



# WLTP-DTP-AP

## VALIDATION PHASE 2 FOR SELECTED ADDITIONAL POLLUTANTS

Status Report and Open issues

Presented to WLTP in Geneva, 8-Jan-2014

*M.C. Astorga*



The information reported here can be found at:

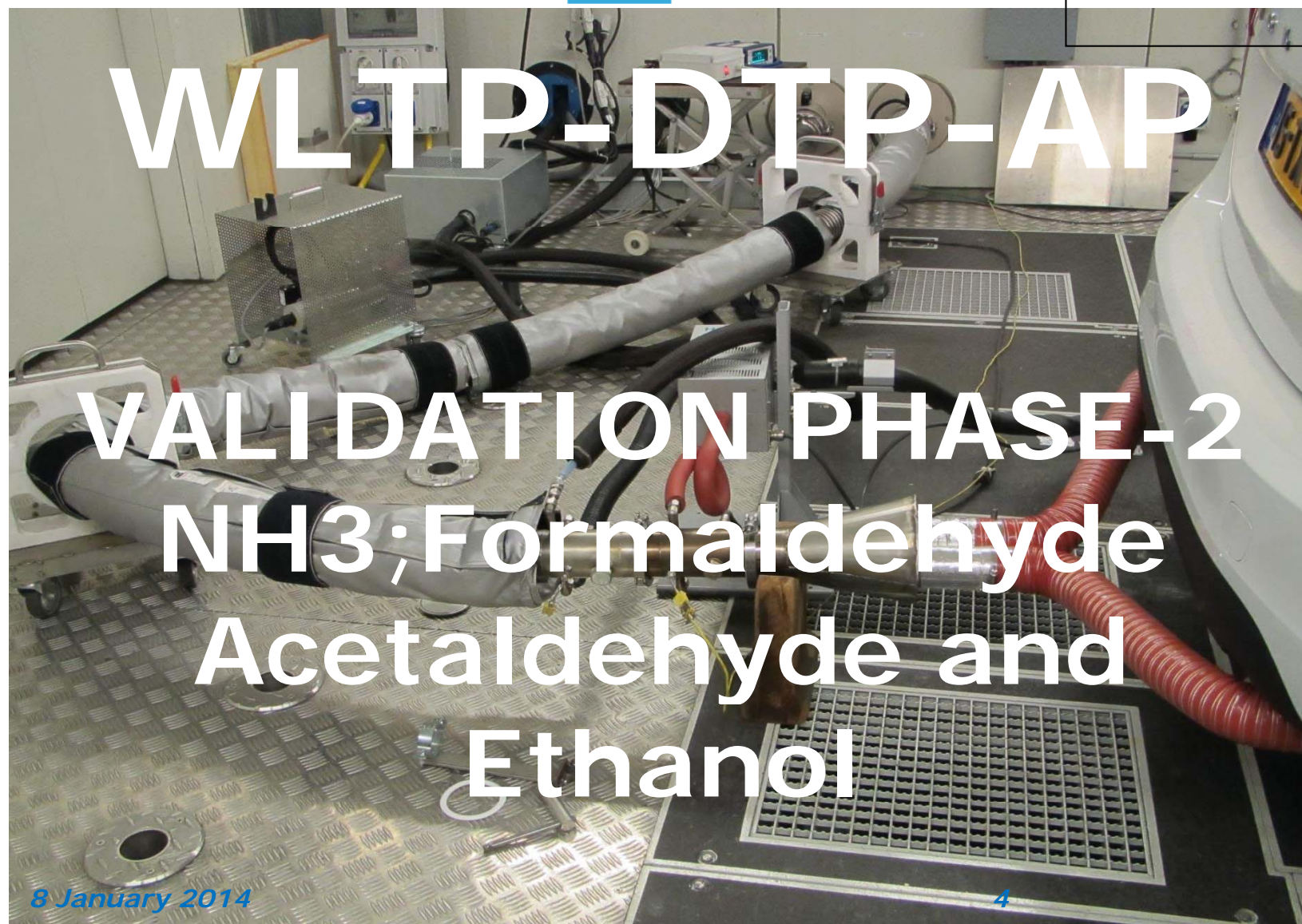
<https://circabc.europa.eu/>

WLTP DTP Additional Pollutants subgroup	
<b>Titles</b>	<b>AP Subgroup 18<sup>th</sup> Tel/Co. — Proposed Agenda and presentation</b>
<b>Working Paper Number</b>	<b>WLTP-DTP-AP-xx</b>

