

**DRAFT Meeting Minutes  
11<sup>th</sup> Meeting of the Subgroup on Safety (SGS)  
of Hydrogen-/Hydrogen Fuel Cell Vehicles**

15-17 February, 2011

Place: European Commission DG Enterprise and Industry  
Avenue d'Auderghem 45 1040 Brussels  
Meeting room: BREY 12/A  
POC: Peter Broertjes, DG Enterprise and Industry, Unit D/5  
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Schedule: Tuesday, 15 February 09:30 – 18:00  
Wednesday, 16 February 09:00 – 18:00  
Thursday, 17 February 09:00 – 17:00

Video equipment and wireless internet connection are available

**1. Welcome and Introductions**

Meeting start was delayed due to a transit work stoppage. This is the last “planned” meeting of SGS prior to submitting GTR as informal document to GRSP in May, 2011. Expectation is for good, substantive and detailed, discussion to resolve outstanding issues.

Attendees included representatives of German Ministry of Transport, USDOE consultant, JASIC, Honda, Nissan, EC, CATARC, KATRI, TUV, OICA, GM, BMW, Daimler, Volvo, Citroen, Transport Canada, JRC, USDOT NHTSA, US LANL

**2. Logistical Arrangements**

2.1 Meeting arrangements

The same room is available for all three days. Coffee is available in the room. Wear the badge to allow easier access to the building. Cafeteria is on the 15<sup>th</sup> floor. A group dinner (no-host) is planned for Wednesday. We will break at 1pm for lunch for one hour on Tuesday, and perhaps at 12pm on the other days. The meeting room will be locked during lunch.

**3. Approvals**

3.1 Minutes/decisions of the 10<sup>th</sup> Meeting (San Francisco, Sept 2010)

No comments – adopted.

3.2 Decisions of TF Meeting in Berlin (November 2010)

No comments (minutes were not distributed or posted – the co-chair will check and send to WP.29 secretariat.)

3.3 Action Items from the 10<sup>th</sup> Meeting and/or TF Meeting in Berlin

**Action Items from the 10<sup>th</sup> Meeting**

1. US DOE will provide update presentation so that it can be posted – 9/17/2010 - **pending**
2. USDOT/NHTSA to provide vehicle crash test results as soon as available – October, 2010 -

report is being reviewed by DOT/NHTSA - pending

3. Secretariat will insert a link to the draft ELSA document. – 9/17/2010 - **entire document has been inserted**
4. BMW will check on the minimum yield strength (Rp) – 10/8/2010 - **done for Berlin meeting**
5. BMW and GS will develop a proposal for a test method for the LH2 Leak Test. – September, 2010 – 10/8/2010 - **done**
6. Interested parties will develop clarifying language for Vacuum Loss Test related to the text around the first and second pressure relief valves. – 10/8/2010 - **done**
7. BMW and GS will develop a proposal for an LH2 crash test procedure once the CH2 crash test procedure is available (LH2 will likely be a modification of the CH2 test). – 10/8/2010 - **done**
8. BMW will check on the potential for release of some of their LH2 data. – 10/8/2010 - **answer received, data are not available (issue is ongoing)**
9. EC and BMW will develop proposal for type approval of critical LH2 components – 10/8/2010 - **done (draft forwarded in February 2011)**
10. All CPs and interested experts should provide comments on the revised LH2 sections. October 30 - **many comments received and distributed prior Berlin meeting**
11. ELSA will provide input for Part A and Part B by 15 October - **ongoing**
12. Co-sponsors and ISO will draft language in Part A for an advisory that discusses tank types that are covered by this regulation, and that new materials or container designs may require additional test procedures to verify equivalent safety. - October 15<sup>th</sup> - **ongoing**
13. OICA members will be surveyed about their willingness to share tank testing data. - September 30<sup>th</sup> - **issue is that there are only limited data available and tests were likely not done according to the standard test procedures in the draft GTR (OICA survey was sent to all members).**
14. SNL presentation on the hydrogen release in vehicle will be distributed to SGS-10 as soon as appropriate. - **will be distributed**
15. Participants are asked to provide Comments on the new localized fire test procedure. October 8<sup>th</sup> - **done**
16. China to provide the citation for the paper published in IJHE on the use of compressed air in the bonfire test. - September 24<sup>th</sup> - **done**
17. Canada will check to see if the report on gas cylinder accident is available – September 24<sup>th</sup> - **ongoing**
18. CPs are asked to provide comments on the potential to use compressed air in tank testing, per China's proposal, rather than hydrogen. - **done**

