ISO TC 197, WG 24
Gaseous H2 Fueling Stations - General Requirements

Team Status December 4th, 2014

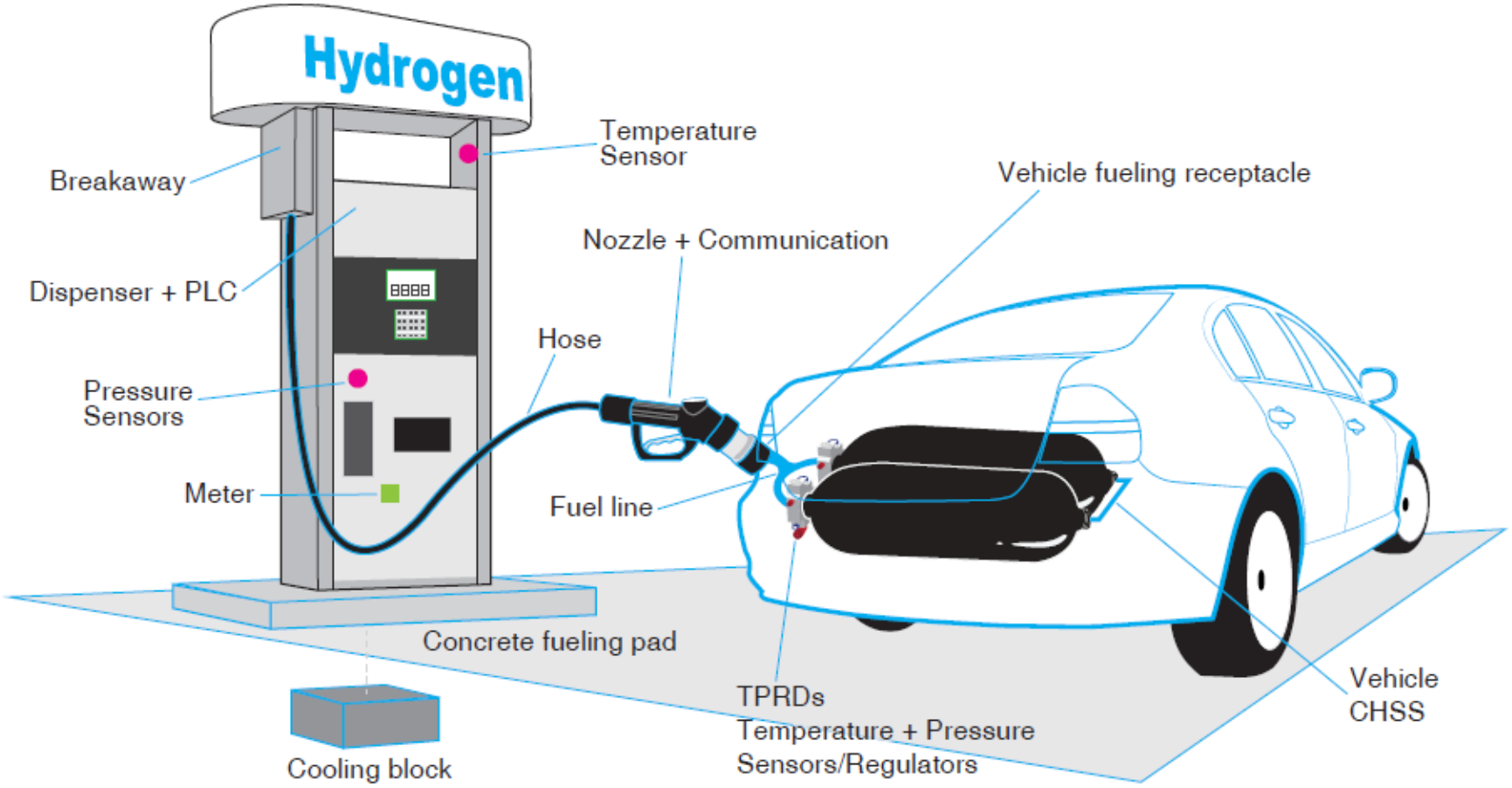
Jesse Schneider, BMW (US) Guy Dang-Nhu, Air Liquide (FR)

Nick Hart, ITM Power (UK)

ISO TC 197, WG 24 Plenary Update Outline

- Updated Timeline
- 2015 Schedule of Meetings
- Subteam Update
- Comment Control / Document Updates
- External Informative References

