

**Progress report to the WP.29 on the work of the Informal Group on
Electrical Vehicle Safety in the context of the 1998 Agreement**

This report provides an update on the progress in key technical areas of the IWG and its nine task forces. Most recent developments pertain to the conclusions of the 8th informal working group meeting that took place in Washington DC in June 2015.

1. Objectives, scope and the mandate

The GTR will address the unique safety risks posed by EVs and their components. It will be performance-based to the extent possible so as not to restrict future technology development. It will be preceded by an exchange of information on current and future planned domestic regulatory safety requirements for electric vehicles based on section C of the formal proposal, (ECE/TRANS/WP.29/2012/36 and its Corr1) including the underlying scientific and technical basis and research.

The GTR will also set provisions and test protocols to ensure the vehicle system and/or electrical components perform safely, are appropriately protected, and are electrically managed while recharging from external electricity sources, whether at a residence or other charging location.

The GTR will cover high voltage electrical safety, electrical components such as electric inlets, and REESS -- in particular those containing flammable electrolyte. The provisions will address the safety of electric vehicles, both in-use and post-crash. Informal working group may consider other safety related topics, insofar as these topics prove to be relevant for the technical requirements to be developed. Under the current mandate (end of 2015), the adoption of the GTR is expected in November 2016, during the 170th session of WP.29.

2. Working set-up

The format of the IWG meetings has been modified in 2015, adding an additional, a third IWG meeting on the annual basis. In October 2013, the IWG decided to form 8 Task Force groups to address specific technical issues. This will provide a more efficient way to resolve technical issues. A ninth TF was added to address the REESS safety warning. The progresses of these TF teams are described below.

3. Update on on-going and planned research

At the eighth IWG meeting, the U.S. presented an update on its research including short term and long term items.

4. Reports from Task Forces and key issues

Task Force 1 – Protection against water

- TF1 has a broad agreement on the contents and draft test procedures. The TF1 group agreed to remove the heavy rain test and keep the hose spray and water trough for vehicle level testing. The proposed test parameters are kept in square brackets at the time being while members evaluate the proposal. The members will continue the discussion at the next IWG.

Task Force 2 – Low electricity energy option

- TF2 so far assembled all the relevant material and reviewed the inputs of the involved experts.
- A critical issue of the TF2 is a consideration of the “barrier” option, the effectiveness of further discussion pending NHTSA's review of a petition submitted by Auto industries, which amongst others is essential for the certification of fuel-cell vehicles.
- Regarding the low energy option, the U.S provided a rationale for not accepting this option. The main concern is the low energy option does not contain the same level of safety as the other options. The TF2 will study the rationale and discuss further at the next IWG meeting.

Task Force 3 – Electrolyte leakage

- Non-aqueous leakage for in the in-use and post-crash scenarios, observation times, and evaporative emissions remain the issues yet to be addressed by this task force. TF3 notionally agreed to step up the requirement for non-aqueous batteries in the post-crash situation, where no leakage in the passenger compartment is allowed.
- JRC presented the results of the experiment measuring electrolyte leakage volume from the opened cells of different types of batteries. While NHTSA recognized the importance of the work of the JRC, OICA challenged the relevance of the experiment as it has not been performed at the system level and the result would not be representative of real conditions.

- It has been agreed that TF3 will take over the discussion on gas management and venting and should come forward with a concrete proposal well ahead of the next IWG meeting.

Task Force 4 – REESS in-use testing

- The TF4 team continued to discuss provisions for 48V vehicles. These vehicles have certain AC components that exceed the maximum voltage limit (30V) thus required provisions to ensure safe operation for in-use and post-crash. OICA will prepare a proposal for consideration at the next meeting.
- The U.S. presented its proposal for BMS functionality requirements for in-use which addresses events of over-charge, over-current, over-temperature and over-discharge. The proposal contains similar test procedures as the OICA proposed test procedures with slightly different boundary conditions. The U.S. will prepare regulatory text for discussion at the next IWG meeting.
- The U.S. introduced a recommendation for shock, vibration test, and thermal cycling including pass/fail criteria. The recommendation was a result of a research analysis and was put forth for discussion. The U.S. will prepare regulatory text as needed for discussion at the next meeting, drawing parallels with the current GTR text. China also expressed that they would like to propose a random vibration provision and will provide a proposal and data at the next meeting.

