

## **SGS 7 - 03**

### **7th Meeting of the Subgroup on Safety (SGS) of Hydrogen-/Hydrogen Fuel Cell Vehicles DRAFT Minutes**

**21-23/24\* September 2009  
Ottawa, Canada**

Place: Meeting Room: FC29 & FC30  
Transport Canada  
330 Sparks Street, Place de Ville, Tower C  
Ottawa, Ontario, Canada, K1A 0N5  
Telephone: 613-998-1961  
SGS Contact Person: Mr. Matthew Coons, Senior Regulatory Development Engineer,  
Transport Canada

Schedule:                    Monday, 21 September        10:00 – 17:30  
                                  Tuesday, 22 September      09:00 – 18:00  
                                  Wednesday, 23 September    09:00 – 18:00

\*Co-sponsors Technical Meeting:      Thursday, 24 September      09:00 – 12:00 (Transport  
Canada)

### **DRAFT Minutes**

#### **1. Welcome and Introductions**

Opening remarks: Overview of Transport Canada, Road Safety.  
Chair Narusawa welcomed the delegates and thanked Transport Canada for hosting the  
meeting.

Representatives from USDOT/NHTSA, Ministry of Land, Infrastructure, Transport and Tourism  
of Japan, Honda/JASIC, Nissan/JASIC, European Commission, DG Enterprise, Daimler,  
USDOE, GM/OICA, Volvo/OICA, Peugeot Citroën, ISO TC197, Korea Automobile Testing and  
Research Institute, Transport Canada, Tsinghua University, Chinese Automobile Test and  
Research Center, US Los Alamos National Laboratory, Ministry of Transport of Germany.

#### **2. Logistical Arrangements**

##### **2.1 Meeting arrangements**

Lunches provided, Restaurant selected for dinner Tuesday (no-host due to government  
regulations). Restaurant is 5-10 minute walk (Elgin Street). Reservation at 6:30pm. Meet in the  
lobby at 6:15pm

#### **3. Approvals**

##### **3.1 Minutes/decisions of the 6th Meeting**

Comments on minutes: Make sure the heading is changed to "Minutes" so that it does not seem  
to be only the Agenda (heading on the web page says it is the agenda).

##### **3.2 Action Items from the 6th Meeting**

1. OICA will discuss with BMW the possibility of submission of a proposal for LH2 that mimics

- the structure and detail of the OICA CH2 proposal - **done, Will be posted**
2. China will provide details of the tests performed on the tank and on the fuel cell - **Electronic version will be delivered after this meeting.**
3. Korea will provide test report in English at the next meeting - **Report will be provided**
4. All should provide comments on Part A to Secretary as soon as possible - **done (did get some comments and these were incorporated into the current draft of the GTR)**
5. Glenn Scheffler will suggest simplified diagrams and a section on LH2 for Part A - **done**
6. ISO will provide descriptions of existing standards for the list of regulations (Part A Section 4) - **have title and number of the existing standards**
7. Korea will provide information on regulation for inclusion in the list (Part A Section 4)- **done**
8. Secretary will distribute table with assignments for contributions to the Technical Rationale section - **done**
9. US (DOT) will develop a proposal for a telltale warning - **done**
10. US (DOE/Glenn) will provide justification for increased time interval for measurement of vehicle exhaust - **?**
11. OICA will provide justification for 3-second interval for concentrations exceeding 4% - **OICA submitted proposal**
12. US/Secretary will develop a draft of the sunlight protection requirement for consideration - **outstanding**
13. US (DOE/Chris) will provide text describing the risk-based assessment in support of sunlight protection for hydrogen tank but not gasoline tank (1.2.2) - **outstanding, may be in Part A**
14. OICA will discuss issue, consider the proposal for multiple shutoff valves (1.3.1) and provide justifications why one valve would be enough; Japan to provide justification why one shut-off valve is not enough for Part A. - **discussion to be held**
15. TUV to provide technical justification for overpressure protection of the low-pressure section (1.4.1) - **Co-sponsors decided to discuss here (paper was developed). Issue is outstanding**
16. Germany will check with the EC representative to see if the EC will present the overpressure protection issue to WP.29 (1.4.1) - **see above**
17. OICA/SAE/TUV to provide proposed language on hydrogen detection in enclosed spaces (1.5.1) – (draft language provided at the 6th meeting) - **done**
18. Japan and TUV will prepare rationale and submit an objective test procedure for compliance for air tightness test (2.2.1) at vehicle level - **to be discussed**
19. OICA to modify the text on the test conditions and procedures, to be consistent with current requirements so that the procedures can be modified - **adapt procedure to meet the requirements (which need to be fixed)**
20. ISO will provide presentation slides for posting - **done**
21. US (DOE) will distribute pneumatic performance testing document (OICA proposal) - **Powertech final report was provided, and will be distributed**
22. OICA to discuss removal of the temperature range specification provision from the OICA proposal in response to Canada and US comments.- **further discussion required within OICA**
23. China will check into getting the Tsinghua University presentation from 27 May - **will send after this meeting**
24. US (DOE) will get information from 'first responders' regarding the direction of PRD discharge valve - **outstanding**
25. Germany and OICA work together on simplifying language for 5.2.2.3.3.- **to be discussed**
26. Canada and US provide testing results on the localized fire project - **report is draft at this point, is being reviewed. Modifications needed. Will be released once it is final.**
27. US (DOE/Chris) will provide suggestion for heading for 5.2.2.3.4.- **not sure what this is**
28. US will check on implementation of information collection for H storage container - **not sure what this is (might be related to the DOE Technology Validation Program and collection of real operating data from various manufacturers).** Outstanding

