EVS-05-28e

EVS IWG Session #5 —draft minutes

**Location:** The U.S. Department of Transportation (DOT)

1200 New Jersey Avenue, SE Washington, DC 20590

**Date: May 15-17, 2014**

**1. Welcome and Introductions**

Mr. Daniel Smith, Senior Associate Administrator of NHTSA, welcomed all the participants of the EVS Informal Group on behalf of the US Department of Transport who hosted this meeting. He emphasized the importance of this GTR activity to the US as well as to other contracting parties and to the industry. The US representative showed the strong and active intention to develop a robust and science-based GTR on EV safety. He recalled the NHTSA position that the US would not accept a development of the GTR in 2 phases. He also encouraged the IWG to continue to conduct and share research results that would eventually contribute to the development of the GTR.

**2. Approvals**

* Approval of the Agenda: Updated Agenda was introduced by the chairperson and approved by the participants.
* Approval of 4th meeting minutes:

The IG vice-chairperson gave a brief report of the 4th EVS Informal Group meeting. He highlighted the establishment of seven Task Force (TF) groups to work on specific technical items that will provide the necessary details for the draft EVS GTR. The TF groups are making good progresses and would welcome all comments as well as expert participation.

* Action items

 All 23 action items are shared and explained by the Secretary. The status will be discussed and confirmed during this 5th informal working group meeting.

**3. Reports of UN Activities**

* + 54th Session of GRSP in December 2013

The Chairperson gave a progress report to the experts at the working party of passive safety (GRSP) in December 2013. The report included the progress of the 4th EVS IWG meeting, the timeline of the EVS GTR establishment, GTR approach (1 or 2-step approach), and possible extension of the mandate.

* + 161st and 162nd Sessions of WP.29:

The EC representative gave a progress report to the 161st Session of WP.29 in November 2013. The highlights included the 4th EVS-IWG meeting and the TFs. At the 162nd Session of WP.29 in March 2014, the US representative gave a report on the progress of the TF groups and made an announcement of the 5th meeting. He also recalled the possibility of extending the mandate of the IWG.

* + EVE Meetings:

The Secretary gave a report on 3 recent EVE IWG meetings. These meetings, 7th to 9th EVE IWG, were conducted in - Oct 2013, Jan 2014, and Feb 2014.

The EVE IWG has been making good progress. They have been developing a reference guide that included four areas of interest that are recommended for further work and might be considered for possible GTR candidates: vehicle range and energy consumption testing, method of stating energy efficiency, battery performance and durability and battery recycling, . The reference guide was agreed by EVE IWG and will be submitted to the June 2014 GRPE session for approval to forward for WP.29 review in the November 2014 WP29 session.

**4. Update on ongoing and planned research and rulemaking, Research and testing activities:**

* + Korea:

Korea gave a report on their regulation activity covering alignment of new HFCV GTR.13 and its Electric Vehicle provisions.

* + US DOE:

The US Department of Energy reported outline of their Electric Vehicle related research program including EDV Safety, Cabin Climate Control, EV Grid Integration Safety (need to be controlled on the vehicle side as well), Vehicle Grid Integration Research, Wireless Health and Safety research, Power Electric thermal management, Advanced Vehicle Testing Activity, HEV to PHEV Conversion Issue, Thermal Event Study including National Fire Prevention Act Project, Charger and ESS temperature research and its Code and Standard updated status report. Answering to a question, the DOE representative suggested that DOE had a close contact for almost of all activities with other agencies such as DOT, NHTSA.

* + US DOT:

Mr. Will Godfrey, NHTSA’s Office of Defect Investigations, presented on cases of real world incidents in which a HV or HEV light or medium/heavy duty vehicle were investigated. Incidents observed outlined the importance of vehicle design elements when considering the performance and safety of a HV batteries involved in a fire. The importance of proper battery pack enclosures, gas venting management, EV vehicle identification, first responders education, post incident handling, stranded energy management, and managing rekindling of stored energy was all observed in the field events. All material used in the presentation is sourced from public information provided by the agency’s investigation closing report and images used were from public sources (internet).

