

9.00 AM 9.30 AM



1 h



6.00 PM

TUESDAY 30

WELCOME

OPENING
SESSION

ROOM 1

S1 - HYDROGEN ENERGY CARRIER

ROOM 1



PROMETH₂O WORKSHOP

SOLD OUT

ROOM 3

WELCOME
APERITIVE

WEDNESDAY 31

WELCOME

ROOM 2

S2 - ADVANCES IN
GAS METROLOGY

ROOM 1

S3 - INDUSTRIAL
INNOVATION

POSTER
SESSION

GAS ANALYSIS HUB

ROOM 2

S2 - ADVANCES IN
GAS METROLOGY

ROOM 1

SHORT COURSE
Accreditation

GALA
DINNER

THURSDAY 1

WELCOME

ROOM 2

SHORT COURSE
Hydrogen Safety

ROOM 1

SHORT COURSE
Uncertainties

ROOM 2

S4 - ENERGY TRANSITION

ROOM 1

S5 - CLIMATE AND AIR QUALITY

CLOSING

ROOM 2

FULL PROGRAMME



ORGANISING & SCIENTIFIC COMMITTEES

- Annarita **BALDAN** - VSL / The Netherlands
- Paul **BREWER** - NPL / United Kingdom
- Martine **CARRÉ** - AIR LIQUIDE / France
- Kevin **CLEAVER** - BOC | THE LINDE GROUP / United Kingdom
- Ortwin **COSTENOBLE** - PAC PETROLEUM ANALYZER COMPANY / The Netherlands
- Jack **DE JONG** - AIR LIQUIDE / The Netherlands
- Paul **HOLLAND** - EFFECTECH / United Kingdom
- Tracey **JACKSIER** - AIR LIQUIDE / USA
- Heinrich **KIPPHARDT** - BAM BUNDESANSTALT FÜR MATERIALFORSCHUNG UND -PRÜFUNG / Germany
- Tatiana **MACÉ** - LNE / France
- Stefan **PERSIJN** - VSL / The Netherlands
- Etienne **SMITH** - AP2E / France
- Lucio **TADDEO** - CETIAT / France
- Anne **TRUMPFHELLER** - EURAMET / Germany
- Valentijn **VAN MISPELAAR** - SHELL GLOBAL SOLUTIONS INTERNATIONAL / The Netherlands

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Annarita BALDAN
VSL - The Netherlands



Martine CARRÉ
Air Liquide - France

◆ GAS2024 co-chairs ◆



Cosimi CORLETO
CFM President - France

We are pleased to assume the role of chairs for the second time at the GAS Analysis event and are proud to announce the exciting features. This event, characterised by its international scope, will bring together experts from around the globe to exchange knowledge, explore metrological approaches and show innovative analytical tools.

The scientific programme, featuring +80 lectures and posters, offers a unique opportunity to learn about the latest developments in gas analysis solutions that address the grand challenges of climate, environment and energy. And, to underline the cooperation with Hyvolution exhibition, the first day of the event will be focused on methods and standards for hydrogen quality, safety and production.

We are also happy to share that GAS2024 will include three short courses covering accreditation, measurement uncertainty and safety topics and that they will be provided by renowned international experts. Not least, the "GAS Analysis Hub" within Hyvolution exhibition and the social programme will greatly encourage networking opportunities.

We look forward to meeting you in Paris!

For the second time, we deeply appreciate the continued trust of the GAS Analysis organising committee in CFM's ability to host this prestigious technical and scientific conference.

The 2024 edition is set to be held in Paris, uniting approximately 300 experts from both industry and academia, including national metrological institutes and research centers. In a groundbreaking move, this event is being organised in partnership with the Hyvolution Trade Show, focusing on hydrogen across the entire value chain, from production to usage.

The programme of GAS Analysis will therefore include talks, posters and short courses about hydrogen, but also other topics like gas metrology, industrial innovations and the gas analysis dedicated to energy transition and climate and air quality.

