

# WLTP-AP

## VALIDATION PHASE 2 FOR SELECTED ADDITIONAL POLLUTANTS

Status Report and Open issues

6<sup>th</sup> WLTP - Vienna, 26-28-April-2014

# WLTP-(DTP)-AP

## VALIDATION PHASE-2 NH<sub>3</sub>

28 March 2014

2

**It is perfectly possible to measure NH<sub>3</sub> at the exhaust with and “on line” method with all the guaranties of reproducibility and Repeatability of the results.**



## *NH3 measurements in the gas phase of LD vehicles' Exhaust*

(3 instruments have been validated during VP2)

The VP2 allows to include method for NH3 in the GTR:

We have recovered the text from the last version of the GTR basically as it was (annex 5 in point 7.1.1 and following). Now includes the instruments and some more precise analytical instrumentation.

***A document with the information from the campaign HAS BEEN SENT to the WLTP Chair and is now loaded @ 06-27e***

***[https://www2.unece.org/wiki/display/trans/WLTP+6th+<sup>3</sup>session](https://www2.unece.org/wiki/display/trans/WLTP+6th+3session)***



# NH<sub>3</sub>

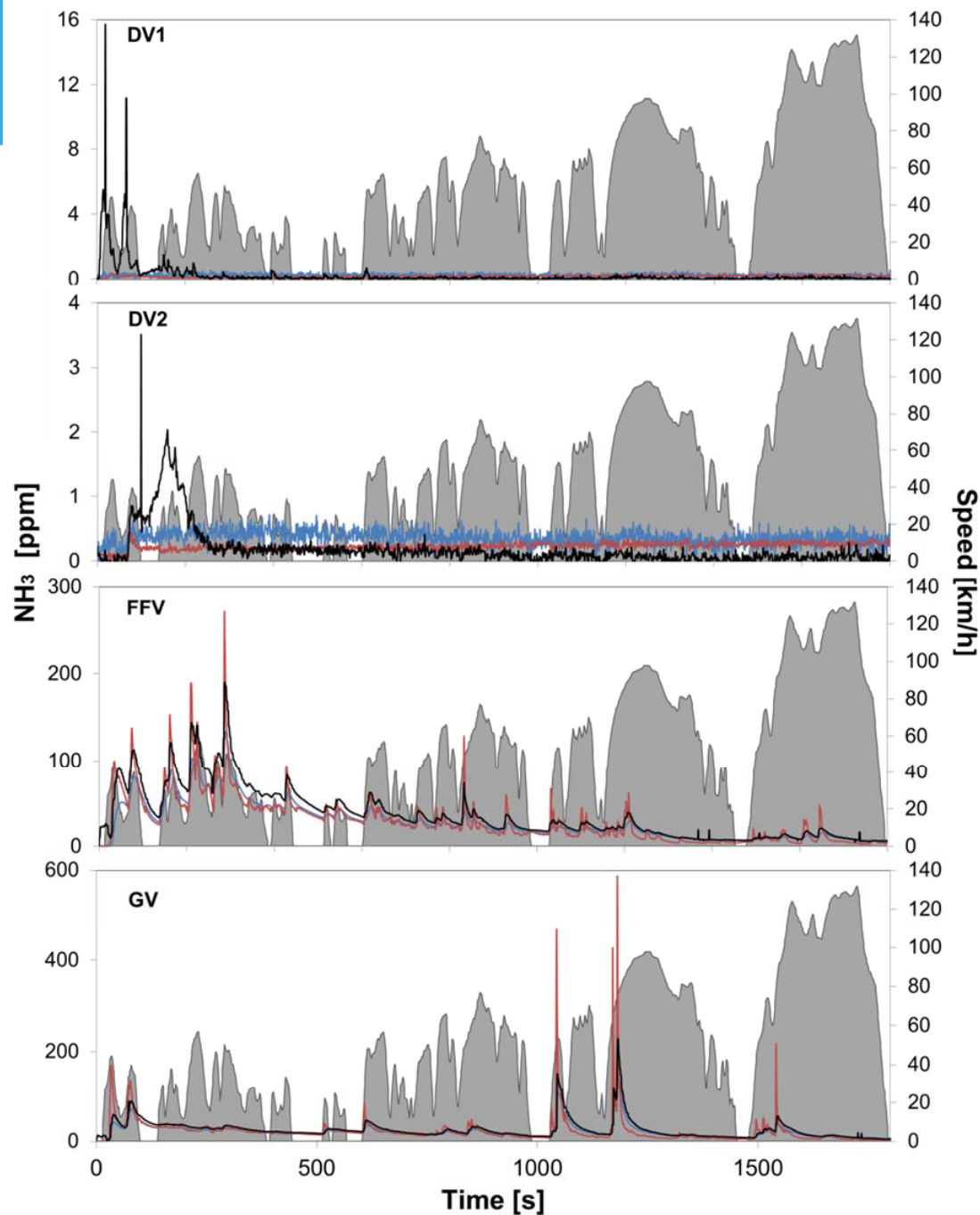
Instrument	Sampling flow (l/min)	Frequency (Hz)	System temp (°C)
FTIR (JRC)	10	1	190
BLAQ-Sys (CGS QCL)	1	1	Sampling 190 Analyzers 100
QCL-IR (HORIBA MEXA1400QL NX)	9	5	113

