



COMPARATIVE STUDY OF REGULATIONS, CODES AND STANDARDS AND PRACTICES ON HYDROGEN FUELLING STATIONS

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*controlling risks |
for sustainable development*

Aim of this study was to answer the following questions:

- What are the **regulations** and **best practices** regarding the **design, setting up and operating of hydrogen fuelling stations**? In particular:
 - Which safety barriers are required or recommended for hydrogen fuelling stations to prevent or reduce the **effects of fires or explosions**?
 - What are the **safety distances** of the hydrogen fuelling stations from other installations?
- Are there different processes for obtaining a **license** to operate a hydrogen fuelling station? Which governmental organization or private agency is responsible for the enforcement of the regulations?

Existing hydrogen stations

2015 there have been 184 hydrogen in operation all over the world

- The brand new station opened in 2014:
 - 12 in Europe
 - 2 in North America
 - 3 in Asia
- 1/3 of these new stations get « green hydrogen »

Zone	Number of H2 stations in service
Europe	82
North America	63
Asia	38
South America	1

New planned stations : **129**



Zone	Number of planned H2 stations
Europe	53
North America	55
Asia	18
South America	19

Source: www.H2stations.org

Situation in France



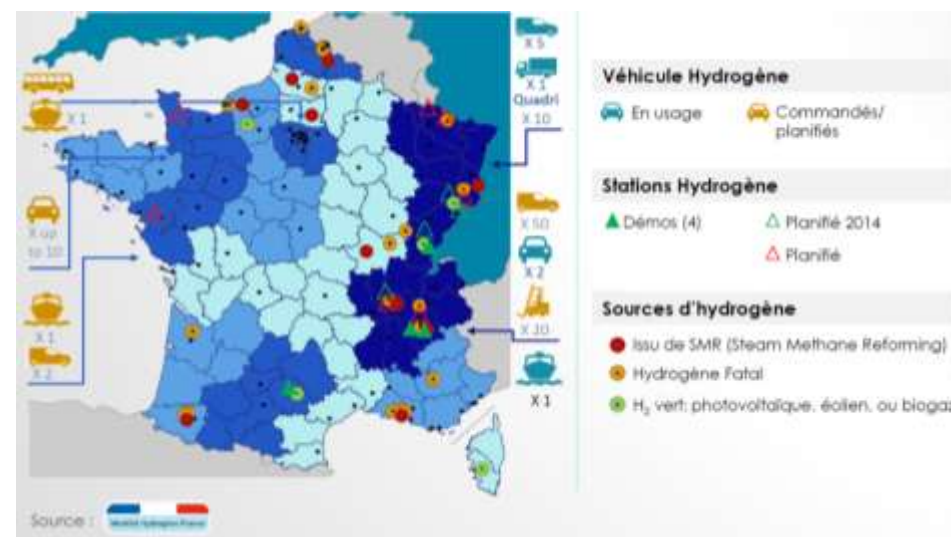
Until 2020 passing by a fleet clusters:

- 500-700 light vehicles
- Less than 100 small trucks
- 15 to 20 stations serving 350 & 700 bar at the borderlines
- 350 bar for the range extender fleets



Today there are the following stations:

Place	Service pressure [bar]
Saint-Lô	350
Grenoble	350
Dole	350
Albi	350
Luxeuil-les-Bains	350
Territoire de Belfort	350
Sassenage	350/700
Loges-en-Josas	350/700



The benchmark was targeted the on the following on countries

- the USA (California),
- the United Kingdom,
- Germany,
- Italy,
- Canada,
- Sweden,
- Norway,
- Denmark
- and Spain.



Asia was unfortunately not included...