ISO 19880-1
Hydrogen Fuelling Diagram



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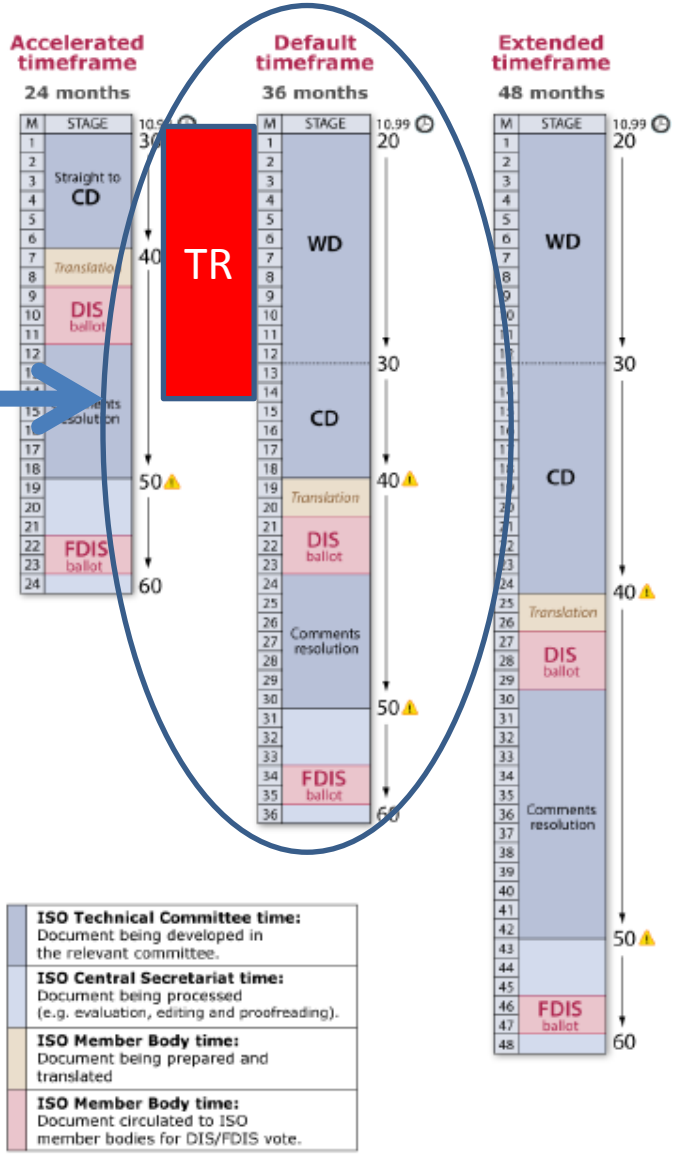
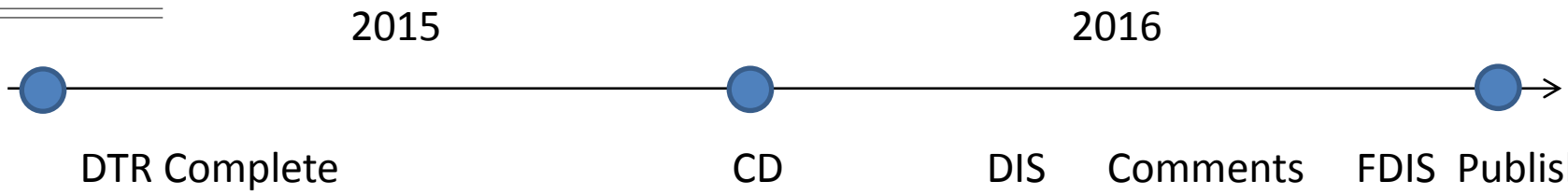
19880-1 Planning vs. ISO Deliverables and Development tracks

TR-IS Timeline Moved
As per WG 24 meeting
On October 14th



TR to IS Milestone New Timeline



December 2014: Draft V.7 Review, Working Draft at ISO TC 197 Plenary. Release of Version 8

February 2015 : WG 24 meeting and final comment review before DTR

March 2015 : Release V.9 DTR for voting and P-Member comments. Technical Work on IS started in parallel

June 2015 : Finished TR

December 2015 : CD for comments

March 2016 : DIS for balloting and translate

October 2016 : FDIS Ballot

December 2016 : IS published

Country Adoption: 1 Year (2017)

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2015
ISO 19880-1 F2F Schedule