Mr. Brian Smith, NHTSA’s Office of Vehicle Safety Compliance, presented on real-world incidents involving vehicles equipped with Li–ion batteries. The Fisker Karma damage caused by flooding during Hurricane Sandy, the post-crash-test incident with the Chevrolet Volt, and the battery incidents aboard the Boeing 787 Dreamliner were discussed. These incidents demonstrated the risks associated with failure modes due to mechanical intrusion, immersion in conductive fluids, single cell internal failure, and venting of gases from battery cells. The incidents also demonstrated the importance of robust mechanical protection strategies, managing exposure to conductive fluids, the need to protect against loss of isolation, and the importance of the management and containment strategies for thermal events and venting gases when a battery fails.

Mr. Brian Park, New Car Assessment Program (NCAP) and Office of Vehicle Safety Compliance (OVSC) team, gave a presentation regarding the supplemental test procedure that evaluates any unforeseen safety risks from crash tested plug-in hybrid electric vehicle (PHEV), battery electric vehicle (BEV), and hybrid electric vehicle (HEV). Since 2001 NCAP/OVSC used this procedure to evaluate many BEVs/HEVs/PHEVs. The procedure includes three steps, pre-test evaluation, post-crash evaluation, and post-test assessment. In the pre-test, by using OEM supplied test hardware, the health of the battery pack was examined along with FMVSS No. 305 preparation. In the post-crash evaluation, the vehicle was inspected for FMVSS No. 305 and any physical damage to the battery pack. Lastly, in the post-test assessment, the pack’s cover was physically opened for the structural integrity inspection, tested for FMVSS No. 305, and inspected for the health of the pack. After three weeks from the test date, the inspection of the health of the pack was conducted. Often if necessary and requested by OEMs, the pack was discharged per respective OEM’s instruction.

Mr. Phil Gorney, NHTSA Research, presented an update on the Li-ion Battery Research program, specifically, the test procedure development, safety assessment method /tools. Regarding the progress, their FMEA has been under final review, and expected that all project will be completed by the end of 2014. Their test procedure development study contains the development of overcharge test, short circuit test (broad range impedance), BMS performance test, vehicle immersion, thermal containment/mitigation, fire exposure, vibration (shock and thermal cycle), and vehicle system test (over discharge, over temperature etc), and internal isolation test, and some are expected to measure venting (EUCAR 3-4), fire (EUCAR 5) from REESS.

NHTSA also informed that they are scoping the test conditions to include dual point failure modes only in case of a failure of the RESS control system. He gave some examples of their test such as the level 3 DC fast charge with SAE J1772, water soak test, single cell thermal runaway test. According to him, those are not quality tests, but NHTSA expects to view them as safety performance tests with the exception of a vibration test and comprehensive vehicle system test.

The presentation contains that REESS safety management process as well to manage the potential risk and some quality improvement.

After the presentation, the Mr. Gorney emphasised that it is too premature to form any decision as to what part of US research will be recommended as GTR candidate, but the goal of this research/study is to develop the requirements for the draft GTR as well as supporting justification and rationale.

* + Canada:

The Canadian representative made a presentation on their internal test results for electric vehicle which contain cell level nail penetration test, short circuit test, overcharge test, propagation test, battery fire test with propane gas, and also their consideration for the failure diagnostic was presented.

**5. Development of draft GTR:**

* + **GTR Outline Table:**

The GTR outline table was discussed and update. The participants were requested to provide update on the estimated completion dates for their respective research by the end of May 2014.

* + **Operating Principles for Task Forces:**

The Vice-Chair introduced and explained the details of the Operating Principles (OP),(EVS-05-02e). The OP were prepared by the co-sponsors providing guidelines to the TF activities.

**6. Development of draft GTR**

 Reports from Task Forces

 TF No.1; **Test against Water**

Mr.Zhang Tianqiang as TF1 leader explained the status summarizing the discussion of TF1 which agreed about the necessity of water proof type test, but details to be further discussed.

OICA requested clarification whether the isolation failure is against chassis or not and how to measure the isolation. Isolation resistance can be treated not only by water test but more general way. Class 2 components definition is necessary.

More deep discussion is necessary for the “isolation resistance”, since it looks like there are variations in kinds of isolation resistance interpretation during past discussion such as USA, China, and others.

Japan explained their position that isolation resistance is necessary but not only by the water test but in general way. Details of the test procedure can be discussed in the further TFs.

China as the leader of TF1 agreed to treat the isolation resistance in general to reduce the risk of electrical shock and that detailed work needs to be done by TF1. The REESS and high voltage system in the whole vehicle level (component level can be also discussed when it can show the equivalency) will be under the scope of this activity.

The condition to be considered here must be general and may not include the special occasion such as flood.