29. ISO and OICA/SAE work together on developing paper for the Task Force meeting - **Task Force meeting was not held. Draft GTR incorporates comments from both proposals (OICA was the key document, ISO recommendations noted). To be discussed further.**

30. ALL provide comments by June 30 on OICA and ISO proposals - **done**

NOTE:

Q = Question

A = Answer

C = Comment

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

4.1 148th Session of WP.29 in June 2009

Informal Document WP.29-148-20: Status report. Progressing according to the action plan. At this moment, SGS is still on schedule. Open issue: prevention of overpressure downstream of pressure regulator. If not resolved within SGS, the WP.29/AC.3 will be asked for guidance. Also reported on status of ELSA. TOC of GTR included in the report.

Task Force meeting did not take place, and therefore now we may be in a delay.

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

5.1 National/Regional

Canada: Localized fire impingement study has been delivered and is being reviewed. This is a joint project with the USDOT

Q: Will this be incorporated into the GTR?

A: Yes, it is the intention of the US and Canada. By the next meeting, a proposal will be presented.

Q: Supplement or replace bon fire test?

A: More severe, stringent test - can replace the bon fire test, but may include both.

China: Last month, had a meeting of fuel cell vehicle standards development. Three new standards should be released soon: dynamic test methods, hydrogen fueling device, and on-board hydrogen systems specification, Complex approval procedure, so may not be finalized soon. Should have a final draft by the end of the year.

Q: Can the SGS have an English version of the standards? Summary would be acceptable.

A: Should be possible.

**ACTION: China will provide summary of standards as soon as possible.**

EU/EC: Document is being drafted, and is being reviewed. Will check for the latest update. Technical part of the type approval for hydrogen fuel cell vehicles will be finalized (needs to be translated into many languages). Beginning of next year. Political part was decided and adopted. Detailed technical implementation measures are being work on..

Q: Two sets (political and technical) - can the draft be shared? What is covered?

A: Whole vehicle, all safety measures. Both the final political and draft technical documents are available on the internet.(same link as previously given)

Japan: hydrogen storage standard: up to 35 MPa. Draft has been completed for up to 70 MPa.

Under public comment (started August 31<sup>st</sup>, ends Sept 30<sup>th</sup>). Materials testing under 90 MPa. Sequential test introduced. Drop test is excluded from the sequential test. Pressure cycle test number is reduced to 5500. Expectation: March 2010 it will be published and put in force.

Q: what is the reason for the material testing pressure at 90MPa?

A: 125% of the maximum operating pressure (70MPa - settled pressure at standard temperature). Filing station is not allowed to exceed 70MPa delivered pressure)

Q: is the draft available?

A: only in Japanese.

C: US has some capability to translate - it is important to get this document so that we can compare this requirement

**ACTION: Japan to provide draft document (pdf) to USDOT for translation.**

Q: why is the drop test excluded?

A: did not include the drop test in the sequential test. It is a parallel test.

Q: are the material restrictions still included in the draft?

A: materials are specified.

Q: hydraulic and drop test are done in parallel?

A: Yes

Q: pressure cycling reduction - passenger vehicles or for buses?

A: Passenger vehicles - 5500 cycles; Buses (commercial vehicles - 11000 cycles

Q: Has the test series been completed?

A: draft of the procedure is completed, in the public comment phase for this month.

Q: When will the drop test be incorporated into the sequential testing procedure?

A: Revision is expected by 2012

Q: how will the GTR be incorporated into Japanese regulation or law?

A: Japan has joined the discussion of the storage system. In principle, when the GTR is established, it will be introduced into the national regulation. Japan has an established a storage system standard, and have not decided how to implement the GTR into their regulation. Japan will join the storage system discussion, but this is a political decision. Want to contribute to the development of the GTR. Position has not been established as to the adoption of the GTR.

C: The stated purpose of the GTR is to eliminate technical barriers and conflicting standards which hinder trade. Storage system is the most expensive part - if car manufacturers have to establish a different storage system for each country, this will be a huge barrier.

Korea: 3-year program includes frontal and side impact tests. Results will be provided at the May 2010 meeting.

Q: Why not rear impact? Won't the tanks be in the back?

A: rear impact tests will be included by the end of this year or early next year.

Q: Standard to be published?

A: No – only research results.

US: Update on research funded by NHTSA: Four projects

1. Collect information and review reports on hydrogen related projects. It is an extensive report and we are evaluating the information for use in the GTR.

