PlasTEP

"From lab to real life"

First Results of Field Tests: VOC and NO_x reduction

M. Schmidt[1], R. Brandenburg[1], A. Schwock[1],
I. Jõgi[2], C. Irimiea[3], E. Stamate[3], M. Hołub[4]

[1] INP Greifswald (Germany)

[2] University of Tartu, (Estonia)

[3] Technical University of Denmark (Denmark)

[4] West Pomeranian University of Technology, Szczecin (Poland)

Baltic Sea Region
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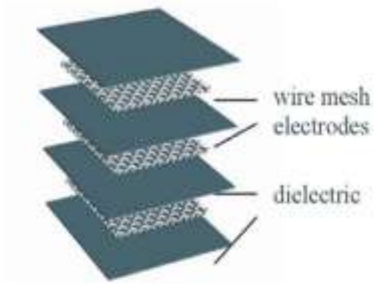
plasma for environment protection

Field Test Experimental Equipment

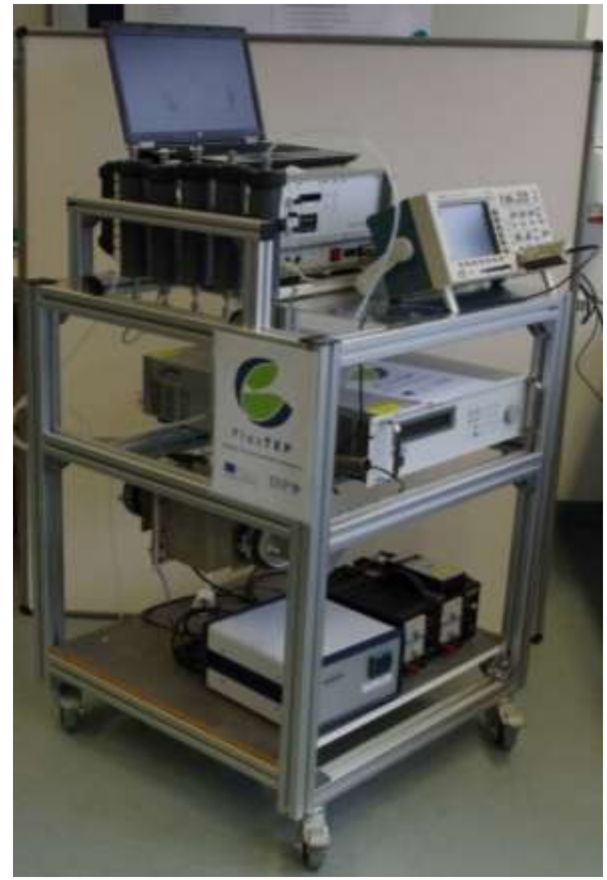
Mobile Plasma Source



Mobile Gas Diagnostics

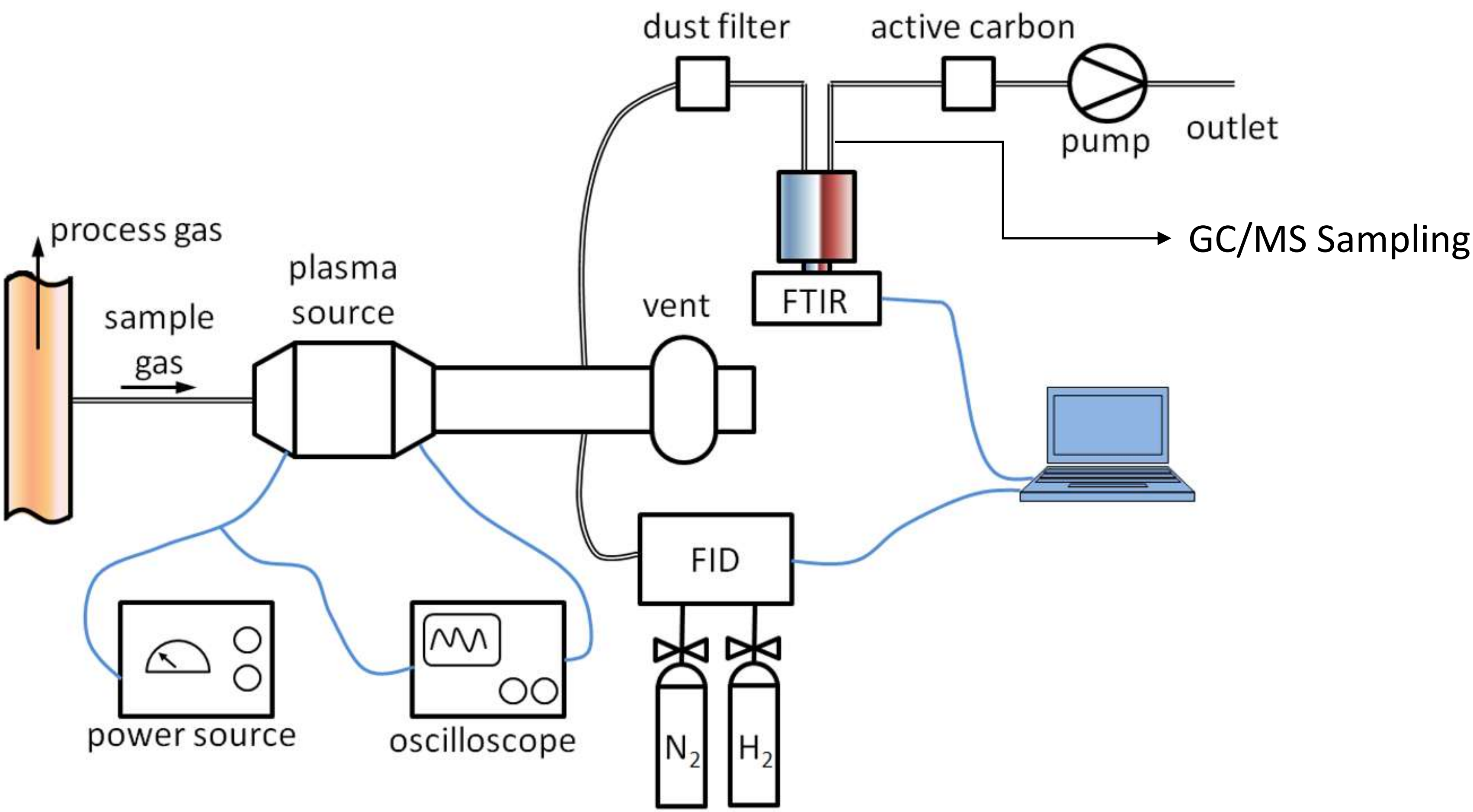
Flame Ionisation Detector

Infrared Spectrometer



Mobile Setup

Mobile Experimental Setup



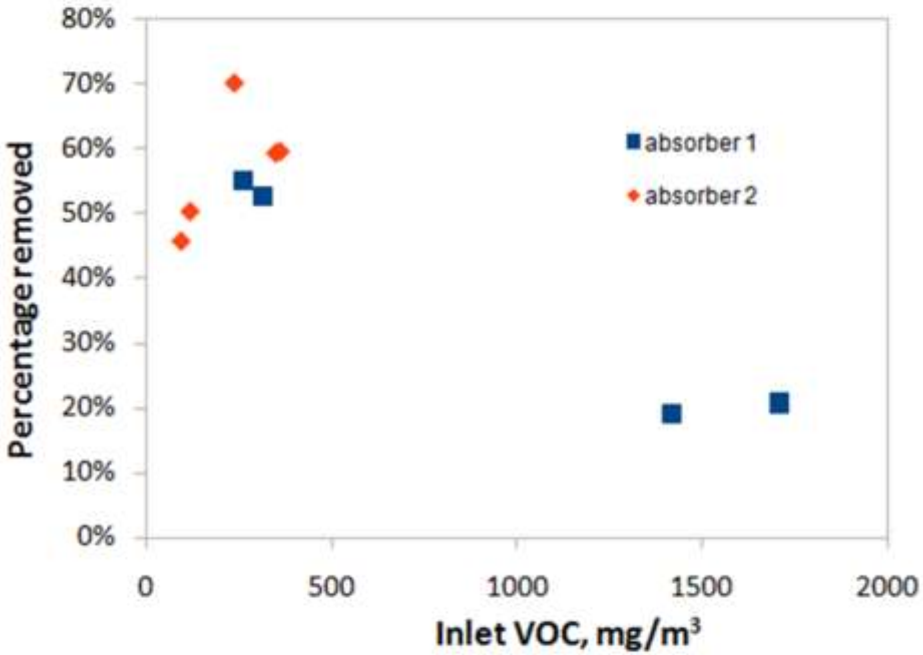
Field Test Experiments

- Waste water treatment
- NO_x and toluene treatment
- Poultry farm
