

Analysis and substantiation of test and HVAC operating modes

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The list of tested vehicles

The study was carried out on the Central scientific research automobile and automotive engine institute (NAMI) in it's Testing Centre - Dmitrov proving ground

There should not be other vehicles during the whole test in the vicinity of test vehicle

Data of testing 5 - 25 October 2017

Test car number	Engine type	Mileage before testing, km	Type of gearbox
1	gasoline	6450	manual
2	gasoline	35600	automatic
3	gasoline	29650	manual
4	diesel	8800	automatic
5	diesel	21000	manual

Test modes

- 1. Movement at constant speed 50 km/h**
- 2. Movement at constant speed 90 km/h**
- 3. Movement at constant speed 110 km/h**
- 4. Movement at constant speed 130 km/h**
- 5. Idling**
- 6. Acceleration from a speed of 60 km/h at WOT to a speed of 130 km/h and a free coasting down to a speed of 60 km/h**

On each of the driving and idling modes, the measurements of the pollutants were made during the performances of the following operating modes of the ventilation and recirculation systems (next slide)

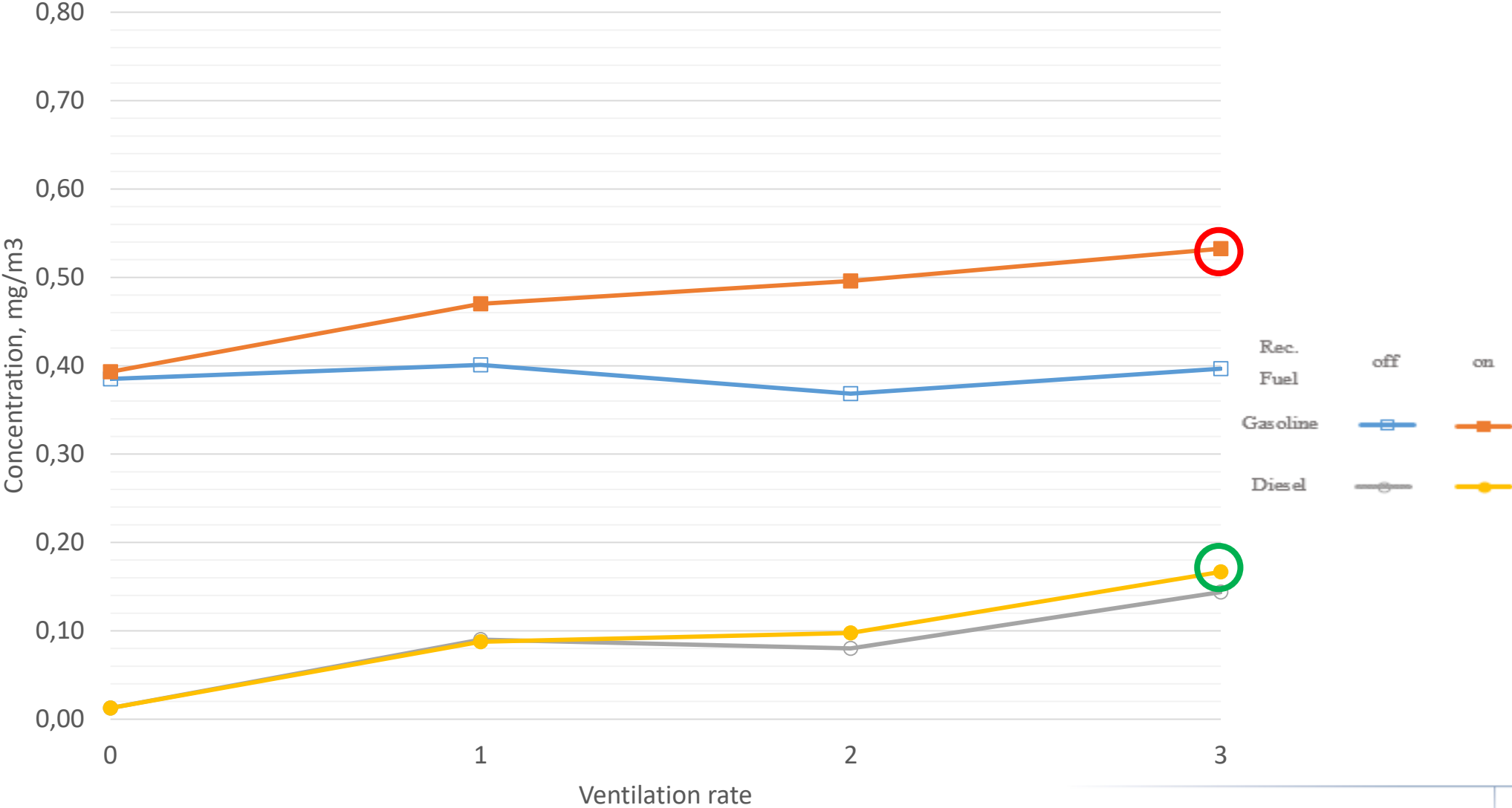
Operation modes of the ventilation and recirculation systems during tests