**1**  
**VP2 for AP**  
**September 2013**  
**(JRC-Ispra , ITALY)**



**2**  
**OPEN QUESTIONS**  
**& NEXT STEPS for AP**  
**(after Geneva**  
**January 2014-Phase 1B)**





## *Experimental Campaign September 2013*

**Location: VELA2 Lab, JRC, Ispra (VA), Italy**

### **Timeline**

When	
09.09.2013	Start
Weeks: 37-38	EtOH and Aldehydes
Weeks: 39-(40)	NH <sub>3</sub>
30.09.2013	End of the VP2



Participants	Role/Instrumentation
JRC	Responsible for the campaign: Vehicle tests, regulated compounds, FTIR, HPLC
HORIBA	FTIR AND QCL (MEXA1400QL NX)
CGS	BLAQ-Sys (Measuring principle: QCL)
VW	Diesel SCR EURO6 & Analysis of EtOH samples from impingers
University Biel (CH)	Flexi fuel Euro 5 vehicle
FORD	Flexi fuel Euro 5 vehicle

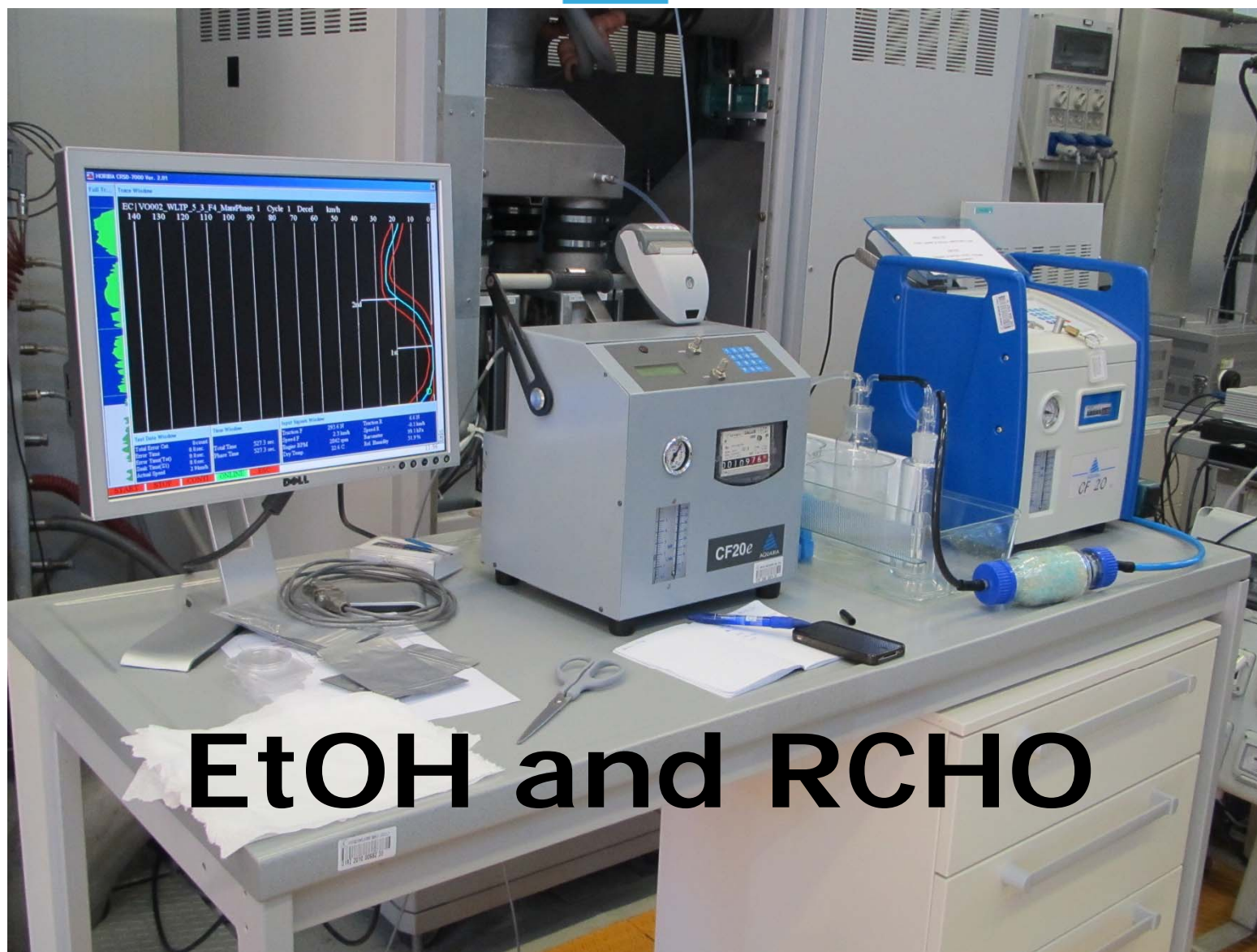
*My acknowledgement to all participants*