Purpose of this study

In order to establish a regulatory framework for the distribution of hydrogen, the purpose of the study were to:

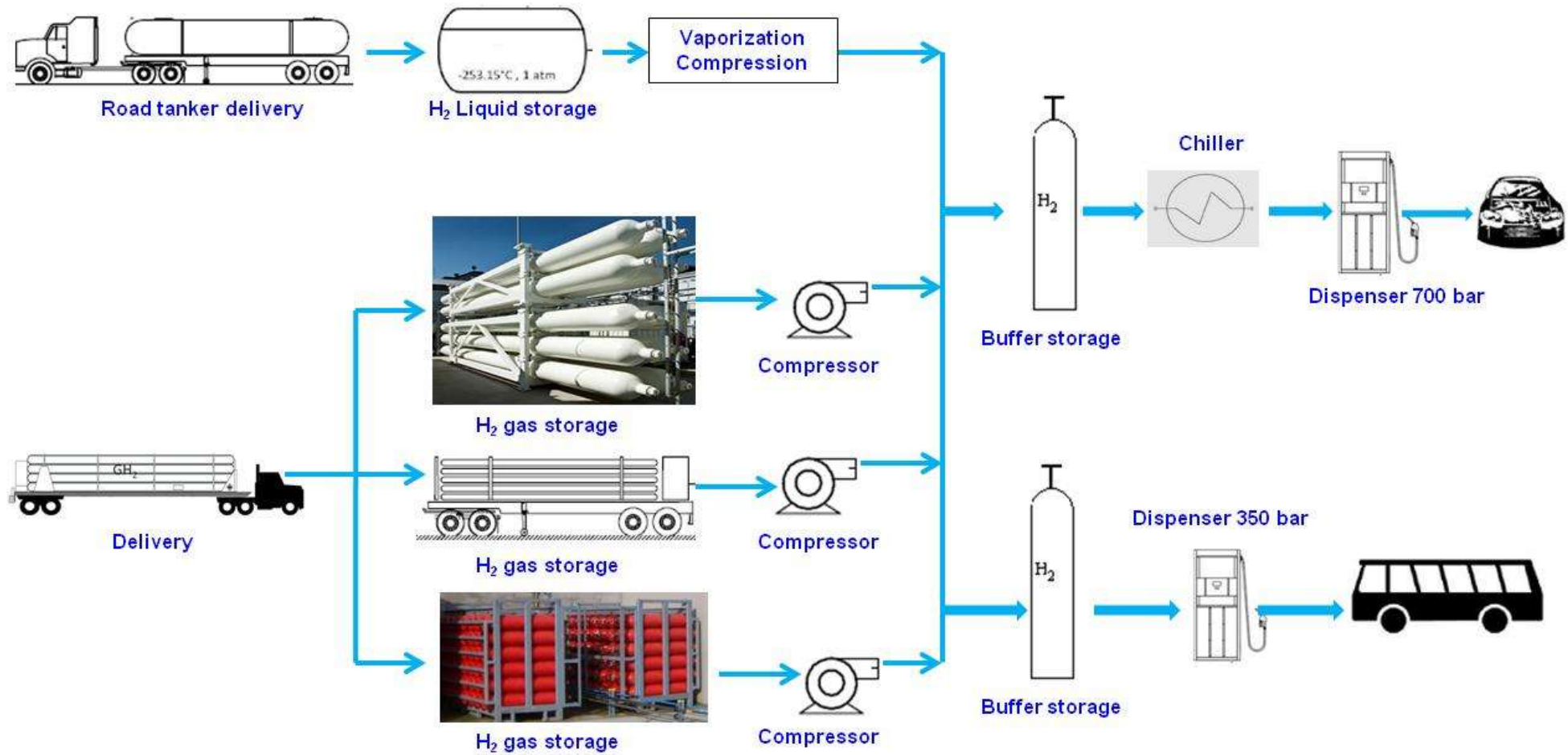
- enhance safety hydrogen knowledge on fuelling station technologies,
- identify the key legislations,
- and highlight main safety barriers.

The resulting report will be used by French competent authorities. It is also available to the public to inform stakeholders and increase public confidence.