Recirculation mode	Ventilation mode			
	Off	Minimal	Medium	Maximum
Off				
On				

8 combinations of ventilation speed and recirculation mode in total was used

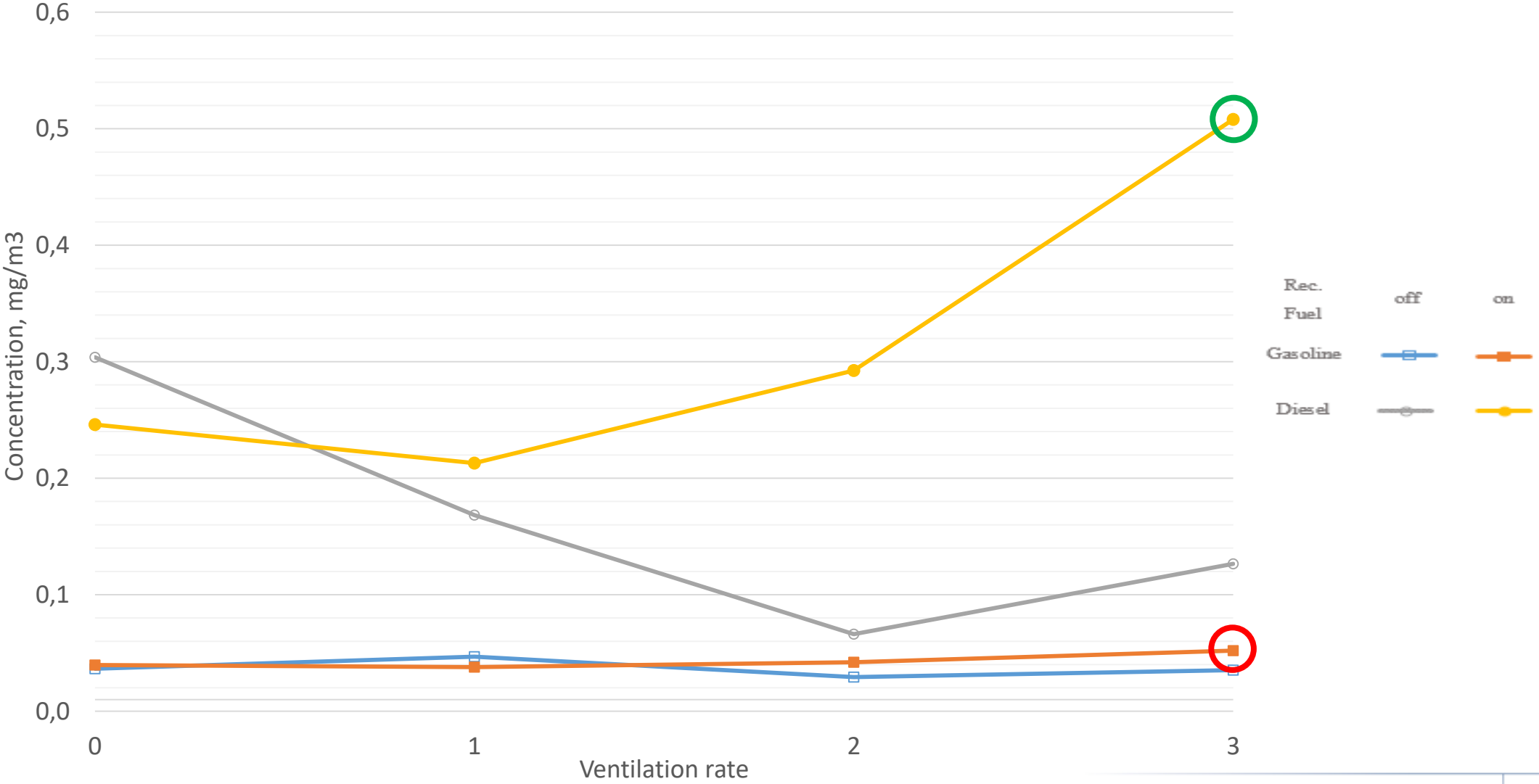
Analysis of test results at idling

CO concentration at idling speed



