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Non-legislated Emissions of a Passenger Car with Ethanol Blend Fuel E85

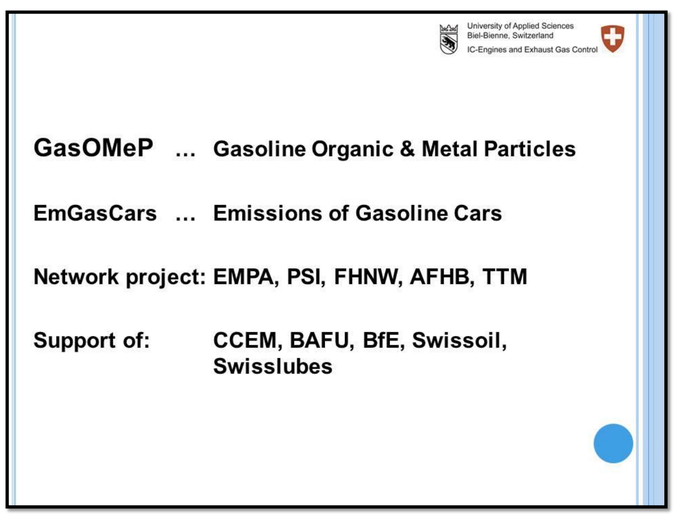
J. Czerwinski, P. Comte AFHB, University of Applied Sciences, Biel-Bienne, CH
S. Hermle, BfE
S. Renz, Renz Consulting
N. Heeb, EMPA

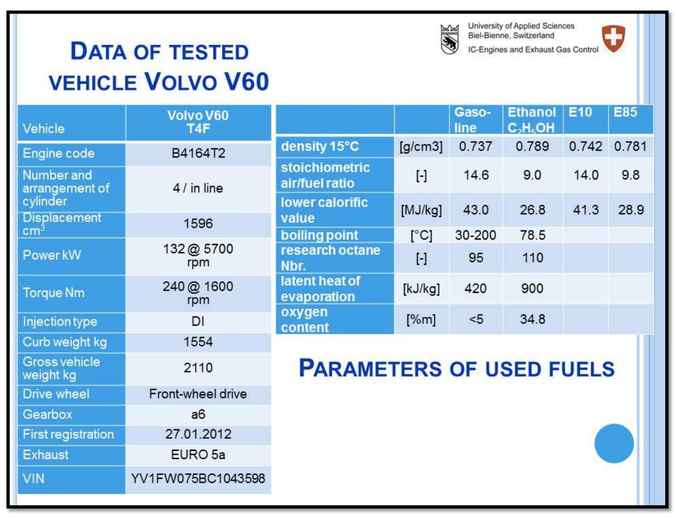
Abstract

An important objective for a sustainable development of individual transportation worldwide is a well-balanced use of alternative fuels.
Several countries have objectives to substitute a part of the energy of traffic by ethanol as the renewable energy source.
The global share of Bioethanol used for transportation is continuously increasing.
Investigations of limited and unregulated emissions of a flex fuel vehicle with gasoline-ethanol blend fuel have been performed in the present work according to the measuring procedures, which were established in the previous research in the Swiss Network (since 90ties).
The investigated fuel contained ethanol (E), in the portion of 85% by volume.
The investigated vehicle represented a newer state of technology and an emission level of Euro 5. The engine works with homogenous GDI concept and with 3-W-catalyst (3WC).
Since there is a special concern about the particle emissions of gasoline cars with direct injection, the nanoparticle counts measurements were systematically performed with SMPS at stationary and with CPC at dynamic operation.
The non-legislated gaseous emissions were tested with FTIR, this with special focus on NH_3, N_2O and HCHO (Formaldehyde).
The main results to be mentioned are:

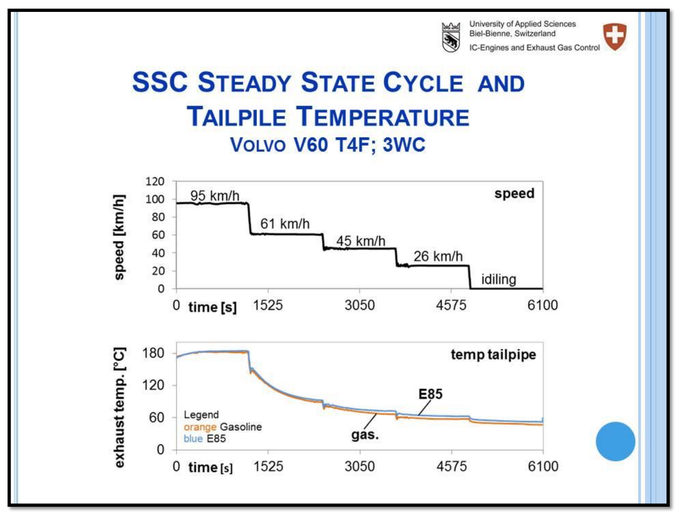
- the particle counts emissions are generally significantly reduced with E85,
- in WLTC there is a clear increase of NH_3 with E85 and an insignificant tendency of increasing HCHO (below 1 ppm),
- with both fuels (E0 & E85) there are no emissions of N_2O.

