Progress Report of the
VIAQ (Vehicle Interior Air Quality)
Informal Working Group

Munich, November 6-7th 2019

Chair: Andrey KOZLOV, Russian Federation
Co-Chair: Jongsoon LIM, The Republic of Korea
Secretary: Mark POLSTER, Ford
During 173\textsuperscript{rd} WP.29 session in Geneva (14-17 November 2017) Proposal for a new Mutual Resolution (M.R.3) for of the 1958 and the 1998 Agreements concerning Vehicle Interior Air Quality (VIAQ) was adopted (ECE/TRANS/WP.29/2017/136). Final text of Mutual Resolution M.R.3 was published at UNECE site on 1 of November 2018 as the document ECE/TRANS/WP.29/1143
ToR for the Second Stage

Terms of reference

✓ Identify and collect the information and research data on interior air quality and its relevance for vehicles, taking into account the activities being carried out by various governments, and non-governmental organizations.

✓ Identify and understand the current regulatory requirements with respect to vehicle interior air quality in different markets.

✓ Identify, review and assess existing test procedures suitable for the measurement of harmful substance into the vehicle cabin (including test modes, sample collection methods and analysis methods, etc.)

✓ Develop provisions and test procedures in a recommendation by including Part 3 in the Mutual Resolution No. 3.
ToR for the Second Stage

Timeline

➢ January 2020: Submit the draft document to GRPE
➢ June 2020: Adoption of the draft document by GRPE
➢ November 2020: Adoption of the draft document by WP.29

• Half of working items almost closed
• Make a drafting group

• Develop provisions and harmonized test procedures.
• VIAQ recommendation (a new part of M.R.3)

2018
1 2 3 4 5 6 7 8 9 10 11 12

2019
1 2 3 4 5 6 7 8 9 10 11 12

2020
1 2 3 4 5 6 7 8 9 10 11 12

WP.29

GRPE

VIAQ

76
77
78
79
11 12 13 14 15 16 17

Informal document
formal document

VIAQ Madate

Informal document
formal document
16th VIAQ IWG Meeting

- Paris, France, May 14-15th 2019
- Two days

17th VIAQ IWG Meeting

- Munich, Germany, November 6-7th 2019
- Two days
Working Items

1. Vehicle Category
2. Test Vehicle age/millage
3. Substances to be Measured*
4. Meteorological Conditions
5. General Test Conditions
6. Test Modes
7. HVAC Modes*
8. Test Procedure*
9. Measurement Methods
10. Sampling Points
11. Sampling Method
12. Test Protocol

* Need clarification of some particular aspects
1. Vehicle Category

Agreed Item

Category 1-1
2. Test Vehicle age/millage

**Agreed Item**

New cars from series production

Millage

3 000 - 15 000 km
# 3. Substances to be Measured

<table>
<thead>
<tr>
<th>Russian Standard</th>
<th>Agreed substances</th>
</tr>
</thead>
<tbody>
<tr>
<td>Formaldehyde CH₂O</td>
<td>Carbon monoxide CO</td>
</tr>
<tr>
<td>Nitrogen dioxide NO₂</td>
<td>Nitrogen oxide NO</td>
</tr>
<tr>
<td>Nitrogen oxide NO</td>
<td>Nitrogen dioxide NO₂</td>
</tr>
<tr>
<td>Carbon monoxide CO</td>
<td></td>
</tr>
<tr>
<td>Saturated hydrocarbons (C₂H₆...C₇H₁₆)</td>
<td>For discussion</td>
</tr>
<tr>
<td>Methane CH₄</td>
<td>(see VIAQ-13-04, VIAQ-14-04 and VIAQ-17-04)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Korea</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon monoxide CO</td>
<td>Formaldehyde CH₂O</td>
</tr>
<tr>
<td>Nitrogen oxide NO</td>
<td>Nitrogen dioxide NO₂</td>
</tr>
<tr>
<td></td>
<td>Particulate matter (PM)</td>
</tr>
</tbody>
</table>
4. Meteorological Conditions

✓ ambient air temperature: from -7°C to +30°C
✓ relative humidity: from 30% to 90%
✓ atmospheric pressure from 85 to 110 kPa
5. General Test Conditions

Agreed Item

1. Test facility for idle test is an open parking zone.
2. Test road for constant speed test is a paved road with the slope up to 6.0%.
3. For the purpose of idle test it is possible to use natural wind (if within the specification) or air blower to provide uniform air flow along the tested vehicle with a velocity of 2±1 m/s.
4. During the tests contamination from outside sources has to be prevented. Therefore background measurements of the analytical substances have to be done before and after the test and in constant speed mode a distances to emission sources has to be not less than 100 m.
5. General inspection should be checked before testing.
6. Windows, doors and ventilation hatches should be closed.
7. HVAC outside flaps have to be closed.
6. Test Modes