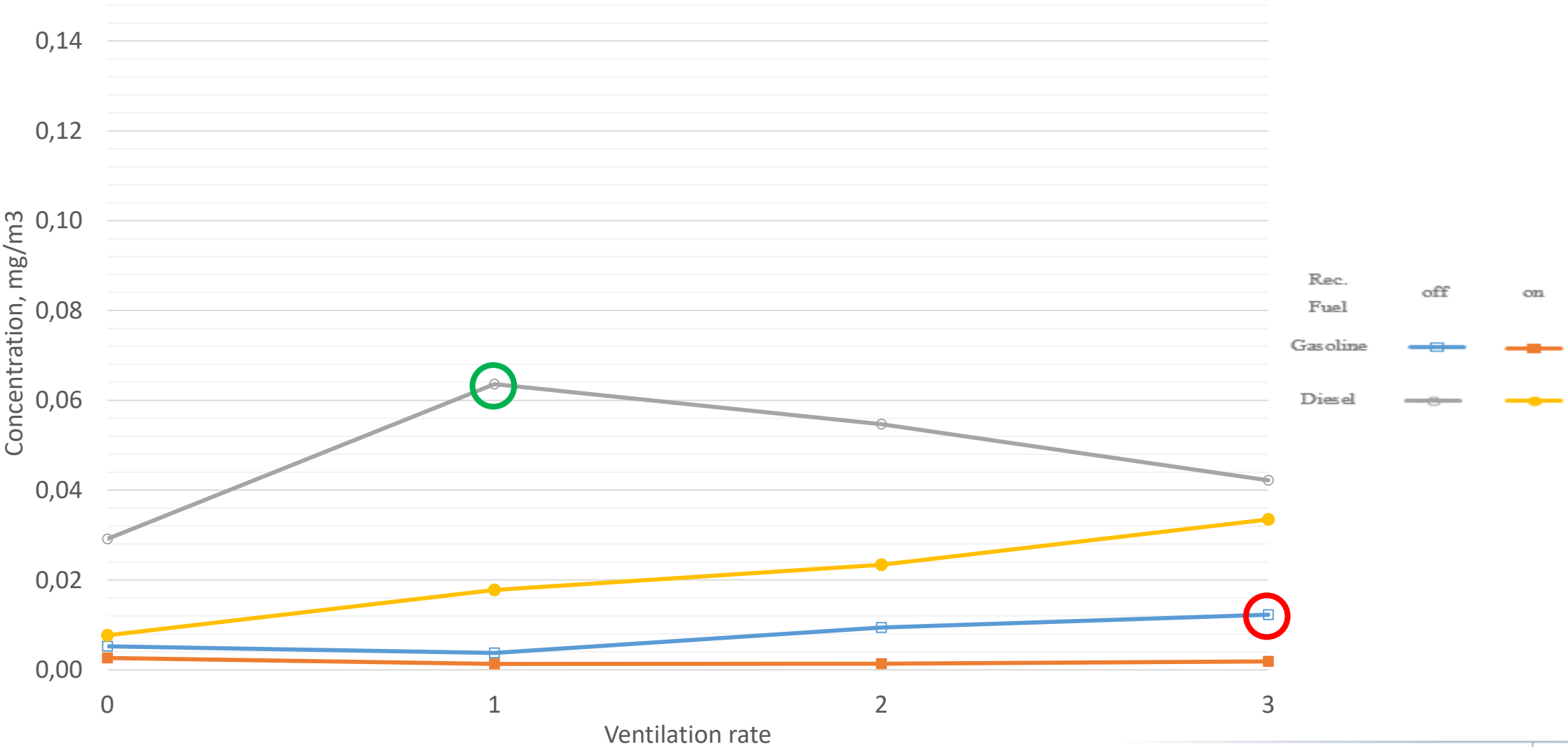
Analysis of test results at idling

NO concentration at idling speed



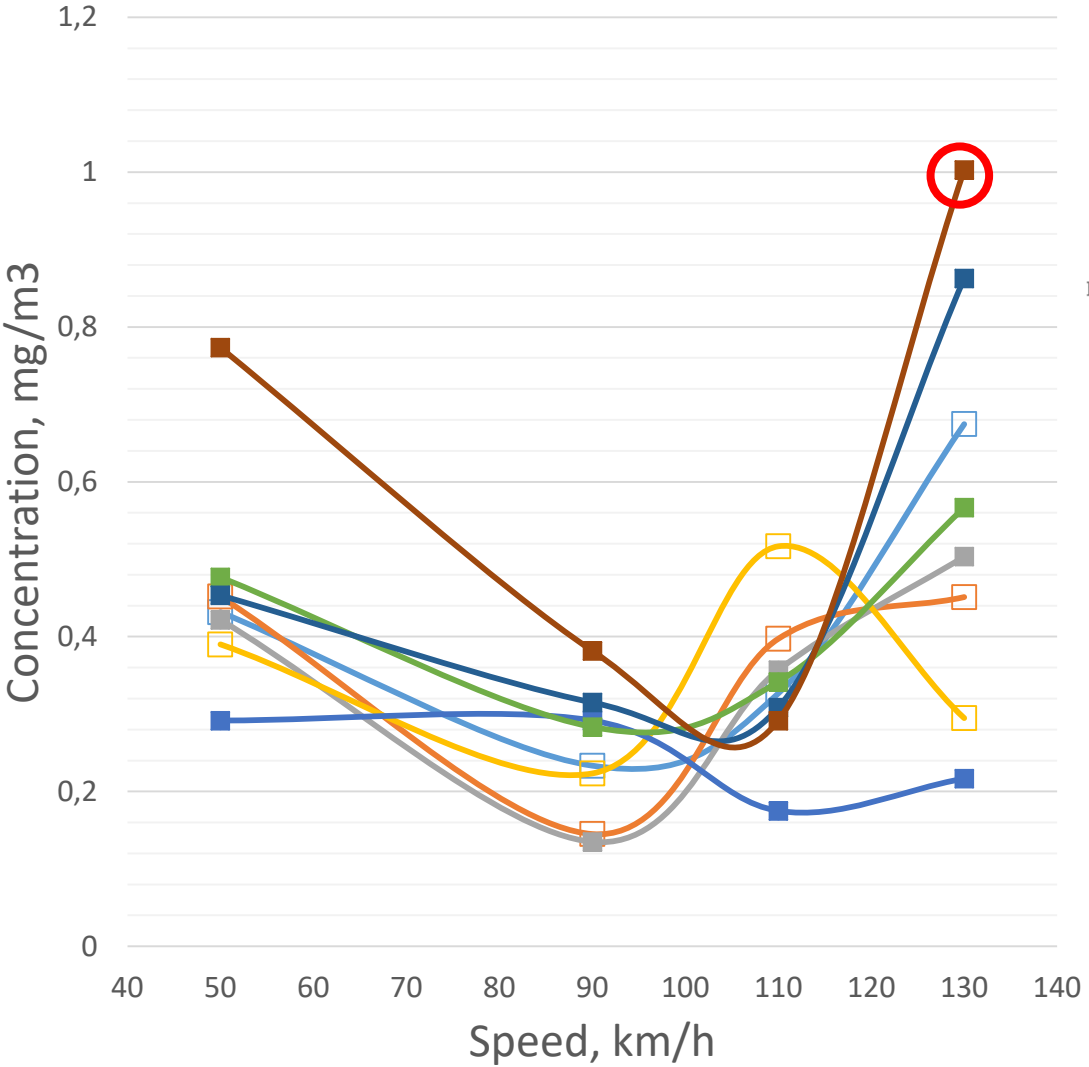
Analysis of test results at idling

NO2 concentration at idling speed

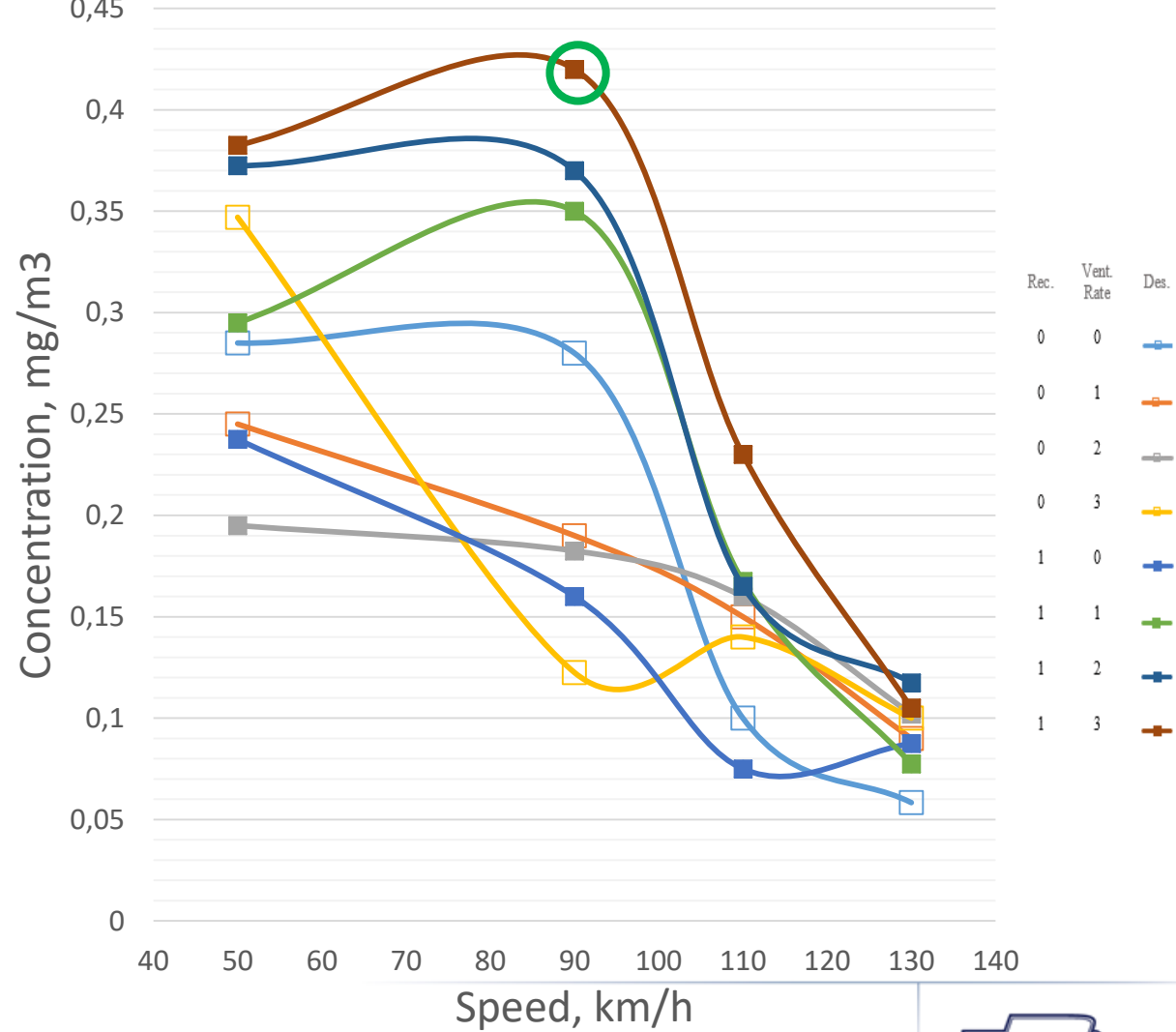