19. Participants will develop appropriate language for consideration to be included in Part A to clarify what is meant by 15-year service life. October 15<sup>th</sup> - ongoing (to be discussed)
20. OICA will draft text for inclusion in Part A that distinguishes between initial burst pressure and end-of-life (residual) burst pressure. October 22<sup>nd</sup> - done
21. The EC will provide modifications to the text on the receptacle requirements that have been moved to section B.7.3.2, as required. October 15<sup>th</sup> - ongoing (to be discussed)
22. Outstanding issues from Action Items from SGS 9: co-chair information on WP.15 (bulk transport labeling - no overlap with this GTR activity); EC complete task #19; September 30<sup>th</sup> - done
23. Secretariat will clean the draft GTR from SGS-10 and distribute to the group by September 17<sup>th</sup> - latest version
24. Co-sponsors will develop an agenda for teleconference. October 29<sup>th</sup> - done

### Action Items from TF Berlin

1. All documents will be posted on the UNECE website ASAP - clarify
2. Determine if CSA will allow the use of some or all of the text of CSA HPRD1:2009 and HGV 3.1:2011 (check valve and shut off valve) into the GTR. If yes, incorporate the text into the draft GTR (keep in square brackets in Annex Y). - done (incorporated in the draft GTR, still in brackets)
3. Consult with EC on the elimination of the “or other gas” from the localized fire test section. - ongoing - will be discussed
4. GS to propose text for Part A explaining why the LH2 system does not need a separate test for a TPRD, since the LH2 system has a test for the pressure control (tanks have PRDs that are tested) - ongoing
5. The Secretary will define the terms “burst” and “rupture” and propose which one should be used in the document (or both for specific cases). - done
6. ISO will determine if ISO 1251-1 is equivalent to the European standard EN 1251-2 for cryogenic hydrogen tanks. - ongoing
7. EC representative to review new text in Section B.7.2. - this is now section B.7.3 - will be discussed
8. BMW will extract the relevant part(s) of the EC and EU regulations for inclusion in Annex X on component testing of closures for LH2 systems. - done
9. BMW will work with EC to determine if a section on conformity of production for LH2 tanks is required in the GTR. - to be discussed
10. ELSA will incorporate its current version into the latest version of the HFCV GTR. - done
11. Material qualification test procedure for hydrogen embrittlement section will be finalized for

inclusion in the GTR in Annex Y, with inclusion of a table with detailed data on the qualified materials with respect to temperature, pressure, and stress limitations at a later date. - **to be discussed**

12. Co-Sponsors are to discuss the material compatibility issue with Mr. Albus. - **ongoing**
13. CS and ISO will propose language to incorporate the stress rupture material test into the appendix - **done**

#### **4. Reports of UN Activities**

##### 4.1 48<sup>th</sup> Session of GRSP in December 2010

Another 6-month extension was requested - needs to be endorsed at the March 2011 meeting. The outcome of this meeting will determine if the 6-month extension is sufficient. Need to have a good document to avoid approval delays. Current draft is available on the website, and GRSP was informed of the web address.

If only a 6-month extension is accepted: April 2011 is the deadline for the submission of the draft document (need to get the draft to the committee so that it can be reviewed for the May 2011 GRSP meeting - Nha would attend the meeting to answer any questions). Final draft of the formal would need to be developed in August 2011 (July preferred). Vote would be in June 2012.

#### **5. Reports of other activities**

##### 5.1 National/Regional

Canada: nothing to report

EC: JRC report - round robin being organized on test procedures under the IPHE and its RCS working group. Permeation measurements will be the first test round robin (accuracy of test procedures, expertise of laboratories, etc).

Germany: nothing to report

Japan: meeting between METI (responsible for hydrogen containers) and government was held following the SGS-10 meeting - June 2012 is the desired date for the GTR, according to the wishes of the Japanese government. Draft GTR must be submitted in May. METI wants to start the implementation of the GTR immediately after the submission of the draft GTR. METI wants LH2 container and material compatibility to be postponed to Phase 2. These issues will be discussed at SGS-11 and the results of our discussion will be presented to METI.

C: the Action Plan includes both CH2 and LH2 in Phase 1.

