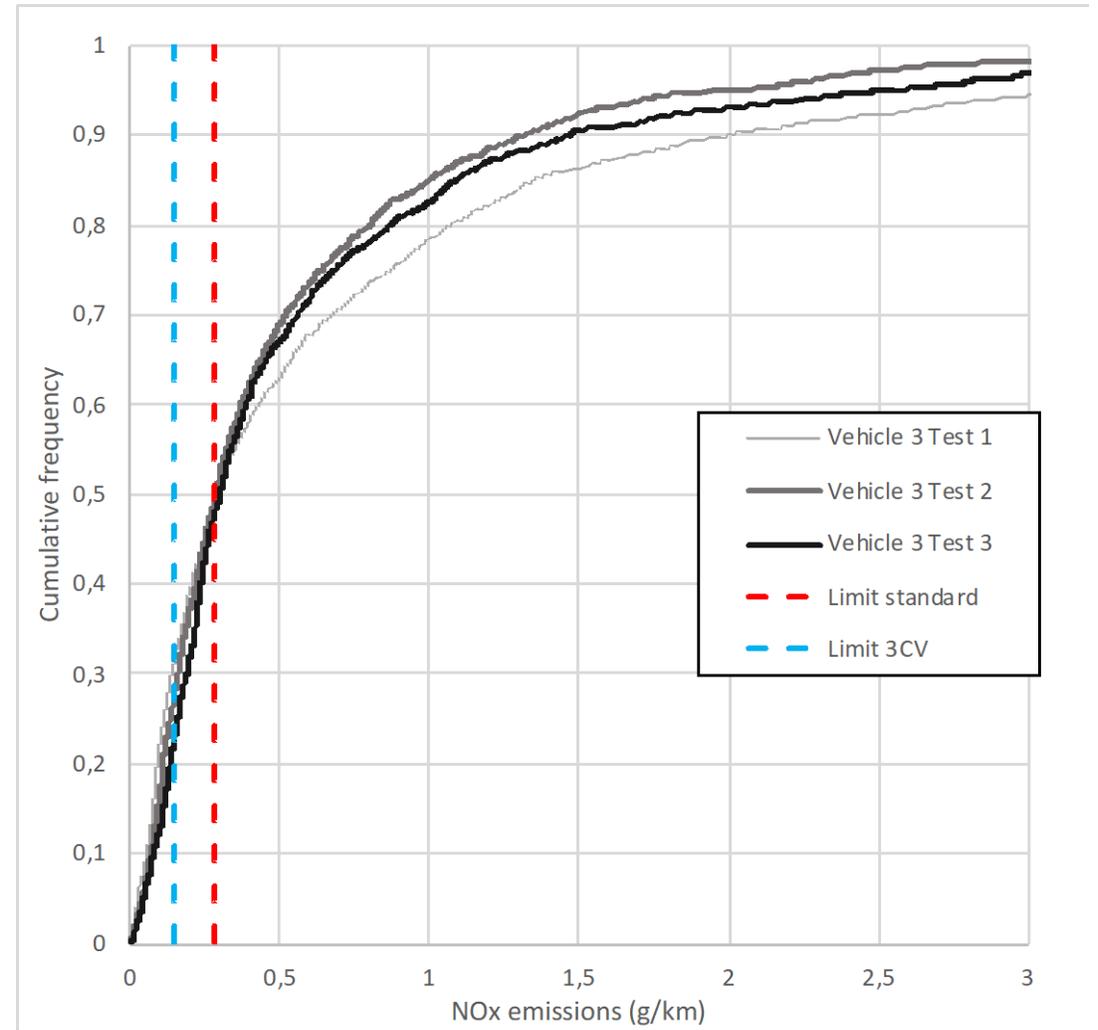
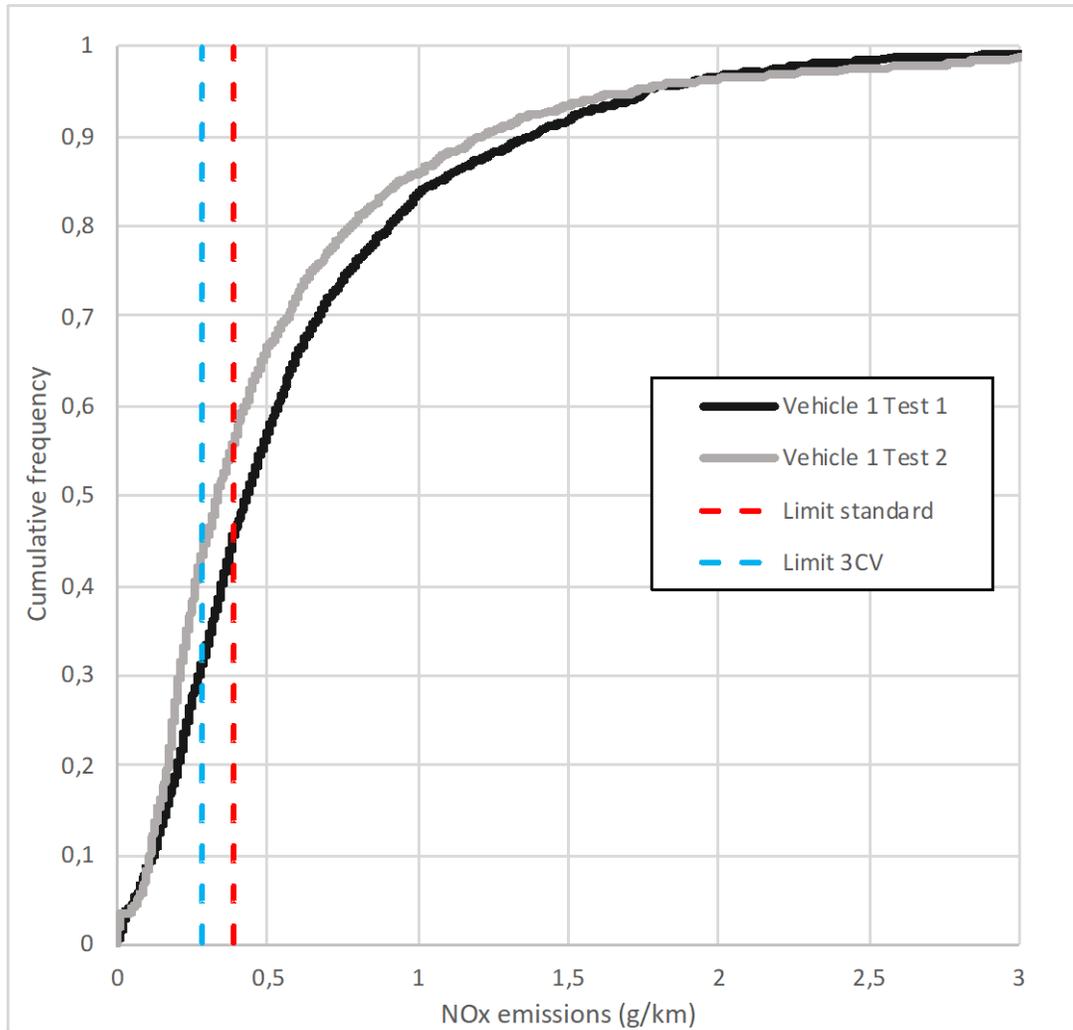
# Comparisons with Lab Measurement

