

Assessment of ambient temperature impact to interior air quality

Andrey KOZLOV
Zinaida BULYCHEVA



Tested cars , measured pollutants, temperature conditions

Tested Car:

- ✓ gasoline fuel
- ✓ automatic transmission

The list of measured pollutants in vehicle interior air under test:

- ✓ Carbon monoxide (CO)
- ✓ Nitric oxide (NO)
- ✓ Nitrogen dioxide (NO₂)

Temperature range:

- ✓ -8...-10°C
- ✓ +5...+11°C
- ✓ +15...+19°C

Tests period: January-May 2018

Test equipment

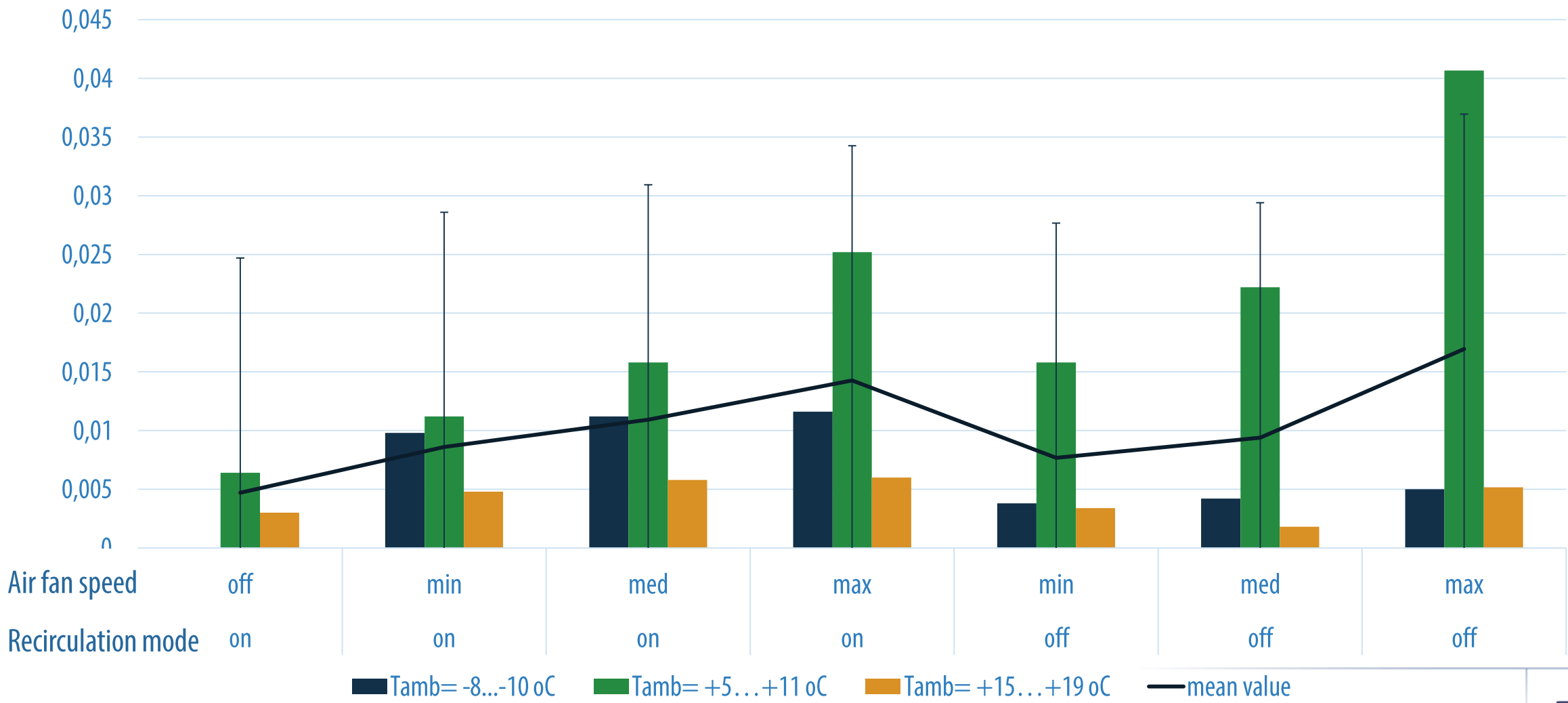
Technical data of test equipment

| Equipment, model, type of detector | Pollutant | Minimal measurable concentrations, mg/m ³ | Range of measurable concentrations, mg/m ³ | Relative error of measurements, % | Absolute measurement error, mg/m ³ |
|--|--------------------------------------|--|--|--|---|
| Gas analyzer "Opto gas 500.4-CO" with electrochemical detector | Carbon mono-oxide, CO | 0.1 | 0 - 3 0 - 50 | $\gamma - \pm 20$ | 0.06 |
| Gas analyzer "R-310A" with chemiluminescent detector | Nitrogen oxides, NO, NO ₂ | 0.001 | NO (0- 0.08) NO ₂ (0- 0.08) NO (0.08 – 1.0) NO ₂ (0.08-1.0) | $\gamma - \pm 25$ $\delta - \pm 25$ | NO - 0.02 NO ₂ - 0.02 |

Note : γ - limit of the allowed basic reduced measurement error;
 δ - limit of the permissible basic relative error of measurements;