- **February 16-20th, 2015 at Shell in Hamburg, Germany**
  - **Main WG 24 Meeting**, Review Comments and Finalize DTR (Draft Technical Report)
  - Preparation Risk Assessment at Shell Hamburg, Germany
- **April 13-17th,2015- at Linde in Munich, Germany**
  - Kickoff WG24 sub group risk assessment
  - **Main WG 24 Meeting** Start of TR to IS Discussions "Should vs. Shall"
- **June 22-26th, 2015 at AFNOR, Paris, France**
  - **Main WG 24 Meeting** Start of TR to IS Discussions "Should vs. Shall"
  - WG 24 Development of DIS/ Discussion with CEN
  - Meeting with ASTM
- **October 12-16th in Japan (Fly to Tokyo, Location TBD)**
  - **Main WG 24 Meeting** Developing Draft CD 19880-2
  - WG24 sub group station acceptance, hydrogen quality and risk assessment
- **December 7-11th, 2015, ISO TC 197, Plenary in LA, USA? (TBC)**
  - Main WG 24 Meeting to discuss final comments before CD

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ISO TC 197 WG 24
Team Structure with subteams

WG 24 Management

Schneider (US), Dang-Nhu (FR)
Hart (UK)

Station Acceptance	Hydrogen Quality	Safety Distance
Moulthrop (US), Elliger (DE)	Tomioka (JP), Boisen(DK)	Julie Flynne (FR), Groth (US)

2014 F2F Meetings		
April, 2014	July, 2014	October, 2014
July, 2014	October, 2014	
October, 2014		

WG 24 Station Acceptance Subteam Update

Station Acceptance Checklists

Content: Consensus Criteria Internal to WG 24 + External References

HFS impact protection Example:

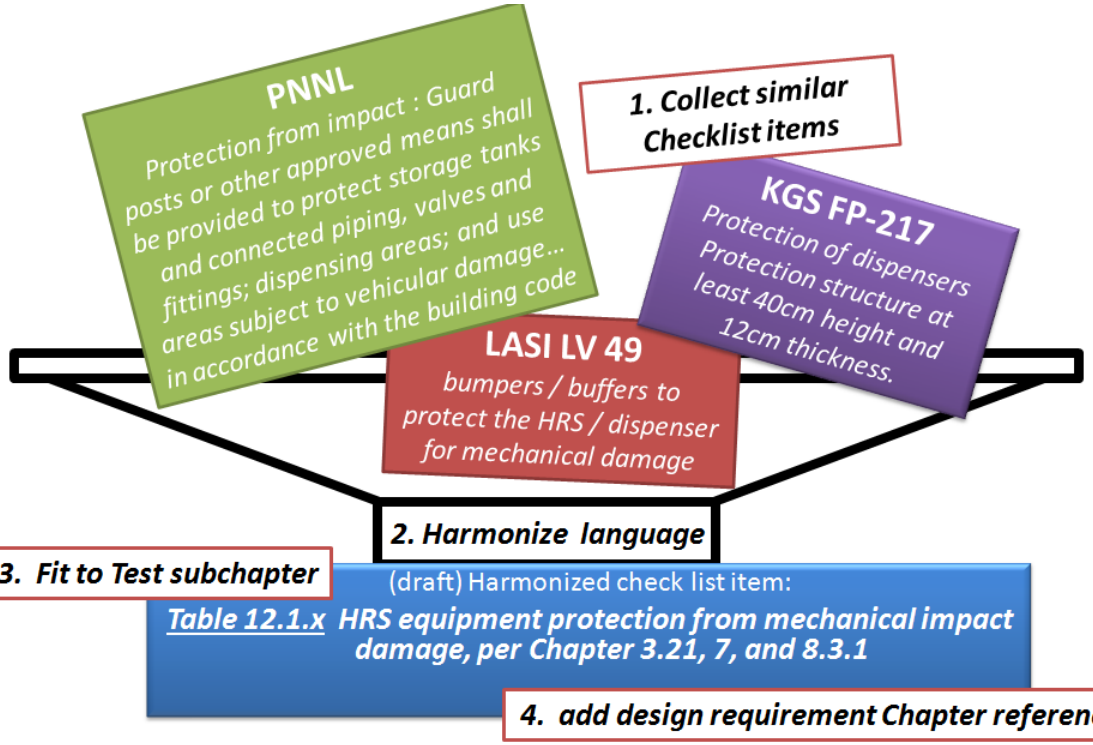

Table 12.1 Minimum HRS Acceptance Inspection Checklist

Name and address of the operator:				
Name and address of the constructor:				
Place and address of the designated operation site:				
Date:				
Inspection by:				
No.	**Content / Requirement**	**Reference to ISO 19880-1 (chapter)**	**Pass/Fail**	**Link to other standards / Remarks**
	Design Documentation			
	Permit for construction/installation			national / local requirements - e.g. BetrSichV in Germany
	Safety concept / description			
	- safety devices / safeguarding process (mechanical, PLC etc.)			set pressure of safety valves, wiring diagram, logic diagram etc. for PLC
	- explosion protection document / zones			
	- Protective measures to avoid building of a hazardous atmosphere			(e.g. ventilation system, gas sensor, etc.)
	- Separation distances			Per national code
	emergency plan			
	Hazard and risk analysis	4.2		PED, national / local requirements
	PID / PFD			
	Civil work – structural			
	Document of Conformity, certifications			ISO 19880-1, PED, EMC, ATEX, Machinery Applicable certifications (ASME B31, B&PVC, NFPA2§10.3)
	Design examination for pressure equipment	5.2		PED, ASME, etc.; CE-marking in Europe, DoC or manufacturer declaration
	- pressure vessel / storage			
	- piping / hose			
	- components			