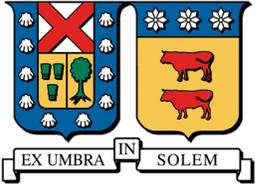
Emissions are higher than the laboratory measurement at 3CV up to 5.9 times.



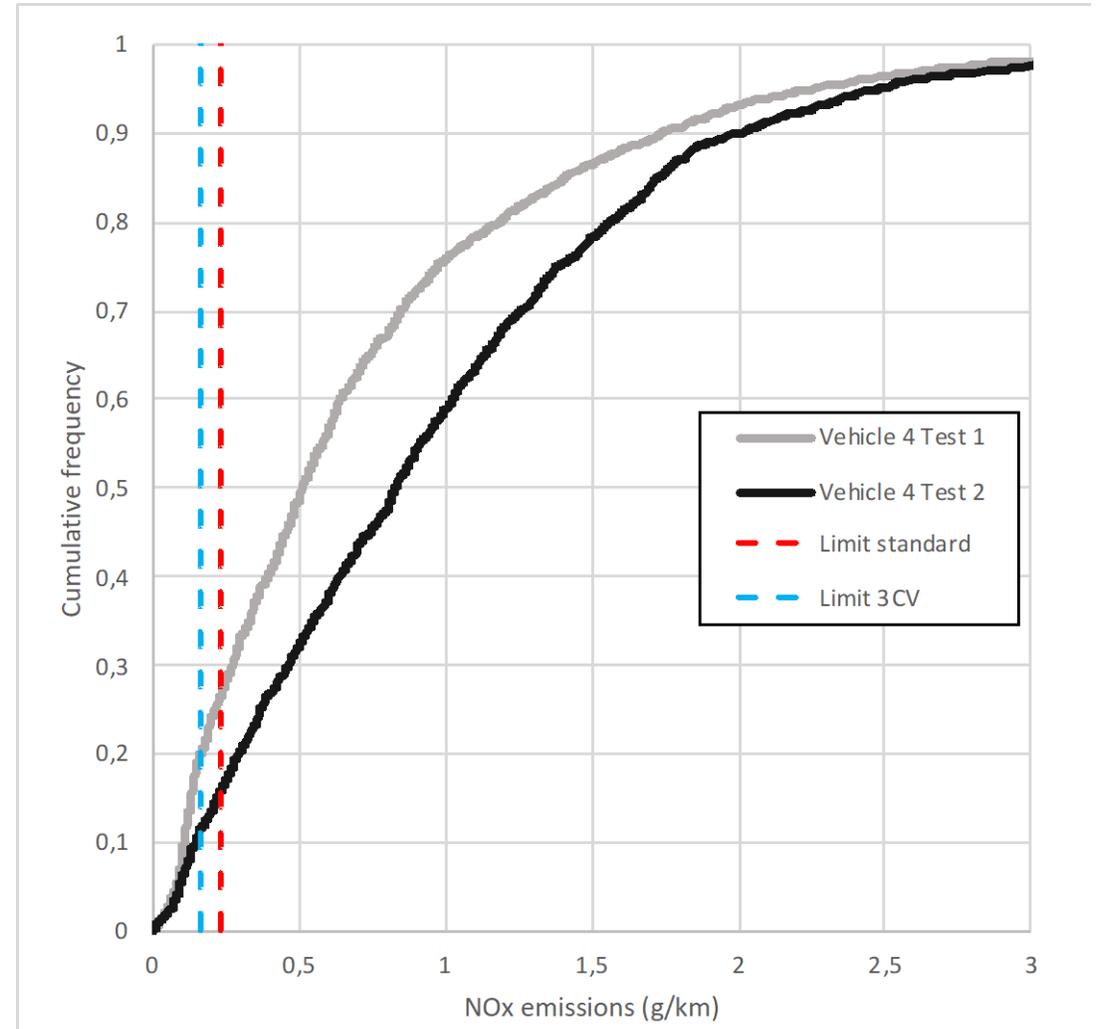
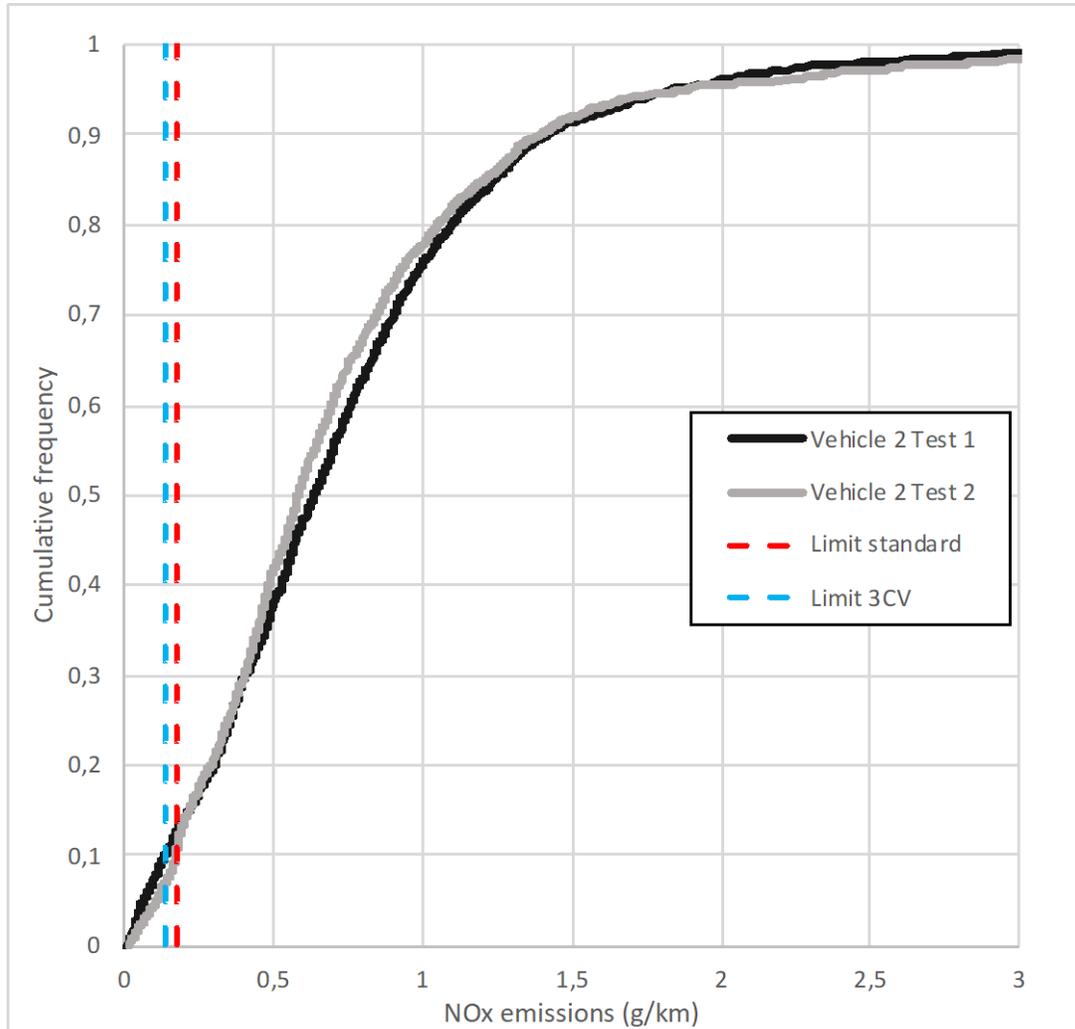


