RICE — GRTgaz
Research & Innovation Center for Energy

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Development of an optical analyzer to measure THT in natural gas and biomethane


Picture of the prototype "ELEMENTS"

Tests performed at RICE laboratories

➪ **Analytical performances**

- Determination of the linearity, limit of detection and quantification,
- 1st estimation of uncertainties,
- Impact of ambient temperature,
- Impact of potential interferences (focus on BTEX).

Context

GRTgaz is looking for new device to control odorization at "best cost" with equivalent performances as µGC largely used on the French transmission network to measure THT concentration.

NB : THT is a sulfur based-odorant used in France

Solution

IFP Energies nouvelles (IFPEN) has developed an optical based analyzer based on UV spectroscopy with the advantages of being accurate and requiring no carrier gas.

Experimental strategy

GRTgaz has performed several tests in its labs RICE to help IFPEN to finalize the development of the analyzer and software and to evaluate the analytical performances of the prototype.

Analyzer	ELEMENTS from IFPEN
Measured parameter	THT concentration
Technology	UV-DOAS (Differential Optical Absorption Spectroscopy)
Gases	Natural gas and RNG
Frequency of measurement	1 second
Ex-proof	No yet (prototype)
Sample	Flowrate: 30 L/h
Carrier gas	None
Zero	With pure methane, each day

Results obtained

Variation of measured THT concentration, at 20°C, in the absence and in the presence of different concentrations of benzene
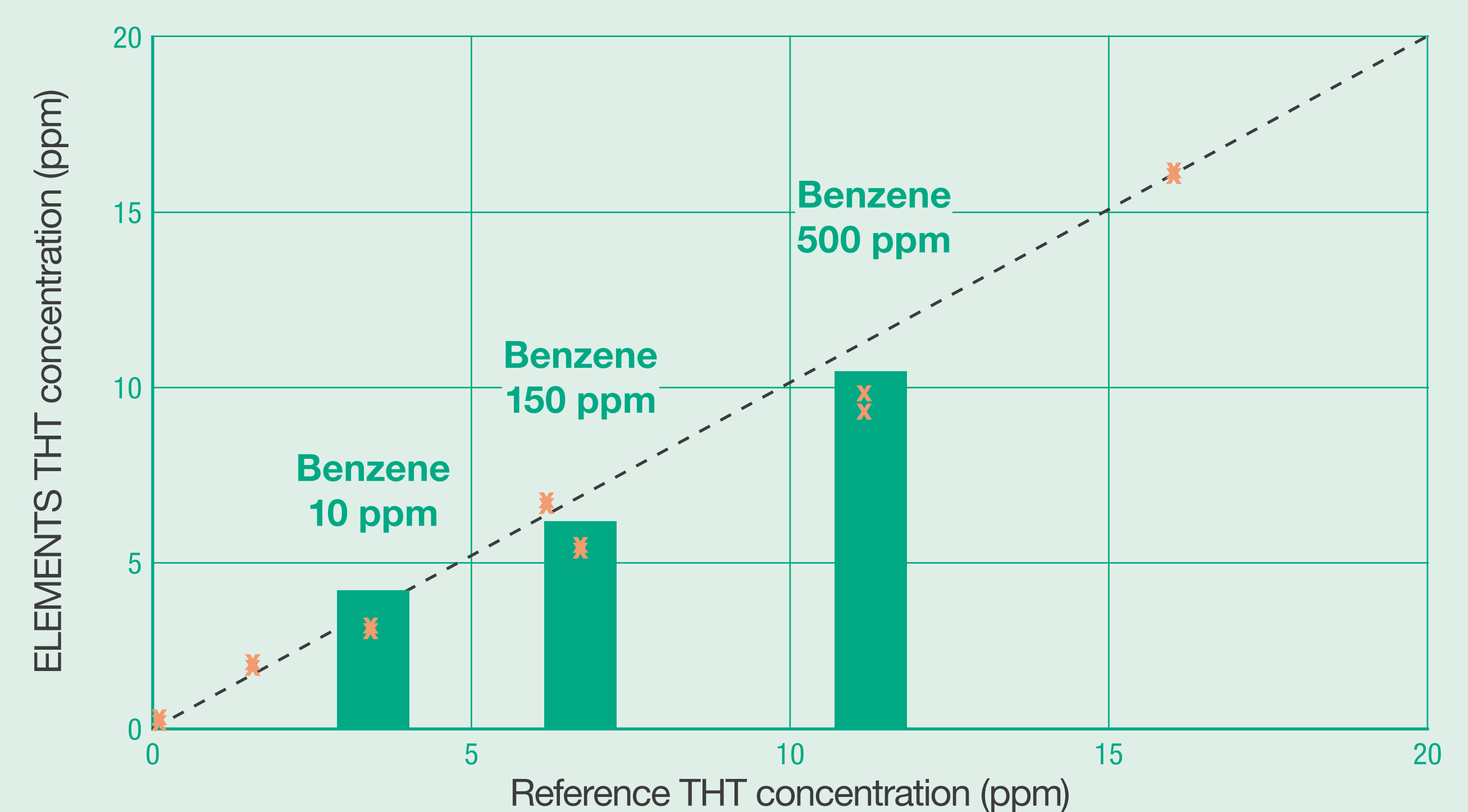
Comparison between the µGC and ELEMENTS regarding important performance parameters (Standard deviation, Accuracy, LOD & LOQ and expanded standard uncertainty)

Analyzer	µGC (Tests on 15, 25 and 40 mg/Sm³ of THT)	ELEMENTS (Tests on 15, 25 and 40 mg/Sm³ of THT)
Standard Deviation	0.18- 0.21 mg/Sm³	< 0.25 ppm (< 0.98 mg/Sm³)
Accuracy (Maximum error)	1.02- 2.18 mg/Sm³	0.41, 0.20, 0.32 ppm (1.56, 0.78, 1.17 mg/Sm³)
LOD/ LOQ	LOD= 0.3 ppm= 1.2 mg/Sm³ LOQ= 0.9 ppm= 3.5 mg/Sm³	LOD= 0.2-0.3 ppm = 0.8- 1.2 mg/Sm³
Expanded Standard Uncertainty	8-12%	3-10 % (need to be confirmed)

Conclusions

➪ Comparable performance level with µGC is demonstrated (good linearity, repeatability, and accuracy) with a similar level of detection capacity with higher level of measurement frequency (1 sec).

➪ No impact of the ambient temperature is observed with the consideration of correction factors in the results.

➪ However, benzene can interfere with THT, and the impact is more important with higher levels of benzene concentrations.

➪ No other trace compounds that can be found in natural gas and RNG (biomethane) present an impact on THT analysis.

Next steps

➪ Further tests are required to confirm the uncertainties on the values measured.

➪ A more extensive study on benzene's impact has to be performed.

➪ Field tests (on GRTgaz site) on the final industrialized configuration for at least 6 months has to be planned.