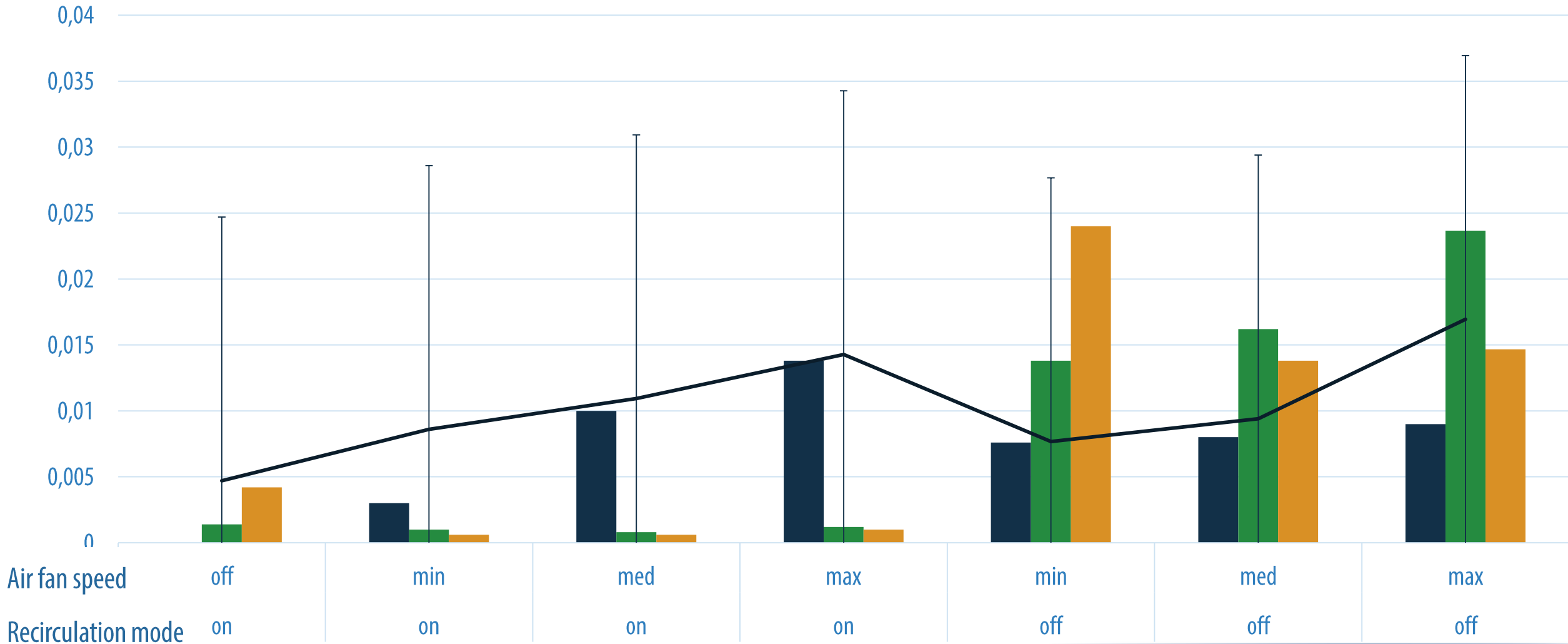
Test results

NO concentration, mg/m³



Test results

NO₂ concentration, mg/m³

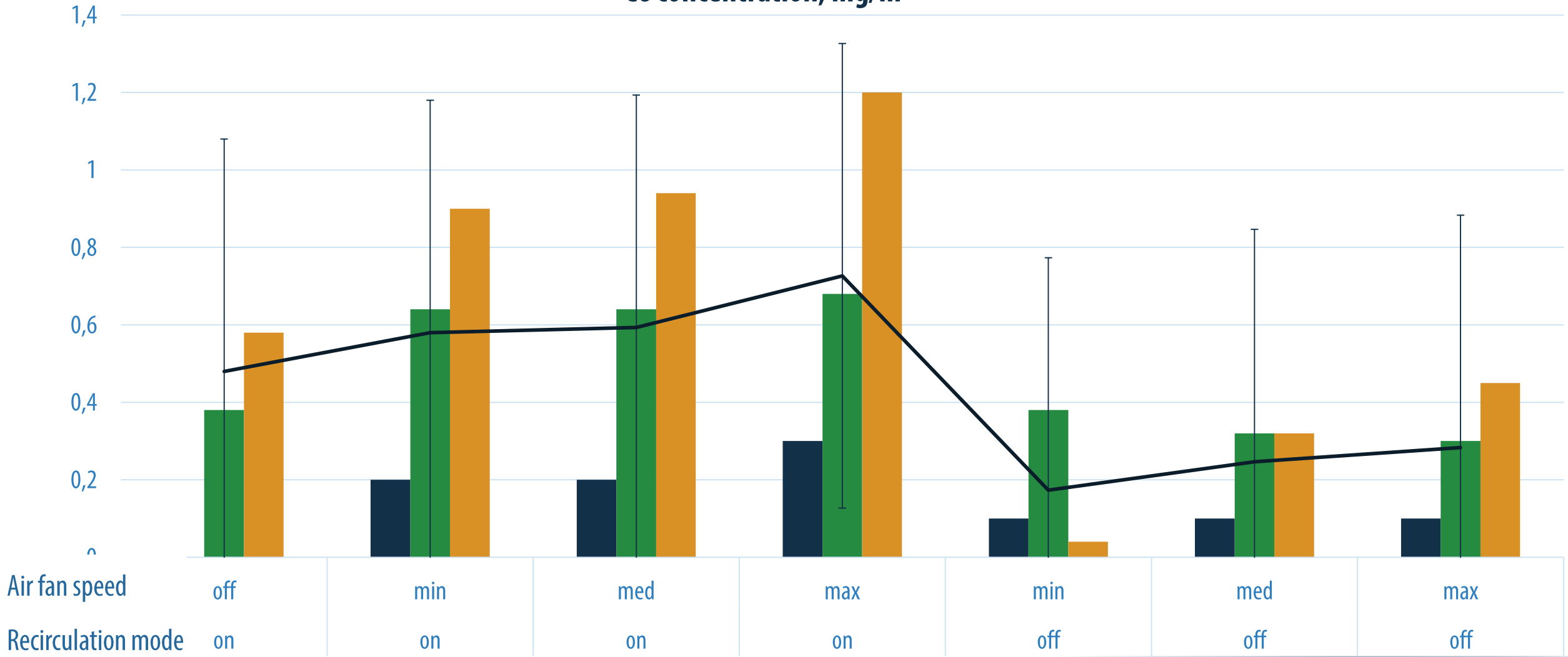


Tamb= -8...-10 °C
 Tamb= +5...+11 °C
 Tamb= +15...+19 °C
 mean value



Test results

CO concentration, mg/m³

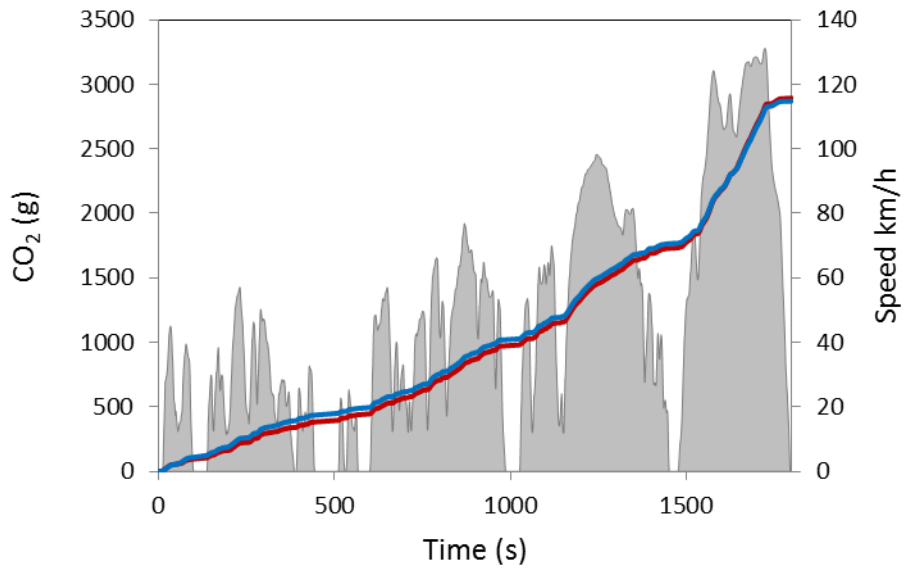
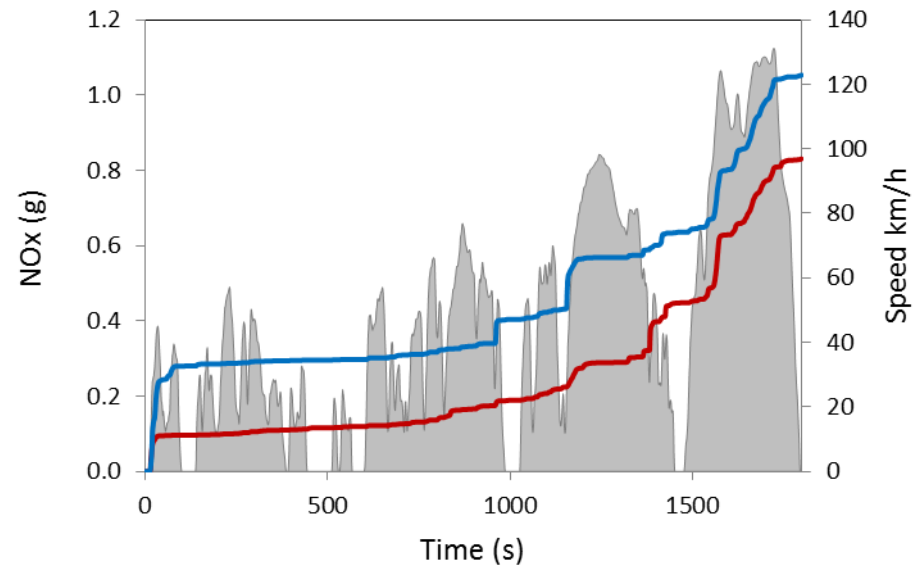