# Results – Cumulative Emissions





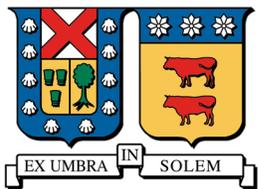
# Results – Cumulative Emissions



# Conclusions



- The results show that the 5 vehicles exceed the emission limits of laboratory values obtained by 3CV. However, these values are expected in an on-road measurement.
- The exceedance rate varies from 1,7 to 5,9 times the emissions standard.
- The results seem reasonable for In-use Emissions Testing with PEMS, emissions values range from 0,54 g/km up to 0,93 g/km, this value are comparable with the values obtained in other studies.
- Main conclusion is that emissions rate for TDI engine maintain their on-road levels in Chile, but the emissions standard is sufficiently high to be consider acceptable.
- **Finally, is key to work on strengthening the emissions standards in South America including RDE methods, but it also key to have more affordable and versatile equipment to be able to perform in use testing.**



# Thank you!

## PEMS – CHILE TEAM

- Mauricio Osses
- Sebastian Tolvett
- Kevin Basoa
- Franco Fuentes
- Nicolas Bravo
- María Paz Dominguez
- Mon Lee
- Danilo Estay
- Adolfo Gaete
- José Nuñez
- German Amador
- Alejandra Labarca
- Cristian León

