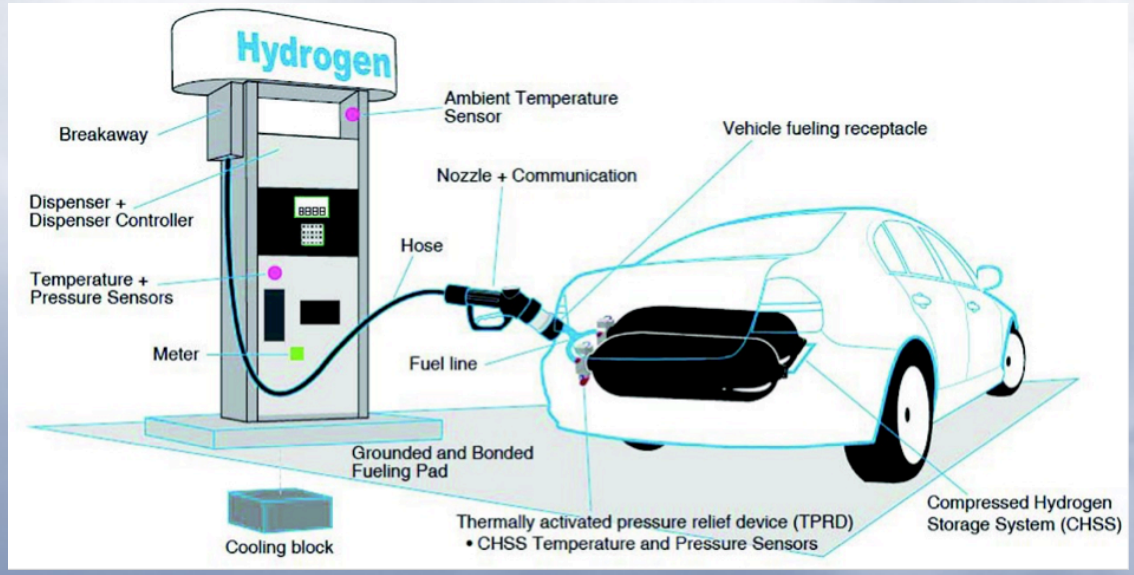
GTR Phase 2 on H/FCEV
Seoul, Korea
June 26-28, 2018