Station Acceptance Testing Device Guidelines

- On-site "Field test" before normal operation of station

- periodic - e.g. every year for verification of safety relevant PLC

	HRS performence	Hydrogen Gas Quality	Particle Mesurement	Mass Transfer Measurement
Existing Standard	No, Guidelines	Yes (ASTM)	Yes (ASTM)	No, Guidelines
Goal to test or verify (parameter)	p, T in vehicle tank	To collect sample gas	Particle identification	Verification of mass transfer
Safety relevant for interface HRS-FCHV	**YES**	No	Yes	Yes
min. requirement = part of ch. 12	**YES**	**YES**	**YES**	**YES**

Station Acceptance: Risk Assessment

Lead: Lars Zimmermann (Germany) from Shell

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SCOPE OF RISK ASSESSMENT AND MITIGATION WG 24

Scope:

- Risk Assessment/Mitigation of the Hydrogen Fueling Process mainly the effect of the station on the vehicle storage system (including PRV)
- Vehicle Data including IrDA Communication
- Fueling of Vehicle Tank with respect to limits of pressure and temperature of dispenser and vehicle components
  - Evaluate during and "After the Fueling" affects
- Reliability of fueling limits
- Identifying Issues possible, quantifying risks, determine example mitigation measures

Not in Scope:

- Minor leaks
- Conventional Station Risks (Vehicle Drive Away, Hose Rupture, Dispenser Leaks, Hydrogen Quality)
- Vehicle Component Issues

Shell Deutschland Oil GmbH

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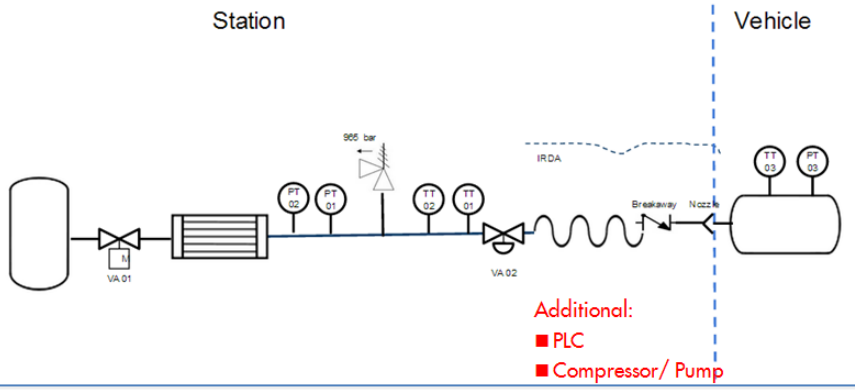
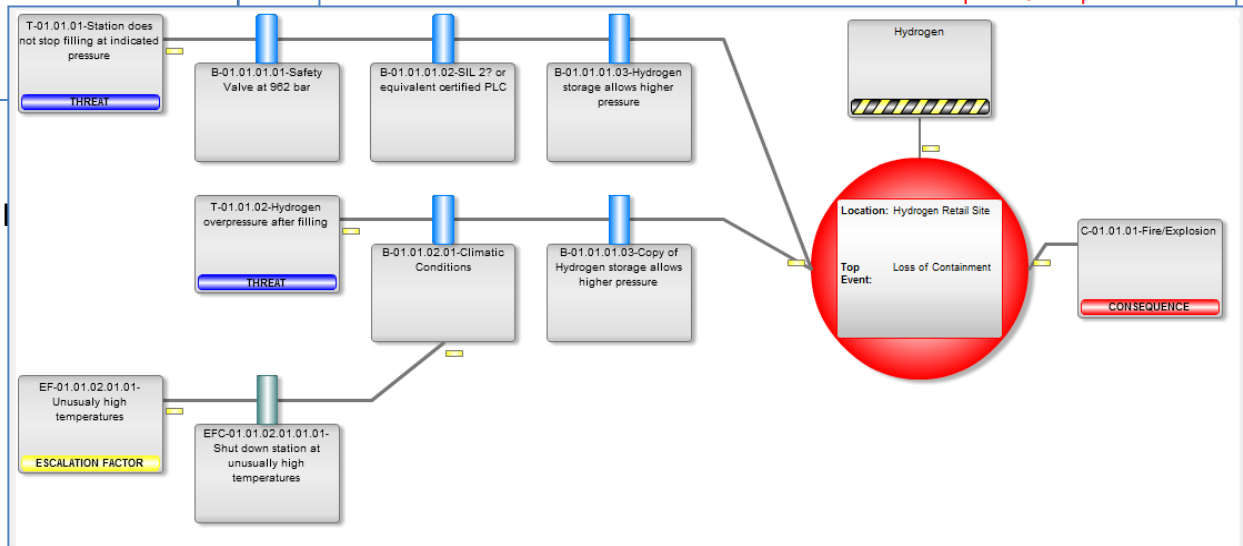
SUGGESTED SYSTEM BOUNDARIES