This programme will complement an area on the tradeshow dedicated to industrial solutions and a "GAS Analysis Hub" where all participants will gather and network during various social events.

We are waiting for you in Paris!

9.00 AM

WELCOME / DOORS OPEN

ROOM 1

OPENING SESSION

9.30 AM Annarita **BALDAN** - VSL / The Netherlands & Martine **CARRÉ** - AIR LIQUIDE / France
Cosimi **CORLETO** - CFM / France

OPENING LECTURE

9.45 AM Hydrogen: a new player at the service of the environment and the economy
Laurent **ANTONI** - IPHE & FRANCE HYDROGENE / International

10.20 AM



S1

HYDROGEN ENERGY CARRIER

ROOM 1

Chair: Ortwin **COSTENOBLE** - PAC / The Netherlands

11.00 AM Development of multicomponent reference materials for hydrogen fuel and its application to interlaboratory comparison
A. **MORRIS** - NPL / United Kingdom



11.20 AM Stability study of formaldehyde mixture in hydrogen
J-L. **BLANC** - AIR LIQUIDE / France



11.40 AM How the general gas law supports ISO 21087 hydrogen fuel specification analysis
R. **STRIK** - PAC / The Netherlands

12.00 PM Preparation and analysis of a gas standard according to specifications of ISO 14687-1
F. **PIGAZZINI** - SIAD / Italy


12.20 PM Hydrogen fuel quality and compliance with national standards
C. **WIDDOWSON** - MARKES INTERNATIONAL / United Kingdom

12.40 PM



ROOM 1



- 1.40 PM** Measurement of impurities in hydrogen using LEDs and lasers
S. PERSIJN - VSL / The Netherlands
- 2.00 PM** Combination of OFCEAS analyzer and GC with SePdd TCD FID detectors for optimal laboratory setup following ISO 14687:2019
E. SMITH - DURAG GROUP / France
- 2.20 PM** Plasma Emission Detector: a novel tool for trace impurities measurements in gas phase samples
S. ZUIJDENDORP - PST / France
- 2.40 PM** How TDLAS technology can help to produce high quality green hydrogen with high throughput
D. JANSSENS - SIEMENS / Germany
- 3.00 PM** Going green thanks to hydrogen fuel: generation of trace level gases that are essential for the calibration and certification of the H2 purity analysers
L. COURTHAUDON - ALYTECH / France
-
- 3.20 PM** 
-
- 4.00 PM** Gas transmitter for monitoring the condition of an electrolyser
C. HEFFELS - SIEMENS / Germany
- 4.20 PM** Qualification of ENGIE method to perform Hydrogen quality control at the nozzle of hydrogen refueling station
E. MOREIRA - ENGIE / France
- 4.40 PM** Assessment of different technologies for hydrogen and methane leak monitoring
H. BARROS - NPL / United Kingdom
- 5.00 PM** Closing session on hydrogen future
A. BALDAN - VSL / The Netherlands & M. CARRÉ - AIR LIQUIDE / France


ROOM 3

SOLD OUT

Places are limited

Contact gas@cfmetrologie.com to register.

The PROMETH2O project seeks precise gas moisture measurement. Despite advances in mid-to-high humidity, low water content measurement gaps remain. It enhances trace water measurement in vacuum and UHP gases, developing standards and innovative techniques. The workshop fosters global collaboration, aiming to transform industry practices, improve metrology, and engage stakeholders in solving measurement challenges.