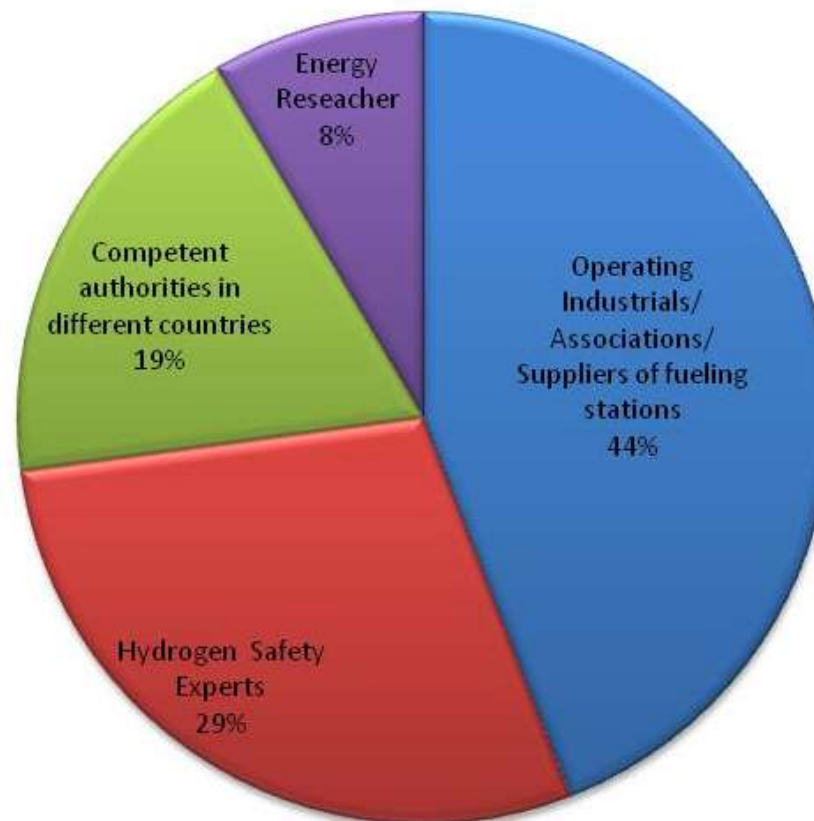
<http://www.ineris.fr/centredoc/dra-71-rapport-benchmark-station-service-hydrogene--diffusion-1-1427110132.pdf>

Scope of the study



In order to identify the key legislation, INERIS conducted in a first part a bibliographic search to identify **regulatory documents, standards** and **professional guides**.

To complete the information, a questionnaire was sent to around 60 contacts:



=> In total 12 answers have been received

Methodology

Priority questions

- 1 In your country, what are the **existing regulations** regarding hydrogen fuelling stations?
- 2 Are there **specific standards or best practices** used for hydrogen fuelling stations regarding technical aspects or the qualification of employees...?
- 3 Which government **department or private agency** is **responsible** for the **enforcement** of the regulations?
- 4 Are there any **known safety distances** for the localization of the hydrogen fuelling stations (distances to: other hazardous installations, hospitals/schools, neighbourhood...)?
- 5 Which **safety barriers** are required or recommended for hydrogen fuelling stations to prevent or reduce the effects of fires or explosions?
- 6 Does the legislation give **technical requirements** (e.g. use of cryogenic instead of compressed gases or inverse, underground storage, type of compressors, maximum design pressure, material requirements e.g. 316 stainless steel etc...)?

Supplementary questions

- 1 In your country, are there **regulations in progress** regarding hydrogen fuelling stations?
- 2 Which **regulation is required for the hydrogen fuelling** stations? Labour regulation? Environment Code? Town planning code?
- 3 Are there different **processes for obtaining a license** to implement hydrogen fuelling stations (e.g. just notification, authorization, demonstration that risk is acceptable...)? Does it depend on quantity stored or mass flow of hydrogen?
- 4 Are there **specific regulations or requirements** regarding hydrogen fuelling stations **without service personnel**?
- 5 Are there **different regulations** or requirements regarding hydrogen fuelling stations for **buses** and **cars**?
- 6 In your country do you **record accidents** regarding hydrogen fuelling stations? If yes, do you identify the root causes? Which measures have been taken following accidents? Are these incidents/accidents documented into any database and if possible could you forward us these information if they are public?