Next Steps:

-P-Member Survey on Participation and Information Needed

-Preparation Meeting: February

-Kickoff April 2015

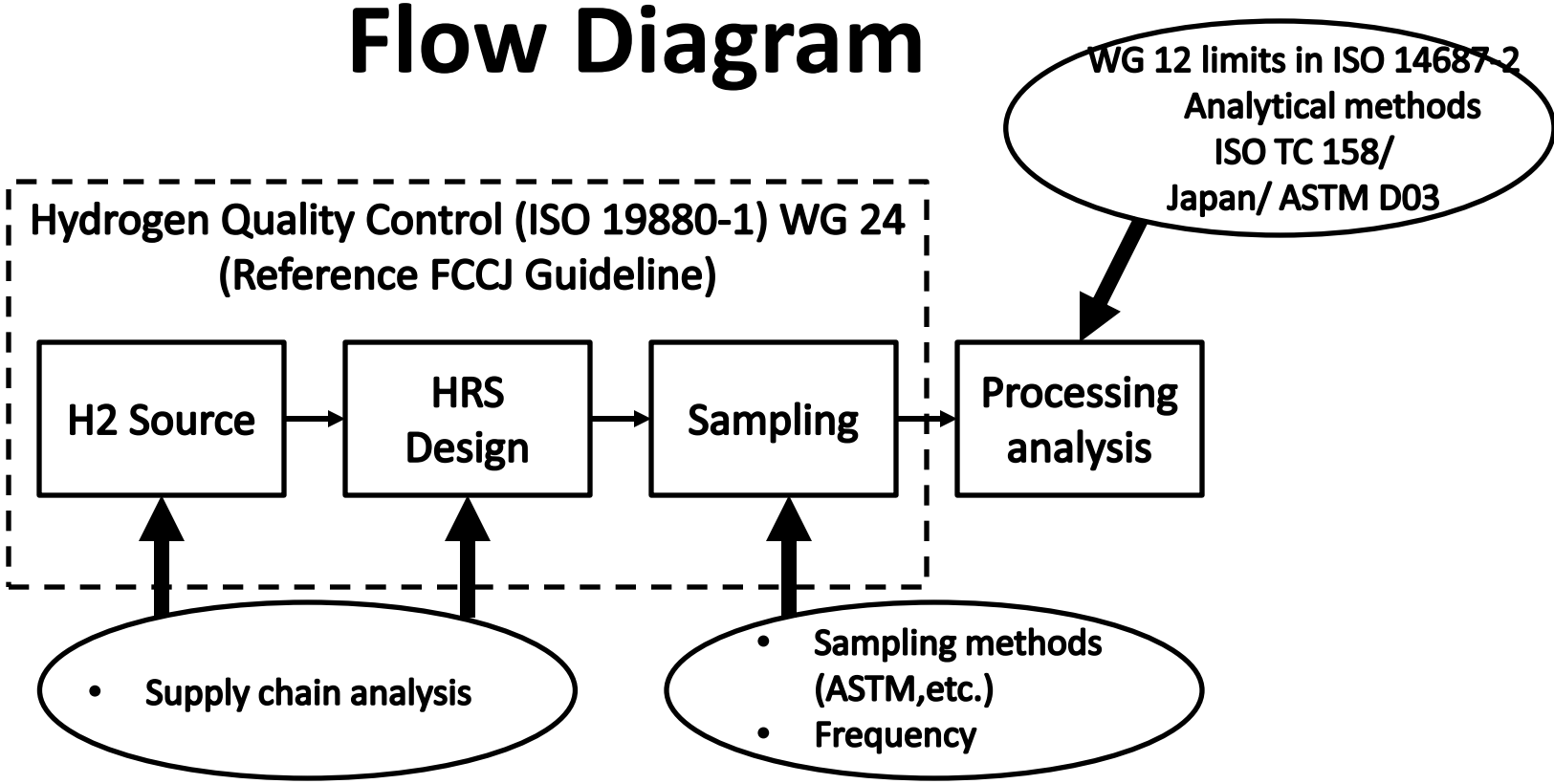
-Automotive Co-Lead (TBC)