- 2.00 PM** Workshop opening: outline of the PROMETH2O project
V. FERNICOLA - INRIM /Italy
- 2.15 PM** Measurement challenges for trace water in pure gases
S. BELL - NPL / United Kingdom
- Industrial challenges in producing and assessing ultra-pure process gases**
- 2.50 PM** Water measurement and control in pure gas manufacturing
S. BOGGIO - NIPPON GASES / Italy
- 3.10 PM** Calibration and measurement: ensuring traceability to industry
N. HAWES - QROMETRIC / United Kingdom
-
- 3.30 PM** 
-
- Meeting the stakeholders needs**
- 4.15 PM** Novel reference standards to provide measurement traceability in the part-per-billion regime
D. HUDOKLIN - UNIVERZA OF LJUBLJANI / Slovenia
- 4.35 PM** Virial coefficients of mixtures of water vapor and simple gases from first-principles calculations
K. MEIER - HELMUT-SCHMIDT-UNIVERSITÄT INSTITUT FÜR THERMODYNAMIK / Germany
- 4.55 PM** Next-generation of trace water sensors and analysers for the industry
L. GIANFRANI - UNIVERSITA DEGLI STUDI DELLA CAMPANIA "LUIGI VANVITELLI" / Italy
- 5.15 PM** Validated software applications for moist real gases
S. TABANDEH - VTT-MIKES / Finland
- 5.35 PM** Wrap-up and conclusions



5.45 PM



WELCOME APERITIVO

GAS ANALYSIS HUB



9.00 AM WELCOME / DOORS OPEN

S2

ADVANCES IN GAS METROLOGY

Chair: Paul BREWER - NPL / United Kingdom

ROOM 2

9.30 AM Improvement of spectral resolution in a miniaturized trace-moisture analyzer based on cavity ring-down spectroscopy
H. ABE - NATIONAL METROLOGY INSTITUTE OF JAPAN NMIJ / Japan

9.50 AM Meeting the industry's needs: advances in generation of trace level HCl gas reference materials
Y. HRISTOVA - NPL / United Kingdom

10.10 AM Performance evaluation of rapid-scan CRDS moisture analyzer using multi-gas trace-moisture generator
M. AMANO - NATIONAL METROLOGY INSTITUTE OF JAPAN NMIJ & AIST / Japan

11.10 AM A high accuracy reference facility for ongoing comparisons of CO₂ in air standards
J. VIALON - BIPM / France

11.30 AM Development of carbon dioxide total amount fraction and isotopic composition measurement capabilities at NIST
K. HARRIS - NIST / USA

11.50 AM Do temperature, regulation or gas depletion of a high-pressure CO₂ cylinder affect the ¹³C and ¹⁸O isotope ratios?
T. JACKSIER - AIR LIQUIDE / USA

12.10 PM Facility for the conversion of methane to carbon dioxide for linking of $\delta^{13}\text{C-CH}_4$ to $\delta^{13}\text{C-CO}_2$ using optical spectroscopy
A. HILLIER - NPL / United Kingdom

12.30 PM Assessing parameters affecting low-cost gas sensor signals in the European photoreactor (EUPHORE) simulation chamber
M. ITURRATE-GARCIA - FEDERAL INSTITUTE OF METROLOGY METAS / Switzerland

S3

INDUSTRIAL INNOVATION

Chair: Etienne SMITH - AP2E / France

ROOM 1

9.30 AM The value of artificial intelligence and data science for analyzer operation and maintenance
L. ARSLAN - SIEMENS / Germany

9.50 AM The nanostructured p-n interfaces manipulation strategy toward ultra-high sensitivity
A. TURLYBEKULY - NATIONAL LABORATORY ASTANA / Kazakhstan

10.10 AM Metrological performance testing of a laser hygrometer for H₂O quality control in H₂
J. NWABOH - PTB / Germany

11.10 AM How soft sensors for gas analysis can disrupt the way we measure today?
P. STRAUCH - SIEMENS / Germany

11.30 AM Cool down NGD to detect light molecules at ppb levels
D. SANZ - APIX ANALYTICS / France

11.50 AM On-line process gas analyzer for measurement of hydrogen and water concentration in refinery hydrogen recycle gas
A. AMEROV - AMETEK PROCESS INSTRUMENTS / USA

12.10 PM Test on a natural gas analyzer based on optical spectroscopy
K. HOVET - TUNABLE / Norway

12.30 PM Fast gas analyzer for calorific value measurements
K. HARR - SIEMENS / Germany

12.50 PM

1.50 PM

POSTER SESSION

See details of the posters on next page.