**Table 1.** Vehicles description.

# NH<sub>3</sub>

<b>Denomination</b>	<b>DV1</b>	<b>DV2</b>	<b>FFV</b>	<b>GV</b>
Combustion type	Diesel	Diesel	Flex-fuel gasoline/EtOH	Gasoline
EU emission standard	Euro 6	Euro 5	Euro 5a	Euro 5
<b>After-treatment</b>	<b>DPF, SCR</b>	<b>DPF</b>	<b>TWC</b>	<b>TWC</b>
<b>Fuel</b>	<b>B5</b>	<b>B5</b>	<b>E5</b>	<b>E5</b>
Fuel system	TDI	TD	DI	GDI
Engine displacement (cm <sup>3</sup> )	1968	1560	1596	1390
Engine power (kW)	105	84	132	132
Odometer (km)	22362	18871	24334	38541
Vehicle weight (kg)	1712	1282	1481	1194

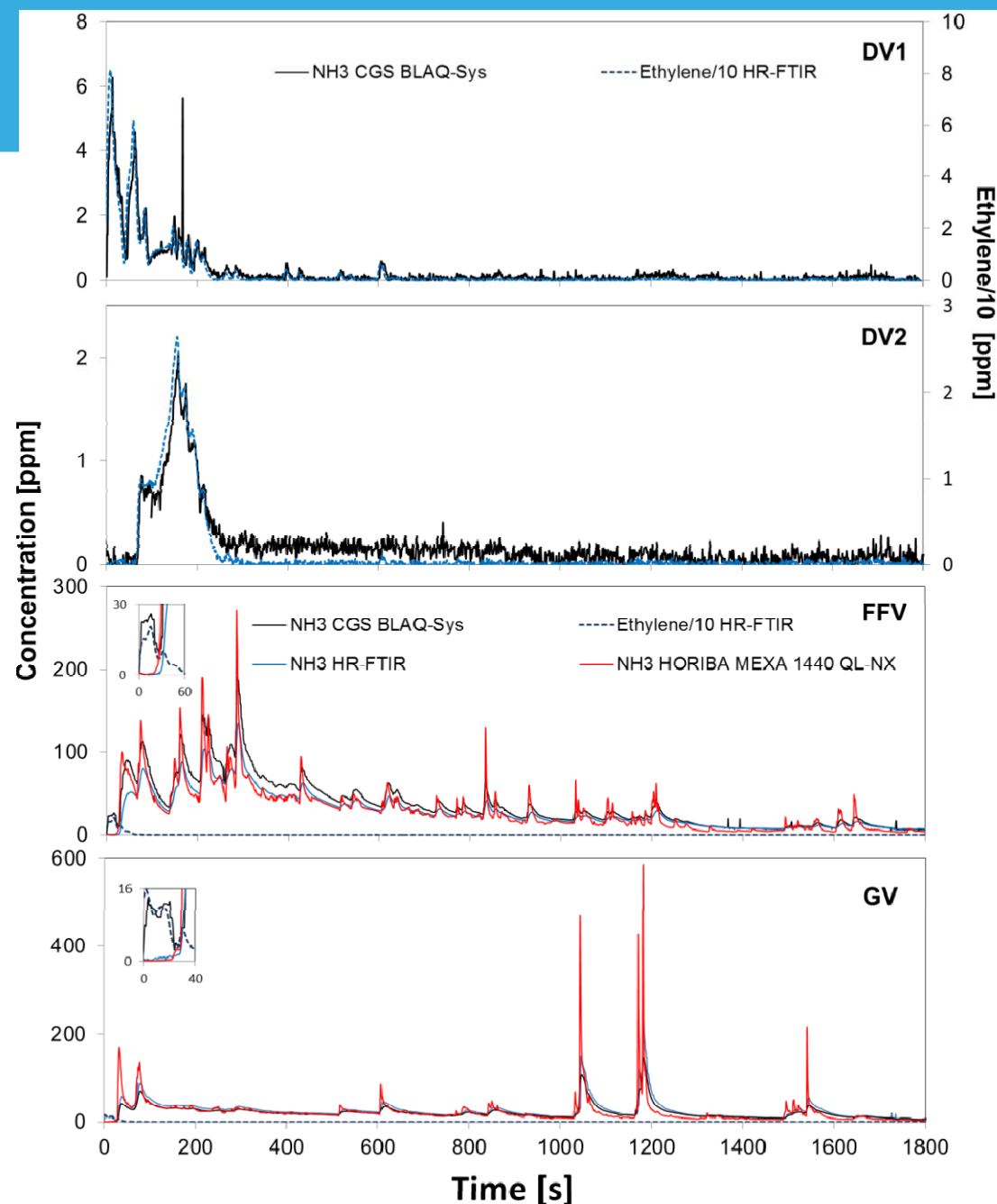
# NH<sub>3</sub>



**Fig3.** Real-time ammonia emission concentration for vehicles DV1, DV2, FFV and GV over the WLTC measured by HR-FTIR (blue), HORIBA MEXA 1440 QL-NX (red), and CGS BLAQ-Sys (black).



# NH<sub>3</sub>



**Fig4.