2. Localized fire test - report is being reviewed. Test procedure will be prepared for next meeting

3. Container - sequential test is being run by contractor. Similar to the OICA procedure. About to start at Powertech. Testing is to be completed by middle of next year. Drop test is part of the hydraulic sequential test.

4. Fire hazard test - contractor will introduce a leak into the vehicle (trunk or passenger compartment, or under the hood). Slow leak all the way to 118 l/min, and then double that value. The first test into the trunk - tried to ignite what they thought was 4% hydrogen - but it was actually at 20% (it exploded). Sensor was not correct, and is being checked.

Currently under rule making on electrical safety (see Safety item in this agenda for more details).

Q: Are these tests different from the test report requested in the action list?

A: No - same item. Do not have enough data and want to generate own data.

Q: Is it really the same test? Are they being paid twice?

A: same procedure - want to get more data, performed on additional tanks. Regulators need more data.

## 5.2 ISO/SAE

ISO: See container discussion section

SAE: Documents published in January (vehicle level and storage containers). No significant changes.

## **6 Discussion of Key Items for HFCV GTR/Report on the decisions of the Drafting Task Force – Revised Draft GTR (dated August 3rd)**

OICA/SAE proposal was incorporated into section 5.1 (is in brackets until approved)

### 6.1 Part A

Q: Graphics and pictures - may be too specific. The figure is only one possible configuration. Why have this variation in the document?

A: figures are indicated to be only a possible configuration or typical

C: this is not typical and has the potential for misinterpretation

C: want to have an example of a fuel cell vehicle - this is only an example. Perhaps the use of the word "typical" is a problem.

C: big potential for misunderstanding

C: non-technical readers of the regulation would need some examples. How can we illustrate this better? "For illustrative purposes only"

C: should have separate illustration for LH2 and CH2 vehicles.

C: The only current LH2 vehicle is not a fuel cell vehicle. The power plant sees gaseous hydrogen in both vehicle types.

C: Figure 1: only sections A (fueling) and B (storage) are different for LH2 and CH2.

**ACTION: OICA and SAE will develop new Figures 1 and 2, so that they are more generic or general.**

C: Change Figure 2 caption to Sample Fuel Cell Vehicle (for illustrative purposes only)

C: Figure 1 is too detailed for a non-technical person (is more for an engineer).

C: Should use SI units (kilometer, MPa) instead of miles and psi.

**ACTION: Secretary to make sure SI units are used throughout.**

Q: How should the differences between LH2 and CH2 systems be addressed?

A: BMW should be involved in this decision

**ACTION: Germany to consult with BMW so that LH2 is properly addressed and handled**

**ACTION: Co-chair (US) will suggest structural changes to the document**

Concern about specification of 70MPa - this comment was meant for references to pressure that are found in Part B. Comment was moved to section 5.1

Listing of existing regulations. Information received from participants was incorporated. Japan's new container regulation is not finalized yet. Will be added when it is an approved standard.

Note: there is a change to the numbering system in Part A: The numbers are reflective of the Part B section, so that there is a change in the numbering: technical justification in Part A for the storage system. May or may not keep it this way for the GTR (it is not typical to do it this way)

C: Need to make it clear that the justification is only valid for CH2. Need to leave space for the LH2 rationale (to be provided). Header added to Part A (it is already stated to be CH2 only in Part B). A placeholder for the LH2 section has been added.

Q: Lifetime of storage system - end-of-life markings on the storage system?

A: A marking is required (as discussed in Beijing)

C: That was a Part B discussion. Part A has the rationale for the 15-year life.

C: Tests described actually are illustrative of 25 years (tests are stronger than the 15-year requirement). There has not be discussion of enforcement of the 15-year lifetime. Car companies cannot keep track of car ownership - federal governments may be able to do this, but it has not been discussed.

C: Japan can do this because there is a required inspection.

C: EU could include an additional inspection for this check.

C: the general public might be at risk if older vehicles are shipped to countries without inspections. There is not uniform inspection around the world, but the good thing is that the tank testing indicates a much longer lifetime than the 15 years on the label (25 years or more).

Q: Are we not limiting the age of a vehicle to 15 years?

A: only if there is enforcement (and there is not a legal requirement for such enforcement).

C: up to the manufacturer to recommend timing for replacement of the container (in the user manual, for example). Not part of the role of the government (especially in North America).

C: There is an error in the text - it is supposed to say TEN service station overpressure events (not one). These are multiple fault events - pretty rare situation (even once).

Q: Are we limiting the vehicle to 15 years without appropriate technical justification?

A: This is possible - leave the text as yellow for the time being (especially since the test is indicative of a much longer life).

C: The test data indicate 25 years. There is a technical reference to support the 25 year rationale. Stress data are logarithmic.

**ACTION: Japan will provide rationale for the 15-year limit (this is in their regulation)**

Q: Penetration test (gunfire test) - what is the technical justification for this test?

