

# HyCoRA

## Project objectives, scope and brief summary of results

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## Hydrogen Contaminant Risk Assessment

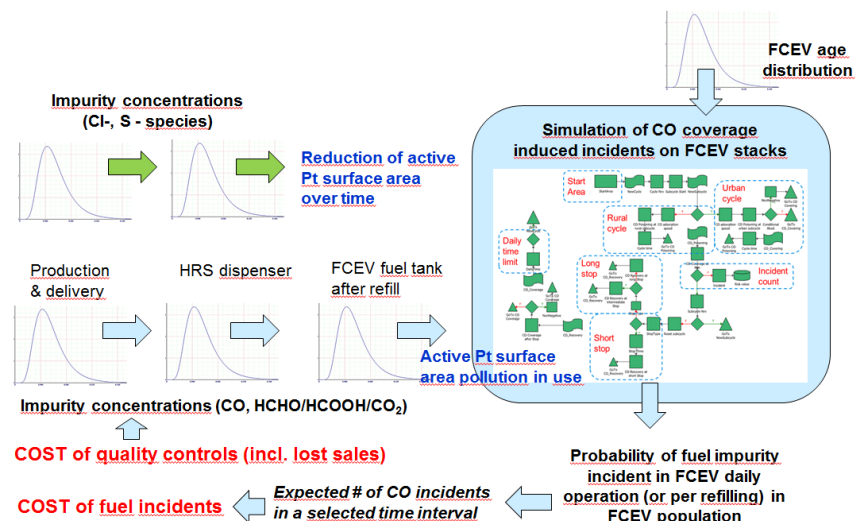
- 3-year EU project (FCH JU), 2014-17 coordinated by VTT
- 6 European partners. Total budget 3.907 M€.
- The objectives of the project are
  - to provide information to reduce cost of hydrogen fuel quality assurance (QA)
  - to provide recommendations for revision of existing ISO 14687-2:2012 standard for hydrogen fuel in automotive applications



## HyCoRA approach – a quantitative risk model

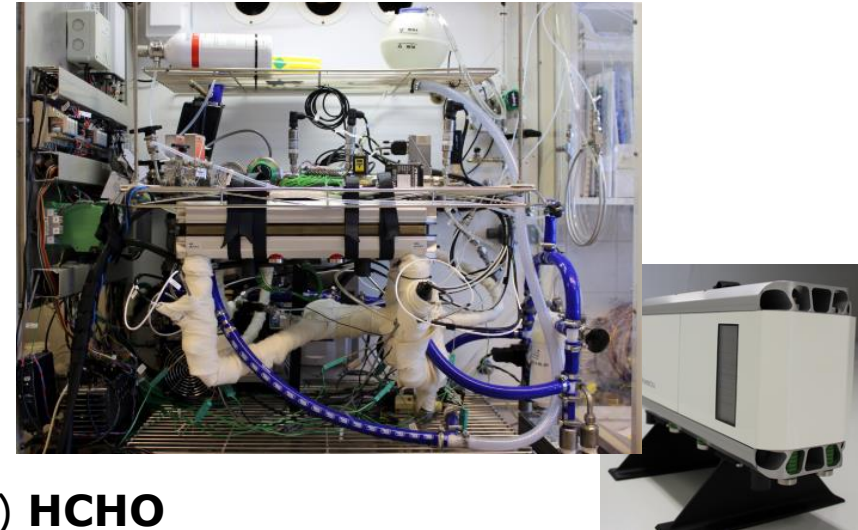
- HyCoRA strategy for cost reduction of H2 quality assurance (QA) – **Risk Assessment**, qualitative and quantitative, requires information from

- a) Real susceptibility for various poisonous species specifically for automotive applications
- a) Probabilities for QA failure in hydrogen production site and/or at HRS
- b) Concentration correlations between contaminant species in fuel

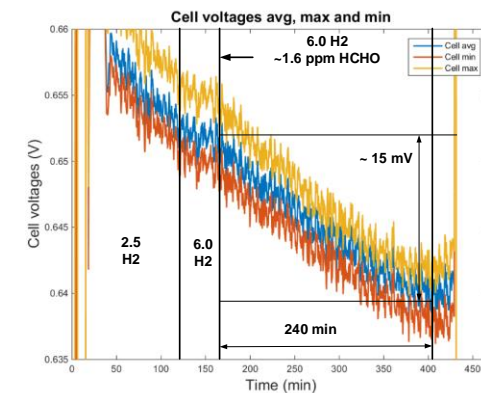


## FC measurements – HCHO and HCOOH

Measurements with automotive alike FC system were needed for determination of correct limits for formaldehyde and formic acid



- **2.0 ppm** (200 x limit in ISO 14687-2:2012) **HCHO** has a very small effect
- **20 ppm** (100 x limit in ISO 14687-2:2012) **HCOOH** has a very small effect