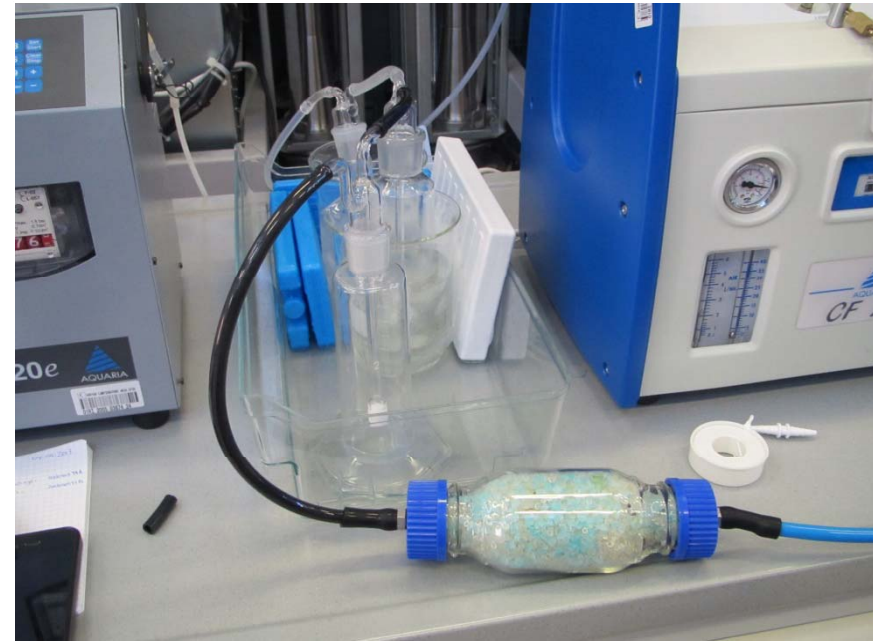
## Vehicles: G=gasoline; D=diesel; F=flexifuel

	Model	EURO/ year	Technical	displacement	Power	Fuel
<b>FFV1</b>	<b>Volvo S60</b>	<b>5/ 2012</b>	<b>DI / TWC</b>	<b>1596 cm3</b>	132 KW	<b>E85-E5</b>
<b>FFV2</b>	Ford Focus	5/ 2014	GTDI/ TWC	1596 cm3	110 KW	E85
<b>GV</b>	<b>VW Polo Ref.Car</b>	<b>5/ 2012</b>	<b>DI / TWC</b>	<b>1390 cm3</b>	132 KW	<b>E5</b>
<b>FFV3</b>	Volvo V60	5/ 2012	DI/ TWC	1596 cm3	132 KW	E85
<b>DV1</b>	<b>VW Passat</b>	<b>6/ 2012</b>	<b>DPF / SCR</b>	<b>1968 cm3</b>	105 KW	<b>B5</b>
<b>DV2</b>	<b>Volvo Ref.Car</b>	<b>5/ 2012</b>	<b>DPF</b>	<b>1560 cm3</b>	84 KW	<b>B5</b>









**RCHO sampling system for DNPH cartridges (diluted exhaust) and impingers for EtOH (diluted exhaust): Both “classical methods”**