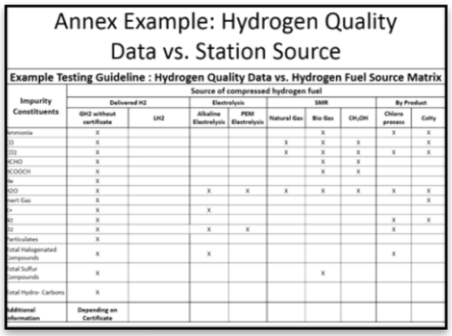
WG 24 Hydrogen Quality Subteam Update

ISO WG 24 Hydrogen Quality "Industry Agreement"

- Consensus on Content of chapters 7.3 & 7.4 (H2 quality & quality control)
- Splitting responsibilities between WG24 & WG 12
  - WG12: H2 Quality Specification and liaison with TC 158 (analytical methods)
  - WG24 : Quality control recommendations & requirements
    - Sources for H2 supply / HRS
- Review of requirements for H2 quality
  - Ranking impurities
  - Validated analytical methods
- FCCJ Guideline: Input to H2 quality control
  - Release in January 2015
- Time-lime for standard with regards to European Directive on alternative fuel infrastructure

ISO WG 24 Hydrogen Quality Flow Diagram

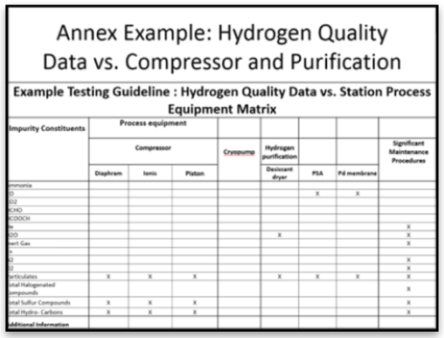




Annex Example: Hydrogen Quality Data vs. Station Source

Example Testing Guideline : Hydrogen Quality Data vs. Hydrogen Fuel Source Matrix

Impurity Constituents	Source of compressed hydrogen fuel									
	Delivered H2		Electrolysis		SMR				By Product	
	GH2 without certificate	LH2	Alkaline Electrolysis	PEM Electrolysis	Natural Gas	Bio Gas	CH_3OH	Chloro process	CoHy
Ammonia	X					X		X	X
CO	X				X	X	X		X
CO2	X				X	X	X	X	X
HCHO	X					X	X		
HCOOH	X					X	X		
He	X								
H2O	X		X	X	X	X	X	X	X
Inert Gas	X								X
N2	X		X						
O2	X							X	X
Particulates	X		X	X				X	
Total Halogenated compounds	X		X					X	
Total Sulfur compounds	X					X			
Total Hydro- Carbons	X								
Additional Information	Depending on Certificate								



Annex Example: Hydrogen Quality Data vs. Compressor and Purification

Example Testing Guideline : Hydrogen Quality Data vs. Station Process Equipment Matrix

Impurity Constituents	Process equipment							
	Compressor			Cryopump	Hydrogen purification			Significant Maintenance Procedures
	Diaphram	Ionic	Piston		Desiccant dryer	PSA	Pd membrane	
Ammonia								
CO						X	X	
CO2								
HCHO								
HCOOH								
He								X
H2O					X			X
Inert Gas								X
N2								X
O2								X
Particulates	X	X	X		X	X	X	X
Total Halogenated compounds								X
Total Sulfur Compounds	X	X	X					X
Total Hydro- Carbons	X	X	X					X
Additional Information								

Quality Control Methodology Per Source*

Site		Production method	Species to analyze		Frequency of analysis
Central production facility		Fossil fuel process	Prerequisite species	N_2, Ar, H_2O, O_2	
			Canary species	CO	Continuous
			Other species		
		Brine or water electrolysis	Canary species	O_2(water), Cl_2(brine), H_2O	
			Other species		
Fueling station	On-site station	Fossil fuel process	Prerequisite species	N_2, Ar, H_2O, O_2	
			Canary species	CO	Continuous
			Other species		
		Water electrolysis	Prerequisite species	N_2, Ar	
			Canary species	O_2, H_2O	Continuous
			Other species		
	Off-site station		Prerequisite species	N_2, Ar, H_2O, O_2	
			Contaminants from station		

NOTE 1 Fossil fuel process indicates steam reforming, catalytic reforming or COG. Hydrogen produced by these processes is premised on purification with PSA, membrane separation or cryogenic separation.

