

Informal document GRPE-85-26-Rev.1  
85<sup>th</sup> GRPE, 11-14 January 2022  
Agenda item 12

# **Status Report of the VIAQ (Vehicle Interior Air Quality) Informal Working Group**

Geneva, January 11-14, 2022

Chair: Andrey KOZLOV, Russian Federation

Co-Chair: Inji PARK, The Republic of Korea

Secretary: Andreas WEHRMEIER, BMW

## Terms of reference and rules of procedure for the IWG on Vehicle Interior Air Quality

**Background.** The group considered the inclusion in the scope of interior air pollutants from outside sources as a possible extension of the mandate at third stage. As an extension of the existing Mutual Resolution on VIAQ, this will take into account not only interior air emissions generated from interior materials and exhaust gases from the vehicle entering into the cabin but also outside air pollution sources. The list of outside air pollutions could include CO, NO, NO<sub>2</sub>, SO<sub>2</sub>, O<sub>3</sub> volatile organic compounds (VOC), aldehydes, aromatic and aliphatic hydrocarbons, particulate number (PN) and mass (PM) and microbiological substances, e.g. allergens, fungi, bacteria and viruses. As an extension of the existing Mutual Resolution on VIAQ, this will take into account not only interior air quality but also the air cleaning efficiency of the vehicle air handling & treatment system.

**Objective.** This proposal expands on the issues of the vehicle interior air quality, addressing outside air pollutants entering into the vehicle cabin and the interior air cleaning efficiency, to develop a test procedure in a recommendation by including Part 4 in the Mutual Resolution No. 3.

**Scope and work items.** Outside air pollutants entering into the vehicle cabin and their cleaning efficiencies

- (a) Collect the information and research data on relevant air pollutants and similar issues, and understand the current regulatory requirements with respect to vehicle interior air quality in different markets.
- (b) Review, assess and develop new test procedures suitable for the measurement methods of air pollutants entering into the vehicle cabin and their cleaning efficiencies (including test modes, sample collection methods and analysis methods, etc.)
- (c) Discuss the potential of air pollutants in the vehicle interior air with toxicologists.
- (d) Develop a draft for test procedures in a recommendation.

### ➤ **23<sup>rd</sup> VIAQ IWG Meeting**

- Webex, 25<sup>th</sup> November 2021
- Half a day

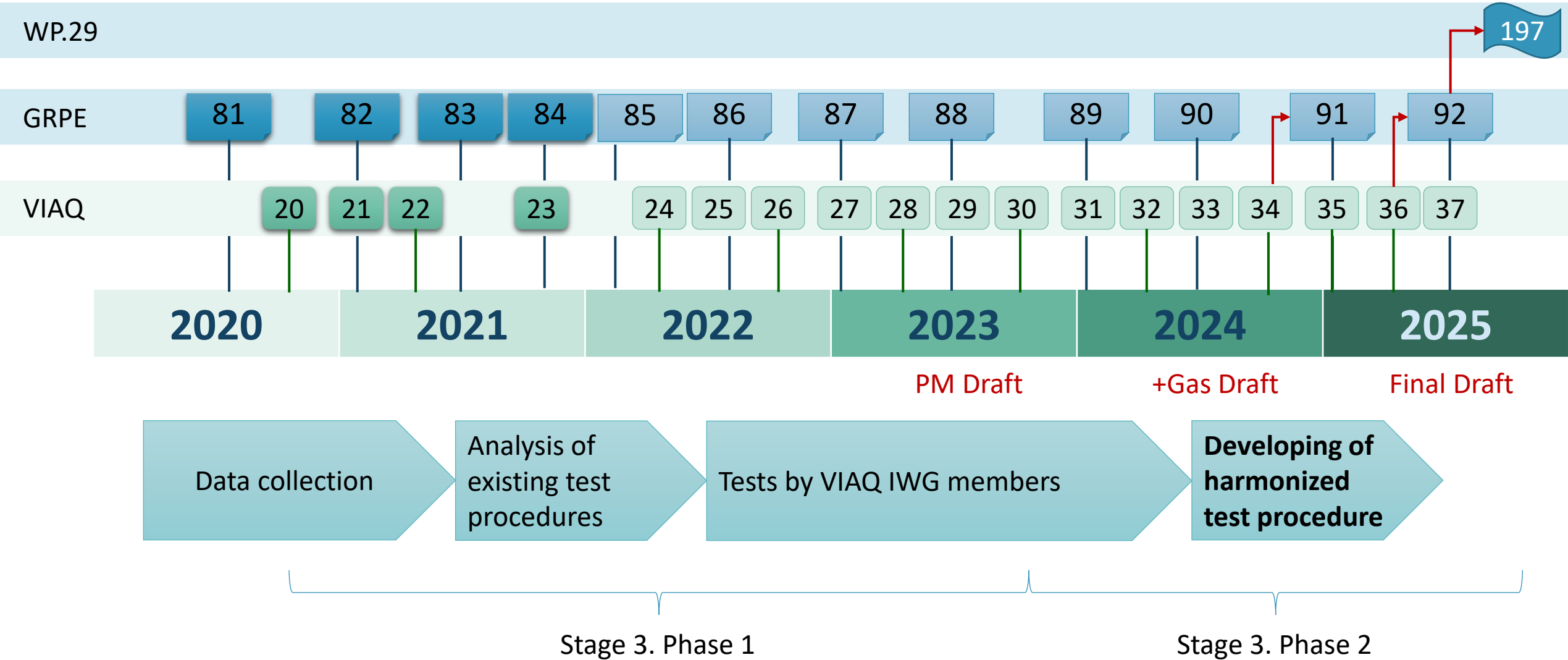
**New vice-chair of Informal Working Group** was elected:

**Inji Park**, Chief Researcher

Korea Automobile Transportation Research Institute

Inji Park is in charge of vehicle interior air quality for new vehicles and Korean Green NCAP of VIAQ stream.

# Timeline



# Information discussed last meeting

Company	Presenter Name	Document Title	Document No.
KATRI	Inji Park	Effect of cabin ventilation mode on VIAQ during high PM episode in Korea	VIAQ-23-04
Fraunhofer IBP	Matthias Brunnermeier	Controllable lab test environment for assessing cabin air quality regarding PM2.5 and CO2	VIAQ-23-05
AIR	Nick Molden	CEN Workshop 103: Validation of proposed cabin air quality assessment method – results of repeatability and reproducibility testing	VIAQ-23-06
NAMI	Andrey Kozlov	Measurement of inside and outside PM concentration with one DRX Aerosol Monitor	VIAQ-23-07
NAMI	Andrey Kozlov	The group feedback analysis regarding to test methodology, conditions, equipment	VIAQ-23-08 VIAQ-23-09
CERTAM	David Preterre	Reproduction of traffic pollution in a test bench to expose a whole car to reproducible scenario of urban pollution: IAQ devices and/or strategies assessment	VIAQ-23-10
UTAC	Nadir Hafs	Definition of protocol for vehicle in cabin air quality measurements	VIAQ-23-11

## The items

1. Vehicle Category
2. Criteria for excluding a vehicle from tests
3. Test Vehicle age/millage
4. Meteorological Conditions
5. Test Conditions
6. Sampling Points/Sampling Lines
7. Background air pollution level
8. Cabin air filter age
9. PM and gas components to be Measured
10. Measurement Methods
11. Test equipment requirements
12. Gas Analysers Calibration
13. Test Modes
14. HVAC Modes
15. Test Procedure
16. Test Protocol

# Feedback form

<b>Name</b>	
<b>Organization</b>	
<b>Items</b>	<b>Comments, suggestions</b>
Criteria for excluding a vehicle from tests	
Test Vehicle age/millage	
Meteorological Conditions	
Test Conditions	
Sampling Points/Sampling Lines	
Background air pollution level	
Cabin air filter age	
PM and gas components to be Measured	
Measurement Methods	
Test equipment requirements	
Gas Analysers Calibration	
Test Modes	
HVAC Modes	
Test Procedure	
Test Protocol	

# Responses from:

**CEN/WS  
103\***

CEN

**OICA  
Members**

OICA

**CLEPA  
(EU  
Association  
of Supplier)**

CLEPA

**UTAC/ES  
TACA  
(Paris  
saclay)**

UTAC

**Korea  
Automobile  
Testing &  
Research  
Institute**

Korea

**CabinAir  
Sweden AB**

CabinAir

The full text feedback tables are in the document VIAQ-23-09

\*CEN/WS 103 items from the document "Real drive test method for collecting vehicle interior air quality data" // Doc. CEN/WS 103 N. 23, 2021



## 1. Vehicle Category (agreed)

### Category 1-1

## 2. Criteria for excluding a vehicle from tests

### Proposals:

Exclusion shall be based on a positive answer to any of the criteria below:

- ✓ Is the vehicle **more than one month aged**?
- ✓ Does **the vehicle not have a full service history**?
- ✓ Is there a **Malfunction Indication Light** showing on the vehicle instrument panel?
- ✓ Has the **vehicle had unauthorised vehicle repairs**?
- ✓ Has **any part of the vehicle's heating and ventilation system replaced with non-original parts**?
- ✓ Through visual inspection of the vehicle, are there **any damaged ventilation system relevant components**?
- ✓ Are there **any obstructions to the vehicle air intake path**?
- ✓ Is **the vehicle not in overall safe operating condition**?
- ✓ Is there **any damage to the body of the vehicle**, including but not limited to doors, windows and the rear?

## 3. Test Vehicle age/mileage

### Proposals:

1. 3 000...15 000 km
2. 3 000...160 000 km
3. <25 000 km and age <2 years
4. >5 000 km

This item needs additional discussion

## 4. Meteorological Conditions

### Proposals:

Weather condition: no rain, fog, snow or standing water on the carriageway

Relative Humidity            40...80%

Atmospheric pressure        85...110 kPa

### **Temperature:**

1. -7...+35°C
2. 10...20°C
3. 5...25°C

Temperature range needs additional discussion

## 5. Test Conditions

### Proposals:

- The test must be primarily conducted **on city roads and urban locations**
- Driving time Monday to Sunday, 06:00 to 20:00
- Road condition Paved streets
- It is recommended to **avoid long tunnels, high altitudes and construction areas.**

Each trip shall meet the conditions below:

- **Instantaneous vehicle speed  $\leq 60$  km/h**
- **Minimum distance 10 km**
- **Minimum duration 30 min**
- A normal driving style shall be adopted.
- **Average speed 40...60 km/h**
- **Average altitude 0...700 m**
- There should **the driver and one passenger present in the vehicle for the duration of the test.**
- All **outer clothing of the driver should be made of [polyester] to minimise particle generation** from the driver.
- The cabin before the test should be cleaned and free of dust or other dirt.

### Alternatively:

UN Requirements to RDE

The item needs  
additional discussion

## 6. Sampling Points/Sampling Lines

### Proposals:

1. The interior sampling point should be a **head-height between the front headrests**
2. The external sampling point should be **as close as reasonably possible to the ventilation air intake**. Sampling should be isokinetic.  
Alternatively: Not measured, and used PM10 and PM2.5 **data from real-time roadside monitoring** stations
3. The sample lines should be made of a near-zero-loss material such as PTFE for gas and anti-static material for particulates.  
Not longer than 1 m and with no sharp bends.

The item needs additional discussion

## 7. Background air pollution level

### Proposals:

PM<sub>2.5</sub> concentration:

- 5...100 µg/m<sup>3</sup>
- 10...200 µg/m<sup>3</sup>
- 81...150 µg/m<sup>3</sup>
- > 30 µg/m<sup>3</sup>

The item needs additional discussion

## 8.Cabin air filter age

### Proposals:

HVAC filter age:

- New, OEM-approved
- Normal filters use for 3000 km or Ageing procedure
- Original OEM HVAC filter with max. 3000 km
- Aged filter out of filter replacement cycle which driving mileage 10 000 km~15 000 km
- Both New and Aged

The item needs additional discussion



## 9. PM and gas components to be Measured

### Proposals:

PN (10 nm to 10  $\mu\text{m}$ )

PM<sub>2.5</sub>

PM<sub>10</sub>

CO

CO<sub>2</sub>

NO<sub>2</sub>

### Optionally:

small fraction PM (0.1-1  $\mu\text{m}$ )

tVOC

PAH

NO<sub>x</sub> (NO<sub>2</sub> & NO)

NH<sub>3</sub>

O<sub>3</sub>

The item needs additional discussion

## 10. Measurement Methods

### Proposals:

PN concentration	Condensation particle counter (10 nm to 10 µm)
PM concentration (<10 µm)	Mini Wide Range Aerosol Spectrometer Aethalometer 90° light scattering & filter-sampling
CO concentration	Non-dispersive infra-red Electrochemical cell
CO <sub>2</sub> concentration	Non-dispersive infra-red
NO <sub>2</sub> concentration	Non-dispersive ultra-violet chemiluminescent detector