<table>
<thead>
<tr>
<th>Working Items</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Agreed Item</strong></td>
</tr>
<tr>
<td>1. Idling Test</td>
</tr>
<tr>
<td>2. Constant Speed Test</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>
7. HVAC Modes / 8. Test Procedure

Idle test

Test conditions:
✓ wind velocity 2.0±1 m/s
✓ velocity difference between anemometers 1, 2 and 3 not more than 15%

HVAC mode:
✓ recirculation: ON
✓ air conditioner: OFF
✓ ventilator speed: MAXIMAL
✓ outside air flaps: closed
✓ temperature setting: manual and coolest level
✓ dashboard vent: all open and horizontal
✓ rear vents: closed

It is acceptable to use air blower to simulate air movement around tested vehicle

1 - Anemometer (constantly monitor center location); 2,3 - Anemometers (side location)
7. HVAC Modes / 8. Test Procedure

**Idle test**

1. Insure the wind speed is equal to 2±1 m/s in case of testing at natural air movement.
2. Park the vehicle in a position so the wind direction achieves a linear speed of air perpendicular to the rear of the test vehicle.
3. Locate the sensors to the center point behind the test vehicle to measure wind speed, temperature and humidity.
4. Verify the uniformity of the wind to insure it is constant across the vehicle within the airflow tolerance and perpendicular to the rear of the vehicle.
5. Start the engine and warm-up vehicle by driving for a minimum 15 minutes.
6. After warm-up, park the vehicle by backing into the previous position. Set the vehicle’s climate system to air conditioner: OFF; recirculation: ON; outside air flaps: closed; temperature: manual and coolest level; fan: highest level; dashboard vent: all open and horizontal, and rear vents: closed.
7. With the engine off, ventilate vehicle for 5 minutes with all doors and windows open. Then close the doors and windows. During sampling, no people are inside the test vehicle.
8. With the engine off measure the background pollutant concentrations.
9. Open the door, start the engine, confirm the climate system settings, exit and close the door. This operation should take about one minute. Sample air from a location between the front seats, take at least 5 measurements during 15 minutes.
10. Take another background measurement according to chapter 8.
11. Vehicle idle test is complete.
## Working Items

### 7. HVAC Modes / 8. Test Procedure

**Constant speed test**

1. **Speed modes:**
   - ✓ 50 km/h (city traffic)
   - ✓ 130 km/h (highway)

2. **HVAC mode:**
   - ✓ air conditioner: OFF (option is ON)
   - ✓ recirculation: ON
   - ✓ ventilator speed: MAXIMAL
   - ✓ outside air flaps: closed
   - ✓ temperature setting: 20±2°C
   - ✓ dashboard vent: all open and horizontal
   - ✓ rear vents: closed
1. Start the engine and warm-up vehicle by driving for a minimum 15 minutes.
2. After warm-up, park the vehicle and set the vehicle’s climate system to air conditioner: OFF; recirculation: ON; outside air flaps: closed; temperature: 20±2°C; fan: highest level; dashboard vent: all open and horizontal, and rear seat vents: closed.
3. With the engine off, ventilate vehicle for 5 minutes with all doors and windows open. Then close the doors and windows.
4. With the engine off measure the background pollutant concentrations.
5. Start the engine, confirm the climate system settings. Start driving and accelerate smoothly to a speed of 50 km/h. Measure the vehicle interior pollutant concentration level. Sample air from a location between the front seats, take at least 5 measurements during 15 minutes.
6. Repeat measurement in accordance with item 5 at a speed of 130 km/h.
7. Take another background measurement according to chapter 4.
8. Stop all measurements, park the vehicle and switch engine off.
9. Vehicle constant speed test is complete.
### 9. Measurement Methods