2.50 PM



S2

ADVANCES IN GAS METROLOGY

Chair: Paul BREWER - NPL / United Kingdom

3.30 PM Gas standards and reference methods for nitrogen dioxide emission and air quality monitoring

A. VAN DER VEEN - VSL / The Netherlands

3.50 PM Improvements in NO₂ sampling: a case study of integrated pressure regulator valve

S. VAN ASWEGEN - NPL / United Kingdom

4.10 PM Accuracy and stability of nitrogen dioxide standards

E. FLORES - BIPM / France

4.30 PM Feasibility of measuring impurities' contents in CO₂ with FT-IR spectroscopy

J. VAN WIJK - VSL / The Netherlands



4.50 PM Optical gas standard: laser absorption spectroscopy for traceable hydrogen purity analysis

Z. QU - PTB / Germany

5.10 PM A facility for the calibration of trace water sensors and analysers in moist hydrogen

R. NOBAKHT - INRIM & POLITECNICO DI TORINO / Italy



ROOM 2

ROOM 1

SHORT COURSE

Accreditation in gas analysis

Chair: Valentijn VAN MISPELAAR - SHELL / The Netherlands

Speakers:

T. MACÉ - LNE / France

W. WETERINGS - AIR LIQUIDE / The Netherlands

3.30 PM

The objectives of the short course « Accreditation » are to provide the procedure and steps to follow for the organisations willing to be accredited according to the two following standards:

- ISO/IEC 17025 - General requirements for the competence of Testing & Calibration Laboratories (2017) and
- EN ISO 17034 - General requirements for the competence of reference material producers (2016).

5.00 PM

7.30 PM



GALA DINNER AT "LA COUPOLE"

Places are limited.



GAS ANALYSIS HUB

POSTER SESSION

Solutions for calibration of mercury measurement systems for oxidized mercury species
T. RAJAMÄKI - VTT MIKES / Finland



Matrix influence on analysis of sulfur-containing compounds in hydrogen-enriched natural gas and hydrogen with GC-SCD
R. BEELEN - VSL / The Netherlands



Instrumented platform on gas sensor systems evaluation in a controlled environment
T. MACÉ - LNE / France

Development of a generator for humidified VOC standard gases
T. WATANABE - AIST / Japan

GC solutions for hydrogen analysis with and without using pre-concentrators
O. COSTENOBLE - PAC ANALYTICAL CONTROLS / The Netherlands

Development of a trace carbon dioxide isotopologue analyzer: performance evaluation study
G. LEGGETT - LI-COR / USA

Gas metrology in Germany: contributions to climate and air quality metrology
O. WERHAHN - PTB / Germany (presented by H. KIPPHARDT - BAM / Germany)

Optimal total analytical solution for fuel-cell-grade hydrogen using cavity ring-down spectroscopy and mass spectrometry
M. REGAYA - PROCESS INSIGHTS / Germany

Reliable on-site testing of siloxanes and terpenes in landfill and biogas from sewage using GC-IMS
T. WORTELMANN - G.A.S. GESELLSCHAFT FUER ANALYTISCHE SENSORSYSTEME / Germany

Certification of a multicomponent reference material from natural gas mixture by gravimetry and gas chromatography-FID
N. ALYAMI - SASO & NMCC / Saudi Arabia

Calibration gas mixtures for breath analysis
G. BISSOLOTTI - SIAD / Italy

GAS ANALYSIS HUB

POSTER SESSION

Monitoring trace impurities in bulk and specialty gas by ultra-sensitive FTIR
K. MCPARTLAND - THERMOFISHER SCIENTIFIC / USA

Gas monitoring systems and calorimeters for decarbonization technologies
K. KOJIMA - RIKEN KEIKI / Japan

A method for intermediate check of particle counters
S. AGGARWAL - CSIR-NATIONAL PHYSICAL LABORATORY / India

Measuring H₂O and O₂ in hydrogen production for energy applications and a review of analytical methods
S. SANTARPIA - ENDRESS+HAUSER / France

