What are the next steps - impurities risk analysis ?

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Workshop MetroHyVe / Hydraite

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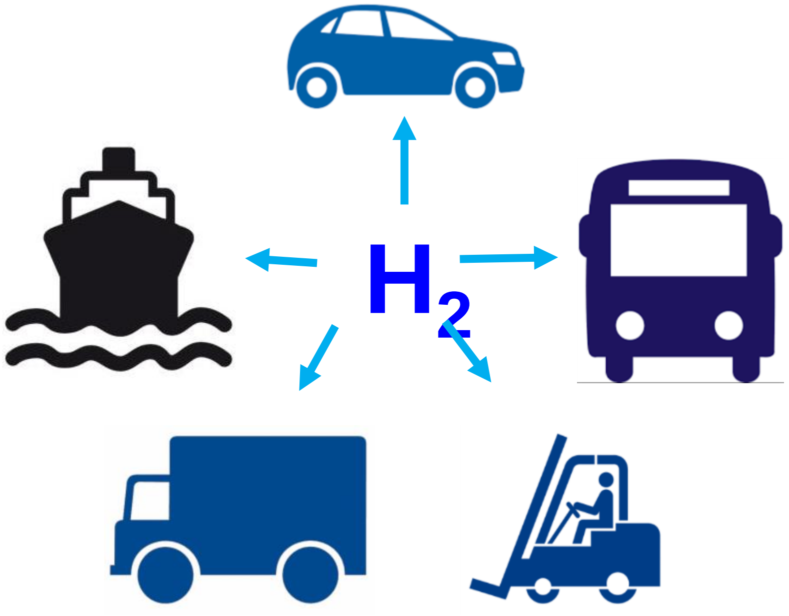
Impurity Risk Analysis and Quality Assurance

1. Standards and Regulation
2. ISO 19880-8 - Application by industry
3. Industrial needs and Metrology involvment

European Regulation and standards

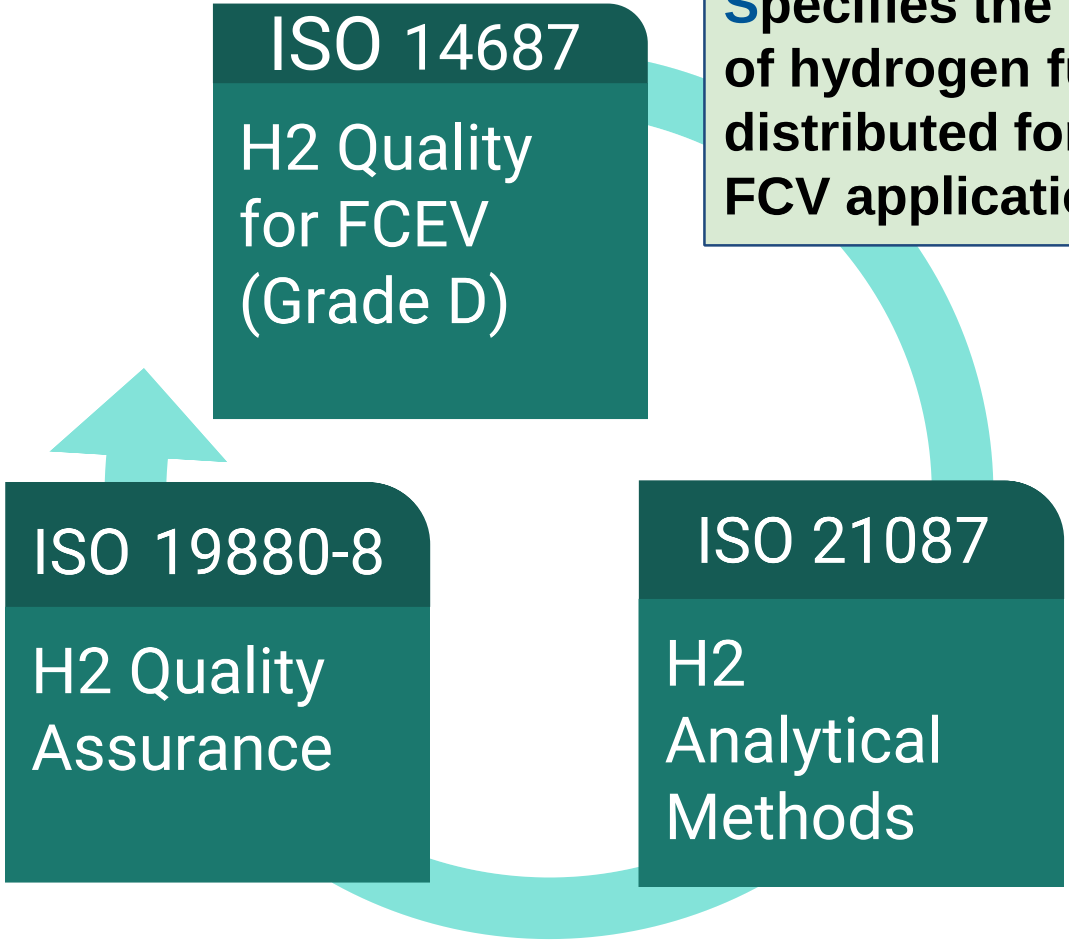
- Alternative Fuel Infrastructure European Directive (AFI) is applicable since January 2018
- Each European country has to translate this directive in national regulation
- H2 quality for fuel cell vehicles shall be in agreement with EN 17124

