



**RÉPUBLIQUE
FRANÇAISE**

*Liberté
Égalité
Fraternité*



*controlling risks
for sustainable development*

HYDROGEN ENERGY: AN OVERVIEW OF THE STATE OF STANDARDIZATION AND REGULATION ON SAFETY IN FRANCE

**BENNO WEINBERGER
R&D MANGER**

Ineris - Public Expert in Industrial and Environmental Risk Management

- **EPIC under the sole supervision of the ministry in charge of the environment.**
Created in 1990 from the Cerchar (Center for studies and research of French coal mines) and the Ircha (Institute of Applied Chemistry Research).
- **Contribute to the prevention of risks that economic activities pose to health, safety of people and property, and the environment.**
- **About 550 people** (including about 35 doctoral students).
- **Locations:**
 - Headquarters in Verneuil-en-Halatte (Oise), 40 ha including 30000 m² of laboratories;
 - Teams based in Nancy, Aix-en-Provence, Bourges and Lyon.



Global regulatory framework

Environmental Code:

Classified Installations
Transport Pipelines

European Directives: Seveso Directive
IED Directive

Labor code : worker
protection
ATEX

ADR -
TPED
TMD Order

(External site)

H₂

Transport pipeline

Electrolysis system

Storage system

Distribution system

Distribution Terminal

Flexible and vehicle interface

Components and systems for stationary applications

Vehicles and
Components

"New Approach" Directives

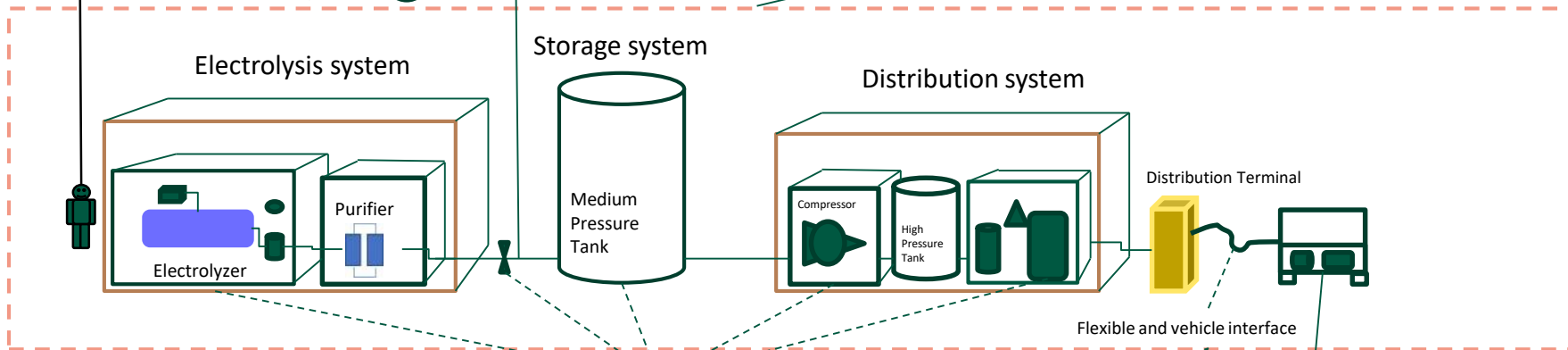
Specific Standards
(ex: SAE J 2601)

UN Regulation
R134

Harmonized Standards
(ex: EN 17127, EN ISO 17268, EN 17124)



Rules applicable to market
placement



Typology of Hydrogen Systems

Stationary Applications

Electrolysis

Compression

Storage

Fuel Cell

Distribution

Mobile Applications for Internal Use

Forklifts

Other Construction Equipment

Specific Standards

ISO 22734

NF EN 1012-3

NF EN 17533

EN IEC 62282

ISO 19880

Road Mobile Applications

ISO Standards... ISO 12619

New Mobile Applications

Trains

Maritime Navigation

Inland Navigation Air Navigation

Transport of Hydrogen as "Dangerous Goods"

Regulatory Framework

New Approach Directives (Decision 768/2008/EC on a common framework)