- Iron foundry
- Pig farm
- Shale oil production
- Production of polymer concrete

Field Tests - Challenges

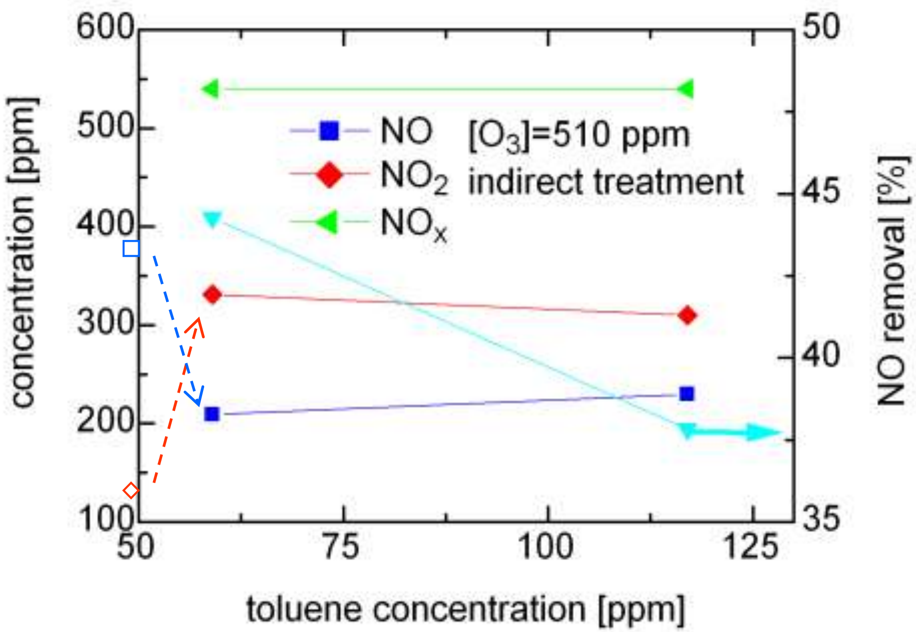
- Uunstable conditions and varying process conditions
- Harsh environment (low temperature, dust...)
- Very limited time
- Unknown components to be analyzed later in the lab
- Weak coupling between process settings and experimental settings
- Laboratory equipment is to be integrated in an industrial process