** Concentration of ammonia measured by HR-FTIR (blue), HORIBA MEXA 1440 QL-NX (red), and CGS BLAQ-Sys (black), compared with one tenth of the concentration **of ethylene**, measured by HR-FTIR (dotted blue) over the WLTC. Ethylene concentration for DV1 and DV2 is found on the right axis.

**Table 3. Average ammonia concentration from the four tests vehicles, DV1, DV2, FFV and GV using HR-FTIR, HORIBA MEXA 1440 QL-NX, and CGS BLAQ-Sys.**

Vehicle	Concentration	JRC HR-FTIR	HORIBA QCL-IR	CGS BLAQ-Sys
<b>DV1</b>	<b>Average<sup>1</sup></b>	<b>0.5 (±0.1)</b>	<b>0.1 (±0.1)</b>	<b>0.2 (±0.1)</b>
	Max	1.0	0.8	6.6
<b>DV2</b>	<b>Average<sup>1</sup></b>	<b>0.5 (±0.1)</b>	<b>0.1 (±0.1)</b>	<b>0.2 (±0.1)</b>
	Max	1.0	0.5	2.0
<b>FFV</b>	<b>Average<sup>1</sup></b>	<b>20 (±7)</b>	<b>21 (±7)</b>	<b>23 (±11)</b>
	Max	135	272	190
<b>GV</b>	<b>Average<sup>1</sup></b>	<b>22.3 (±0.6)</b>	<b>24 (±1)</b>	<b>24 (±2)</b>
	Max	155.0	587	229

<sup>1</sup>Average concentration (ppm) of the three tests performed per vehicle. Max refers to the maximum concentration registered value (ppm) during the three tests.