- **EN 17124: Hydrogen fuel — Product specification and quality assurance — Proton exchange membrane (PEM) fuel cell applications for road vehicles**
  published in November 2018 at CEN level
  Published in January 2019 (in France)



ISO Standards for quality

ISO 14687 H_2 Grade D:
Specifies the quality characteristics of hydrogen fuel produced and distributed for utilization in PEM FCV applications.



ISO 19880-8:
Specifies the methodologies to establish Quality Assurance plans for H_2

ISO 21087:
Specifies validation protocol of analytical methods for controlling H_2 quality

ISO 19880-8 - Quality Assurance

- **Objective:**
  - For each H_2 Refuelling Station: Evaluation of the risk to have impurities above the threshold values from production up to the HRS

- **3 key questions:**
  - What might go wrong: which event can cause the impurities to be above the threshold value?
  - What is the likelihood (probability of occurrence) that impurities can be above the threshold value?
  - What are the consequences (severity) for the fuel cell car?

  → Define an acceptability table

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ISO 19880-8 - Quality Assurance

Acceptability table

		Severity				
Occurrence as the combined probabilities of occurrence along the whole supply chain		0	1	2	3	4
	4					
	3					
	2					
	1					
	0					
	Unacceptable risk ; additional control or barriers are required		Further investigations are needed: existing barriers or control may not be enough		Acceptable risk area Existing controls acceptable	

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ISO 19880-8 – Application by industry

Customize the quality assurance according:

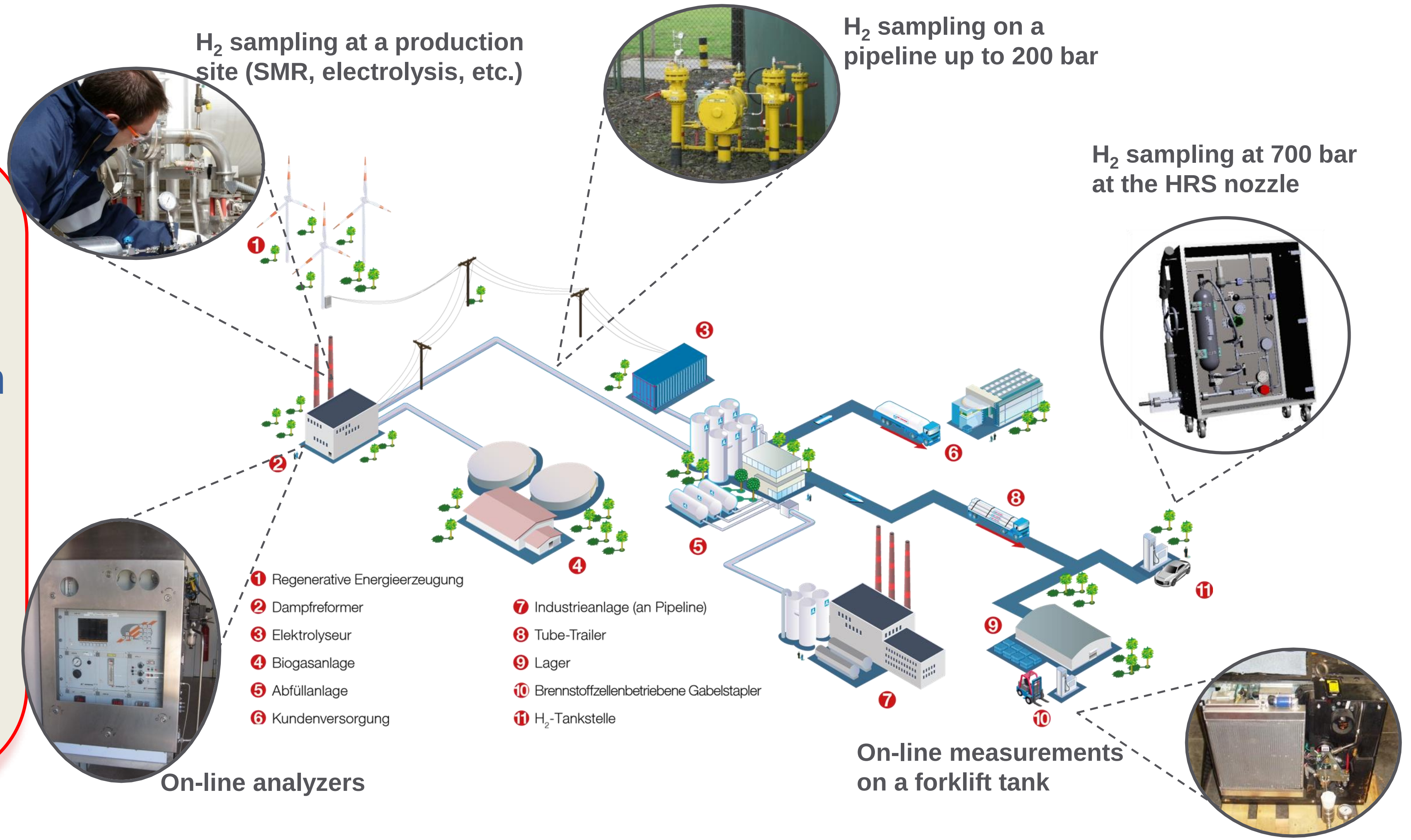
- **Evaluated risks**
- **Available controls on the supply chain**