Korea: A plan is being prepared for regulation of HFCV by 2012. High pressure gas components will be included in KMVSS regulations by 2012.

C: implementation will be based on GTR.

China: no additional progress. GTR and harmonization with Chinese system - some differences exist (high pressure tanks and the bonfire test). Report on the contents of the GTR will be made to the government. Use of hydrogen in the bonfire test is not allowed, and China wants to use compressed air instead. Would like experts to visit China to see the testing with compressed air and to discuss whether the test results are equivalent. This is the most important issue for

China.

Q: there was a comment added to Part A that allowed for the use of compressed air (less strict test) for vehicles to be used in a particular country (could not be exported). Is that not sufficient?

A: China would require the validation of any imported vehicle by testing with compressed air. Looking for clarification of the basic issue of the GTR system, and how text in Part A or in Part B are to be interpreted.

US: Crash testing of a hydrogen-retrofitted CNG vehicle. Preparing to crash test a fuel cell SUV by the end of the calendar year. Also preparing a study of the ELSA barrier option (should be completed in end of April or May). Final rule is expected to be published for electric safety shortly.

Q: has the post-crash leak-testing been conducted in the passenger compartment?

A: no pressure drop was observed, so there was no leak. Sensors might be added to the SUV crash test.

## 5.2 ISO/SAE

ISO: Reported by CS: Work Group 6 on high-pressure hydrogen containers met in November 2010 for the first time in 3 years. The next meeting is in March in Japan. Will discuss separately containers for passenger cars, fork lifts, and mixed fuels (high NG content, for example). Draft document has the current content of the GTR for the passenger vehicle. TS-15869 - land vehicle fuel tanks (hydrogen and hydrogen blends). Major revisions are expected to the 2009 version.

SAE: no report (no meeting has been held since the TF meeting in November).

## 6. Finalizing the Drafting GTR

### 6.1 Revised Draft GTR

Reviewing lasted draft. ***Discussion of each section that is still highlighted.***

**ACTION:** Post the comparison of the GTR and the European regulation (following the review of the report by EC)

### ***Part A Open Issues:***

Section A.4.3: Japan wants to include day as well as month/year. Over a 15-year lifetime, 30 days represents a difference of only 0.55%.

EC: adding the day is an unreasonable burden to the manufacturer

Q: A more important issue is the date of installation and the potential (significant?) difference between when the tank is manufactured and when it was put into use. Which date is to be on the (permanent) label? Is it the start of the service life or the manufactured date?

C: for tires, the date is when manufactured. For tanks, it will depend on the resting time effect on the tank (not known at this point).

C: the date of importance is when the tank is first pressurized.

C: using the date of manufacture is more conservative, and if no one objects, it is possible to use the earlier date.

C: the discussion of 15-year life of tank was based on the pressure cycles, and so we should be

consistent and label the tank with the date put into service.  
C: it is certainly easier to know when the tank was manufactured.

Japan: The date of manufacture is defined to be the date of the proof pressure test.

A simple solution is to assume that the day is the 1<sup>st</sup> of the month if the day is missing. This is accepted (tentatively)

**ACTION:** Japan will confirm its agreement with listing the date for removal from service as month/year by implementing within Japan the requirement for removal from service on the first day of the month.

Next issue: China wants to use compressed air in localized fire test, rather than hydrogen.  
China will accept tanks tested with hydrogen.

C: It is possible to have options in the GTR (child door lock example)

C: Suggest the change from “hydrogen or air” to “hydrogen or another gas”

C: we do not have any data on the difference between tests conducted with air and those conducted with hydrogen.

CS: We do know that the thermal conductivity and heat capacity (and consequently the pressure) of hydrogen and air in the tank are going to be very different - will the difference in pressure inside the tank result in different behavior?

C: Issue is the acceptance of tanks tested with air by CP that does not allow testing with air.

**ACTION:** China will propose text for Section A.4.3 on the use of compressed air in the tank test.(will be proposed and discussed on Wednesday if possible) - **completed (see follow-up discussion below)**

C: propose the removal of the phrase starting “but would not ...”

This discussion may be continued tomorrow (depending on proposal and sidebar discussions)

**Follow-up discussion:** China would like to add a simple sentence into the GTR. The removal of the phrase starting with “but..” is acceptable. The two options for Part B, at the end of the section on bonfire test: may select compressed air...- or - use of compressed air is acceptable.