Quantification of hydrogen in natural gas by gas chromatography using carrier gas mixtures
G. WESELOH - PTB / Germany



Odorization of biomethane: how to assess its safe use?
M. FERRAGATTA - SIAD / Italy

Evaluation of stability of NO mixtures at ppb level
L. GAGNI - SIAD / Italy

Investigating a practical measure of dilution accuracy in dilution of binary gas mixtures using gas-diluter
H. BOSE - CHEMTRON SCIENCE LABORATORIES / India

Primary reference materials for quality assurance and quality control measures in material emissions testing
E. HENDERSON - VSL / The Netherlands



Raman measurement of H₂ in natural gas blending
K. ROELSTRAETE - ENDRESS+HAUSER / Belgium

A case study on proficiency testing of carbon monoxide for the dissemination of international system of units (SI) in ambient measurement
K. SINGH - CSIR-NATIONAL PHYSICAL LABORATORY / India

A novel approach for the preparation of calibration gas mixtures of VOCs: benzene in nitrogen
D. SONI - CSIR-NATIONAL PHYSICAL LABORATORY / India



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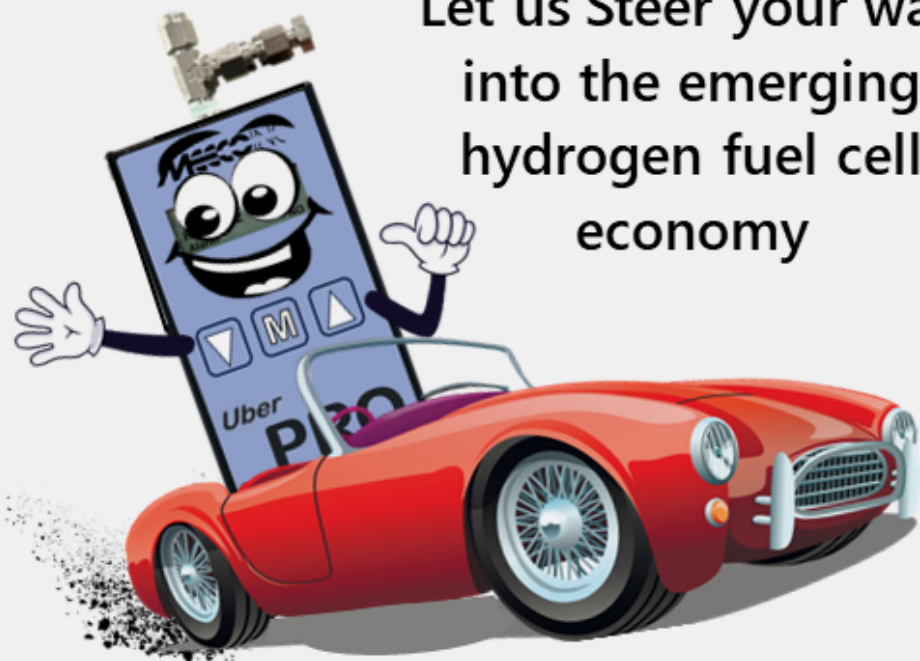
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9.00 AM

WELCOME / DOORS OPEN

9.30 AM

SHORT COURSE

ROOM 2

Metrology and safety in hydrogen equipments

Chair: Jack DE JONG - AIR LIQUIDE / The Netherlands

Speakers:

T. CLAUDE - INERIS / France
B. TRUCHOT - INERIS / France

The large development of hydrogen as new energy carrier requires a massive production of carbon-free hydrogen thanks to electrolysers. This presentation will detail the different electrolyser technologies and the associated risk. The failure chain that leads to those major events will be detailed to specify measurement systems. Metrological expected characteristics of those systems will be discussed.

11.00 AM



9.30 AM

SHORT COURSE

ROOM 1

Measurement uncertainty in the preparation of calibration gas mixtures

Chair: Paul BREWER - NPL / United Kingdom

Speaker:

A. VAN DER VEEN - VSL / The Netherlands

In this short course, the evaluation of measurement uncertainty in the dynamic and static calibration gas mixture preparation is revisited. It is shown how uncertainty is evaluated so that it meets the requirements of ISO/IEC 17025.