To avoid:

- **Unnecessary costs**

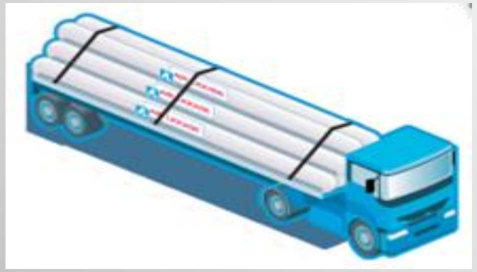
To maintain:

- **High level of guarantee**



Establish risk analysis from production to HRS

- **Production site**
  - SMR*
  - Electrolysis



- **Transport**
  - GH2
  - LH2

- **Point of use**
  - Automotive and
  - Stationnary applications

Impurity risk analysis done by experts

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Example: one HRS supplied by SMR

ISO spec 14687 (new)		Supply Chain			Compounded probability	Severity	Criticality
Contaminant	Threshold	Production SMR	Filling center and TT transport	HRS			
Inert gases : N2	300	1	2	3	3	1	
Inert Gas Ar		0	0	0	0	1	
Oxygen	5	0	0	1	1	0	
Carbon dioxide	2	0	0	0	0	1	
Carbon monoxide	0,2	3	0	0	3	2	
Methane (CH4)	100	0	0	0	0	1	
Water	5	0	0	3	3	4	
Total sulphured components	0,004	0	0	0	0	4	
Ammonia	0,1	0	0	0	0	4	
Total hydrocarbons	2	0	1	1	1	4	
Formaldehyde	0,2	0	0	0	0	2	
Formic acid	0,2	0	0	0	0	2	
Halogenated compounds	0,05	0	1	1	1	4	
Helium	300	0	0	0	0	1	

Critical impurities:

N2, CO, H2O,
Total Hydrocarbons,
Halogenated compounds

To reduce the risk additionnal barriers are necessary

Define the quality assurance plan

- According to the risk assessment:
  - *Define the critical impurities to follow*
  - *Define the frequency of analysis*
  - *Establish the sampling protocol (production, transport or HRS)*

Selection of laboratory for analysis

- Criteria for selection:
  - *Is it able to make the sampling ?*
  - *Is it able to transport samples according to transport regulation*
  - *Is it able to analyze all impurities ? In which delay ?*
  - *Validation of the methods according to ISO 21087*

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Industrial needs

- **Reduce cost for analysis:**
  - **On line sensors**
  - **Less impurities to control**
  - **Clarification of "total" in the specification**
  - **Reduce sampling device cost ….**
- **Analytical methods validation**
  - **Need reference gas mixtures**
  - **Need proficiency tests**
- **Collect all data from different production sources and HRS to define probability of occurrence for impurities**

- **Better knowledge of critical impurities for the fuel cell with acceptable threshold**
- **….**

THANK YOU

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Metrology involvement

- To be discussed ….

- Questions for Speakers ?