A: Historically, the regulators were not car people (tank manufacturers probably), and there was some belief that this was representative of a crash scenario. Not sure if there is any technical rationale. Could be an issue with local fire marshals who are concerned about gunfire - highly

unlikely to have a tank subjected to armor-piercing bullets.

C: suggestion is that this should be deleted as a requirement. Will be addressed in Part B.

**ACTION: Secretary will rewrite Part A section 5.2.1 as a rationale for what remains in Part B**

C: the telltale section does not belong in the regulation (it is design-specific, should only be as an example). The need for a warning can be included, but the GTR should not specify what kind of warning. First two paragraphs in this section describe the hazard (rationale).

C: we did discuss and agree to the need for a visual and audible warning in specific parts of the vehicle (passenger compartment, luggage compartment). There was not agreement on the specific requirement of a telltale.

C: this section covers the rationale for the warning (there is a corresponding section in Part B).

C: There are GTRs that have a requirement and specific description for the telltales. This is not a new requirement (see other GTRs such as ESC - electronic stability control).

C: DOT is requiring a description of the telltale.

C: US can require the telltale, option for every contracting party.

C: this is not in the best interest of any manufacturer - every contracting party could require something different.

**ACTION: Co-Chairs will work to address Germany's concerns regarding the telltale section (description of the telltale is not appropriate for Part A - only the rationale for such a warning is appropriate for this section)**

C: The OICA proposal was written in a specific way. In the case where the design of the vehicle has made it such that no concentration >4% is possible, there is no need to warn the driver or to close the shutoff valve. Add the OICA sentence "If a single failure of the hydrogen systems results in a hydrogen concentration in air greater than..." to the beginning of the Part A section, which makes the telltale (or any warning system) an option.

C: The telltale is needed if the concentration in these compartments has any possibility to exceeds 4% and the shutoff valve has been closed because of this leak into the compartment..

C: DOT/NHTSA does not accept the proposed language - not sure how to verify.

C: It is possible to test - run a hydrogen source anywhere in and under the vehicle where hydrogen could potentially leak, and test for hydrogen concentration in the compartments

C: Levels of safety: passive safety (by design), active safety (I.e., using ventilation), reactive safety (hazard exists and system is reacting).

C: Regulators cannot verify that a system will never fail.

C: Normal wear and tear could degrade some of the passive safety design elements.

C: Storage system will be qualified - should have a similar requirement for the rest of the system.

C: The Japanese regulation includes requirement for and location of sensors. Other contracting parties with existing regulations also have requirements for sensors.

C: Current EU regulation does not require sensors.

C: Hydrogen sensors are not reliable or durable. Relying on the proper operation of hydrogen sensors for safety is not possible.

C: Difference between "If a single failure of the hydrogen systems results in a hydrogen concentration in air greater than..." and "When a single failure of the hydrogen systems results in a hydrogen concentration in air greater than..."

C: For China, basic requirement - hydrogen concentration cannot exceed 4% in any case.

C: OICA proposal (6.2 in draft GTR) addresses demonstration of compliance. Do not have to measure hydrogen concentration; pressure drop could be used to detect a leak, as could other

methods. Identifying the worst case leak is difficult. Might be a small, slow leak.

This discussion is tabled for the moment to allow a small group of interested parties (OICA and GTR cosponsors) to develop a proposed text.

**RECAP:**

Chair: the discussion focused on continuing disagreement on the hydrogen detection and warning and shutdown requirement. OICA and industry members are asked to work on new language for this section. Suggested deadline of November 30<sup>th</sup> - send to all group members, the revised language.

Response from OICA representative: Timing is rather difficult (need face-to-face meeting for this to be effective, and hydrogen is only one of many important issues). Will try to meet the deadline, but may not be able to meet it. Note that OICA provided a proposal more than one year ago, but until yesterday, did not receive any technical comments. Concerned about the timing for completion of the GTR. Members are encouraged to provide comments to OICA. Need direct technical comments. Tried to modify the draft to accommodate the discussion yesterday.

Germany: Rationale for Part A was extended. Would like to have the SAE paper circulated

SAE: cannot circulate it without each person purchasing (copyrighted)

Germany: We did get a for-our-use-only for ISO documents, which are also copyrighted and sold.

SAE: Will ask DOE to provide SAE 2009-01-0012

China: clarification of comments Chinese regulations: Single failure cannot lead to undesired acceleration or reversing (uncontrolled movement of the vehicle). Also, the 4% hydrogen concentration prohibition is in the enclosed spaces. These are two key aspects of the Chinese regulations. Regulation should be released next year.

Q: How will China deal with any differences between the GTR and the regulation

A: Once the GTR is released, China will consider adoption. Want to have fuel cell vehicles in use as soon as possible, so will need national regulation in place to protect the public.

Q: the three standards mentioned yesterday cover these aspects?

A: Yes, these are included in the draft standards being considered in China.

## 6.2 Part B

**Definitions:**

Review of definitions: may remove UFL (not used in the text); High voltage: ELSA agreed to the definition, limits; Enclosed space - will discuss later (and may change the definition).