# NH<sub>3</sub> & GTR

Date	Name of the file
<b>08.03.2013</b>	<a href="#"><u>WLTP-2013-016 Consolidated Draft GTR 08.03.2013.docx</u></a>
Modifications after VP2 for AP 2014	Annex 5: test equipment and calibrations: 7.1.1. Extractive sampling ,,, 7.1.1.1,,, and following (numbers may change in the new version).



## 7.0 Additional sampling and analysis methods

### 7.1. Sampling and analysis methods for NH<sub>3</sub>

NH<sub>3</sub> sampling is done in the undiluted exhaust gas. The analyser shall be installed either within an analyser cabinet using extractive sampling in accordance with the instrument manufacturer's instructions or directly in the exhaust pipe (in-situ).

#### 7.1.1. Extractive sampling

**7.1.1.1. The sample path up-stream of the analyser (sampling line, pre-filter(s), pumps and valves) shall be made of stainless steel or PTFE and shall be heated to set point between 110 and 190 °C in order to minimize NH<sub>3</sub> losses and sampling artefacts. In addition, the sampling line shall be as short as practically possible. On manufacturers request a temperature between 110 and 133 °C can be chosen.**

# VP2 – NH<sub>3</sub>

# 1

Doc 06-27#

Docs loaded in:

<https://www2.unece.org/wiki/display/trans/WLTP+6th+session>



# 2

VP2 for AP  
RCHO & EtOH



# 2'

OPEN QUESTIONS  
& NEXT STEPS for AP  
(after 6<sup>th</sup> WLTP Vienna;  
March 2014- Phase 1b)



**RCHO sampling  
system for DNPH  
cartridges  
"classical method"**

**Sampling:  
diluted exhaust**

For Adehyde and Formaldehyde we **still** need confirmation that the online instrumentation is available and ready to be used



European  
Commission



ELUTION OF  
CARTRIDGE



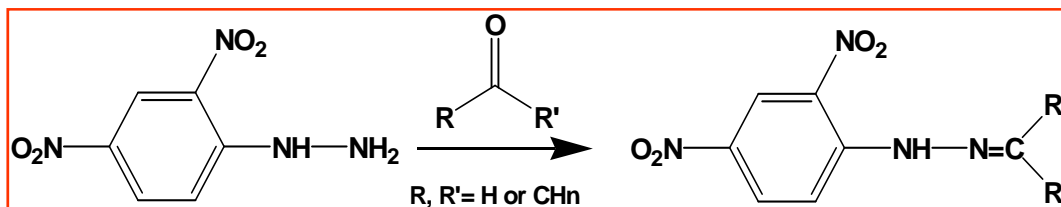
5 ml of fresh prepared  
solution of:

CH<sub>3</sub>CN / H<sub>2</sub>O milliQ (50:50)



ELUTED sample

1 mL



The method described has been developed on the basis of the "compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air (2nd Edition)"

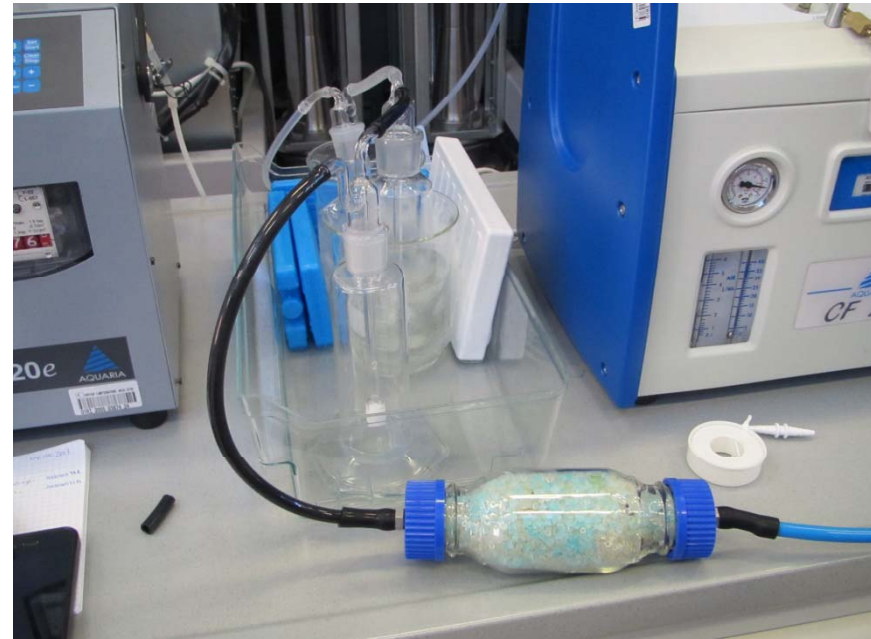
EPA/625/R-96/-1-b; Compendium Method TP-11A: Determination of Formaldehyde in Ambient Air Using Absorbent Cartridge Followed by High Performance Liquid Chromatography (HPLC)