VKG/ Estonia - VOC removal



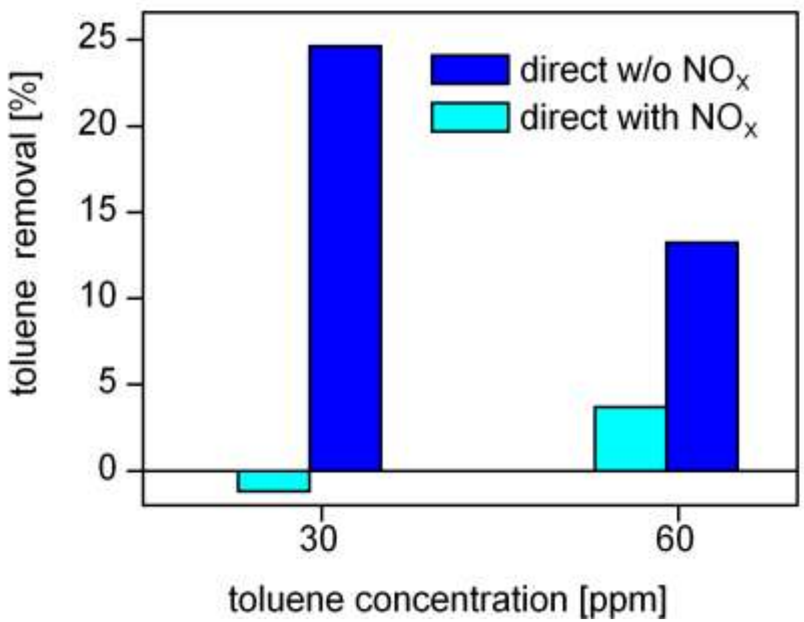
- Shale Oil production and processing leads to VOC emissions
- Outdoor experiments T ≈ 5°C
- Plasma power ≈ 125 W
- Gas flow 13 - 21 m^3/h
- Significant VOC removal at inlet concentration below 500 mg/m^3
- Removal of total amount of VOC more efficient than removal of aromatic compounds

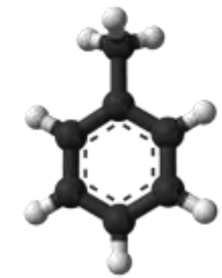
DTU Roskilde/ Denmark - NO_x treatment



- Plasma reactor prior to LTO reactor chamber (510 ppm O_3), admixture of toluene after plasma stage
- Room air and temperature conditions
- P ≈ 130 W; Q ≈ 3 m^3/h
- Inlet concentrations:
  NO 370 ppm, NO_2 130 ppm,
  C_7H_8 varying
- Increasing C_7H_8 concentration leads to decreasing NO conversion
- NO_x (NO + NO_2) unaffected → conversion of NO to NO_2

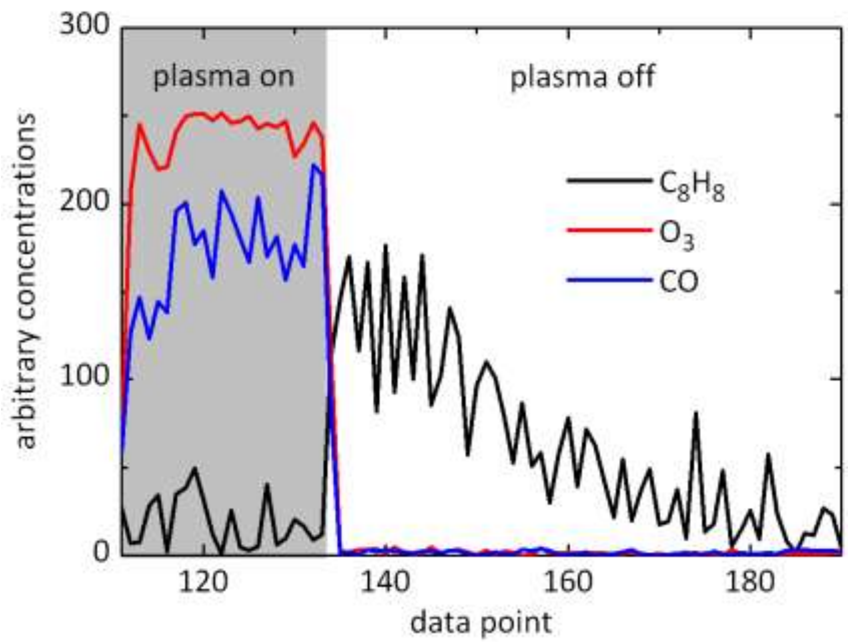
DTU Roskilde/ Denmark - toluene treatment