**Storage system:**

Reminder that SGS agreed to use the OICA proposal as the starting point.

ISO comment: do not want to have an upper limit on the system pressure (no need to specify).

C: The current draft does not state that there is an upper limit, although there may be reference to 70 MPa in Part A, only as examples. Search of the current document indicates that there is no limit in Part B.

C: This may be the result of the comparison of the various regulations and standards, some of which have stated limits (i.e., Japan regulation - material requirements are stated, and the testing requirements are for 70MPa as the nominal (normal) working pressure - tested for 125% or at 90MPa). May not need to specify the pressure, but only refer to the NWP and % of NWP.

C: The issue of the interface with the vehicle and higher-pressure refueling needs to be considered in the discussion.

C: Receptacle standards are being developed to prevent use of incorrect refueling pressure, and regulations in Japan and Europe have restrictions on the nozzle pressures (specific designs for each pressure level).

Q: if the receptacle design prohibits the connection of a higher pressure refueling nozzle, is an upper limit necessary?

A: In Europe, the pressures are set (cannot have in-between pressures) according to the existing regulations (35 MPa and 70 MPa only). This should not be taken as a model for the GTR. Too design-restrictive. Try not to set certain pressures in the GTR. May have to set the upper limit, but should allow anything in between (intermediate operating pressures should be allowed).

C: the tests that qualify the storage system scale with pressure.

Contracting Parties remarks:

Canada: If a limit is to be added, there needs to be a strong rationale for the upper limit. The interface issue is less clear with respect to an upper limit. Not sure pressures will go much higher. Have not heard a strong safety rationale for the limit.

China: No comment at this point

EC: prefers not to have a limit in the GTR, in order to not impede technological advancement. Want the contracting parties to decide on an upper limit at the community level (EC decides (there is a vote) on for the European Community and it is then the same for all members).

Germany: Upper limit of 70 MPa (no test procedures for higher pressures (procedures state NWP) - do not have data).

Japan: 70MPa is the upper limit that will be allowed. Regulation is based on current technology. Revision of the GTR to increase the pressure or incorporate other technologies is possible in future phases.

Korea: No comment at this point

US: Does not want an upper limit on pressure in the GTR. Reference to testing at the NWP is required, and standardization between the refueling station and receptacle is required.

EC: suggest to add "upper limit of at least 70MPa"

Suggestion: "The upper limit of the NWP shall not be lower than 70MPa"

Japan: for the moment, this is fine

Germany: wants justification for not setting upper limit (safety basis)

ISO: original comment can now be removed. The discussion is related to the scope of the GTR

OICA: the approach used in all standards is based on no upper limit. Would really have to provide a justification for an upper limit if one is required. Do not have the resources to provide justification for every provision.

China: Unnecessary to limit the pressure. Requirement is related to management and not to technology. OK with the proposed language.

EC: want to make sure that all understand that it is important to have the minimum upper limit to prevent cutoff at lower NWP.

#### **ACTION: Contracting parties to provide justification for position on upper pressure limits**

Comment included in the text that we need definitions of components. Do have definitions for most of the components in the SAE document.

#### **ACTION: GS will provide definition of the typical components within the pressure boundaries**

Japan has proposed changes for tank testing (handout - updated presentation will be provided)  
Add additional test/inspection - testing at extreme temperature (-40C and 85C, rather than ambient pressure) and add maximum defect size inspection (calculation).

Hydraulic test: 5500 cycles at extreme temp.

Static pressure test: for 1000 hours at 85C. Appropriate to evaluate safety at end of life.

Failure mode changes from leak to fracture for VH4 (plastic liner) tanks between 125% and 150% NWP.

Tests were conducted at 35MPa.

Failure mode at 125% NWP and high number of cycles is different from the failure mode at 150% NWP and smaller number of cycles - is the shorter test at higher pressure too stringent? Are these two tests equivalent or evaluating the same tank characteristic?

OICA: fully supports investigation of alternative testing by SAE and JASIC/JAMA

Q: would you expect different results if the test were conducted at 70MPa?

A: Japan will check

Q: how is this related to the new Japanese regulation? Are these findings included in the new regulation? The new regulation allows for 70MPa tanks

A: New test sequence (second presentation)

Q: why is this different from the proposal?

A: GTR draft proposal for test procedure is still under investigation and it cannot be adopted for Japanese regulation.

Q: Will Japan move to the GTR in the future?

A: Currently, 35MPa standard is established. For 70MPa, GTR discussion was taken into account, but had to compromise since there is no GTR now. For the future, when the GTR is accepted, will be incorporated into the national regulation.

C: ISO suggests that it may be time to have a task force meeting to harmonize testing requirements.

Discussion on ISO recommendation on keeping definitions for tank types (there may be exceptions to some of the tests for some of the tank types)..

US: would rather not include a list of the types of containers (design-specific). All containers have to be tested and must meet the safety criteria.