NOTE 2 Hydrogen produced by alkaline or water electrolysis is premised on purification with TSA, PSA or cryogenic separation.

NOTE 3 "Canary species" means species that indicate the existence of other species.

WG 24 Safety distance Subteam

P-Member Survey results – Example: Clearance distances

			Italy	Sweden	Germany	UK	US NFPA 2 GH2 (517 to 1000bar)	US	Japan	France > 100kg	France < 100kg	Canada CHIC 2007 GH2 > 35kg
CLEARANCE DISTANCES *The clearance distance is the minimum distance between the potentially hazardous installation /equipment and the vulnerable targets within the establishment. Here, the hydrogen installation is regarded to be the source, while the surrounding people /objects are considered to be the targets.*	Personnel of the HRS (1st party)	m										
	Users of the HRS (clients, 2nd party)	m	10									
	Public (Third party)	m					4.6	2 (2hr fire)				
	Other fuelling facilities within the establishment, like gasoline storage, delivery facilities.	m		25								
	Gasoline storage	m	10		3		4.6		6			3.1 to 15.2
	LPG storage	m	20		8		4.6					
	CNG hazardous elements	m	15				4.6					
	Bulk liquid oxygen storage	m			5							NFPA 51, chap 9
	Between H2 dispensing and others fuels (LPG,CNG,gasoline)	m	8				4.6					
	Buildings inside the plant	m		12								
	Building of combustible material	m		6			4.6	5				15.2
	Building openings /windows / access doors	m		12		5	10.7	6	8			
	Building non combustible material	m					1.6 (2hr fire-	1.8				1.5 (2hr fire)
	Air intakes / ventilation	m		12	Outside of	5	10.7	12	8			15.2
	Other	m										

Safety distances

- Achieved goals for TR level:
  - Definition & basic principles
    - Aims and Possible methodologies : deterministic / comparative / probabilistic (chapter 4.1 & 4.2)
    - Standardized methodology for a generic Quantitative risk assessment (chapter 4.3)
    - List of potential mitigation measures (chapter 4.4 to 4.8)
  - Comments
    - Add a short introductory part
    - Define whether a part the detailed QRA description should be removed in annex A
    - General requirements for using relevant, open and validated models and tools
      - Data / Probabilistic models / engineering models

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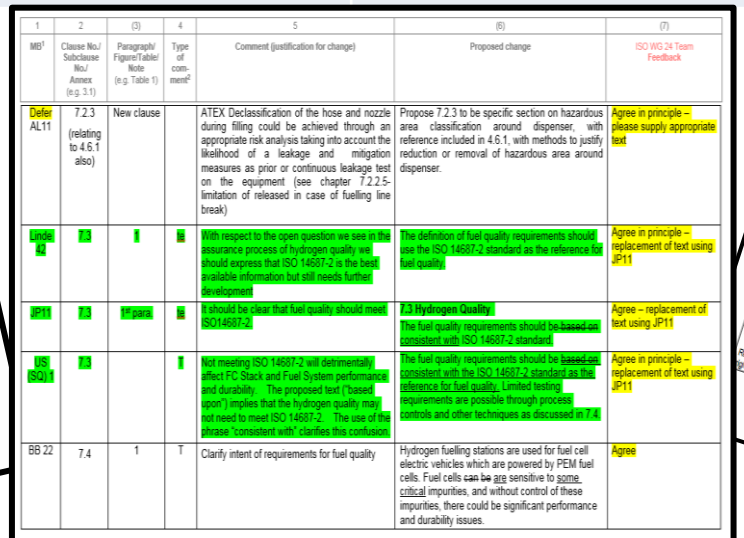
Development of ISO WDTR 19880-1