Analysis of test results at constant speed movement

CO concentratio depending on the speed for gasoline vehicles

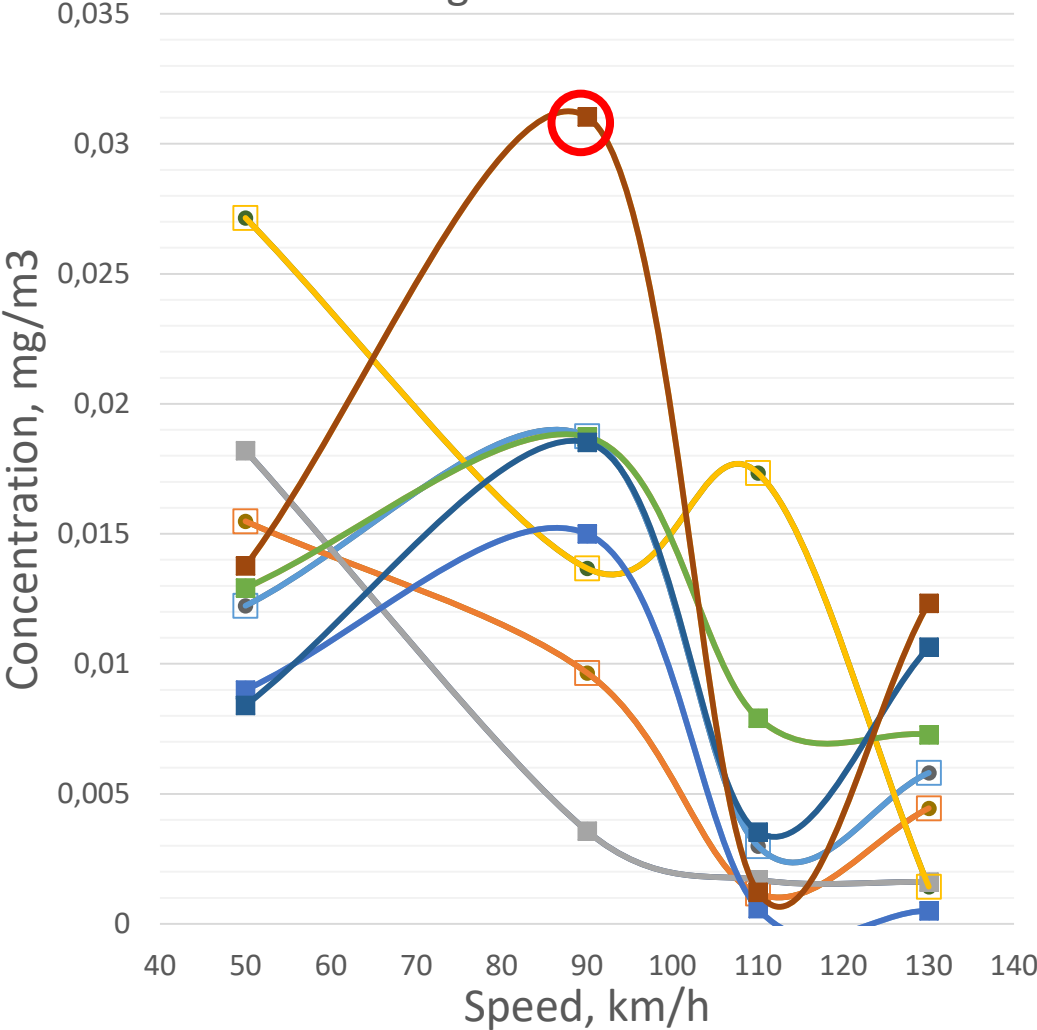


CO concentratio depending on the speed for diesel vehicles



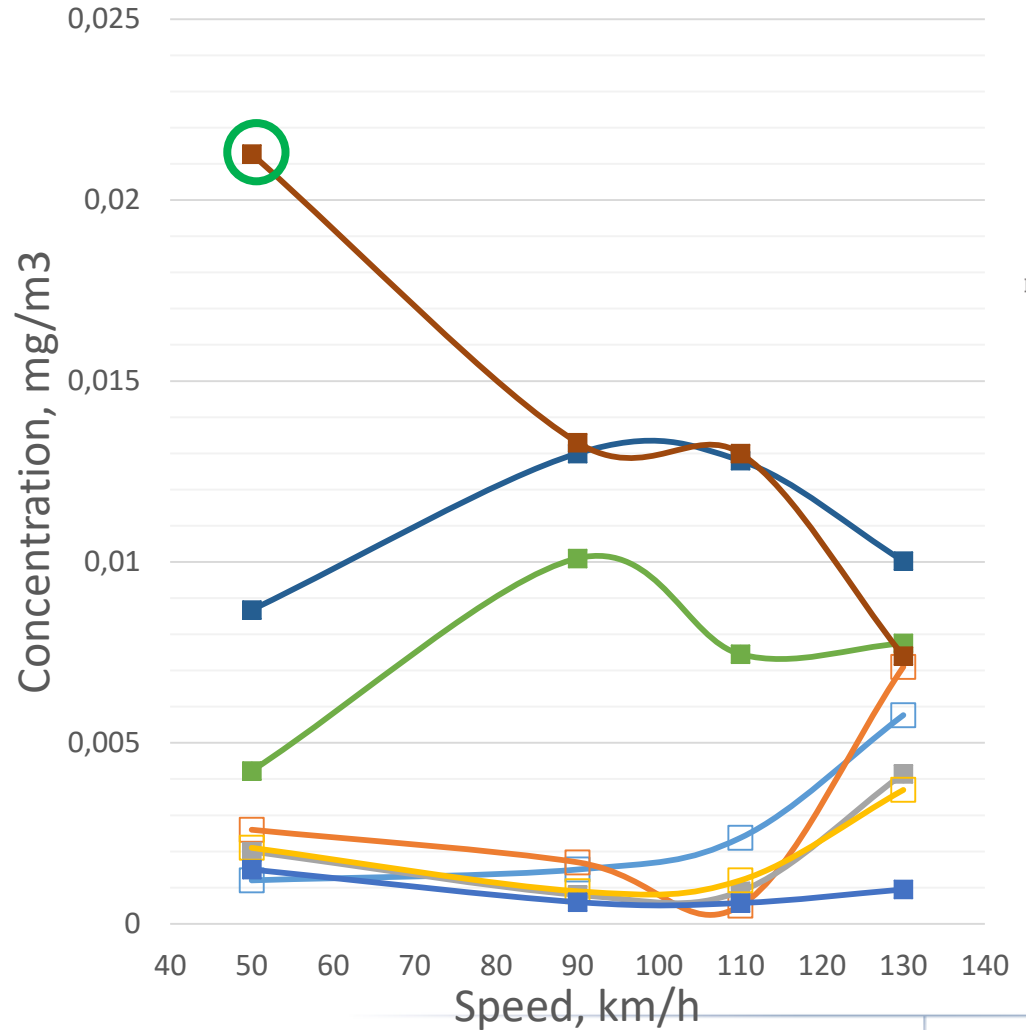
Analysis of test results at constant speed movement

NO concentratio depending on the speed for gasoline vehicles



Rec.	Vent. Rate	Des.
0	0	Des. 0
0	1	Des. 1
0	2	Des. 2
0	3	Des. 3
1	0	Des. 0 (1)
1	1	Des. 1 (1)
1	2	Des. 2 (1)
1	3	Des. 3 (1)

