METROLOGY for HYDROGEN VEHICLES

HYDRAITE

What are the next steps - Hydrogen Purity

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ISO/TC 197 Technical Program Director
(Fuel Cell and Stationary Application)

Venue: VSL Dutch Metrology Institute
Date: 11 and 12 September 2019

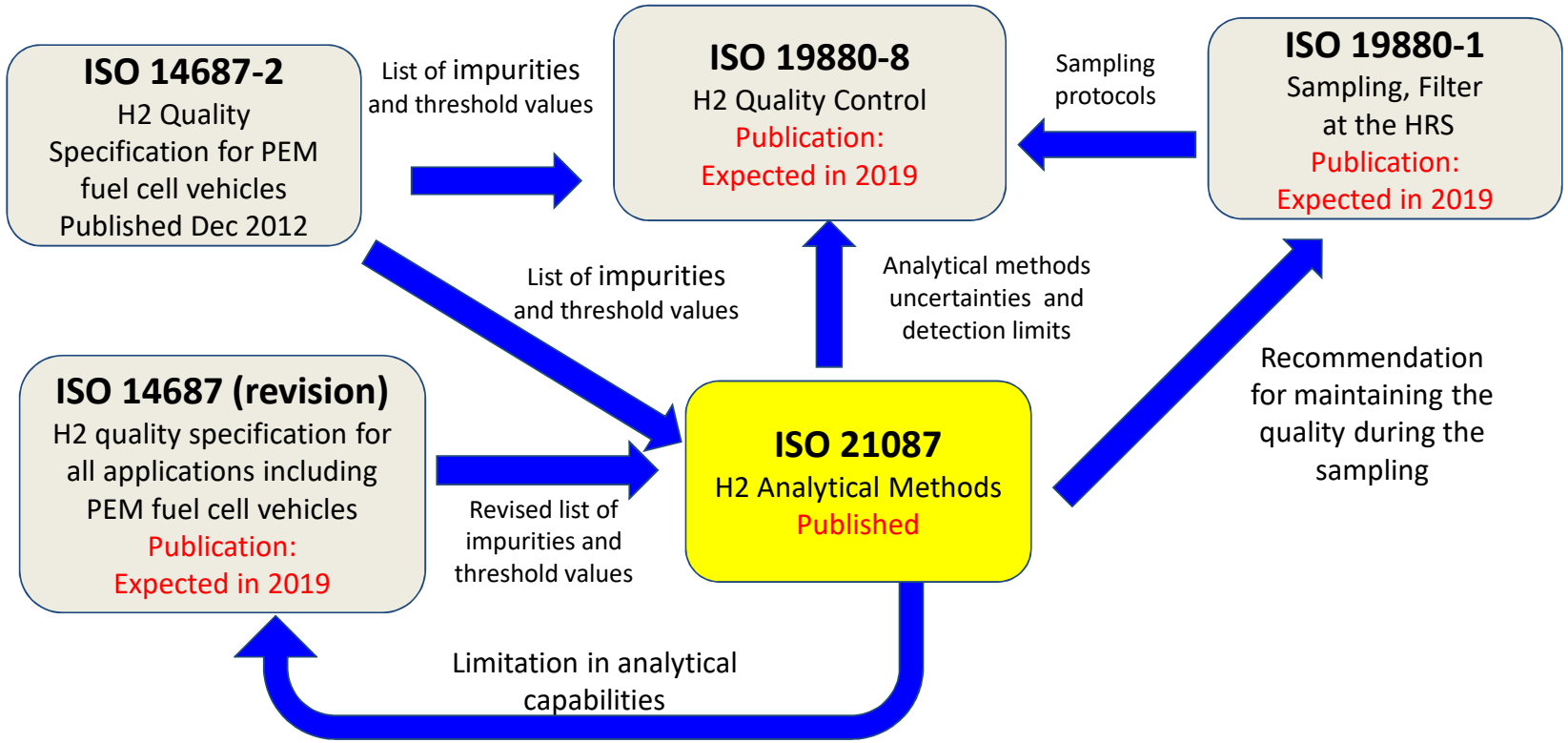
EMPIR EURAMET FCH

ISO TC197, H_2 Quality

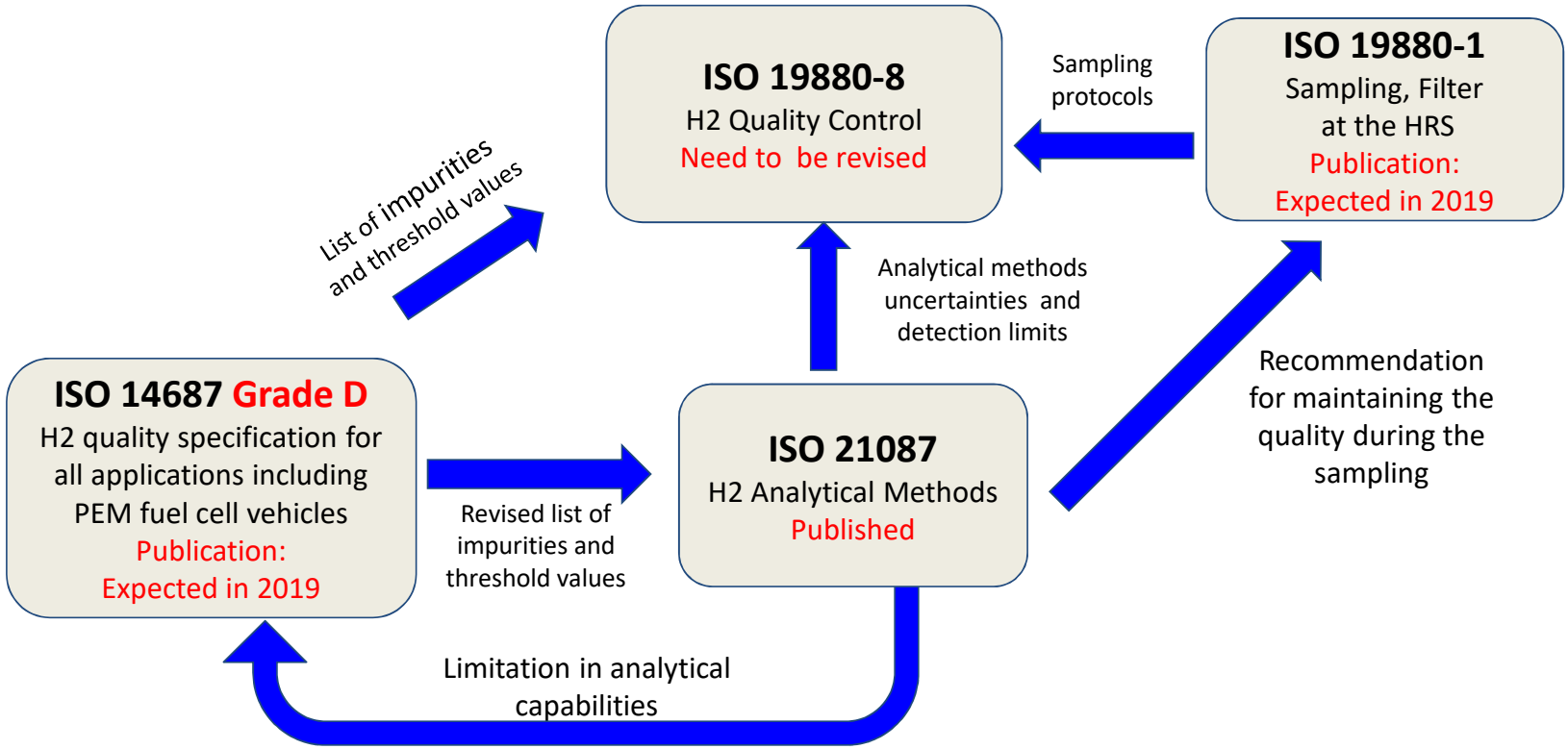
September 11th 2018

Hidenori Tomioka, JISC
ISO/TC197 Technical Program Director

ISO H_2 Quality Standards status



ISO H_2 Quality Standards vs. SAE J2719



Clarification of WGs' responsibilities and progress

Trilateral structure of H2 Quality for FCV

- ✓ **WG 27: Threshold Specification, discussed in ISO14687 Grade D.**

  DIS ballot was Approved without negative vote on 2018-09-05.