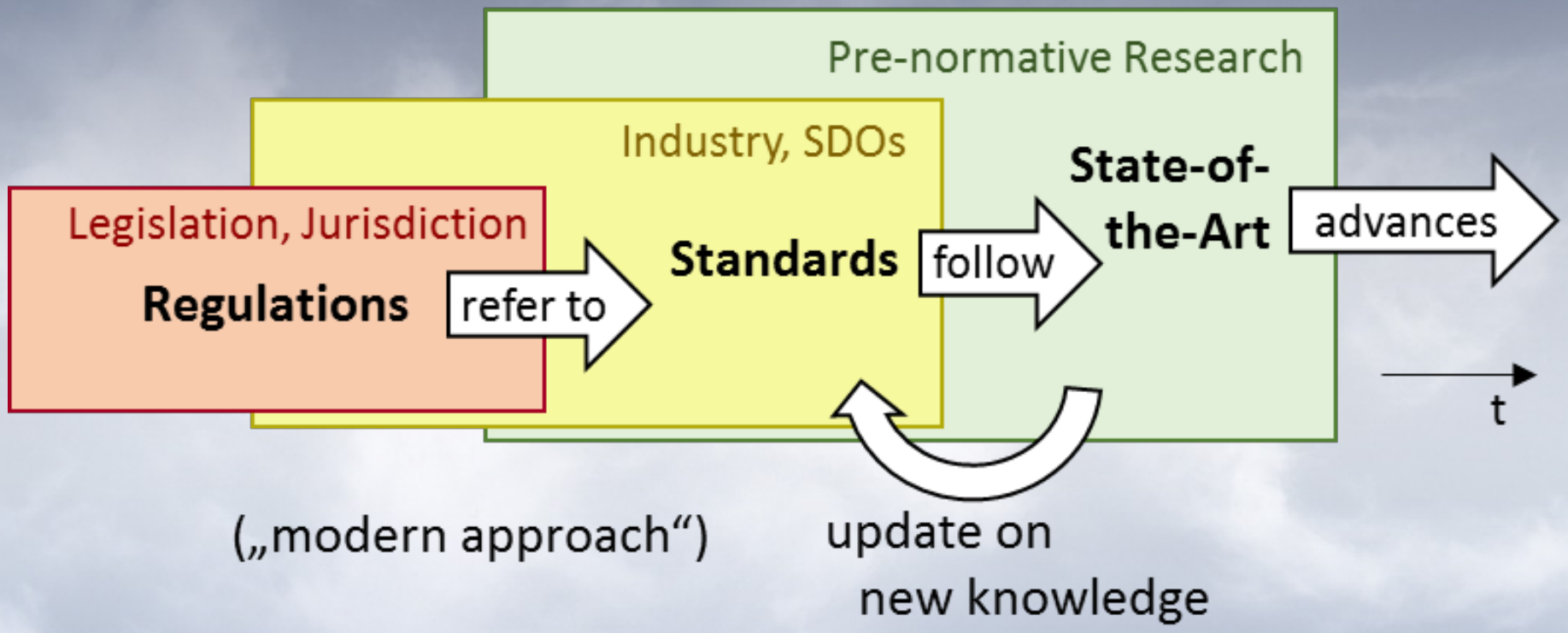
Recommendations from ISO/TC 197

Andrei V. Tchouvelev on behalf of TF5



Courtesy of CaFCP

High-Level Motivation of ISO/TC 197



Interrelations between development of regulations, standards and state-of-the-art

Courtesy of PRESLHY, EU FCH 2 JU

TF5 Members

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A. Harris (Air Liquide USA)
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P. Karzel (Shell)
S. Mathison (Honda R&D Americas)
S. Schmidt (Auto Alliance)
S. W. Kwon (KOTSA)
Y. Fujimoto (Toyota)

Completed Issues and Assignments

- Preamble Para.61 (f) subclause (i) – rationale for fuelling/de-fuelling cycles (para. 5.1.2.4.)
- Preamble Para.81– rationale for 5.2.1.5 fuel leakage
- Definition 3.28. "Hydrogen-fuelled vehicle”
- Definition 3.34. "Lower flammability limit (LFL)”

TF5 Proposals Review Meeting

Dear Andrei

I attached results of discussions in Torrance last week (June 7, 2018). JAMA supports the proposals in the attachment.

The discussions were lead by Glenn. The attendees were:

Y. Tamura	I. Yamashita	N. Kinoshita	A. Ishizuka
H. Tamura	M. Schwarz	C. San Marchi	G. Scheffler
A. Ryan	Y. Fujimoto	S. Mathison	M. Leavitt
S. Chigusa	F. Yamanashi	L. Gambone	J. Eihusen

Thank you.
Fuji
June 13, 2018

Completed Issues and Assignments

Preamble Para.61(f) – rationale for 5.1.2.4 :

- **Original text:**

(f) Extreme pressure conditions for fuelling/de-fuelling cycles (para. 5.1.2.4.)
(i) Fuelling station over-pressurization constrained by fuelling station requirements to less than or equal to 150 per cent NWP. (This requirement for fuelling stations shall be established within local codes and/or regulations for fuelling stations);

- **Proposed text:**

Fuelling station over-pressurization constrained by fuelling station requirements to less than or equal to 150 per cent NWP. (This requirement is based on a dispenser systems designed to a MAWP of 137.5% NWP with pressure protection set to activate the highest permitted value of 137.5% and limit dispensing faults to no more than 150% NWP. ~~for fuelling stations shall be established within local~~ Local codes and/or regulations for fuelling stations may lower the permitted value for pressure protection, but 150 per cent is expected to be the worst case and, given dispenser protections with the control system, expected to occur only under multiple fault situations.);

2018 June 7th Pre-GTR Meeting Proposal:

OK with Andrei's proposal

Completed Issues and Assignments

Preamble Para.81– rationale for 5.2.1.5 fuel leakage:

- **Original text: "Detectable leakage is not permitted"**
- **Proposed text: Detectable leakage <u>of the hydrogen fuelling line and the hydrogen system(s) downstream of the main shut off valve(s)</u> is not permitted.**

2018 June 7th Pre-GTR Meeting Proposal:

"Detectable leakage <u>of the hydrogen fuelling line and delivery system</u> is not permitted."

** As this sentence is in section 5.2 ("Vehicle Fuel System"), the purpose is to prohibit leaks in the hydrogen fueling and delivery systems. The purpose is not to check the fuel cell stack for hydrogen that may vent from it, so the sentence "downstream of the main shut off valve(s)" is not in line with the intention of the requirement.*

5.2.1.5.	Fuel system leakage The hydrogen fuelling line and the hydrogen system(s) downstream of the main shut off valve(s) shall not leak. Compliance shall be verified at NWP (para. 6.1.5. test procedure).