Where it all began….Paris 2013: Restructure of ISO/DIS 20100: Draft 2011

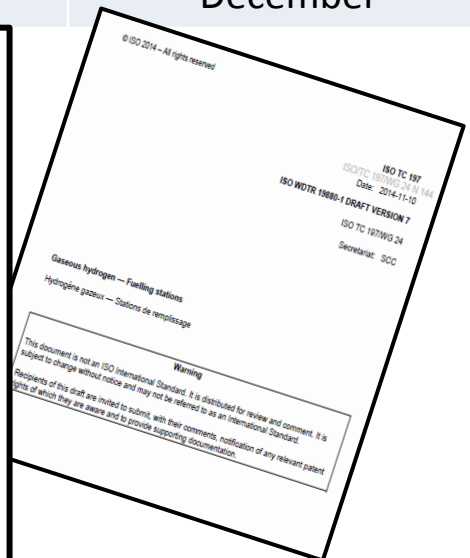
ISO/DIS 20100: Draft 2011	ISO/WDTR 19880-1 draft 4	ISO/WDTR 19880-1 draft 5	ISO/WDTR 19880-1 draft 7
198 comments received	22 comments received	550 comments received	320 comments received
Tokyo – Feb 2014 *California – April 2014*	*Washington – June 2014*	*Munich – October 2014*	*Fukuoka – December 2014*
65 comments addressed	22 comments addressed	460 comments addressed	140 (major) comments addressed / ongoing to end December
ISO WDTR 19880-1 prepared	ISO/WDTR 19880-1 draft 5 prepared	ISO/WDTR 19880-1 draft 7 prepared	Revised draft due end December


DRAFT INTERNATIONAL STANDARD ISO/DIS 20100

Gaseous hydrogen — Fuelling stations



MB[1]	Clause No./ Subclause No./ Annex (e.g. 3.1)	Paragraph/ Figure/Table/ Note (e.g. Table 1)	Type of com-ment[2]	Comment (justification for change)	Proposed change	ISO WG 24 Team Feedback
Defer AL11	7.2.3 (relating to 4.6.1 also)	New clause		ATEX Declassification of the hose and nozzle during filling could be achieved through an appropriate risk analysis taking into account the likelihood of a leakage and mitigation measures as prior or continuous leakage test on the equipment (see chapter 7.2.2.5-limitation of released in case of fuelling line break)	Propose 7.2.3 to be specific section on hazardous area classification around dispenser, with reference included in 4.6.1, with methods to justify reduction or removal of hazardous area around dispenser.	Agree in principle – please supply appropriate text
Linde 42	7.3	1	te	With respect to the open question we see in the assurance process of hydrogen quality we should express that ISO 14687-2 is the best available information but still needs further development	The definition of fuel quality requirements should use the ISO 14687-2 standard as the reference for fuel quality.	Agree in principle – replacement of text using JP11
JP11	7.3	1st para	te	It should be clear that fuel quality should meet ISO14687-2.	**7.3 Hydrogen Quality** The fuel quality requirements should ~~be based on~~ consistent with ISO 14687-2 standard.	Agree – replacement of text using JP11
US (SQ) 1	7.3		T	Not meeting ISO 14687-2 will detrimentally affect FC Stack and Fuel System performance and durability. The proposed text ("based upon") implies that the hydrogen quality may not need to meet ISO 14687-2. The use of the phrase "consistent with" clarifies this confusion.	The fuel quality requirements should be ~~based on~~ consistent with the ISO 14687-2 standard as the reference for fuel quality. Limited testing requirements are possible through process controls and other techniques as discussed in 7.4.	Agree in principle – replacement of text using JP11
BB 22	7.4	1	T	Clarify intent of requirements for fuel quality	Hydrogen fuelling stations are used for fuel cell electric vehicles which are powered by PEM fuel cells. Fuel cells ~~can be~~ are sensitive to some critical impurities, and without control of these impurities, there could be significant performance and durability issues.	Agree


ISO TC 197
ISO WDTR 19880-1 DRAFT VERSION 7
Date: 2014-11-10
ISO TC 197/WG 24
Secretariat: SCC

Gaseous hydrogen — Fuelling stations

Hydrogène gazeux — Stations de remplissage

Warning

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WG 24 Coordination with CEN

The European Commission has published its Alternative Fuels Infrastructure Directive (AFI) in 2014 and has named ISO Standards as reference:

- **ISO 14687-2 Hydrogen Quality**
- **ISO TS 20100- Hydrogen Stations and Fueling or latest revision**
  - **WG 24 needs to communicate replacement of ISO 20100 with ISO IS 19880-1 and meet CEN timing.**
  - **WG 24 needs to communicate gap in ISO standards and references of other standards**
- **ISO 17268- Hydrogen Connectors**

External Informative References

Where ISO/ IEC references do not exist, WG24 has chosen select external references *such as*:

SAE

- J2601 Fueling Protocols for Light Duty Gaseous Hydrogen Surface Vehicles
- SAE J2799 Hydrogen Surface Vehicle to Station Communications Hardware and Software

ASTM

- D7606-11 Sampling of High Pressure Hydrogen and Related Fuel Cell Feed Gases
- D7650-13 Standard Test Method for Sampling of Particulate Matter in High Pressure Hydrogen

Feedback Welcome!