  FDIS ballot has started on 2019-08-28 and will close on 2019-10-23.

  It is expected to be published by the end of this year.

- ✓ **WG 28: Hydrogen Quality Control, discussed in ISO19880-8.**

  DIS ballot was approved without negative vote.

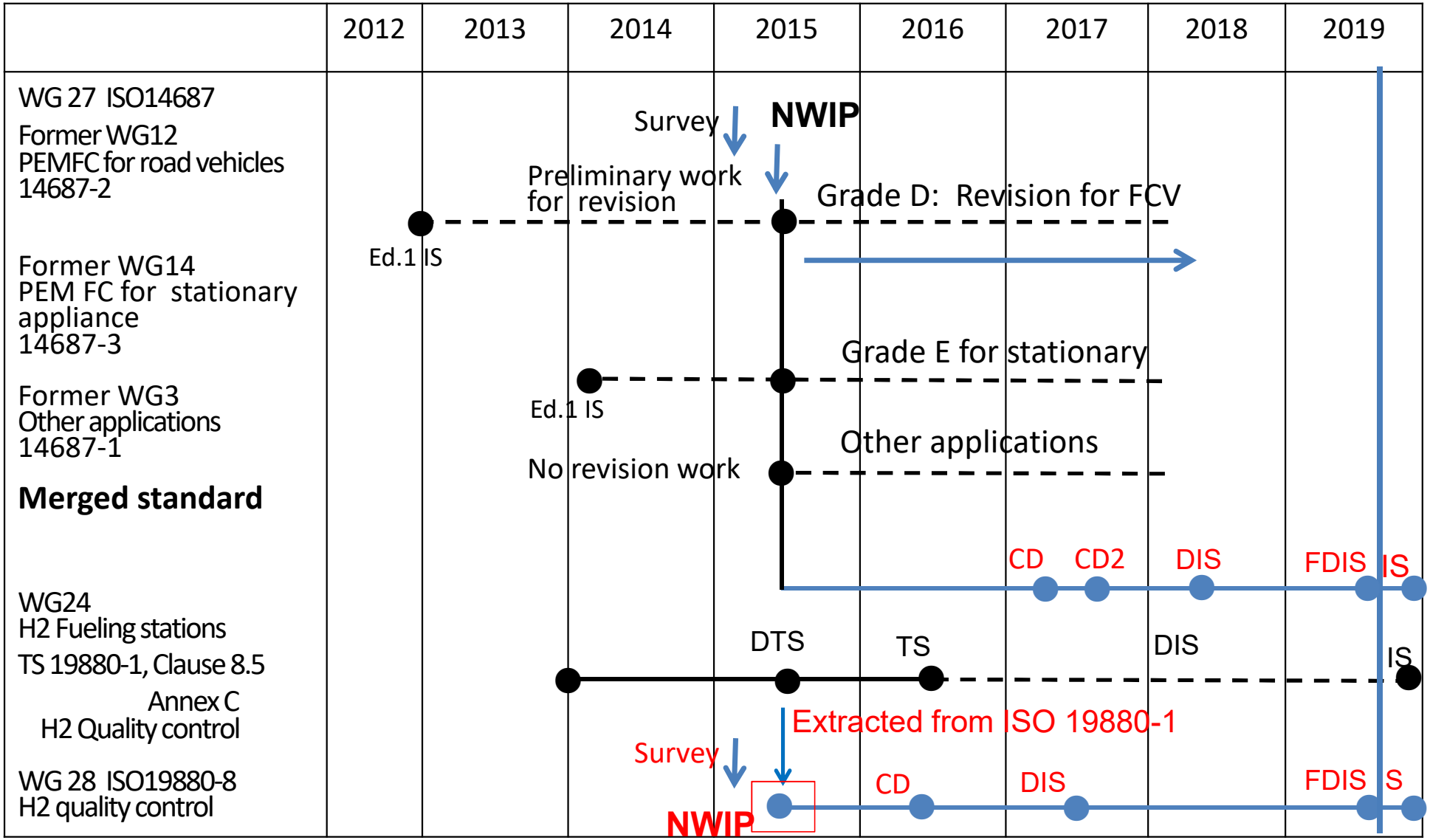
  FDIS ballot has started on 2019-08-08 and will close on 2019-10-03.