SAE: there are already new materials and constructions (i.e., type 5 tanks are being developed and tested). Do not want to prohibit these new tanks because we have not included these tanks.

Germany: we do not know if these new tanks react in a particular way to the current set of tests.. If you have a new tank, you need to have new test requirements.

US: every container has to go through the entire series of performance-based tests in order to qualify. Exceptions should not be included in the GTR..

SAE: the basis for asking for "shortcuts" is not there - not enough experience with hydrogen tanks at 70MPa.

OICA: is a list of unnecessary tests available from ISO? Detailed comments on the OICA proposal are needed.

ISO: have to make sure that the tests will qualify the new tests, which could have a failure mode that is new and is not revealed by the current suite of tests. Might be a new test required to ensure that these new tanks are safe for use.

SAE: the current set of tank tests are pure performance-based tests under conditions that are seen by the vehicle and the tanks.

EC: not opposed to it, but not actively pursuing the inclusion of the list.

Secretary: suggest we go through the set of tests and discuss which tests would not be required by a particular tank type. Then we can decide if we would need to include.(see Table 5.1.1). The right-hand side of the table will be modified based on the Japanese proposal in discussion with SAE and OICA, so will not be discussed (rationale and justification for alternative tests will be

included).

Q: are the details of the production qualification tests to be included in the GTR?

A: Yes (see section 5.1.3). Procedures are in sections 5.1.2.2.2.x and the companion sections in 6.4.1.x - need to cross reference these sections in the text.

Material testing for embrittlement will be added to the list of material testing requirements in a future version of the GTR, once an appropriate test is developed. Research continues in the US, Japan and Europe to develop a reproducible and reliable hydrogen embrittlement test procedure.

COP = Conformity of Production.

Section 6.4.1.6: this is currently design-specific/restrictive, but these are the only materials that we know are appropriate for hydrogen. This will be removed once there is an appropriate embrittlement test for metals. Should provide justification in Part A.

C: it is critical that these test procedures be incorporated before the GTR is finalized, because this is so restrictive that industry will not support its passage.

C: previous embrittlement work is not considered acceptable, and cannot be used in support of material selection.

#### **ACTION: Secretary will update numbering system in the GTR draft**

Section 5.1.2.1.1 Baseline Initial Burst Pressure Test

ISO comments: this is a long discussion - a presentation was provided to assist with the discussion. Harmonization is progressing. Some issues need to be resolved (i.e., cycling, material testing, leak before break test, and batch and routine tests)

Q: GTR is supposed to be finalized by end of 2010. What is the timing of the ISO document and can it be in line with the GTR document? (second presentation on ISO procedure)

A: Fast-tracking is possible within ISO. Within one year, a TS can be converted into a standard. (metal hydride container standard example)

Q: does the soon-to-be newly configured ISO working group intend to include more than the tank in the revision?

A: it could be extended to include more than just the tank.

C: All major countries with fuel cell experience voted "no" on the DIS. The state of the art had moved past what is in that document. Regardless, there are a number of important aspects of this work that need to be incorporated into the GTR.

Proposal for a task force meeting is being made by ISO.

C: SAE is convening just such a group where all these discussions are being held (next meeting is in November). Meetings are open.

C: ISO finds this to be irrelevant to the work of this group.

Chair: the first propriety is to discuss this draft. Table this discussion of the need for a task force meeting and continue the discussion of the GTR text.

Proposal from the Chair: we have only 1.5 days remaining. We should focus first on the draft GTR. The cosponsors have discussed the task force, but with budget restrictions, it would be difficult to have a meeting separate from the next SGS meeting. The proposal is to have a task force meeting on Monday and Tuesday in Geneva, followed by the SGS-8 on Wednesday and Thursday (and possibly Friday) January 18-22.

#### **ACTION: All participants are to submit proposed text, written comments and other documents prior to the next meeting, no later than November 30<sup>th</sup>**

Container requirements (ISO table). See SGS-6-11r1

C: EC has an end-of-life burst pressure ratio at 1.8. The ISO table was rejected by the EC - did not accept that a high-pressure vessel would require a lower burst pressure ratio than a low-pressure vessel of the same material (carbon tanks),.

C: Glass tanks are not used in the developed world, but could be used elsewhere, The material really degrades over the life of the vehicle (unlikely to be used by the OEMs in a safety-critical component).

**ACTION: Secretary will post the Powertech test report**

Section 5.1.2.1.2 Baseline Pressure Cycle Life Test: Germany will make a proposal for amendment regarding the number of samples that must be tested to be considered a representative set.

Performing test in series or in parallel - cumulative impact is more severe test. ISO requires tests to be performed in parallel, and there may be a significant number of containers tested in parallel. Powertech report has data on the series tests. A tank that passes the test in parallel may or may not pass the tests in series, but a tank that fails this test when performed in parallel would most certainly have failed the series test.