These suggestions are similar to what was added during the SGS-10 meeting (see Section B.5.1.4 - the previously crossed-out text, which was going to be moved to Part A, but could be left in Part B). There are no experimental data that show the equivalence of testing with compressed air or hydrogen. China would also like this sentence (or similar) to be in the test procedure (which specifically states that hydrogen is used).

Next issue: Section A.5.1.1.1: Baseline Burst Pressure: 200% NWP or should it be changed to 225% NWP? The value was 180% in prior versions. Changing to 200% makes it consistent with the figure.

C: need a good strong rationale that shows this is a justified requirement, one which provides

higher safety level.

**ACTION:** OICA and CS will modify the rationale in Part A for the initial (baseline) burst pressure in Section A.5.1.1.1 to discuss how the GTR is at least as stringent as the current EU directive.

***Part B Open Issues:***

B.3.2: Current definition of hydrogen storage system is not applicable for the LH2 system, so a change is needed. Make this definition for compressed hydrogen storage system. The proposed language from Japan for the LH2 storage system is acceptable to BMW.

B.3.x: Hydrogen container assembly definition is not currently in the definitions list and should be added. Only appears in the test procedure (B.6.2.5.1). No need to move it to Definition section, since this is the only place it is used.

B.5.1.1.2: baseline initial pressure cycle life (Japan technical comments document)  
Number of cycles should be specified as 4 times the initial number of cycles, which cannot be less than 5,500 cycles.

Q: why “four” times the number of cycles?

A: this is the number used in traditional standards

C: this is not based on scientific evidence, but is based only on what was used previously. Modern standards are working to reduce this number. What is the risk being mitigated? At 22,000 cycles, this represents an enormous number of km (10M kilometers) or miles (6M miles), at a level that will never be reached..

C: this is also part of the Japanese regulation. The regulatory agencies will not reduce this number unless the lower number is shown to give the same level of safety.

**ACTION:** Japan will compile a justification for the proposed change to 4 x initial cycles versus the current number 22,000.

CP survey:

US: comfortable with the current requirement of 22,000 cycles

Canada: ok as is

Korea: ok as is

China: keep original number. Discuss any new proposal in Phase 2.

Germany: Current number is sufficient

EC: no technical support or justification for the increase. Ok as is.

Next issue: fueling port label (see Japan document)

Want to add additional line in the GTR that allows for more information to be included in the label.

OICA: Keep in mind the area available for information (refueling hatch). This could be included in the user manual. Information on the refueling hatch should be (limited to) the information that is required for refueling.

EC: supports the change, but the added information would be “relevant”

China: proposal is reasonable, but this is not required to be in the GTR, which should define the basic requirements.- this is part of the implementation of the GTR.

C: this should be in Part A. The GTR does not preclude the inclusion of additional information.

Japan agrees that this sentence should be in Part A.

Germany also agrees.

Next Issue: Residual Strength Burst Test (B.5.1.3.5) Japan document

Proposal has two parts: First is to delete the burst test in pneumatic sequence. Leave it in hydraulic sequence. Propose to add a requirement to examine the container for deterioration.

C: the criteria for pass/fail is unclear and highly subjective. Need to clarify the criteria in the proposal

**ACTION:** Japan will develop specific pass/fail criteria for the proposed test at the end of the expected-service pneumatic test

Next Issue: Pressure Cycling Test (B.6.2.2.2) - Japan document

Request change to the cycle test to match the Japanese regulation (specification of the hold time - needed in order to keep the temperature constant).

The test procedure requires that the temperature be maintained during the entire test. Does not specify how to keep the temperature constant. Powertec may have a different methodology for maintaining the temperature constant.

This change could result in a significant increase in the time required to complete the test (increase of factor of 10).

Why 60 seconds? How was this determined? Do we have any data that support this amount of wait time as sufficient, or is it too long?

Japan will explain to KHK the reason for not making the change, since it is already required by the procedure to maintain temperature, with the method used to be determined by the tester. The proposed change would only specify one way to (perhaps) maintain the temperature.

Next Issue: Drop Test (B.6.2.3.2) - Japan document

Japan proposes to drop the container in each direction because it is not necessarily true that the 45 degree drop is the worst case scenario. The proposed change would make the GTR consistent with the Japanese regulation.

This may not add additional test burden, and would allow for future container shapes that are not cylindrical with dome ends.