  It is expected to be published by the end of this year.

- ✓ **ISO/TC 158/JWG 7: Analytical methods for FCV.**

  It was published on 2019-06-26.

Schedule for developing H2 quality standards (WG27, WG28)



The Progress of ISO/TC197/WG27 H_2 Quality: ISO14687

The status of ISO/TC 197/WG 27

ISO/TC 197/WG 27: Hydrogen fuel quality

initiated on October 15, 2015

Conveners: Yasuo TAKAGI (TG1), Osamu TAJIMA (TG2): JISC (Japan)

Secretary: Hidenori TOMIOKA: JISC (Japan)

ISO/FDIS 14687: (50:20) (2019-08-28)

Proof sent to Secretariat or FDIS ballot initiated: 2 months

Hydrogen fuel quality — Product specification

Participation: CA, DE, FR, GB, JP, KR, NL, NO, US

The scope of ISO 14687:

This International Standard specifies the minimum quality characteristics of hydrogen fuel as distributed for utilization in vehicular and stationary applications.
It is applicable to hydrogen fuelling applications, which are listed in Table 1 of this International Standard.

The major change from ISO14687-2: 2012

Items for inert gases and CH_4.

- **N_2 and Ar 100 to 300 ppm (Agreed upon among OEMs)**
- **CH_4 to be separated, the others are still C1 equivalent.**

The summary of the consensus for CO, HCHO, HCOOH and halogens.

- **The WG fully agreed to use those values EIGA proposed (CO: 0.2 ppm, HCHO: 0.2 ppm, HCOOH: 0.2 ppm, Sum of these three constituents: 0.2 ppm) in the ISO/DIS 14687 based on the data provided including JARI (JPN)'s data.**

- **Delete "Total" from halogenated compounds**
  Note: All halogenated compounds which could potentially be in the hydrogen gas (for example, hydrogen chloride (HCl), and organic chlorides (R-Cl)) should be determined by the hydrogen quality control plan discussed in ISO 19880-8.

The specification change for new ISO 14687 and ISO14687-2: 2012

For FCV

Constituents	Grade D, ISO14687 New	ISO 14687-2: 2012
Hydrogen fuel index	99,97 %	99,97 %
Total non-hydrogen gases	300 µmol/mol	300 µmol/mol
Maximum concentration of individual contaminants		
Water (H_2O)	5 µmol/mol	5 µmol/mol
Total hydrocarbons except methane (C1 equivalent)	2 µmol/mol	2 µmol/mol Including methane
Methane (CH_4)	100 µmol/mol	
Oxygen (O_2)	5 µmol/mol	5 µmol/mol
Helium (He)	300 µmol/mol	300 µmol/mol
Nitrogen (N_2)	300 µmol/mol	The sum of N_2 and Ar 100 µmol/mol
Argon (Ar)	300 µmol/mol	
Carbon dioxide (CO_2)	2 µmol/mol	2 µmol/mol
Carbon monoxide (CO)	0,2 µmol/mol	0,2 µmol/mol
Total sulfur compounds (S1 equivalent)	0,004 µmol/mol	0,004 µmol/mol
Formaldehyde (HCHO)	0,2 µmol/mol	0,01 µmol/mol
Formic acid (HCOOH)	0,2 µmol/mol	0,2 µmol/mol
Ammonia (NH_3)	0,1 µmol/mol	0,1 µmol/mol
Halogenated compounds (Halogen ion equivalent)	0,05 µmol/mol	0,05 µmol/mol
Maximum particulate concentration	1 mg/kg	1 mg/kg
Note: The sum of CO, HCHO and HCOOH shall not exceed 0,2 µmol/mol.		—

