Re-evaluation of NIES CO Scale
using High Concentration Gravimetric CO Standard Gases

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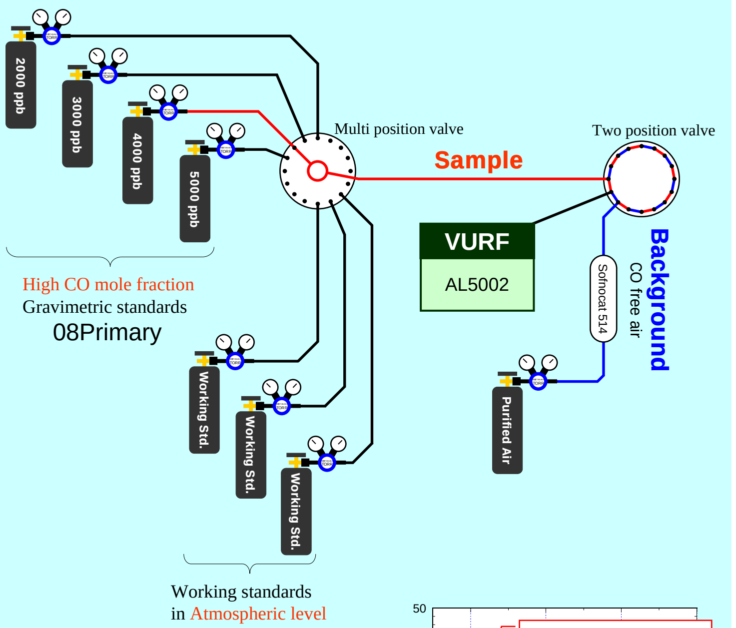
Introduction

CO-in-air standard gas in high-pressure cylinder drifts upward over time.
Drift rates were typically greatest in standards with lower mole fraction.
[Novelli et al., *JGR*, 2003]
→ High CO mole fraction standard (a few ppm level) is considered to be rather stable.

We evaluated ambient level CO standards using ppm level standards.

Experimental



Sample gases and CO free air are introduced into VURF alternately.

VURF response is defined as signals of sample air minus CO free air (background).

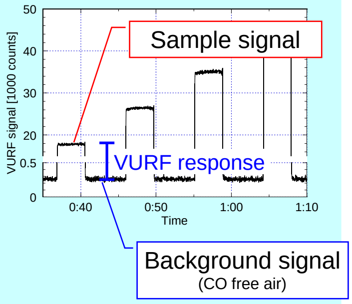


Table 1. CO mole fraction of 08Primary cylinders

Cylinder#	CO mole fraction (ppb)	
	Gravimetric	Corrected
CPC002397	2001.2	2029.7
CPC002396	3000.7	3028.1
CPC002398	4001.3	4026.5
CPC002399	5002.9	5032.0

Conclusions

VURF CO analyzer has good linearity and reproducibility.

Mole fraction of High mixture gravimetric standards (08Primary) were corrected.

1. Corrected to account for impurities 27.55 ppb.
2. Adjusted to fit the liner function.

NIES employs a new scale; NIES 09 CO scale.

Results

1. Linearity and reproducibility of VURF CO analyzer

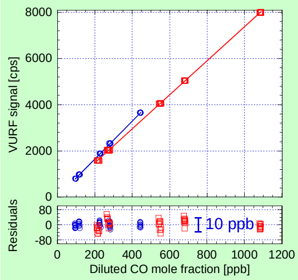


Fig. 1 Linearity of VURF CO analyzer confirmed by comparing dynamic dilution method

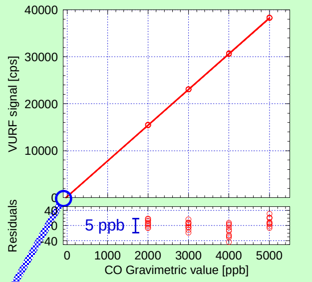


Fig. 2 Reproducibility of VURF CO analyzer

VURF CO analyzer has good linearity and reproducibility.

2. Evaluation of impurities in the cylinders

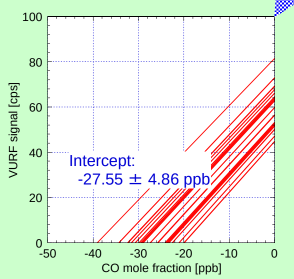


Fig. 3 Enlarged figure of Fig. 2

Intercept of a least liner fit of Fig. 2 is -27.55 ppb. This value was regarded as an impurities in 08Primary cylinders.

Correction of CO mole fraction

1. Corrected to account for impurities 27.55 ppb.
2. Adjusted to fit the liner function.

Corrected values are shown Table 1.

3. Re-evaluation of NIES 96 CO scale

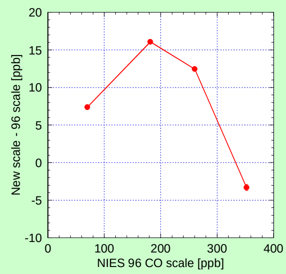


Fig. 4 Difference between NIES 09 scale and NIES 96 scale

Intercept of calibration carves are fixed to 0.

CO mole fractions of NIES 09 scale are 5-10 ppb higher than NIES 96 scale in a range between 70 - 300 ppb, and within ±5 ppb in a range between 300 and 350 ppb.

4. Differences between new scale and NOAA scales

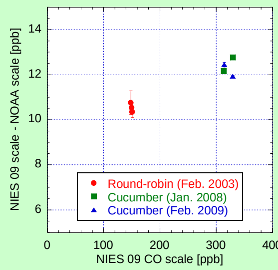


Fig. 5 Difference between NIES 09 scale and NOAA scale

CO mole fractions of NIES 09 scale are 10 ppb higher than NOAA scale in a range around 150 ppb, and 12 ppb higher than NOAA scale in a range between 300 and 350 ppb

Round-robin data are provided courtesy of Dr. Zhou Lingxi.
Cucumber data are provided courtesy of Dr. Andrew Manning and Dr. Armin Jordan.

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