This test addresses the after-market container that might be dropped during transport or installation by a non-OEM (for example).

The drops all need to occur and then the rest of the sequence needs to be performed. There is a problem with the current wording.

**ACTION:** TUV and OICA to survey experts (container manufacturers) on the appropriateness or impact of the proposed change to the drop test – full hydraulic durability sequence test or 5,500-11,000 ambient pressure cycles.

Next Issue: Engulfing Fire Test (B.6.2.5.2) - Japan document (detailed proposal emailed)

Proposal for new procedure for the engulfing fire was distributed via email on Tuesday by Nha Nguyen.

**ACTION:** Secretary will insert modified text on revised engulfing fire test

Next Issue: Verification Tests for Consistency of the Qualification Batch (B.7.1.3) - Japan document

Proposal: First two sentences are Conformity of Production and will be removed (see discussion below). The remaining sections should be moved to appropriate B.5 section (B.5.1.1.2)..

CPS:

US: it needs to be reworded so that it is easier to understand. Also, should specify three cycle numbers (proposal is for 5,500 or 7,500 or 11,000). Some additional edits were made.

EC: text is still confusing and might lead to misinterpretation. Additional change was made, and now it is clear.

China: ok

Korea: ok

Germany: ok

Japan: ok

Canada: ok

Next Issue: clarification needed for telltale warning (B.6.1.3.2.1.d)

How do we insure that the telltale will come on? What is the test procedure? It is a requirement that needs to be verified (compliance confirmation). The text for the alternative test should be moved down a section.

OICA: This requirement is different for hydrogen vehicles than for all other vehicle fuel systems. None have automatic shutoff. Generally, the other systems require the driver to do something.

Co-chair: this too will require action from the driver, such as for example, take the car to have it inspected because of the warning.

US: The automatic hydrogen shutoff is considered to be critical to safety. There has to be a test to verify that the shutoff valve will close.

Japan: Consistency is needed whether or not sensors are installed.

China: the most important function of the telltale is to give warning to driver. None of the 5 or 6 Chinese manufacturers have complained or commented on this requirement.

Korea: two types of telltale - one to warn, and one that indicates that the shutoff valve has been activated. These are mandatory.

Germany: much discussion about the US requirement for a telltale, but does not see the requirement if it is not possible to accumulate hydrogen in the passenger compartment.

Canada: this is a feature not required in other vehicles, and there is the chance that this system will fail.

Co-chair: it is necessary to have a detection system because unlike with gasoline or diesel, we cannot see or smell hydrogen

OICA: in a good design, the detection system will not fail (yellow warning light) and there will not be an accumulation in the passenger compartment which will close the shutoff valve (red warning light).

Discussion is suspended. No consensus.

### ***Main Open issues***

#### **1. Text of Part B and drafting Part A for ELSA**

Incorporated into the GTR.

Post crash test options

- Absence of high voltage ("high" is specified for AC and for DC)
- Electrical isolation
- Energy option is not agreed by CPs (level is too high)
- Barrier option - US is currently conducting a study and hopes to have results by April

Rationale and justification write-up needs to be added to Part A. Secretary is working with ELSA to draft text for consideration in Part A.

**ACTION:** All CPs should comment on the ELSA section, and provide the comments to the Secretary ASAP.

#### **2. Fire test (resolve Japan's request for separate engulfing fire test)**

Japan needs to have (requires) this test, in addition to the localized fire test and the bonfire test. See Sections B.5.1.4 and B.6.2.5 (procedure).

C: Japan wants an additional engulfing fire test with a tank that is completely bare (must be defined). Composite tanks have outer layers or coatings that cannot be removed without damaging tanks.

What is shielding? This needs to be defined - does paint count? What about the outer layer of wrap?

Japan developed a presentation and proposed language to justify the inclusion of Method 1, Method 2, and the engulfing fire test, including definitions of bare container and shielding components.

**ACTION:** Presentation by Japan on engulfing fire test will be posted.

OICA: The additional engulfing fire test adds no additional information for Method 1. It only provides additional information for Method 2.

Japan: A tank with a coating needs to be tested in the engulfing fire test using a bare container. If the shielding is damaged (or could be damaged), the engulfing fire test would be needed to ensure the same level of safety.

No consensus was reached.

#### **3. LH container/post crash**

BMW proposal for parallel sections on LH2 to be consistent with the CH2 sections.