## H2 analyser

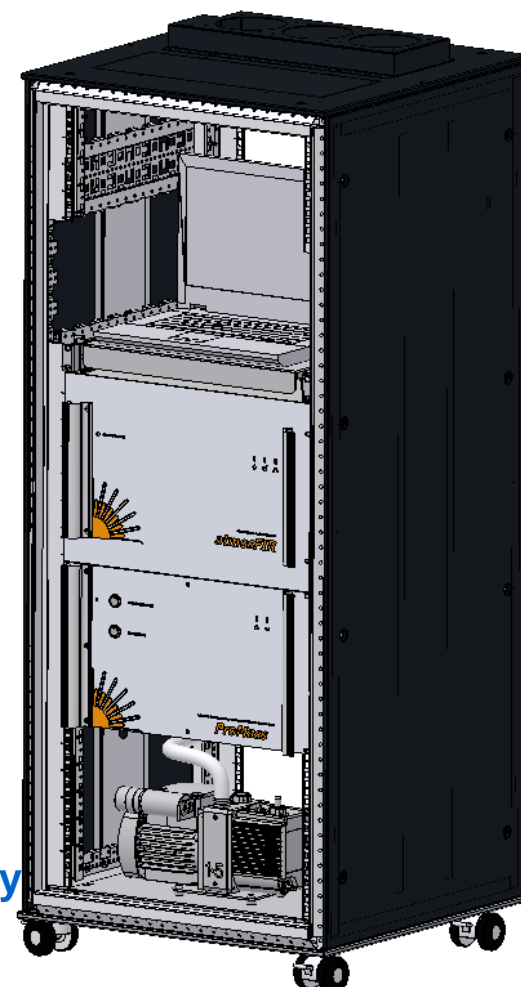
- Combined MS and FTIR system
  - New FTIR analyser system capable of measuring low concentrations of impurities in H<sub>2</sub>
  - The use of a Quadrupole Mass Spectrometer (QMS) analyser allows for the real-time measurement of those diatomic and inert gas species that are not detectable with IR spectroscopy
  
- Instrument configuration has been successfully validated
  - All others included, except total S and H<sub>2</sub>O
  - Both analysers are operating in a laboratory configuration, full integration still in progress

Laptop

FTIR

MS

MS Rotary Pump



## HRS sampling

- 1<sup>st</sup> campaign (CW52 2014): impact of feedstock on fuel quality
- 2<sup>nd</sup> campaign (06 2016): newly commissioned HRS
- 3<sup>rd</sup> campaign (04 2017): Scandinavia

Hydrogen fuel quality generally good

- Impurities does not correlate with H<sub>2</sub> feedstock
- No correlation between commissioning date and fuel quality found
- 3<sup>rd</sup> campaign showed generally good quality



Gas sampling unit  
Linde 'Qualitizer'



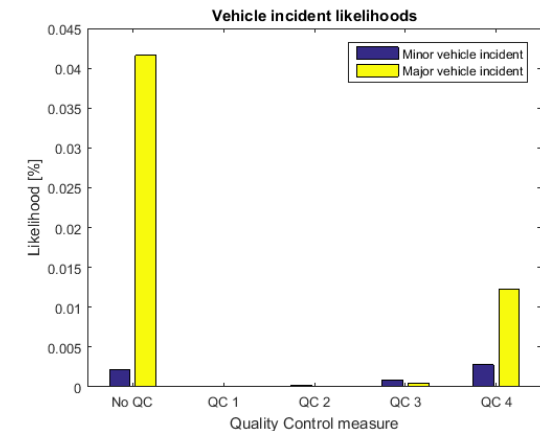
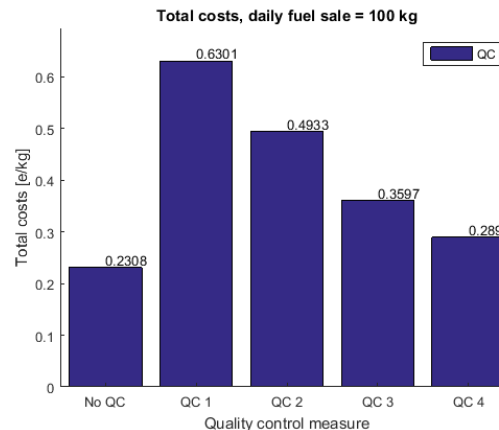
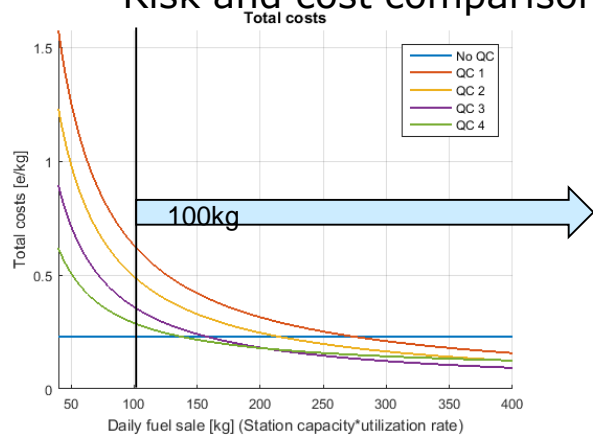
Particulate sampler  
HYDAC PSA-70

# HyCoRA Risk and cost model

Assessing the effect of fuel QC measures introduced in the fuel delivery chain on the risk of degraded FCEV performance caused by contaminants in the fuel

Allows calculating the overall cost associated with the measures, comprising

- the investment and operating costs of the QC measure and
  - the damage costs from the vehicle incidents expected still to occur
- User inputs: FC vehicle & operating characteristics, Pt loading, HRS utilization
  - Model outputs: Fuel QC, Risk of vehicle incidents, Frequency of station incidents, Risk and cost comparisons between the QCs



## Acknowledgements

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**Thank you**

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