Discussion of the reduction of number of cycles. Proposal is to delete the notation discussing taxis (5500 fill cycles x 300 miles/fill cycle = 1.7 million miles or 2.6 million km)

**ACTION: EC will investigate if the reduction of cycles from 11000 to 5500 effectively covers taxis in extremely high use.**

RECAP:

Group would like to have the Powertech report, and the SAE report (this paper can only be used within the group). Agreed not to limit the upper limit of NWP, but will set a minimum upper limit at 70MPa. A concern was expressed that the current testing procedures may not be appropriate for higher pressures - more research may be needed.

Sample size discussion (see section 5.1.2.2.2)

US: we do not set the sample size

Germany: if only one sample is tested, are the results significant or do you need more samples to get a representative data set. An amendment will be provided before end of November.

SAE: concerned that incorporation of a specific number of tanks to be tested would be a problem. There may be other ways to show that there is conformity of production. The length of time required for the pneumatic test is very long.

EC: there is only one hydraulic test performed by the type approval authority, and the COP is part of the data provided by the manufacturer. The regulation does contain the specific number of tanks that must be tested.

ISO: In the TS, the sample size varies depending on the procedure/test.

**ACTION: Germany will present proposal on tank sample size.**

ISO: concerned that the pneumatic test results are not validated, and therefore should be supplemented/replaced by a hydraulic test.

SAE: Powertech observed some unexpected failures in type 3 tanks when tested with hydrogen, and therefore SAE wants to have tank manufacturers perform pneumatic tests using hydrogen. OEMs also had some type 4 tanks that passed the traditional tests but failed the pneumatic

tests. Need the Powertech report to verify these claims.

**ACTION: ISO will present proposal on pneumatic versus/plus hydraulic testing (the Powertech report may provide the needed validation).**

**Permeation rate**

Error in the table presented at Beijing. Revised table presented. Original results were conservative for the European critical condition, and the corrected version has a slight increase in the allowable permeation rate. In addition, it appears that an error has occurred in the translation of the SAE numbers into the ISO document and this should be checked/corrected, as it could result in an unsafe condition.

Q: how do we incorporate this information into a requirement?

A: the component-level numbers can be used to qualify the tanks and/or the system.

Q: is there a HySAFE report available?

A: Yes, it has been circulated. A more user-friendly paper that was recently presented will be provided.

**ACTION: Paul Adams will provide recent paper on permeation rates.**

The HySAFE numbers for the micro garage are more conservative than the SAE proposal (small garage). Need the component number.

**ACTION: SAE and HySAFE will cooperate to develop a proposal for a new paragraph on the leak permeation rate.**

US: Would also like to consider that a maximum for the system be included.

SAE: the HySAFE contains information on this issue.

Q: how/why is this different from the European regulations?

A: the measurements should be done at the higher temperature used in the HySAFE report..

There is a concern that some components may fail under specific conditions that may or may not be caught (?) at the system level.

US: we do not want to start adding requirements to test components.

SAE: can we add something that says the manufacturer has to provide documentation on qualification of the critical components?

US: this is specific to type approval - we do not want to include this type of requirement in the GTR

EC: Any contracting party can require a specific standard to be met with respect to the PRD or any other component. 1998 agreement allows this.

US: It is understood that such requirements can be added once the GTR is adopted.

C: concern that this will make the GTR less useful (conflicting add-ons)

SAE: include the recommended practices (this means it is in Part A), particularly with respect to the critical components, such as the PRD

Q: What is acceptable operation? Should we refer to a particular standard?

A: "such as" would be ok. There is a list of standards in Part A.

Suggested text for Part A:

"Contracting party may clarify requirements for acceptable operation of PRDs, such as CSA.yyyy or ISO.zzzz, for the purpose of type approval."

- or -

"Compliance with requirements for acceptable PRD operation and performance, as found in

CSA.yyyy or ISO.zzzz, is expected."

- or -

Something else?

US: We should not be discussing component level requirements.

SAE: All of the other components (tank, check valve, shutoff valve) associated with the storage system are extensively exercised during the qualification tests. This is not the case for the PRD, and this is why this needs to be discussed and considered as a special case for inclusion in the text.

**ACTION: GS will develop in collaboration with other interested parties, specific language regarding the special case of the PRD durability and performance, for inclusion in Part A.**

#### **Alternative testing procedure**

OICA would like to wait for the discussions to be held at SAE before proposing language for this section.

US: preference is to see only one set of tests for the system. Ask that a clear justification be included for having a separate set of tests for a certain type of container.

#### **Penetration test**

Justification for this test would be needed. It is part of the traditional tank testing. If we remove it, will it be added back in by other authorities. It may be in existing requirements.

C: If we remove it here, it cannot/should not be added back in.

C; do we need to add something in Part A justifying its removal? Probably not, since there seems to be no justification for having it in the first place.

#### **Boss torque test**

No justification is provided for a boss torque test. It is up to the proposer to provide the justification. This is the case for any proposal (all are due no later than November 30<sup>th</sup>)

#### **Storage system production requirements**

US proposes and EC, Korea, China agree to move this entire section to Part A  
Germany has reservations, but will allow it to be moved.