- Added a sentence to introduce cryo-compressed hydrogen
- The EU regulation has a bonfire test. The localized fire test is not needed for LH2 tanks without TPRDs.

C: this is not the only reason to perform a localized fire test. If the outer shell of the LH2 tank is metal, it is not combustible and the localized test would not be needed. But if the tank is made of a flammable material, it perhaps could be an issue to have a directed fire on the tank.

C: regardless of the location of the fire, the pressure will increase and the PRD will release.

C: as long as the container material can withstand the fire (for current metal-walled LH2 tanks, this is true)

C: if the container wall is made of composite materials, a TPRD would be required, and the localized fire test would be performed.

Q: does the current proposed language prohibit the use of non-metal containers?

A; no, other materials are not prohibited. A metal container does not need the TPRD and thus does not need to perform the localized fire test (which is designed to test the TPRD). A tank constructed of combustible material would need to pass the localized fire test.

C: additional discussion may be needed, since this test has an impact on the manufacturers, as it reduces the potential to make the technology affordable (additional components needed, and changes in packaging would be required), and it is not clear that requiring this test will increase safety.

**ACTION:** BMW will develop an additional proposal to fully address the issue of the localized fire test for LH2 tanks. The changes in the temperature profile of the test and the effect on the manufacture of the tank might be very complicated - need to consult with impacted parties.

C: current profile for CH2 tanks is based on real-world data collected for CNG vehicles and actual fires (and how the fires progressed).

Presentation on cryo-compressed tanks. At 300 bar and 38K, the cold gas has a density that is 28% higher than LH2. Type 3 is possible (must use a suitable composite material), but not Type 4 (polymer liner does not work at low temps, and would need to be impermeable because of the vacuum layer. System meets the DOE 2010 target.

**ACTION:** BMW to review cryo-compressed presentation and determine if it can be posted on the website. Shareable presentation will be sent to Secretary and posted on the website, as permitted.

C: Co-chair wants to move the LH2 to Phase 2 of the GTR so that the final draft GTR is not delayed past May 2011.

Additional discussion on the inclusion of LH2 in Phase 1:

Japan needs additional time to learn more about the technical requirements for LH2 systems. If this moved to Phase 2, METI will be able (perhaps) to join the discussion. On the other hand, if LH2 is included in Phase 1, METI will not oppose the GTR, but will not adopt that part immediately.

The US will propose the adoption of the GTR as an FMVSS, in total.

BMW will provide any information and data that are required to assist in the type-approval of LH2 vehicles in a regular way in Japan.

End of additional discussion.

BMW: a small fleet of LH2 vehicles was in use very early. From this point of view, LH2 must be in the GTR, given its maturity and given that it is in the EU regulation. It is acceptable that CP not interested in LH2 may not adopt this part (or have national legislation).

Q: will the LH2 section be completed on time?

A: yes. The new requirement of the localized fire test is not in any existing regulation. Additional discussions are needed to determine if this test can be performed (this test is also new for the CH2 tanks, and this test will be added).

US: the technology is new (although 100+ LH2 vehicles were on the road in 2006, before very many CH2 vehicles were available). NHTSA has crash-tested five CH2 vehicles, but no LH2 vehicles.

C: overburdening the technology with safety features that are required for CH2 but may not be required for LH2 or CCH2, the technology will become expensive and unrealistic to pursue.

TUV: conducted a risk analysis/comparison between CH2 and LH2 systems. Report can be shared.

**ACTION:** TUV to provide report on the safety risk assessment of CH2 and LH2

CP survey for comments on the LH2 provisions in the GTR (mandate in the action plan says both CH2 and LH2 in the GTR)

Germany: there is a European regulation on LH2 vehicles, and should/must be included in the GTR.

Korea: will not adopt the LH2 sections into national regulations

China: will not adopt LH2 sections into their national regulation (do not have any LH2 vehicles or infrastructure). Inclusion of the safety features in the GTR is important, though.

Canada: Will probably adopt US requirements and by reference, the European regulations, as has been done with other GTRs. A few crash tests of gaseous-fueled vehicles are not the best measuring of safety (or a guarantee of safety) - it is the vehicle in regular use, leaks in garages, improper maintenance, etc. These tanks, CH2 or LH2, will be much stronger than gasoline tanks.