HPLC- UV

impingers for EtOH  
“classical method”

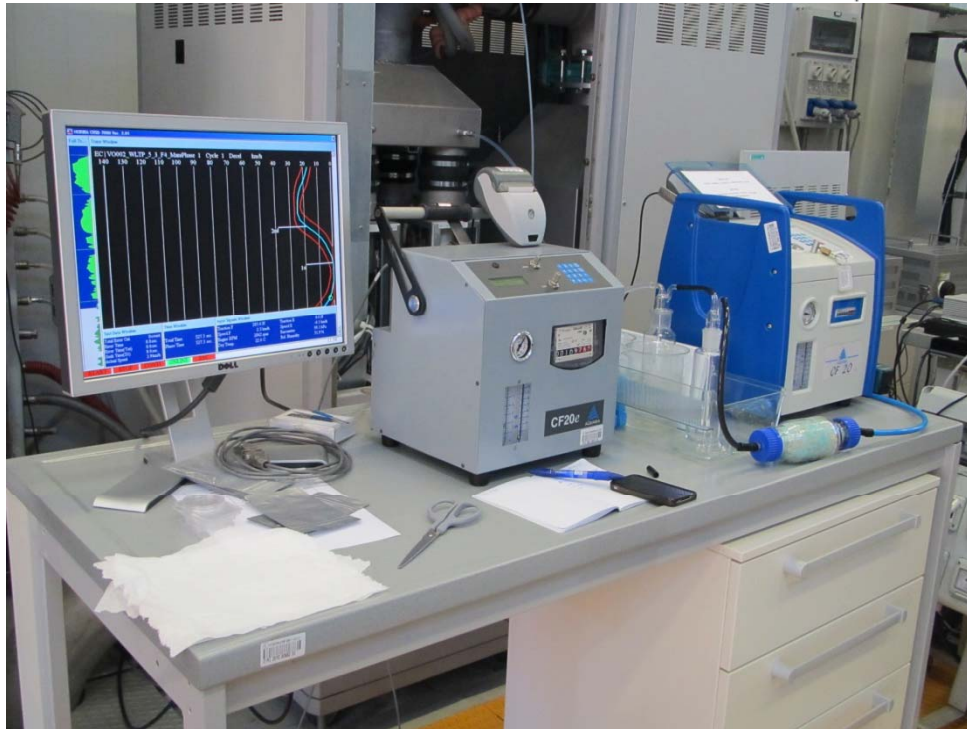
Sampling:  
diluted exhaust



**HORIBA continuous measurement system for EtOH: Fourier Transform Infra-Red (FTIR) Gas Analyzer**

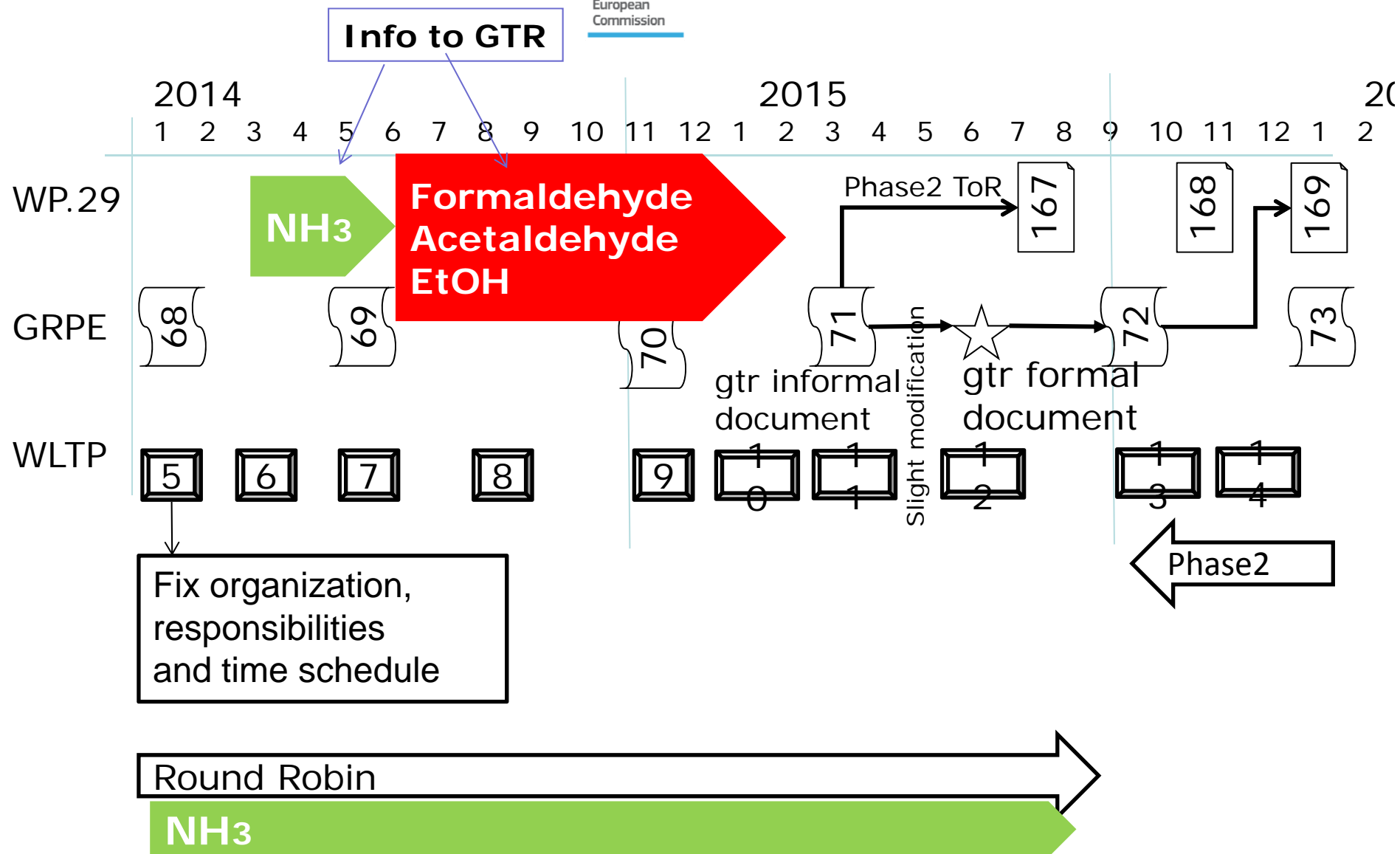
For EtOH we **still** need confirmation that the online instrumentation is available and ready to be used





How to progress after 6<sup>th</sup> WLTP  
Vienna March 2014  
(Phase 1B) **2'**

# WLTP Phase 1b





## **6<sup>th</sup> WLTP Session; Vienna 28<sup>th</sup> March 2014**

Report on NH<sub>3</sub> results from the VP2 Sept 203  
Doc 06-27e

Docs loaded in:

<https://www2.unece.org/wiki/display/trans/WLTP+6th+session>

*Thanks for your attention*  
(Questions....?)