TF No.2; **Low electric energy option**

Mr.Schmit of Alliance reported on the activities of TF2 including the update information about SAE standard and DOE electric safety handbook which contain the justification of energy option for the capacitors. This will be one of the various (four) options for the energy option.

China expressed that the low electric energy requirement is important for HV system, but the threshold 0.2J is too small to conduct real world design without leakage circuit. Excessively strict energy threshold should be avoided.

TF No.3; electrolyte leakage

The TF3 leader, Mr. Tripathy, reported the updated status of TF3. The TF agreed to separate discussion in two parts: 1) REESS with aqueous electrolyte and 2) REESS with non-aqueous electrolyte. The TF has completed the discussion on aqueous electrolyte and the discussion related to non-aqueous electrolyte will be completed before the next EVS IG. TF3 also reported that they will propose the final text by next EVS IG.

Venting gas and gas management itself will be proposed by Japan in other activity.

TF No.4; **REESS in Use test**

The TF 4 chair, Mr.Guse (OICA), explained the outcome of the work undertaken by TF4 in preparing the answers and justification to the questions and comments on the EVS GTR draft proposals, especially REESS in use test protocol related ones. He added there are still some open issues which need to be discussed further.

The EVS IG emphasised the importance of the work and requested the TF to come back with their proposals including justifications and/or recommendations for each item with a view to demonstrate the feasibility of the tests themselves and the proposed method and criteria.

TF No.5; **Cell/Module/System test**

On behalf of Mr.Xiao, Dr. Wang Ying reported the status of TF5 activities.

The TF5 agreed on the importance of the Cell/Module level tests and will continue the discussion for further detail test protocol. Also the proposed definition of “module” was under discussion in the TF5.

The USA commented to the TF5 to consider the cell / module/ system level test with a view to keep the vehicle level safety as a whole and the safety tests at component level are supplementary – to be used when equivalency to the whole vehicle level safety can be demonstrated.

The IG agreed to make discussion for such non-technical discussion can be done in IG not TF level. The IG has three main concerns, firstly the severity of the test; industry standard to be or not, secondly, cell level test and vehicle level test equivalency, and thirdly the delegation to the TF5 to conduct the study for the propagation, internal short circuit test.

TF No.6; **SOC**

Dr.Kawai of Japan reported the status of SOC TF group aiming and considering SOC in relation to REESS safety but not the safety against electric shock. The SOC can be considered the safety risk as the energy level for REESS safety, and electrical shock issue will be measured by voltage level not SOC.

TF6 agreed on the target SOC range but there is still an open issue for the SOC level at testing, i. e. . how to express maximum level of SOC at the testing and how to describe the SOC for HEV with self-charging system. The TF6 have a plan to discuss and to conclude the open issue and complete proposal by the end of March 2015.

TF No.7; **Fire test procedure**

The delegation from Korea, Mr.Jung made the progress report for TF7, fire resistance test. He explained the detailed protocol and the result of their comparison tests between current fire resistance test and the alternative optional fire resistance test (with contracting party decision) using a gas burner. OICA expressed their concern regarding the new test protocol, which could become an optional test by contracting party decision, which particularly from a harmonization point of view would not be ideal.

The questions about the safety risk of test facility and human beings involved were raised and the experience of R100 fire resistance test was shared by test facilities, authorities including UL.

Canada requested Korea to show the temperature equivalency since there are no direct temperature comparisons.

The US and Canadian delegation asked the TF leader to confirm the scope and purpose of fire resistance test itself with explaining the example in HFCV GTR test ask 30 minutes instead of 120 seconds of this test. Especially the scope of the fire resistance test (keep escaping time) and how the criteria are to be set (what test duration is required/relevant) can be discussed further in this Informal Group.