US: Will adopt GTR with the LH2 section included. There may be some difficult to propose the adoption without supporting data, but the attempt will be made.

Japan: no objection to the inclusion of LH2, but the question is whether the LH2 section can be completed by the May deadline. Japan will not implement the LH2 part of the GTR.

#### ***4. Material compatibility***

**ACTION:** Post the presentation by CS on Proposed Material Qualification Test and the paper on Embrittlement

Japan: Test method for new material needs to be discussed more in depth in Phase 2. Need more time to evaluate this test for new materials.

Germany: need more time to study proposal

China: need more time

US: address in Phase 2  
EC: address in Phase 2  
Korea: need more time to evaluate proposal  
Canada: no strong opinion

Secretary will move this informative and valuable material to an appropriate place to preserve it for inclusion in Phase 2 GTR efforts.

Japan wants to discuss the test procedure in Phase 2, but leave the specification of the two allowed materials in Phase 1

C: defining materials in the GTR Phase 1 will lock out other materials until the Phase 2 GTR is approved. Suggest that this section should be deleted.  
C: the listed materials are not applicable for all conditions (cryogenic temperatures, for example) Material specification could/will be different in each CP. There is no harmonization. The material issue is for the entire system, not just the container. Only materials that are proved to be resistant to hydrogen embrittlement (or compatible with hydrogen) can be used.

US: this is an incomplete set of materials, and is not a useful requirement for the GTR. US has asked Japan to provide an explanation of the current limited list in Part A.

CS: text suggestion based on SAE and ISO working groups that are developing standards.- to be discussed.

BMW: the materials used for the cryogenic system are not on the list and are more appropriate. If the list from the CS white paper is included, these better materials will not be useable. Not having the list would eliminate this restriction on LH2 systems.

US: if the list were to be included in Part B, it should be an option. To the US, this list is design restrictive. Prefer it to be an advisory or recommendation. If it is included as a requirement, North America would not be able to adopt it (needs to be advisory).

Japan: the table is needed (as an option, is acceptable) since the government selects the material to be used, not the manufacturer. Part A is ok. Manufacturer does not need to provide documentation (since the government restricts the material)

China: does not want the list to be included in the text - footnote would be acceptable.

Recommendation in Part A would be acceptable.

Germany: should be an example in Part A. Also, a sentence in Part B that indicates that the manufacturer needs to be able to demonstrate and document that the material used is compatible with hydrogen.

Korea: list in Part A

Canada: Part A

EC: pragmatic solution to put the list in Part A.

Co-Sponsors' meeting (Friday) will work to develop a proposal for language in this section. If an agreement can be reached, the proposed text will be distributed to the SGS.

##### ***5. Components (sections that are currently in B.7 that are to be moved to B.5)***

OICA proposal for a series of tests to qualify TPRD, Check Valves, and Automatic Shutoff Valve (will be in Part B.5 - safety-critical components)

**ACTION:** CS to check on the availability of the Powertec report

**ACTION:** OICA to draft a paragraph on the rationale to focus on the three safety-critical high-pressure components only.

Move the LH2 section to B.5 (submitted on Feb 9<sup>th</sup> by BMW)

Move the overpressure protection to B.5

Move fueling receptacle requirements to B.5: EC has been asked to redraft the language to make it more objective, written in performance-based language, as the current language is too subjective.

### **6. Conformity of Production**

US proposes that conformity of production provision should be removed from this GTR (Parts A and B). This removes B.7 and B.8 (requirement and test procedure annexes)

Japan: agreed

EC: agreed that it should be removed

China: agreed that it can be removed.

Korea: agreed

Canada: agreed

## **7. Miscellaneous Administrative Items**

### 7.1 Approval of Decisions and Action Items of the 11<sup>th</sup> Meeting

#### 7.2 Next Meeting

Hold a working meeting in April to complete draft - Japan?

Hold an "editorial" meeting before or after the ESV meeting in DC (June)

Amsterdam is also a possibility

This will be discussed at the Co-Sponsors' meeting on Friday. Delegates need to be notified immediately of the decision.

#### 7.3 Other Issues

Timeline:

- Submit draft GTR to GRSP as an informal document - May 2011
- Submit formal draft to GRSP - meeting is December 2011 - so the draft is due beginning of September 2011
- Submit draft GTR to WP.29 as an informal document - March 2012
- Submit formal GTR to WP.29 for a vote - June 2012