Completed Issues and Assignments

Definition 3.28. "Hydrogen-fuelled vehicle" (1):

- **Original text:** **"Hydrogen-fuelled vehicle" indicates any motor vehicle that uses compressed gaseous or liquefied hydrogen as a fuel to propel the vehicle, including fuel cell and internal combustion engine vehicles. Hydrogen fuel for passenger vehicles is specified in ISO 14687-2 and SAE J2719.**
- **Proposed text:** **"Hydrogen-fuelled vehicle" indicates any motor vehicle that uses compressed gaseous or liquefied hydrogen as a fuel to directly or indirectly propel the vehicle, including fuel cell electric vehicle, battery electric vehicle with a fuel cell range extender and internal combustion engine vehicles. Hydrogen fuel for passenger PEM (Proton Exchange Membrane) fuel cell road vehicles is specified in ISO 14687-2 Type I and II Grade D and SAE J2719. Hydrogen fuel for internal combustion engine vehicles is specified in ISO 14687 Type I Grade A.**

Completed Issues and Assignments

Definition 3.28. "Hydrogen-fuelled vehicle" (2):

2018 June 7th Pre-GTR Meeting Proposal:

"Hydrogen-fuelled vehicle" indicates any motor vehicle that uses compressed gaseous or liquefied hydrogen as a fuel to ~~directly or indirectly~~ propel the vehicle, including fuel cell ~~electric vehicle, battery electric vehicle with a fuel cell range~~ extender and internal combustion engine vehicle~~s~~. Hydrogen fuel for ~~passenger~~ ~~PEM (Proton Exchange Membrane)~~ ~~fuel cell road~~ the vehicles is specified in ISO 14687~~-2 Type I and II Grade D~~ and SAE J2719. ~~Hydrogen fuel for internal combustion engine vehicles is specified in ISO 14687 Type I Grade A.~~

** There is no need to restrict this requirement to PEM fuel cell vehicles. Also, referencing ISO14687 is sufficient, no need to specify the "-2" document*

Completed Issues and Assignments

Definition 3.34. "Lower flammability limit (LFL)" (1):

- **Original text:** **"Lower flammability limit (LFL)" is the lowest concentration of fuel at which a gaseous fuel mixture is flammable at normal temperature and pressure. The lower flammability limit for hydrogen gas in air is 4 per cent by volume. (Para 83 of the Preamble).**
- **Proposed text:** **"Lower flammability limit (LFL)" is the lowest concentration of fuel at which a gaseous fuel mixture ~~is flammable~~ will sustain propagation of a combustion wave at ~~normal~~ a given temperature and pressure. The lower flammability limit for hydrogen gas in air is dependent on the flame propagation direction. At normal temperature and pressure it has been experimentally measured to be 4.0% to 4.15% (normally taken to be 4%) for an upward propagating flame; for both a horizontal and downward propagation flame LFL is between 8% to 10% (normally taken to be 8%). (Para 83 of the Preamble).**

Completed Issues and Assignments

Para 83 for 3.34. "Lower flammability limit (LFL)" (2):

(vii) Lower flammability limit (LFL)

83. (Background for paragraph 3.34.): Lowest concentration of fuel in which a gas mixture ~~is flammable~~ will sustain propagation of a combustion wave. National and international standard bodies (such as National Fire Protection Association (NFPA) and IEC) recognize 4 per cent hydrogen by volume in air as the LFL. The LFL, which depends on the temperature, pressure, flame propagation direction and presence of dilution gases, has been assessed using specific test methods in a fully premixed quiescent mixture (e.g. American Society for Testing (ASTM) E681-04). Hence, the definition of LFL is restricted to fully premixed quiescent environments. Under realistic (non-quiescent) conditions flame propagation is a function of the fluid dynamic environment, which always increases the apparent LFL.

2018 June 7th Pre-GTR Meeting Proposal:

OK with Andrei's proposal

Issues and Assignments TBA

- **Preamble, Rationale for scope, Para. 35 on page 12: *Interoperability* – In-progress, TBA at next IWG meeting**
- **Regulation Clause 5.1.2 Figure 2 on page 58, Verification test for performance durability (hydraulic): *Long term stress rupture for Type 3 and 4 tanks* – Approach proposed in SAE J2579, to be validated; TBA when ready**
- **Regulation Clause 5.1.3 on page 59 (as appropriate), link to gas pressure cycling test Clause 6.2.4.1 on page 79: *T increase to => 90 C and adding material softening test – ref. HyTransfer, SAE J2579 Appendix F and ISO 306* – TBD**

Summary

- Four assignments completed and submitted
- One assignment (long term stress rupture) is in the validation stage under SAE J2579 process
- Two more assignments – "*Interoperability*" and "*High Temperature*" are work-in-progress – TBD at the next meeting (October 2018)