Main conclusions of the survey

The following main conclusions were drawn from the analysis of the questionnaires:

- **No national regulation** (except Italy) specific to hydrogen fuelling stations exist. In Italy, a decree published in 2004; specifies the requirements for fire prevention of such facilities.
- Some countries have no **specific regulation** but **technical guidelines**. This is the case of **Canada** and **Germany** with the Canadian Hydrogen Installation Code (CHIC) or the German Requirement for Hydrogen fuelling stations;
- Such as technical specifications like **ISO/TS 20100** or international standards like **ISO 17268** are considered as references and applied in almost all considered countries;
- Further **SAE standards** focused on the distribution devices and the interface with the vehicle are widely accepted standards that feed the ISO Standards;

Main conclusions of the survey

- The **authorities in charge** of controlling or permitting the hydrogen fuelling stations are **very diverse**, they are sometimes **state authorities** or a **private agencies**;
- Several of reference documents recommend **safety distances** such as **EIGA**, **CHIC**, **Italian decree** - the most cited are the technical specification **ISO/TS 20100** and/or **NFPA 55** standards;
- **Safety barriers** to prevent fire, explosion and overpressure or protect against their effects are mainly inspired from **best practices in industrial activities** where handling **hydrogen is usual**;
- **Specific safety barriers** were developed for: the distribution activity and the associated equipment (hydrogen dispenser, nozzle, interface with the car...);
- Future fuelling stations in Europe should comply with the **2014/94/EC directive requirements**;

- 1/ The directive recommend an **appropriate number** of hydrogen refuelling points, to ensure the circulation of hydrogen-powered vehicles until the 31/12/2025.
- 2/ The directive refers to the following ISO standards and technical specifications while **waiting** for the publication of **ad hoc EN standards**:
 - **ISO/TS 20100** for the conformity of fuelling points and dispensing equipments;
 - **ISO 14687-2** for quality characteristics of hydrogen fuel;
 - **ISO 17268** for the conformity of vehicle refuelling connection devices.

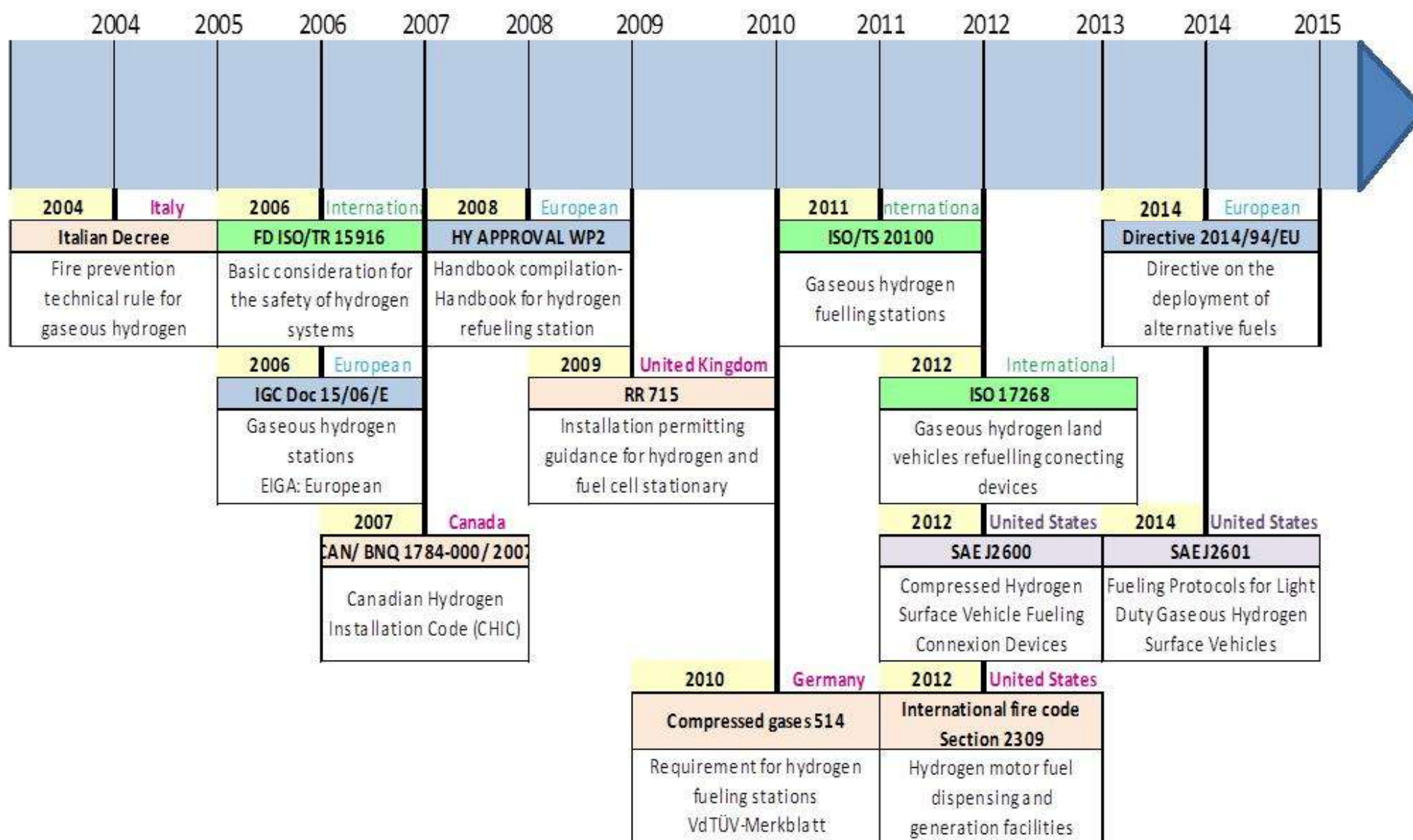
The European Community mandated the **CEN TC 268** to prepare EN standards supporting this directive