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

Time	Carbonyls	EtOH	FTIR
00.00	Set sampler at 2 l/min;	Set sampler at 2 l/min;	Purge configuration, N2(g) < 0.1 l/min. Heated line in "Standby";
00.05	Set time sampling time to 30 min;	Set time sampling time to 30 min;	Fill detector with N2(l), wait 20 min;
00.15		80ml of MilliQ water into impingers 1 and 2. Put impingers in water-ice bath;	
00.35			Increase N2(g) to 0.4 l/min Setup. Run. Take backgrounds;
00.37	Take cartridge from the fridge;		Decrease N2(g) to 0.1 l/min. Start pump and wait until stabilized (10 min aprox.). Start data acquisition;
00.50	Remove caps and connect cartridge to CVS (keep caps);	Connect impinger 1 to CVS, impinger 3 to silica-gel drier and drier to sampler;	
00.55	Sampling starts automatically with the test;	Sampling starts automatically with the test;	
01.25	Sampling stops automatically with the test;	Sampling stops automatically with the test;	Stop analysis. Pump in "Standby" until 15 min before next test, if any, otherwise "Pause";
01.27	Extract cartridge; close caps; put it in aluminum bag. Press <enter>, type barometric pressure in, press <enter>, take note of the sampled volume at 0C. Using a PENCIL write: data, vehicle, test, filename and volume in the provide piece of paper. Staple it to the inferior corners of the aluminum bag;	Disconnect impingers 1 and 3. Press <enter>, type barometric pressure in, press <enter>, take note of the sampled volume at 0C;	
01.35	Store cartridge in a fridge.	Pour 20 ml of sample from impingers 1 and 2 into four labeled vials (2 vials per impinger). Seal vials and store in a fridge.	
01.45			If last test, change configuration to "purge"

## Carbonyls from DNPH cartridges analyzed by HPLC (\*)

Car	Formaldehyde (mg/km)	Acetaldehyde (mg/km)
FFV1	0.09 ± 0.01	<b>0.73 ± 0.06</b>
FFV2	0.13 ± 0.02	<b>0.91 ± 0.07</b>
FFV2	0.14 ± 0.01	<b>0.9 ± 0.2</b>
GV	0.04 ± 0.02	0.04 ± 0.003

\*For the ammonia tests the car VO002 was fueled with standard gasoline (E5)

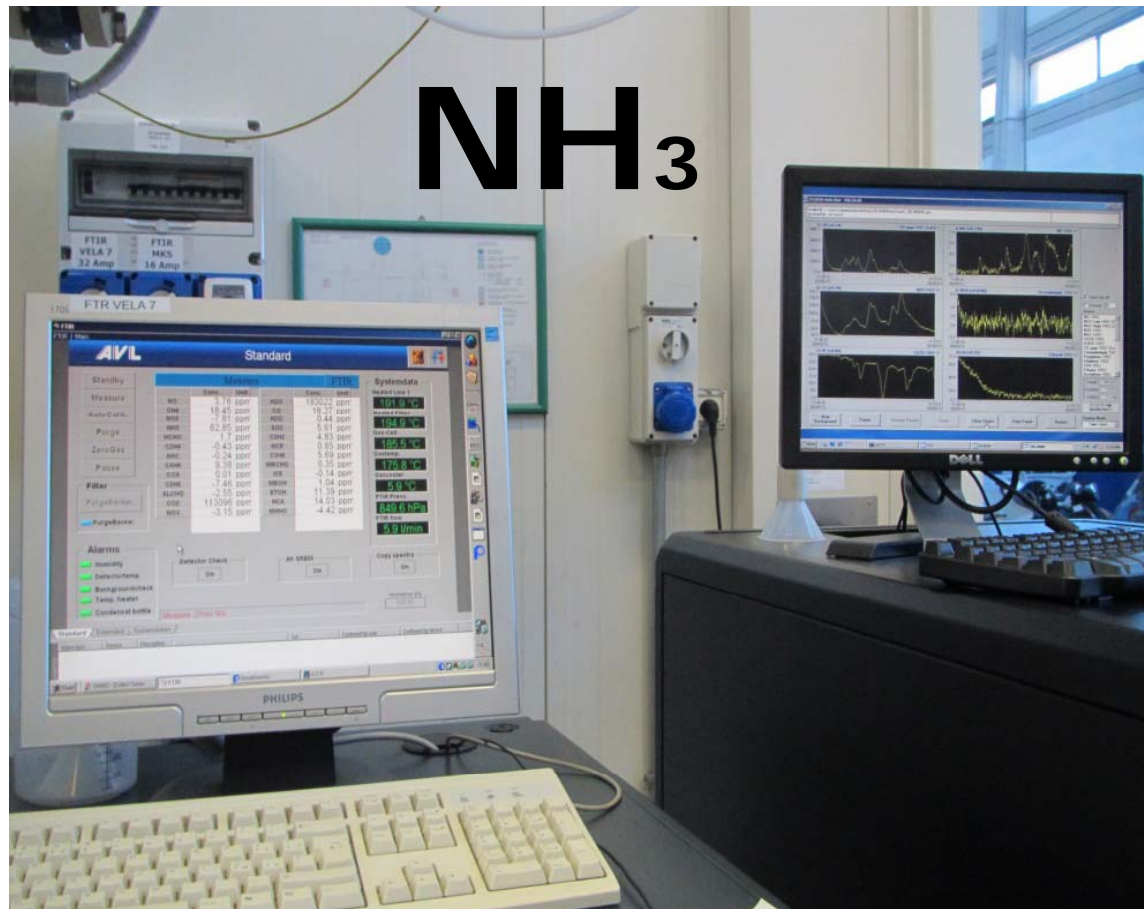
(\*) HPLC is a Reference method, robust and reliable for the Analysis of carbonyls compounds at low concentrations in the Gaseous exhaust (BUT Laboratory dependent)