**7.** Development of draft GTR

 Update GTR draft proposal

* OICA explained regarding Action Item #3, the comparison between HFCV GTR and EVS GTR draft for the electric safety issues. Open issues are whether the isolation monitoring system as mandatory requirement, how to treat physical protection, and energy option issue (covered by TF2). The decision will be at the appropriate timing with enough justification.
* Secretary confirmed that there are no actual comments raised on the justification part of GTR draft, part A of GTR draft. Comments are still welcome but the IWG asked every TF to take into consideration their related GTR justification.
* China explained their position about GTR scope especially for buses and trucks. China proposed that the current GTR scope covering category 1.1 and 1.2 vehicle types could be extended to buses and trucks. After some technical detail discussion such as electric safety in use requirement, the EVS IWG considered it useful to investigate whether and how the scope could be expanded to include commercial vehicles as well, bearing in mind that the TF work and other discussions right now are focusing on category 1 vehicles only.
* EVS IWG decided to establish a TF to study further on this issue. China agreed to chair the 8th task force group to study the possible expansion of the scope of the draft GTR to commercial vehicles. All interested experts are requested to contact the Chair of the TF.
* Korea made its proposal on 4. Application of requirement revision with the agreement with OICA. The new proposed sentences will be put in the EVS GTR draft in [ ].
* UL explain the definition of “rupture” and the TF4 leader emphasised the importance of common definition and is requested to improve the definition of “rupture” inviting UL to join their discussion.
* Action Item #7, consistency of the wording definition with VPSD is still pending since the original discussion on GRPE is still not finished yet.
* Japanese expert, gave a proposal to include a warning system in the event of battery management system failure. The proposal was agreed and the proposed text will be included in the draft GTR and be kept in square-brackets. Any comments on this issue are submitted to Japan.
* China gave a presentation on the need for a warning system for low energy level. The proposal requires the vehicle to provide a warning when the REESS at a very low energy level for safety consideration. The criteria when the warning to be can be further discussed or decided by manufactures. China was requested to provide proposed language at next EVS IWG meeting.
* Action Item #11 the actual changes was proposed but not yet agreed among co-sponsors. So that it still remain as Action Item.
* Action Item #13, since the discussion is ongoing between OICA and USA, it will remain as Action Item.
* Action Item #14, UL explained that they have no problem for the fire hazard but still have a concern about the duration time to flame, and also the definition of Explosion. OICA told that they understand the necessity of the discussion, especially the safety risk criteria. OICA is ready to wait for the research result from the contracting parties,.. The scope of the GTR for fire hazard should also be discussed.
* Action Item #17, Japanese expert, Mr.Komatsuki, explained their gas management proposal as in-use requirement with actual draft language covering two aspects - hydrogen emission from open type battery and other gas management general requirements.
* There is a question whether this requirement shall include a quantitative limit value/criteria, such as gas pressure or concentration other than simply a visual inspection. Especially for the self-certification procedure, objective common understanding for quantitative accountability is very important.

The IG members are requested to read and review the proposed draft text of Annex X for the discussion at the next meeting.

**8. Roadmap for establishing GTR:**

* The EU representative explained the expectations WP29 when the Terms of Reference for the EVS IG were agreed, the current status of EVS Informal Group is making good progress, and the necessity of explain to WP29 and GRSP that the EVS IWG may need more time to finalise the draft EVS GTR. He recommended that the Informal Group should continue its work with a view to finalise it by end of 2015. A an extension of one year for the final completion of the draft GTR to GRSP at May 2014 and WP29 in June 2014 . The EU representative also suggested that increasing the frequency of IWG meetings, for example 3 times in 2015, or be considered to show the IG’s dedication to honour inthe proposed new schedule.
* The US emphasized their requirement to develop a comprehensive EVS GTR which can be adopted by US administration. They are hopeful that this will be possible with a 1 year extension but that patience is needed.
* OICA and other participants ask the contracting party especially USA to give the IWG the information about their research program time line to fulfil the outline table to understand the available timing for the updated supporting data for GTR establishing to make concrete proposal.
* The chairman st and suggested that the editorial work should be done by an editorial group to make GTR draft complete with actual text. OICA requested and obtained confirmation from the Chair that this editorial work would be based on the current draft GTR proposals as developed by the EVS IWG.
* China, Korea, and Japan showed their agreement to request an extension that the research and drafting timelines are clearly defined.

9. Wrap up of the meeting

* Action items

Agreed as attached.

* Future meeting

Next meeting of the EVS IWG will be in the week of 2014, November 17. Korea kindly proposed to host the 6 IWG meeting, which was accepted. The 7th EVS-GTR meeting will be hosted by EU in Europe. Further schedule of future IWG meetings will be discussed in the #6 EVS IG meeting, including the possibility to expand number of meetings in 2015 from two to three.

TFs are expected, and encouraged to continue their work and have the discretion to decide how and when the TF meetings will be held. All TF leaders who would like to have face to face meeting should contact Mr. Brian Lawrence (JLR) for assistance in coordination of TF meetings.