The second part of the course is devoted to the evaluation of stability and homogeneity, and how to use this information obtained for one mixture and using the results for others.

11.00 AM



S4

ENERGY TRANSITION

ROOM 2

Chair: Valentijn VAN MISPELAAR - SHELL / The Netherlands

11.40 AM

Standardising performance evaluation: novel reference standards for laboratory and field-based biomethane analysers
L. CULLETON - NPL / United Kingdom



12.00 PM

Biogas and biomethane impurities: user-tailored gas mixtures
L. GAGNI - SIAD / Italy

12.20 PM

CARABIO: development of an analytical tool for a comprehensive study assessing the composition of French biomethanes
B. SANZ - RICE GRTGAZ / France

12.40 PM

Digitalization of the gas grid: smart monitoring of the gas quality
H. BLOKLAND - TNO / The Netherlands

S5

CLIMATE AND AIR QUALITY

ROOM 1

Chair: Tracey JACKIER - AIR LIQUIDE / USA

11.40 AM

Generation of humid NH₃ reference gas mixtures at trace levels
J. FRISTCHE - FEDERAL INSTITUTE OF METROLOGY METAS / Switzerland



12.00 PM

Improvements in nitrogen dioxide reference materials between 1 and 2000 μmol mol⁻¹ for calibration of PEMS devices
C. BAVIN - NPL / United Kingdom



12.20 PM

Simple high-precision cavity ringdown spectroscopy for monitoring of CO₂ and CH₄ in ambient air
J. HODGES - PROCESS INSIGHTS / USA

12.40 PM

Emission reference materials for indoor air measurements
M. RICHTER - BAM / Germany



1.00 PM



S4

ENERGY TRANSITION

ROOM 2

Chair: Valentijn VAN MISPELAAR - SHELL / The Netherlands

- 2.00 PM** Comprehensive characterization of low carbon SNG quality coming from biomass and waste (RDF) gasification and methanation
E. BASSET - ENGIE / France
- 2.20 PM** The use of Monte Carlo simulations for hydrogen blended natural gas
S. MARR - EFFECTECH / United Kingdom
- 2.40 PM** The challenges of raw renewable gas sampling for the analysis of trace organic compounds
A. LEGENDRE - ESPCI / France
- 3.00 PM** Analysis of CO₂ transport streams with impurities present, techniques and challenges
B. MORLAND - INSTITUTE FOR ENERGY TECHNOLOGY / Norway
- 3.20 PM** Enabling measurement of CO₂ purity and composition: NPL's role as the UK National National Metrology Institute
M. GUDIYOR VEERABHADRAPPA - NPL / United Kingdom



S5

CLIMATE AND AIR QUALITY

ROOM 1

Chair: Tracey JACKIER - AIR LIQUIDE / USA

- 2.00 PM** The challenging calibration of portable emissions measurement systems
P. PETROV - NPL / United Kingdom
- 2.20 PM** Metrological calibration of mercury gas generators
I. DE KROM - VSL / The Netherlands
- 2.40 PM** Development of novel accurate, stable and SI-traceable reference gas standards of oxygenated VOCs relevant for climate
A. BALDAN - VSL / The Netherlands
- 3.00 PM** Volatile PFAS in air: developing methods for targeted analysis and discovery of non-target volatile PFAS
H. CALDER - MARKES INTERNATIONAL / United Kingdom
- 3.20 PM** Intercomparison of greenhouse gas measurements using whole air and synthetic standards at UK tall tower sites
E. SAFI - NPL / United Kingdom



30 MIN CLOSING SESSION

ROOM 2

3.45 PM

2024 GAS Analysis Key Insights and 2026 announcement

J. LOPEZ - CFM / France

Prize-giving ceremony

A. BALDAN - VSL / The Netherlands & M. CARRÉ - AIR LIQUIDE / France

EXHIBITION CLOSSES AT 6 PM