Regulatory and Legal Context

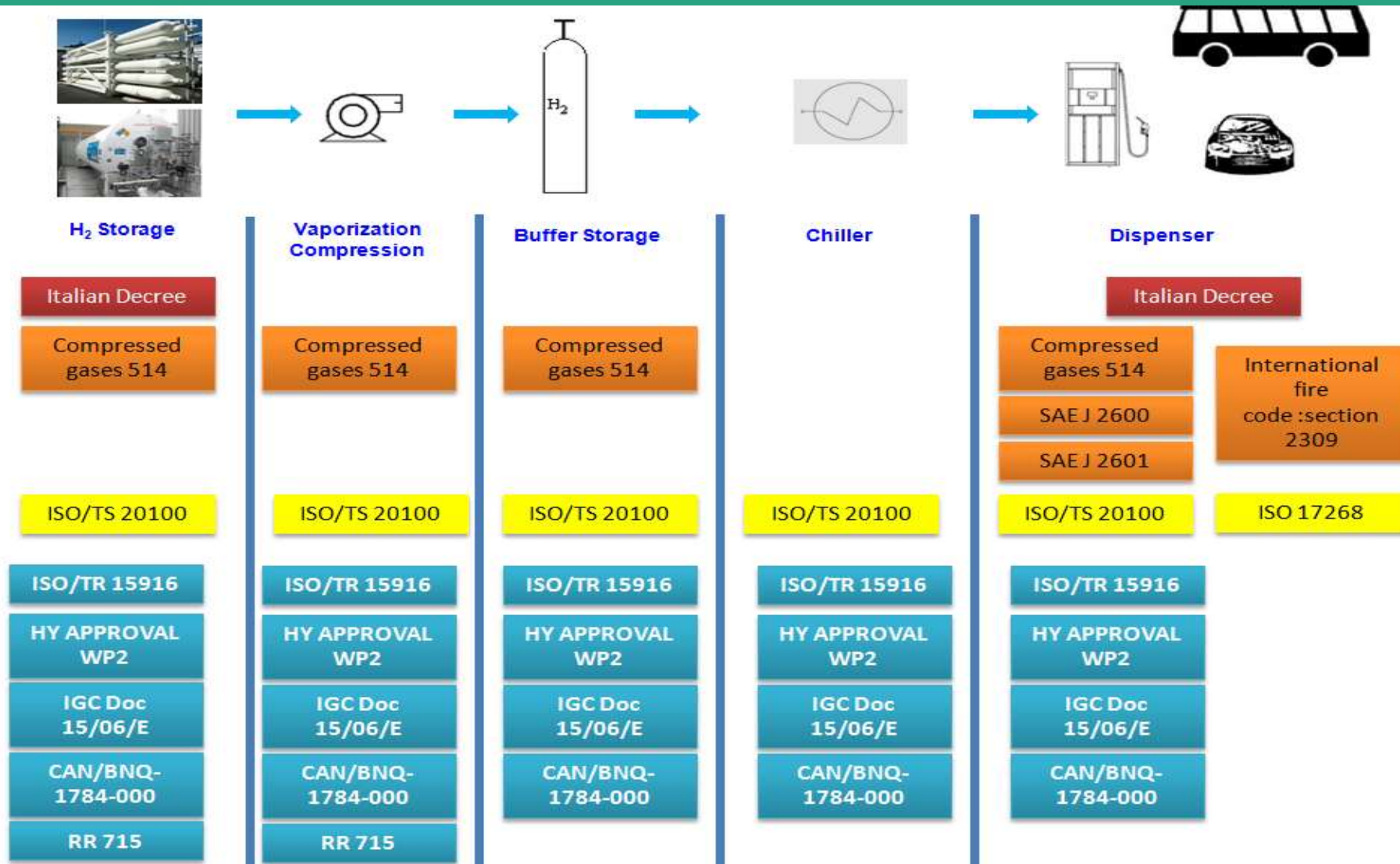
- The directive foresees to include the technical specifications of ISO/TS 20100 on the refuelling aspect - in 2011 this version remained as a draft proposal as no consensus was obtained to pass it as international standard - mainly due to a **disagreement** on the **proposed safety distances**.
- Due to the aforementioned disagreements, a new text, ISO 19880, is currently **under progress in the TC197**:

Standard	Name of the Standard
ISO/AWI 19880-1	Gaseous Hydrogen Fuel – Fuelling Stations - Part 1: General Requirements
ISO/AWI 19880-2	Gaseous Hydrogen Fuel - Fuelling stations - Part 2: Distribution
ISO/AWI 19880-3	Gaseous Hydrogen Fuel - Fuelling stations - Part 3: Valves
ISO/AWI 19880-4	Gaseous Hydrogen Fuel - Fuelling stations - Part 4: Compressors
ISO/AWI 19880-5	Gaseous Hydrogen Fuel - Fuelling stations - Part 5: Piping
ISO/AWI 19880-6	Gaseous Hydrogen Fuel - Fuelling stations -Part 6: Fittings

Chronological Presentation of the Regulatory and Normative Context



Synthesis of applicable texts



	Obligatory (regulations)
	Obligatory but not regulatory (imposed by insurers, a sector of activity...)
	Obligatory in the future years (texts included in the European directive)
	Guides or standards whose application is optional or informative

- Regarding the studied countries there are few mandatory regulatory texts specific to hydrogen fuelling stations.
- The only text that imposes a regulation is an **Italian decree** written in 2004.
- It was an innovative text when it was published and has become difficult to apply with the current evolution of fuelling stations, particularly because it limits distribution pressure to 350 bar, whereas the standard for light vehicles is now **700 bar**.

Conclusion

- Of the studied countries only Italy has adopted a **national specific regulation** on hydrogen fuelling stations. The other countries widely rely on existing international standards.
- The ISO **standardization framework** progress rapidly pushed by the adoption of the 2014/94/CE directive on the deployment of alternative fuels infrastructure.
- Several **reference documents** dealing with safety of unloading, storage, compression and cooling have been identified. Most of them are **directly inspired from industrial best practices**.
- Finally, **safety distances** are still the object needs a harmonized approach.
- A English version of the whole study will be published between 2015/2016 on the INERIS website.

Thank you for your attention!

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