NO concentratio depending on the speed for diesel vehicles

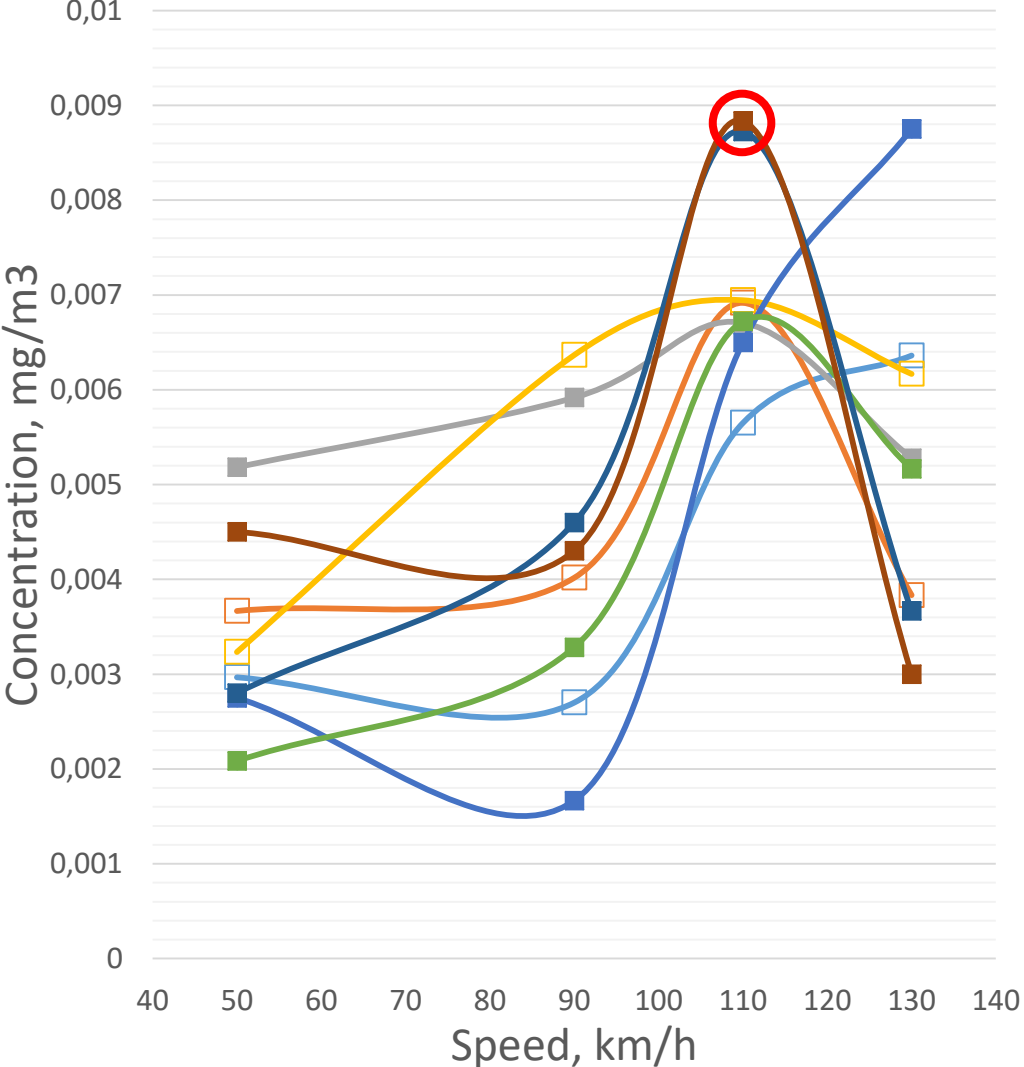


Rec.	Vent. Rate	Des.
0	0	Des. 0
0	1	Des. 1
0	2	Des. 2
0	3	Des. 3
1	0	Des. 0 (1)
1	1	Des. 1 (1)
1	2	Des. 2 (1)
1	3	Des. 3 (1)



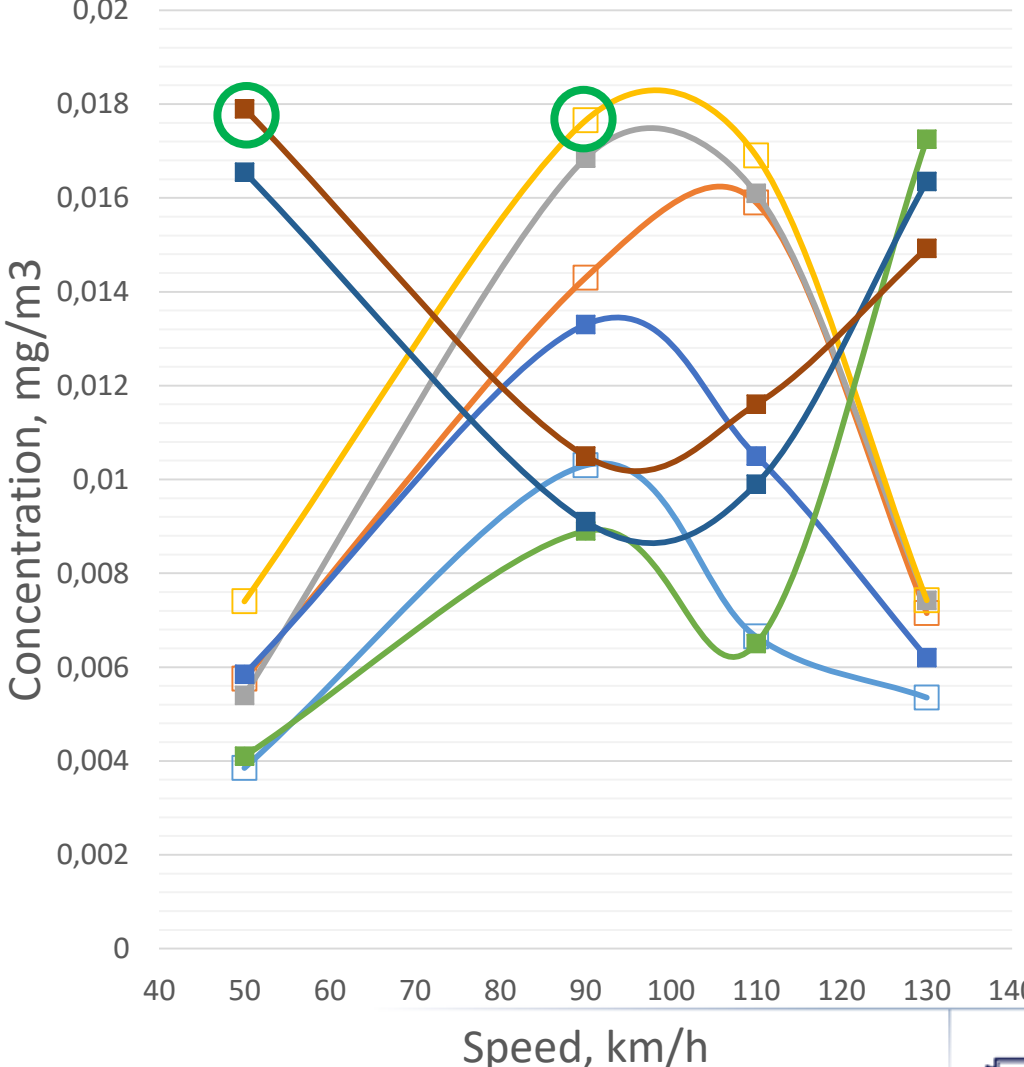
Analysis of test results at constant speed movement

NO2 concentratio depending on the speed for gasoline vehicles



Rec.	Vent. Rate	Des.
0	0	Blue square
0	1	Orange square
0	2	Grey square
0	3	Yellow square
1	0	Dark blue square
1	1	Green square
1	2	Blue square
1	3	Brown square