The item needs additional discussion in connection with item 9

## 11. Test equipment requirements

### Proposals:

PN concentration	0 to 1,000,000 #/cm <sup>3</sup> (particles: 10 nm to 10 μm)
PM concentration (<2.5 μm)	0 to 1 mg/m <sup>3</sup>
PM concentration (<10 μm)	0 to 1 mg/m <sup>3</sup>
CO concentration	0 to 1 ppm
CO <sub>2</sub> concentration	0 to 5,000 ppm
NO <sub>2</sub> concentration	0 to 0.5 ppm

### Alternatively:

PN concentration	1 to 2,000 #/cm <sup>3</sup>
PM concentration (<2.5 μm)	0 to 100 mg/m <sup>3</sup>
PM concentration (<10 μm)	0 to 100 mg/m <sup>3</sup>
NO <sub>2</sub> concentration	0 to 2 ppb

The item needs additional discussion in connection with items 9 and 10

## 12. Gas Analysers Calibration

### Proposals:

For in-field calibration of the gas analysers, a zero and span calibration shall take place at the start of the test and a zero and span check shall be made at the end of each test that is under two hours in length. For tests longer than two hours, mid-test checks of zero or zero and span may be made (such that the time between checks does not exceed two hours); the analyser may be adjusted to the calibration gases if necessary.

Annual calibration following supplier recommendation

The item needs additional discussion

## 13. Test Modes

### Proposals:

1. Urban (city) driving
2. Real driving conditions
3. Stationary test
4. Laboratory test

The item needs additional discussion

## 14. HVAC Modes

### Proposals:

HVAC system settings:

- Automatic mode (or for manual mode fan speed 50%/medium)
- Temperature 21°C (or for manual mode 50%/medium temperature)
- Fresh air mode
- Air conditioning switched ON
- Ventilation flaps fully open and directed straight ahead

### Alternatively:

- Temperature 23°C
- For manual HVAC: xx% fresh, yy% in recirculation
- A/C must be OFF

The item needs additional discussion

## 15. Test Procedure

### Proposals:

1. **Cold start operation shall be excluded.** To ensure this, the first 10 minutes or the first 2 km of driving under internal combustion engine operation shall be excluded from any test, whichever comes later. This restriction does not apply to vehicles with no internal combustion engine.
2. A test is a continuous stretch of driving that can contain **multiple trips**.
3. A test may be split up into multiple trips, each of which must meet the trip conditions. A trip shall start from a point at which the vehicle is stationary, with stationary defined as less than or equal to 0.5 km/h. There shall be no overlaps between the trips. A single trip shall be made up of continuous driving. Multiple trips from the same test can, in-between those trips, allow driving that does not meet the boundary conditions of CWA.
4. For test results to be deemed adequate for use in comparing interior air quality performance between models within the scope of this CWA, it shall be required to collect:
  - at least 3 valid trips in total
  - in the required fan speed/ventilation modes
  - on 1 vehicle of its type.

The item needs additional discussion

### Alternatively:

Measurements with two **consecutive vehicles** (the test is independent on background pollutant concentration)

## 16. Test Protocol

### Proposals:

The protocol contains

1. Vehicle information (car registration number, mileage, engine type, filter type and age...)
2. Test condition information (testing date, driving locations, ambient conditions, number of passengers...)
3. Reporting of trip results (inside and outside measurement results, filtering efficiency...)

The item needs additional discussion



Working Item	Research needed
4. Meteorological Conditions	Acceptable ambient temperature range
9. PM and gas components to be Measured	Which substances concentration to measure (taken into account their toxicity) Include or not CO <sub>2</sub> (non toxic but affects on driver concentration and safety)
8. Cabin air filter age	What is more representative: <ul style="list-style-type: none"><li>▪ New filter</li><li>▪ Aged filter</li><li>▪ Need to test both</li></ul>
13. Test Modes	Which combination of test modes is representative regarding VIAQ assessment: <ul style="list-style-type: none"><li>▪ Urban (city) driving</li><li>▪ RDE (city + suburban + highway)</li><li>▪ Laboratory test</li></ul>
14. HVAC Modes	Which combination of HVAC settings is worst case: <ul style="list-style-type: none"><li>▪ Air conditioner ON/OFF</li><li>▪ Interior temperature setting</li><li>▪ Recirculation ON/OFF</li></ul>

- **24<sup>th</sup> VIAQ IWG Meeting (TBD)**
  - Brussels, Belgium, April-May, 2022
  - or Paris, France, April-May, 2022
  - Two days