Car	EtOH impinger 1* (µg/km)	EtOH impinger 2* (µg/km)
FFV1	0.02 ± 0.01	< 0.005
FFV2	0.01	< 0.005
FFV3	< 0.005	< 0.005
GV	< 0.005	< 0.005

\*Impinger contained 80 ml H<sub>2</sub>O MiliQ

**Sampling with impingers and Analysis of EtOH content in the laboratory is a Reference method, robust and reliable at low concentrations in the Gaseous exhaust  
(BUT quite time consuming and Laboratory dependent)**

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





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

# NH<sub>3</sub>

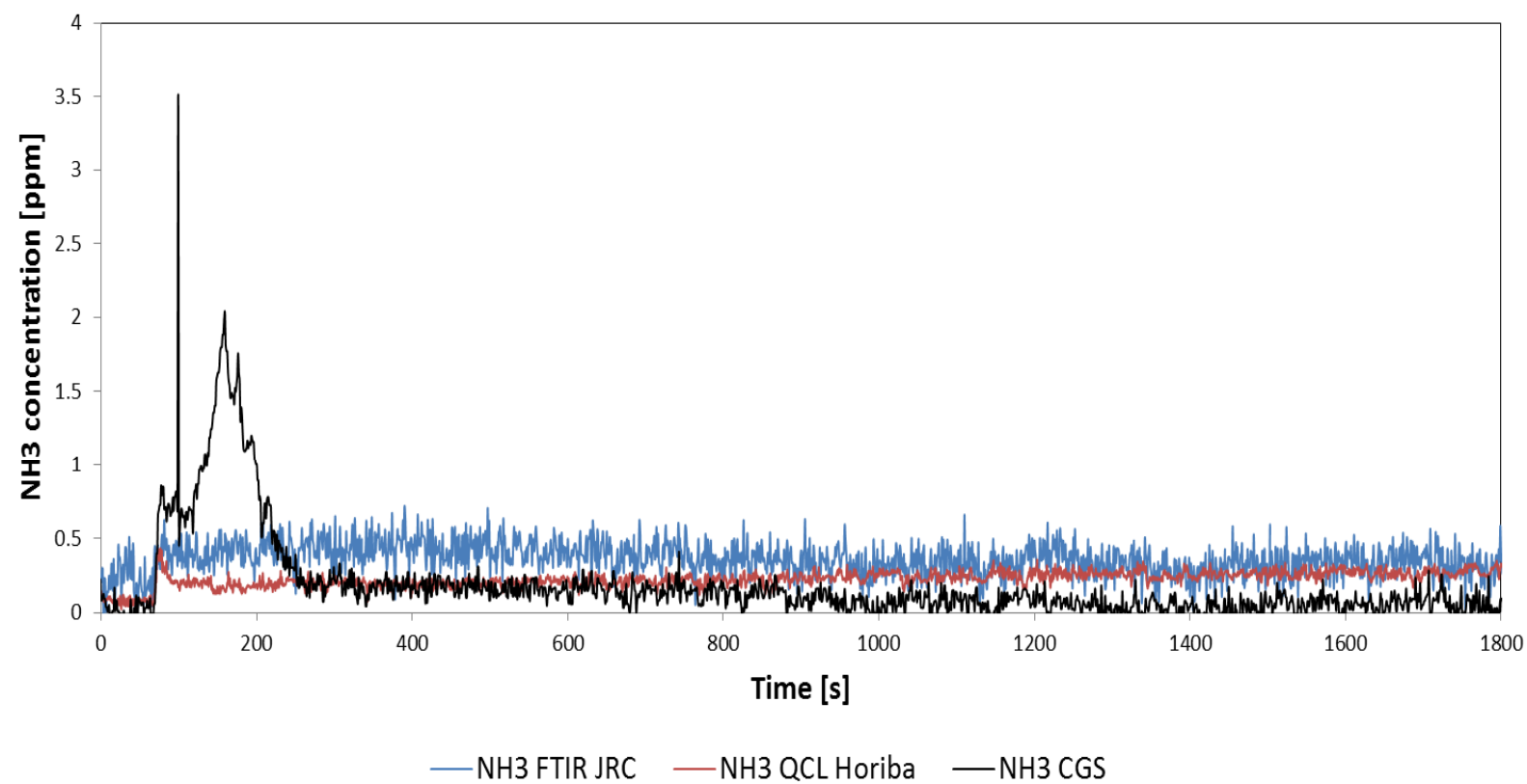


Vehicle	ppm	JRC analyzer: FTIR	Horiba analyzer: QCL	CGS analyzer: BLAQ-Sys
DV1	Average*	0.5 ± 0.1	0.1 ± 0.1	0.2 ± 0.1
	Max	1.0	0.5	3.5
DV2	Average*	0.5 ± 0.1	0.1 ± 0.1	0.2 ± 0.1
	Max	1.0	0.8	15.7
FFV1 (E5)	Average*	20 ± 7	21 ± 7	23 ± 11
	Max	135	272	190
GV	Average*	22.3 ± 0.6	24 ± 1	24 ± 2
	Max	155.0	587	229

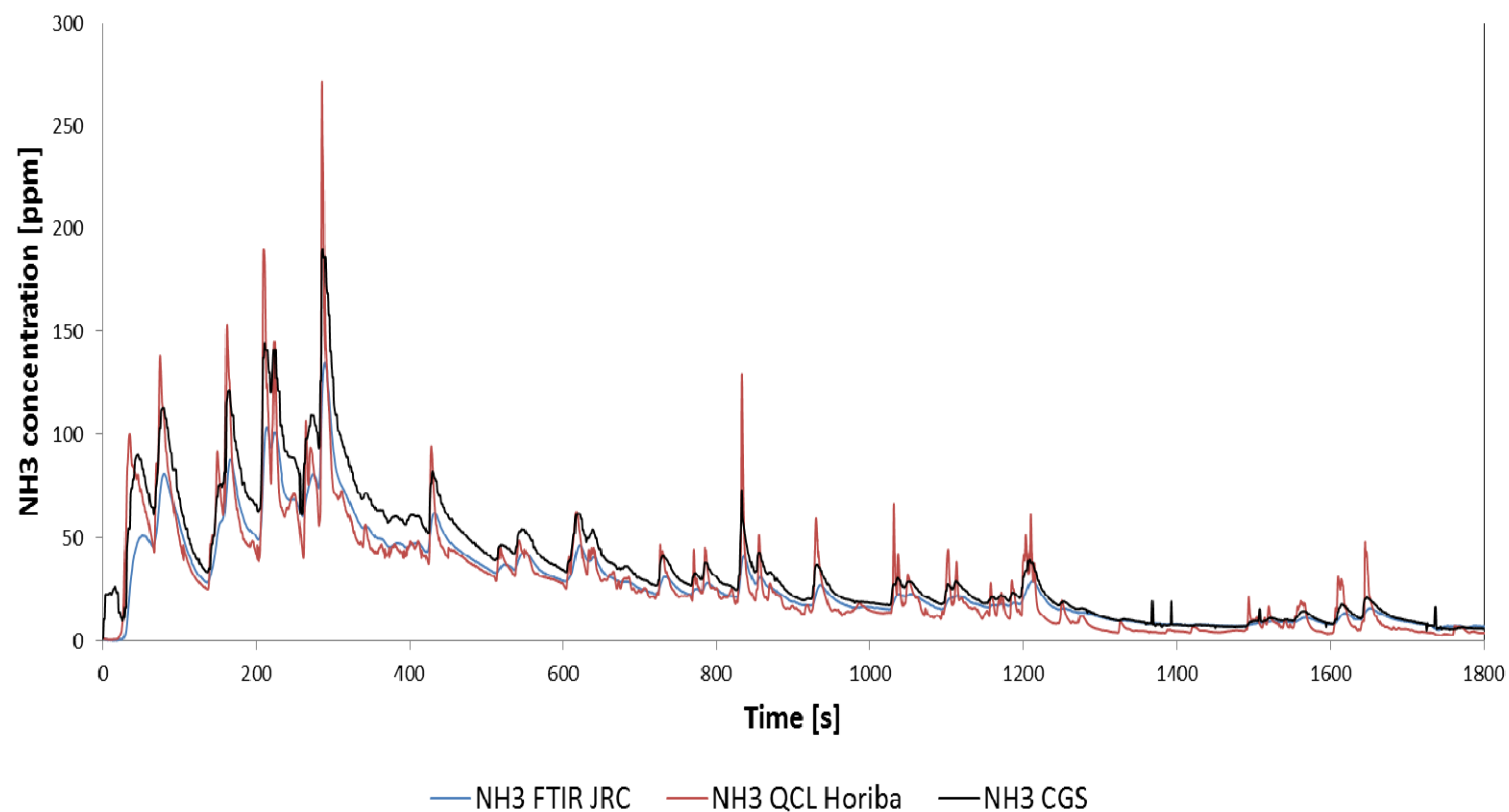
\*Average (ppm) of three tests done per vehicle. Max is the maximum registered value (ppm) during the three tests