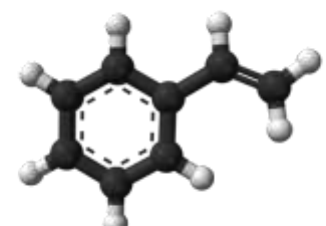


- Toluene admixed to air or air/NOx-mixture before plasma stage
- Significant removal of toluene in air (almost same amount)
- With NO_x lower toluene removal (competing reactions of NO-conversion)

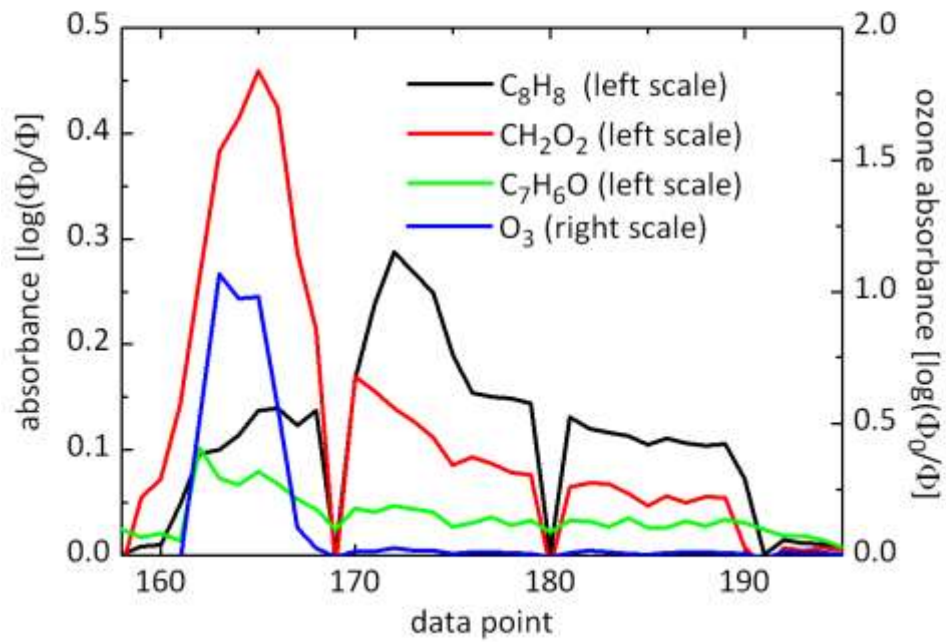
Betonstal Szczecin/ Poland - VOC treatment



- Short emission „peaks“ during polymer concrete preparation for pipe production
- Hot summer day, dusty industrial production room; varying process conditions (change between emission maxima and zero emission)
- P = 150 W and 200 W
- Q ≈ 4 m^3/h
- Styrene (C_8H_8) concentration decreases by plasma activity



Betonstal Szczecin/ Poland - VOC treatment



- Styrene (C_8H_8) signal decreases with plasma on condition
- Concentration of formic acid (CH_2O_2) as the main reaction product beside CO_x increases
- Slight increase in concentration of benzaldehyde (C_7H_6O) as a minor reaction product
- Ozone (O_3) signal as a ‘‘plasma-on‘‘-marker

Summary

- Plasma sources and sensitive laboratory equipment successful applied
  → Plasma source and gas diagnostics work even under harsh conditions
- Plasma activity in several field test installations investigated
  → Feasibility of plasma-chemical treatment of VOC´s and NO_x shown
- In some cases species concentrations are below detection limit
  → olfactometry/arificial nose/GC-MS needed
- It is necessary to understand the emitting process
  → Problem and solution oriented studies

Thank you for your attention
and for the contributions of WP partners!

M. Hołub
M. Balcerak
M. Bonisławski

D. Cameron
M.-L. Kääriäinen
T. Ivanova

I. Jõgi
M. Laan
A. Jalakas

V. Valincius
R. Kėzelis

T. Hoder
M. Schmidt
H. Grosch
W. Reich

A.G. Chmielewski
A. Pawelec
Y. Sun

S. Vasarevicius

H. Barankova
L. Bardos

E. Stamate
C. Irimiea

M. Dors
J. Mizeraczyk