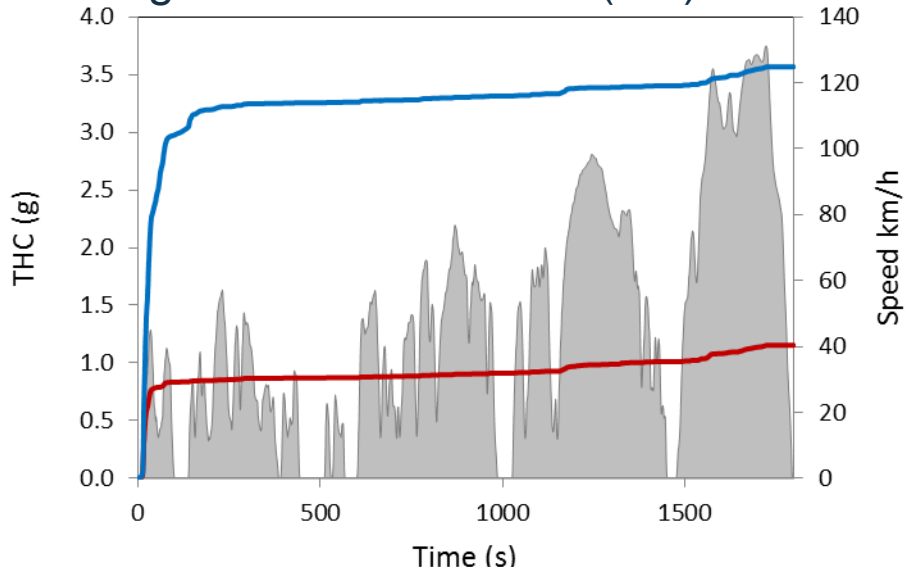
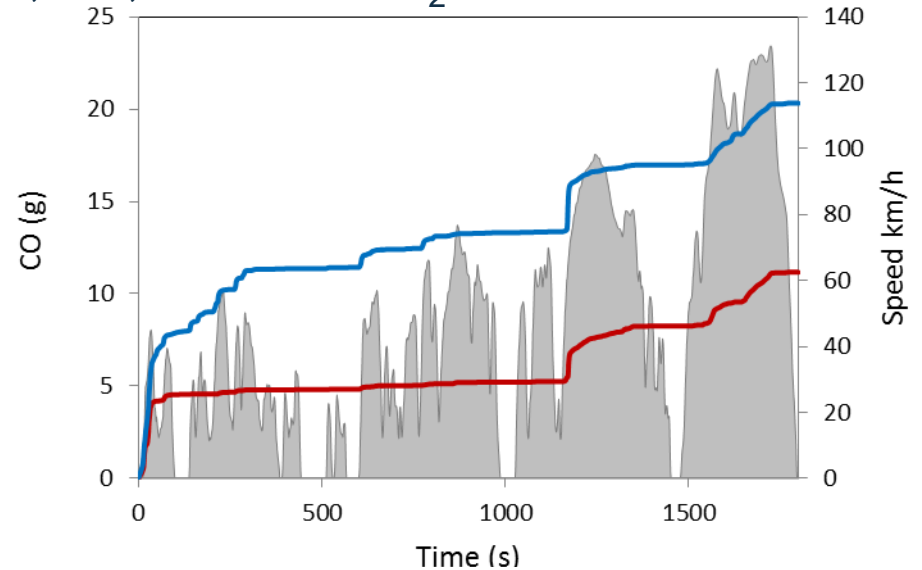


■ Tamb = -8...-10 °C ■ Tamb = +5...+11 °C ■ Tamb = +15...+19 °C — mean value



Emission during the WLTC at different ambient temperatures

THC, CO, NOx and CO₂ cumulative emissions of GV4 during the WLTC at 23 °C (red) and -7 °C (blue)



Conclusions

1. Test of a gasoline car at the same conditions and different temperatures ranged from -8 to +15°C was carried out.
2. Measured concentration of harmful substances (CO, NO and NO₂) was in the range of gas analyzers error of measurements and any kind of relationship of measured concentrations from the temperature was not observed.
3. From another hand relationship of measured substances concentrations and ventilation/recirculation mode had very similar shape.
4. Taking into account reported results and modern emission legislation it is advisable to use the temperature range from -7 to +30°C for interior air quality testing.

- ✓ ambient air temperature:
from -7°C to +30°C
- ✓ relative humidity:
from 30% to 90%
- ✓ atmospheric pressure
from 84.0 to 108.7 kPa

Thank you for your attention!