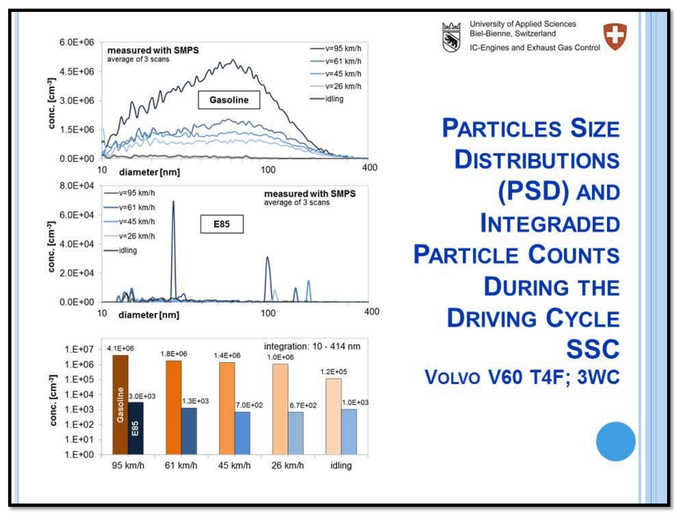
The present research did not address the durability aspects and the cold startability in extreme conditions.



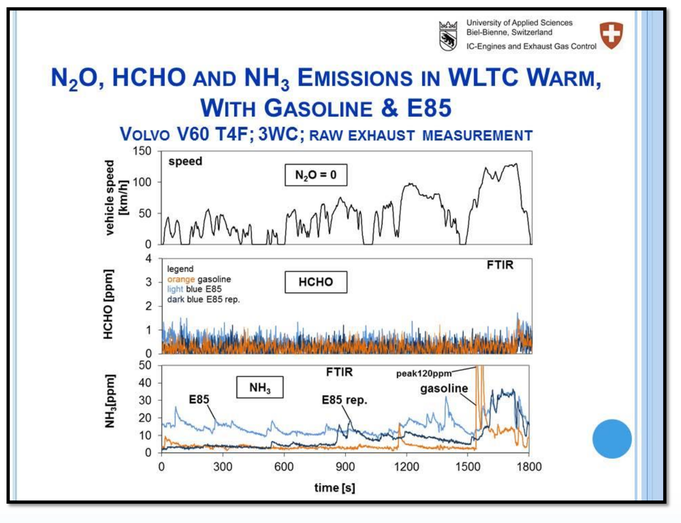


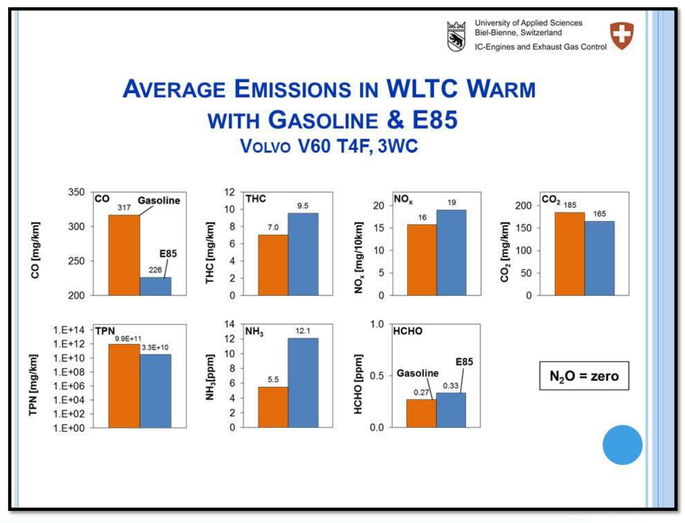
Steady State Cycle SSC





WLTC





Conclusions

Stationary operation:

- clear reduction of summary PC's after switching the fuel from gasoline to E85,
- no distributions (PSD), but only sporadic NP-peaks with E85 at all stationary operating points,
- at 50 km/h lowering of the particle count concentrations of size spectrum bigger 80 nm and shift of PSD median diameter to lower sizes.

Dynamic cycles:

- in the time-intervals of acceleration, peaks of CO, CPC (NP) and sometimes of NO_x can be observed,
- in higher-speed cycles there is mostly higher CO with E85,
- the particle counts emissions are generally significantly reduced with E85
- in WLTC there is a clear increase of NH_3 with E85 and an insignificant tendency of increasing HCHO (below 1 ppm),
- emissions of NH3 in the same cycle are fluctuating,
- with both fuels (EO & E85) there are no emissions of N_2O.

Further information; jan.czerwinski@bfh.ch, pierre.comte@bfh.ch, see paper 21st ISAF – International Symposium on Alcohol Fuels, Gwangju, Korea, March 10-14th, 2015