WG 27 expected milestone

- ✓ **Progress and expected actions (as of 2019-06-04)**
  - **2019-01: WG27 secretary submitted FDIS to TC197**
  - **2019-06: TC197 manager would submit FDIS to ISO CS.**
  - **2019-08-28: FDIS ballot starts (close on 2019-10-23)**
  - **2019-12: Publish IS**

Further revision for ISO14687 Hydrogen Fuel Quality

- ✓ **H_2 quality standard needs to be mature enough to meet the really large hydrogen and FCV market. (Need to be covered the cost issue.)**
- ✓ **It needs to be prepared for the "bad guy" in the market in the future.**
  - **WG27 is going to hold a workshop in conjunction with European hydrogen research projects (HYDRAITE, MetroHyVe) in Delft, the Netherlands in September 2019.**
  - **The preparation for the revision will be initiated soon as a preliminary work item.**
- ✓ **H_2 quality of Grade A gas would also be covered.**

The Progress Report of ISO/TC 197/WG 28 Quality Control: ISO19880-8

The status of ISO/TC 197/WG 28

ISO/TC 197/WG 28: Hydrogen quality control

initiated on October 15, 2015

Convener: Hidenori TOMIOKA: JISC (Japan)

Secretary: Spencer Quong: ANSI (USA)

ISO/FDIS 19880-8: (50:20) (2019-08-08)

Gaseous hydrogen — Fueling stations — Part 8: Hydrogen quality control (Proof sent to Secretariat or FDIS ballot initiated: 2 months)

Participation: CA, DE, FR, GB, JP, KR, NL, NO, US

The scope of ISO 19880-8:

This International standard specifies the protocol for ensuring the quality of the gaseous hydrogen quality at hydrogen distribution bases and hydrogen fuelling stations for PEM fuel cells for road vehicles.

ISO19880-8: Gaseous Hydrogen Fueling Station - Hydrogen Quality Control

- ISO19880-8 guides the ways of quality control for whole supply chain of the hydrogen for the FCV application.
- Two approaches for the quality control in ISO19880-8;
  - A prescriptive methodology to guide the quality control of the hydrogen production and supply of the established processes.
  - A risk assessment method to guide the appropriate quality control manner for the production and whole supply chain to meet the specifications.

Further revision for ISO19880-8 Hydrogen Quality Control

- ✓ **The present ISO/FDIS 19880-8 has been intended to work with ISO 14687-2:2012. It needs to be aligned with the revised specifications in ISO14687 Grade D, new version.**

  - **Right after the ISO14687 publication, WG28 will start ISO19880-8 revision.**

    (WG28 meeting will be held in conjunction with TC197 Plenary meeting in Grenoble in Dec. 2019)

ISO TC197, H_2 Quality

Summary

Hidenori Tomioka, JISC
ISO/TC197 Technical Program Director

Summary of the H_2 Quality Standards and the future actions

- ✓ **Three of those standards will be expected to be published in early 2018 timeframe.**

After publication

- ✓ **ISO 19880-8 (WG 28: Hydrogen Quality Control) needs to be revised in order to modify in order to align with the new ISO 14687 Grade D specifications.**
- ✓ **ISO 14687 (WG 27: Hydrogen Fuel Quality): The preparation for the revision will be initiated soon as a preliminary work item. At the latest 2022-05: WG27 will start ISO14687 revision.**
  — Grade D should cover all road vehicle application using H_2 as a fuel for simplicity of the market.

Open questions

- Any specific questions to the previous speakers
- Questions from the audience