Task Force 5 – Thermal propagation:

- TF5 continued to discuss issues of propagation from the cell to pack level.
- The U.S. presented its research on propagation with an aim at a proposal once its research is completed. The research is to develop a suitable ignition source to represent a credible cell thermal runaway event that would be repeatable. The research is expected to be completed by summer 2016. The U.S. will prepare a regulatory text with some open items for discussion at the next meeting.
- OICA and Japan both questioned the necessity of the multi-point initiation given a limited possibility for a multiple failure stemming from the internal short circuit.
- Japan will provide a definition of the thermal propagation by the next task force meeting.
- TF5 will coordinate 2 meetings before the IWG meeting in September 2015.

Task Force 6 – State of Charge

- The U.S. provided its recommendation for raising SOC level to 97% for in-use and post-crash tests. OICA expressed that maintaining the charge at that level could be problematic. NHTSA will review its recommendation considering the opinions from IWG participants by next IWG meeting.
- The IWG agreed on the proposed temperature condition.

Task Force 7 – Fire resistance

- The TF7 continued to discuss the short-term and long-long term fire exposure tests. Main open issue items for a long duration remains a definition of the purpose of the test, including setting the long term duration target.
- Current proposal allows the use of two different types of burners: LPG and gasoline pool fire. Members suggested instead of requiring the type of burner, temperature profile should be used as the main parameter for the test. The exposure time for long-term fire test was not reached and remains to be discussed at future TF7 meetings.
- Canada presented their research on fire exposure at vehicle level. Fire tests were conducted with electric vehicles and conventional gasoline vehicles. The test results showed electric vehicles did not exhibit higher safety hazard than conventional gasoline vehicles.
- This contrasts the OICA's viewpoint suggesting that it is the purpose of the test that determines whether the fire test is performed at the vehicle or component level.
- Japan reminded that these long term fire exposure requirements should not be confounded with those addressed by the first responders' guide.

Task Force 8 – Bus and Truck Scope study

- The TF8 members continued to discuss the scope of the GTR whether to include buses and heavy commercial vehicles. Some members raised concerns with the complexity of combining provisions for heavy and commercial vehicles with passenger vehicles.
- NHTSA indicated that commercial vehicles and buses would be most likely optional requirements in the US.
- OICA suggested consulting with WP.29 for guidance on this matter.
- The group will continue to discuss further in future meetings.

Task Force 9 – REESS Safety Warning

- The TF9 members reached an agreement on its action plan and will begin to develop parameters for safety warning. A survey of current warning systems equipped in

electric vehicles will be conducted. The TF9 will coordinate a teleconference prior to the next IWG meeting.

Battery Venting

- As much as the purpose of venting, preventing likely rupture or explosion of REESS remains incontestable, the treatment of venting, i.e. gas management needs to be further considered within the IWG.
- There are several main discussion points, the one is whether venting is considered a pass/fail criterion for REESS in-use under the normal (as opposed to abnormal) conditions, in the context of the GTR which tests are considered normal/abnormal and how to verify that the concentration of vented gases does not reach hazardous levels inside the vehicle cabin.
- Feedback from the EU testing centers regarding the interpretation of R100.02 and the Japan's recent proposal on gas management was presented. EU testing centres consulted by JRC considered venting from the REESS during some, or sometimes all, tests as a failure of the test however their rationale differed somewhat.
- EC agreed that the venting mechanism should be recognised as a safety feature, however EC still believes that the venting in the normal use condition should not happen, not only because of the high levels of toxicity of vented gas components, but equally because it is an indication of unwanted thermal processes occurring inside the REESS.
- Japan strongly requested the discussion on venting as a safety feature and toxicity of vented gases to be treated separately.
- The EC and The US expressed that toxicity of vented gases, as a REESS associated hazard, should be included in the scope of this GTR.
- It has been agreed that the issue will be further discussed in the context of TF3.

5. Drafting of the GTR and the timeline

- The IWG agreed to develop the GTR in a 2-phase approach, pending final agreement by China.
- The IWG discussed and updated the GTR outline table. Items were categorized for phase 1 and phase 2. The group also discussed a possible request for extension of the IWG mandate. The request may be made at the WP.29 November 2015 session, depending on the progress of the IWG.

6. Future meetings

- 9th IWG meeting: September 14-18, 2015 in China

In case of the extension of the mandate:

- 10th IWG meeting: February 29 – March 4, 2016 in Japan
- 11th IWG meeting: June 2016 in North America
- 12th IWG meeting: October 2016, in Europe