**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.**

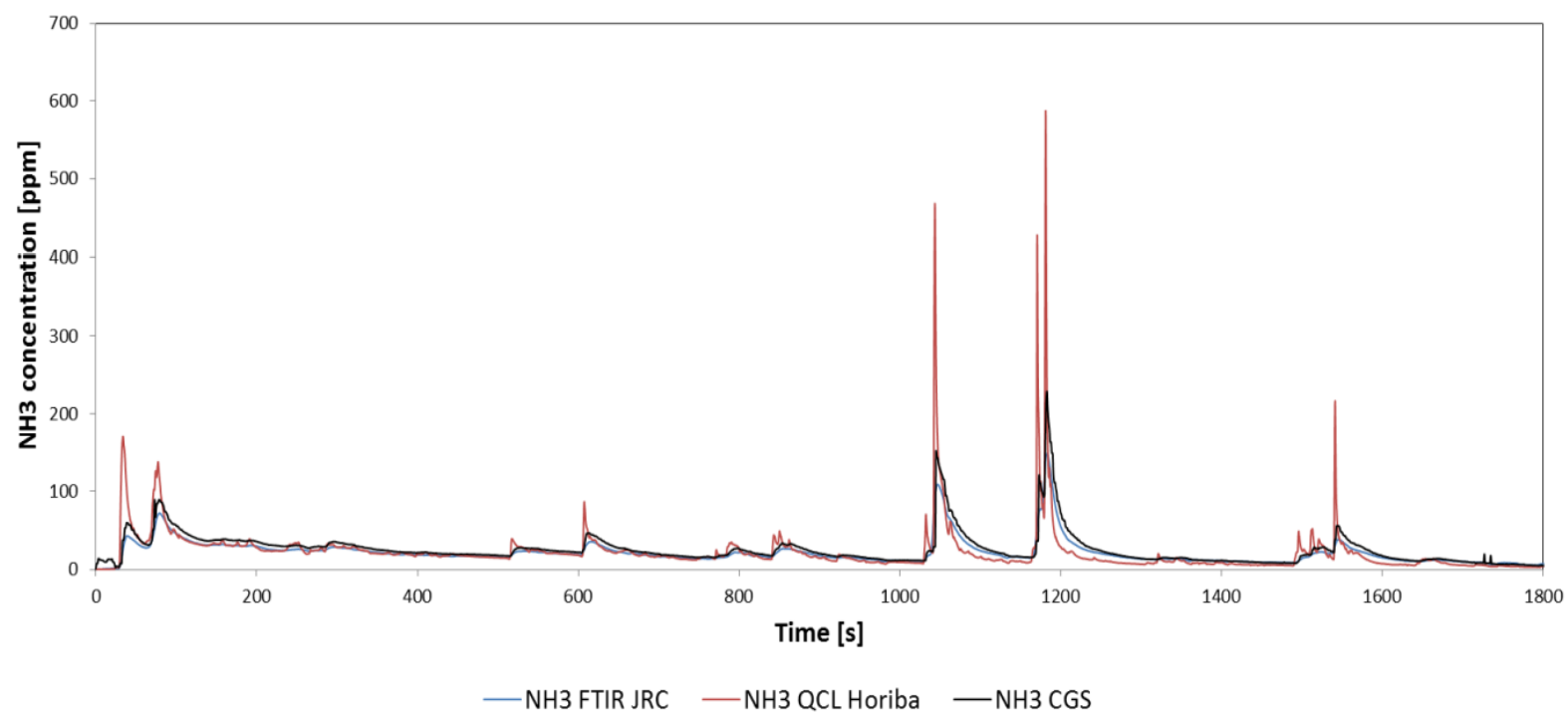
## D1- Diesel Euro 6-SCR



## FFV1-Flexi fuel Euro 5a



## GV-GDI Euro 5







How to proceed  
After WLTP Geneva Jan 2014  
(Phase 1B)