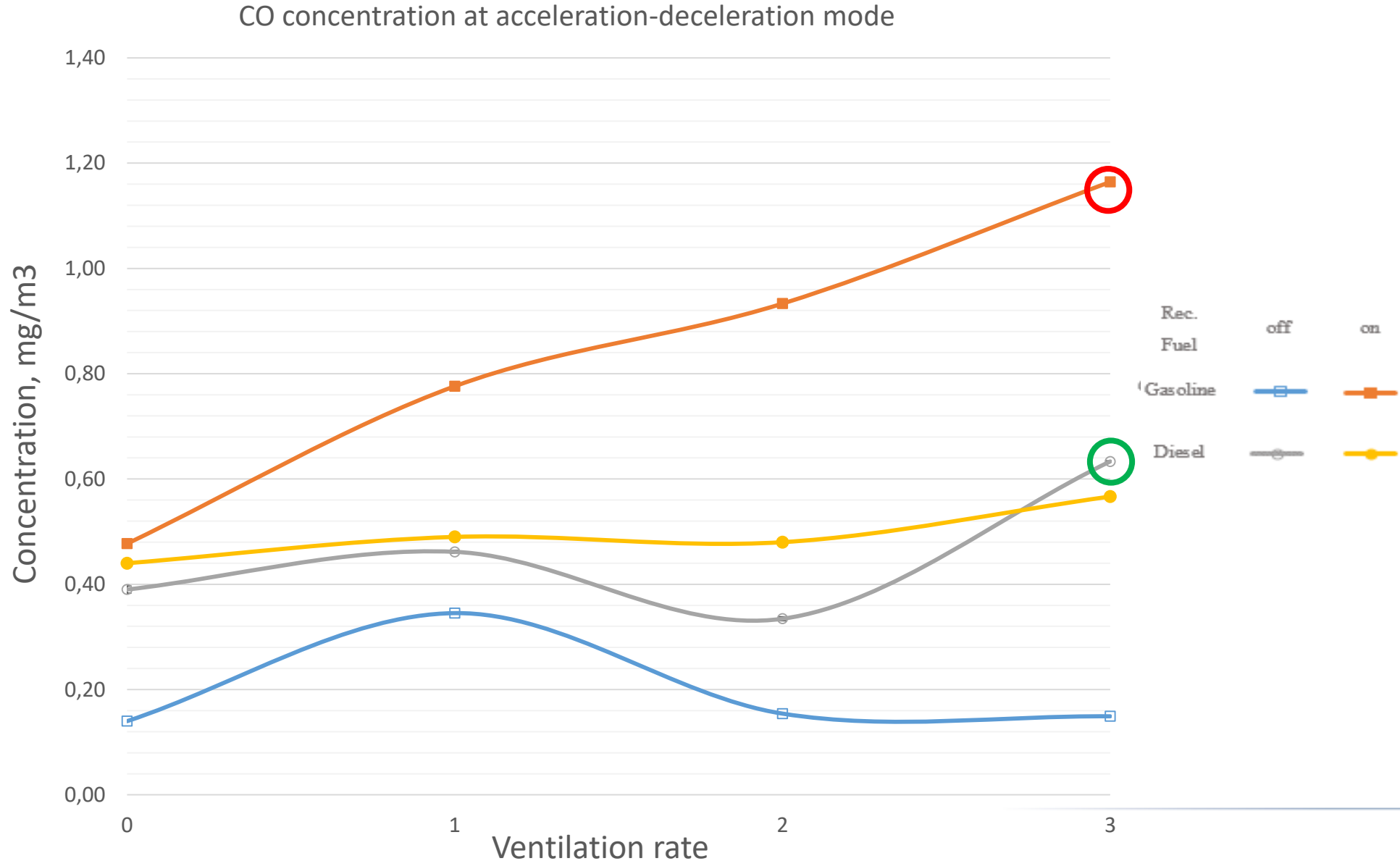
NO2 concentratio depending on the speed for diesel vehicles



Rec.	Vent. Rate	Des.
0	0	Blue square
0	1	Orange square
0	2	Grey square
0	3	Yellow square
1	0	Dark blue square
1	1	Green square
1	2	Blue square
1	3	Brown square