Japan disagrees (wants the documentation of the batch and routine production testing to remain in Part B) - as long as they can require the documentation, they will agree to the proposed move of this section to Part A.

GTR philosophy - only what is written in Part B is enforceable; Part A contains recommendations.

If this remains in Part B, a sentence will be added to indicate that this section is for type approval only. "Provide upon request" covers the self certification countries.

If it is not mandatory, it does not belong in Part B.

Text was moved to Part A and will be edited.

#### **Tank markings**

Justification for 15 years (or any other number) needs to be provided. How to track or enforce?  
Germany: this is in conflict with the existing regulation. Has to do with the possibility to qualify tanks with reduced number of cycles.

Could require that the manufacturer has to put a Date of Manufacture on the tank. Add to Part A some text about tank damage and recommend that tanks should be inspected.

China: date of periodic inspection is required and should be added

Canada: also need a serial number (in case the tank gets moved to another vehicle and is then

subject of a recall or some similar situation).  
There is no consensus related to markings.

### **ACTION: Parties are asked to submit proposals for markings**

#### **Vehicle fuel system**

The protective cap doesn't prevent the PRD from discharging and has to be present for the test of the storage system.

#### **Single failure of hydrogen fuel system**

Three versions

OICA will provide a final new proposal

US: wants a warning (notification) system to the driver and the main shutoff valve is to close if the hydrogen concentration in the passenger or trunk compartments is >4%.

SAE: even if there is no way to ever get hydrogen into the passenger compartment?

US: driver needs to be notified if there is a leak. The closure of the shutoff valve is not mandatory (the manufacturer would have to determine what the vehicle would do depending on the leak rate or some other criterion).

### **ACTION: OICA will provide a new proposal on leak detection for the section on single failure of the hydrogen fuel system**

#### **Driver warning**

Other GTRs have detailed descriptions of telltales. This is a common requirement.

Telltale needs to be defined (symbol in the dashboard/instrument panel), or use the terminology in the UNECE-R121

### **ACTION: Obtain telltale-related terminology from UNECE-R121**

Japan: there is no standard symbol, but most of the OEMs are using H as the symbol. No standard color.

EC, Canada, Korea: would like to specify the symbol

China requires an audible warning if the concentration exceeds 4%. If a visual warning is included, it is a red light (no specific symbols)

OICA: do not think that the driver should be part of the failure response. What is the expected action from the driver?

US: OEMs have to tell the driver (in the manual or through some other media) what the driver should do if the warning light comes on.

OICA: Would like a justification for this being included in the GTR. There is no agreement on this in OICA. Just asking what he has been asked many times in each meeting - why is this needed as written?

US: why would industry not want a standard telltale or icon?

OICA: not arguing against a warning.

EC: can we document that industry is opposed to the harmonization of the instrument panel?

Contracting Parties are in agreement that there should be a harmonized telltale/warning.

EC: not opposed to it, but want to give the manufacturers some freedom. In the general interest of safety, the proposal for a standard icon is supported.

#### **Fuel cell/vehicle discharge system**

OICA response to an action item from the SGS-6. Text edited to include the prohibition on the concentration at the exhaust to never exceed 8%. There are calculations that can be included in

## Part A

### **ACTION: GS to provide calculation of the 3-sec average for inclusion in Part A**

#### **Post crash**

The number for the leak rate keeps changing - the number was originally 118 NL/min (energy equivalence for the gasoline leak rate).. The Japanese regulation has 130 NL/min (could be a difference between use of the lower and higher heating values). SAE J2578 has the calculation which provides the justification for 118 NL/min

#### **Vehicle fueling receptacle markings**

There is a proposal to require a label on the fueling port

### **ACTION: Contracting parties to provide proposals for marking of the fuel receptacle**

**NOTE:** We are missing closure on a number of open issues from the SGS-6 meeting:

- Air tightness
- Multiple shutoff valves
- Overpressure protection for the low pressure section

Cosponsors to discuss tomorrow, and decide if these issues are to be brought to AC.3

## **7. Electric Safety**

### 7.1 Report on September 2009 Meeting of ELSA

First topic: In Use. Finalized proposal for amendment to R100. Second topic: Post-crash. Decided to hold off on this until the US completes the rule-making phase of FMVSS-305 (think it will be published by the end of 2009). Next meeting will be in Feb 2010 in DC.

Will be a delay in the completion of the GTR. The GTR completion date of 2011 will be proposed (to be discussed tomorrow).

### 7.2 Discussion

OICA: The French delegation is proposing to start developing post-crash requirements under the 1958 agreement. The suggestion is that the US consider discussing the post-crash proposal so that further delays do not continue.

## **8. Miscellaneous Administrative Items**

Korea suggests, and Germany agrees, that the Secretary should clean up the GTR so that appropriate text is included in the correct sections (put test procedures in section 6 so that the requirements are the only things in section 5).

### 8.1 Approval of Decisions and Action Items of the 7th Meeting

### 8.2 Next Meeting (Week of January 18-22, 2010 in Geneva)

### 8.3 Other Issues