2

Figure 4: WLTP informal group structure for phase 1b (indicative, maybe subject to change)



## GTR NEXT STEPS...

7	3.1.2.4 ?	calculation formula for ammonia	to be developed	to be developed	AP TF	Cov a.	6	6	<b>AP</b>
7	3.1.2.5. ?	calculation formula for ethanol	to be developed	to be developed	AP TF	Cov a.	6	6	<b>AP</b>
7	3.1.2.6 ?	calculation formula for aldehyde	to be developed	to be developed	AP TF	Cov a.	6	6	<b>AP</b>

## Annex 2: Indicative (non-exhaustive) list of items and timetable for phase 1b

Items	2013		2014				2015			
	3. Qtl	4. Qtl	1. Qtl	2. Qtl	3. Qtl	4. Qtl	1. Qtl	2. Qtl	3. Qtl	4. Qtl
<b>Phase 1b Work</b>										
<b>Report to gtr drafting</b>										
<b>(a) LabProclCE ;</b>										
(i) normalization methods, speed trace index										
(ii) energy economy rating and absolute speed change rating for speed trace violations										
(iii) wind tunnel as alternative method for road load determination										
(iv) supplemental test with representative regional temperature and soak period										
<b>(b) EV-HEV ;</b>										
(i) calculation method of each phase range for pure electric vehicles (PEVs)										
(ii) shortened test procedure for PEV range test										
(iii) combined CO2 (fuel consumption) of each phase for off-vehicle charging hybrid electric vehicles (OVC-HEVs)										
(iv) hybrid Electric Vehicle (HEV)/PEV power and maximum speed										
(v) combined test approach for OVC-HEVs and PEVs										
(vi) fuel cell vehicles										
(vii) utility factors										
(viii) preconditioning										
(ix) predominant mode										
<b>(c) APM ;</b>										
measurement method for ammonia, ethanol and aldehydes										
<b>(d) DHS ;</b>										
(i) speed violation criteria										
(ii) further downscaling in wide open throttle (WOT) operation										
(iii) sailing and gear shifting										
<b>(e) all ;</b>										
others (further improvement of gtr)										
	3. Qtl	4. Qtl	1. Qtl	2. Qtl	3. Qtl	4. Qtl	1. Qtl	2. Qtl	3. Qtl	4. Qtl
	2013		2014				2015			

**GRPE INFORMAL DOC 67-06**

**Before June:**

**Measurements of  
NH<sub>3</sub>, EtOH  
& RCHO**



**NH3....**

we are ready to include information in the  
GTR

RCHO quite possible and we will have the answer very soon  
and in particular for EtOH... we need confirmation that the online  
Measurements are reliable.

## WLTP 10th Session

Docs loaded in:

<https://www2.unece.org/wiki/display/trans/WLTP+UN+GTR%3A+draft+texts>



## 10<sup>th</sup> WLTP Session

Docs loaded in:

<https://www2.unece.org/wiki/display/trans/WLTP+UN+GTR%3A+draft+texts>

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



Open issue	AP solution	DTP opinion/solution
<b>NH3-Measurement</b>	Measurement from raw exhaust during engine off	This issue has to be discussed together with AP-, ICE- and EV-Subgroup
<b>Measurement of EtOH and Aldehydes</b>	new methods not confirmed by VP2	Validation performed separately in Sept. 2013
<b>Calibration gas for Formaldehyde</b>	availability and stability	issue solved during the confirmation campaign in September 2013.

Closed issue	AP solution	DTP opinion/solution
NH3-Measurement (scope of measurement)	SCR-vehicles to prevent overdosing of urea	Issue withdrawn; no scope of technology defined
NH3-Measurement	Measuring concentration at tailpipe	Mass based measurement not feasible.
NH3-Measurement (temperature for sampling and analysis)	110 to 190 C upon manufacturer's request 110 to 133 C	Transpose to GTR consolidated Text
NH3-Measurement	Measurement from raw exhaust influences subsequent CVS measurements: Limit lost sample to 0,5 % of raw exhaust	Transpose to GTR consolidated Text