<table>
<thead>
<tr>
<th>Substances</th>
<th>Proposed measuring methods</th>
<th>Type of analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH₂O</td>
<td>1) High performance liquid chromatography (HPLC) UV detection</td>
<td>1) Off-line analysis at the laboratory after preliminary air sampling to the cartridges</td>
</tr>
<tr>
<td></td>
<td>2) Gas chromatography (GC) with nitrogen phosphorus detection (NPD), or mass spectrometer (MS) and capillary or packed columns</td>
<td>2) Off-line analysis at the laboratory after preliminary air sampling to the cartridges</td>
</tr>
<tr>
<td></td>
<td>3) Photo-electric colorimetric method</td>
<td>3) On-line (express) analysis</td>
</tr>
<tr>
<td>NO, NO₂</td>
<td>1) Chemiluminescence (CLD)</td>
<td>1) On-line (express) analysis or stationary analysis at the laboratory after preliminary air sampling to the sealed bags</td>
</tr>
<tr>
<td></td>
<td>2) High-sensitivity electrochemical detection (ECD)</td>
<td>2) On-line (express) analysis</td>
</tr>
<tr>
<td>CO</td>
<td>1) Infrared photoacoustic spectroscopy</td>
<td>1) On-line (express) analysis</td>
</tr>
<tr>
<td></td>
<td>2) Electrochemical detection (ECD)</td>
<td>2) On-line (express) analysis</td>
</tr>
<tr>
<td>PM_{2.5}</td>
<td>1) Light-scattering laser photometer</td>
<td>1) On-line (express) analysis</td>
</tr>
<tr>
<td>PM_{10}</td>
<td>need additional discussion</td>
<td></td>
</tr>
</tbody>
</table>
The sampling point is between headrests of front seats
The sampling method is aspiration
12. Test Protocol

The data exchange file shall be constructed as follows. Pollutant concentrations as well as any other relevant parameters shall be reported and exchanged as a csv-formatted data file. Parameter values shall be separated by a comma, ASCII-Code #h2C. The decimal marker of numerical values shall be a point, ASCII-Code #h2E. Lines shall be terminated by carriage return, ASCII-Code #h0D. No thousands separators shall be used.

Headers of the Reporting and Data Exchange File are in the table (for example):

<table>
<thead>
<tr>
<th>Line #</th>
<th>Parameter</th>
<th>Basic Data Type [A=Alpha or N=Numeric (max length, fractional digits)]</th>
<th>Data Type [Enumeration String, Decimal, Integer]</th>
<th>Total Digits</th>
<th>Fractional Digits</th>
<th>Minimum Value</th>
<th>Maximum Value</th>
<th>Allowed Values for: Enumeration or Description or Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Process Code</td>
<td>N(2)</td>
<td>Integer</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>99</td>
<td>Version of Test Report. 1st dataset is N=0, highest value is the latest correction of existing dataset</td>
</tr>
<tr>
<td>14</td>
<td>Factory Name</td>
<td>A(50)</td>
<td>String</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Place of Manufacturer</td>
</tr>
<tr>
<td>15</td>
<td>Vehicle Identification Number</td>
<td>A(17)</td>
<td>String</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>17-character vehicle identification number (VIN)</td>
</tr>
<tr>
<td>31</td>
<td>Background – Carbon Monoxide</td>
<td>N(4,1)</td>
<td>Decimal</td>
<td>5</td>
<td>1</td>
<td>0.0</td>
<td>9999.9</td>
<td>CAS#: 201230-82-2 [mg/m^3]</td>
</tr>
<tr>
<td>32</td>
<td>Background – Nitrogen Monoxide</td>
<td>N(4,1)</td>
<td>Decimal</td>
<td>5</td>
<td>1</td>
<td>0.0</td>
<td>9999.9</td>
<td>CAS#: 10102-43-9 [µg/m^3]</td>
</tr>
<tr>
<td>33</td>
<td>Background – Nitrogen Dioxide</td>
<td>N(4,1)</td>
<td>Decimal</td>
<td>5</td>
<td>1</td>
<td>0.0</td>
<td>9999.9</td>
<td>CAS#: 10102-44-0 [µg/m^3]</td>
</tr>
</tbody>
</table>
Items which need additional clarification on 17th meeting

1. Substances to be Measured
   - Formaldehyde CH₂O
   - Particulate matter (PM$_{2.5}$ and PM$_{10}$)

2. Constant speed test
   - Speed 130 km/h
   - Air conditioner: OFF (option is ON)
Revision 2 of M.R.3

Developed and edited during 16\textsuperscript{th} meeting two documents:

✓ Update of part I of Mutual Resolution No. 3 (VIAQ-16-06)
✓ Draft of part III of Mutual Resolution No. 3 (VIAQ-16-08)

as parts of Revision 2 of Mutual Resolution (M.R.3) on Vehicle Interior Air Quality
Next VIAQ IWG Meeting

➢ 18th VIAQ IWG Meeting (TBD)
   • Geneva, Switzerland, January 15th 2020
   • Half a day

➢ 19th VIAQ IWG Meeting (TBD)
   • Paris, France, March 2020
   • Two days