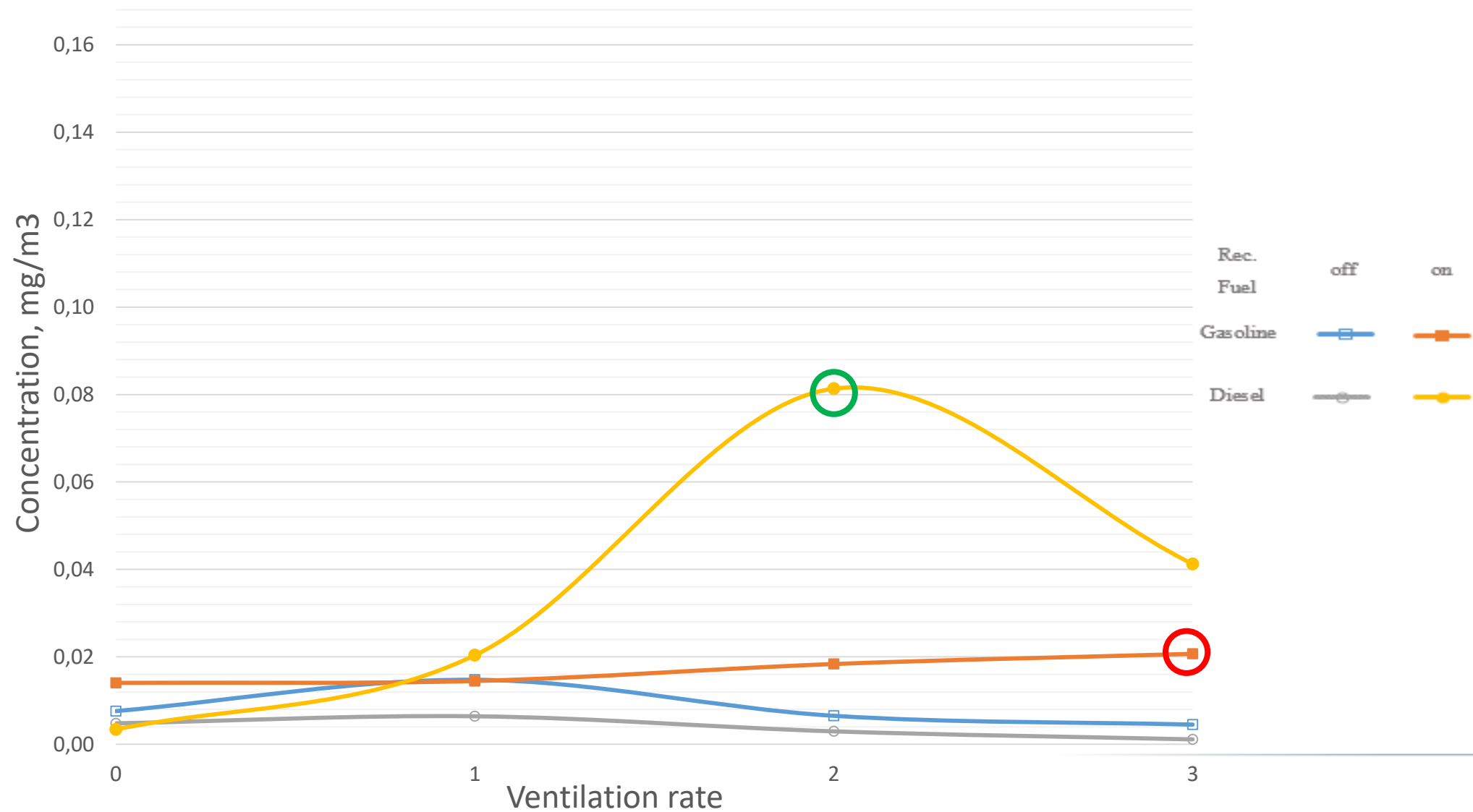


Analysis of test results at acceleration and coasting down



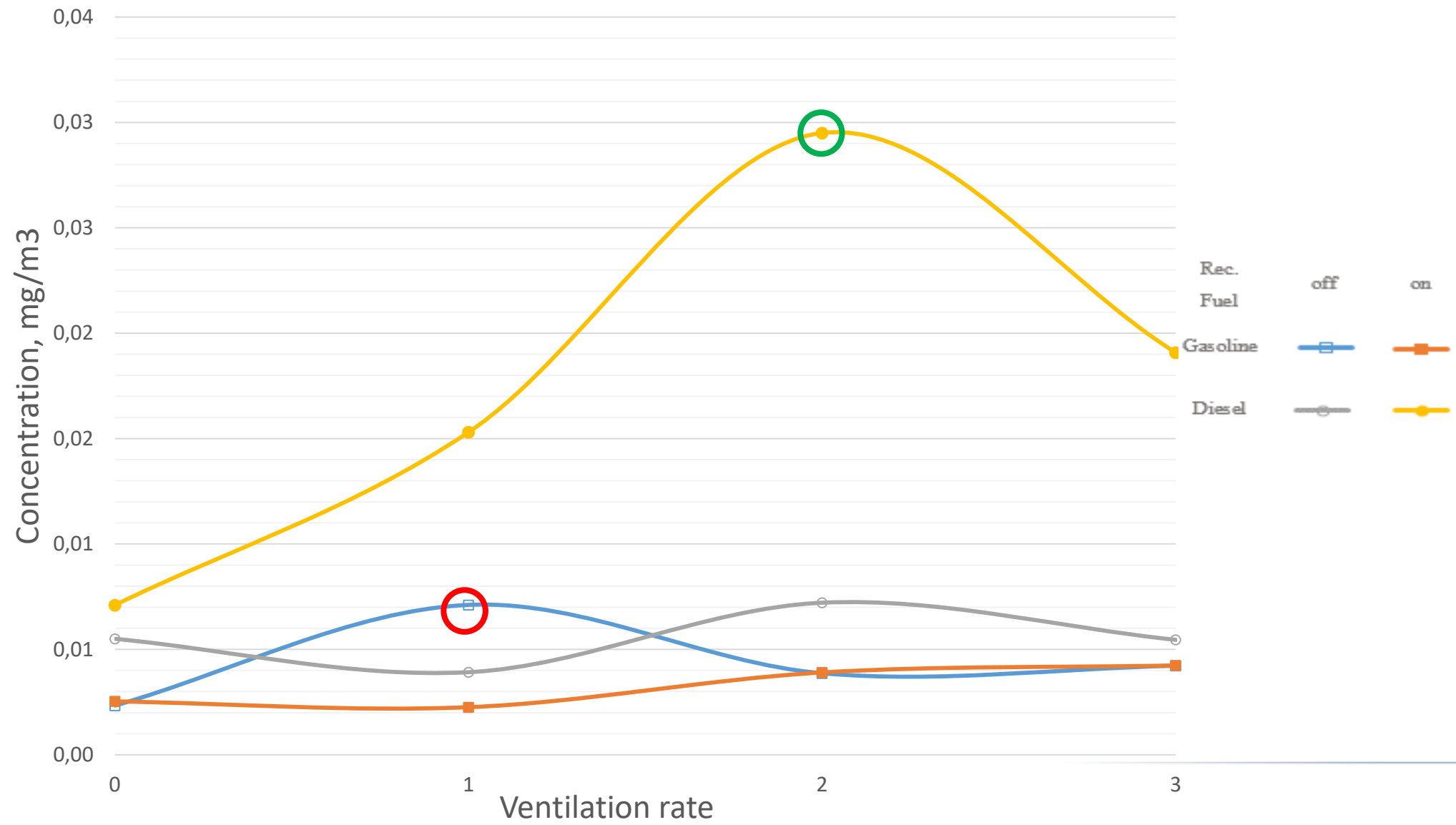
Analysis of test results at acceleration and coasting down

NO concentration at acceleration-deceleration mode



Analysis of test results at acceleration and coasting down

NO2 concentration at acceleration-deceleration mode



Proposed HVAC operating modes

Idling

Recirculation mode	Ventilation mode			
	Off	Minimal	Medium	Maximum
Off				✓
On				✓ ✓

- ✓ CO
- ✓ NO
- ✓ NO₂

Constant speed movement 50 and 90 km/h

Recirculation mode	Ventilation mode			
	Off	Minimal	Medium	Maximum
Off				✓
On				✓ ✓

Acceleration and coasting down

Recirculation mode	Ventilation mode			
	Off	Minimal	Medium	Maximum
Off				
On			✓ ✓	✓



1. Analysis and substantiation of test and HVAC operating modes was carried out for 3 gasoline and 2 diesel cars.
2. Highest concentrations of CO and NO at idling was observed at recirculation on and maximal ventilation rate, for NO₂ at recirculation off and maximal ventilation rate.
3. At constant speed movement highest concentrations of pollutants was observed at speed of 50 and 90 km/h at the same HVAC modes as for idling.
4. At acceleration and coasting down test mode highest concentrations of pollutants was observed at recirculation on for CO at maximal ventilation rate, for NO and NO₂ at medium ventilation rate.
5. It is proposed to use described above test and HVAC operating modes combinations for assessment of interior air quality in frame of VIAQ IWG work.

Thank you for your attention!