PE Directive

2014/68/EU



Harmonized Standards

EN 13445, EN 764-7, EN 13480

Machinery Directive

2006/42/EC

ATEX Directive

2014/34/EU



EMC Directive

2014/30/EU

Low Voltage Directive

2014/35/EU

EN ISO 12100, EN ISO 13849

EN IEC 60079, EN ISO 80079, EN 1127-1

EN 61000

EN 61349

Regulation (EU) 2023/1804
deployment of alternative
fuels infrastructure

EN 17127, EN ISO
17268, EN 17124

Notified Bodies

Yes — if category > I

No

Yes — if category 1 or 2

No

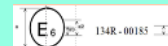
No

No

Regulations and Standards Applicable to Road Vehicles (Category M and N)

Regulation (EU) 2019/2144

UNECE Regulation R134 + Implementing Regulation (EU) 2021/535



A New Framework Under Development

Regulations for the Transport of Dangerous Goods (ADR, RID, ADN) and TPED (2010/35/EU)



EN 12245 (composite tanks), ISO 16111 (hydrides),...

Focus on ATEX regulation

Two directives transposed into French law:

- 1999/92/EC related to the **protection of workers** transposed into the labor code (R 4216-31 and R4227-42 to R4227-54)
- 2014/34/EU related to the **placing on the market of equipment** intended to be used in ATEX transposed into the environmental code (Chapter VII of Title V of Book V - Article L557-xx and R557-xx)

Approach:

- Apply the **principles of integrated safety**:
 - Prevent the formation of explosive atmospheres or,
 - Avoid the ignition of explosive atmospheres and,
 - Reduce the harmful effects of an explosion
- **Assess the risks**
- Establish a **zone classification** where an ATEX is likely to form
- Implement **ATEX certified equipment** in accordance with Directive 2014/34/EU
- **Train the workers**
- Write a **EPD**: collection of risk assessments, zone classifications, risk control procedures, maintenance, competence management

ATEX hydrogen zones:

Zone 0: an ATEX is present permanently or frequently

Zone 1: an ATEX is present occasionally during normal operation

Zone 2: an ATEX is not normally present but only in case of malfunction



A reference standard for ATEX zone classification:

NF EN IEC 60079-10-1

(NF EN IEC 60079-10-2)

Trainings

Regulation of Classified Installations

Three categories of the nomenclature

4715 Hydrogen (storage) – Under Review

1. Greater than or equal to 1 t (A-2)

2. Greater than or equal to 100 kg but less than 1 t (D)

Order of 12/02/1998 (installations subject to declaration) - Under Review

Order of 26/11/2015 (hydrogen gas carts in classified installations)

Other potentially relevant sections:

1414 Installation for filling or distributing liquefied flammable gases, (for the distribution of liquid hydrogen)

2930 Workshops for the repair and maintenance of motor vehicles and engines,

2910 Combustion, excluding facilities covered by sections 2770, 2771, 2971 or 2931

3140 Gasification or liquefaction of coal or other fuels

3420 Industrial quantity manufacturing by chemical or biological transformation of inorganic chemicals,

a) Gases, such as [...] hydrogen (A-3)

Interpretative note of the section to consult in pdf on the AIDA site of Ineris

Section resulting from the IED directive.
 New IED 2 version in effect since 04/08/2024 - with authorization threshold at **50 t/d for electrolysis** Not yet transposed

1416 Storage or use of hydrogen

Gas stations: facilities, open or not to the public, where gaseous hydrogen is transferred into vehicle tanks, the daily quantity of hydrogen distributed being equal to or greater than 2 kg/day. (DC)

Order of 22/10/2018 (installations subject to declaration) - Under Review

New multi-fuel section under creation

DRAFT N° 4715 Nomenclature of classified installations

Hydrogen (CAS No. 133-74-0)	A: authorisation, E: registration, D: declaration, C: subject to the periodic inspection	Radius
The quantity likely to be present in the onshore facility is:		
1. For service stations, for the supply of gaseous hydrogen trucks, for the filling of tanks on semi-trailers, for the supply of a fuel cell and for compressor stations associated with hydrogen transport pipelines:		
a. Greater than or equal to 5 t	A	2
b. Greater than or equal to 1 t but less than 5 t	E	-
c. Greater than or equal to 100 kg but less than 1 t	D	-
2. For other facilities, including, where applicable, the activities set out above:		
a. Greater than or equal to 1 t	A	2
b. Greater than or equal to 100 kg but less than 1 t	D	-

An installation is considered to be land-based if it is located on land, in an inland waterway or within the administrative boundaries of a seaport.

Process for elaboration of the regulation ICPE

The regulation must guarantee that the risk will be maintained below acceptable limits independently of the local context

The regulation is elaborated by the ministry in charge of the environment with technical support by Ineris

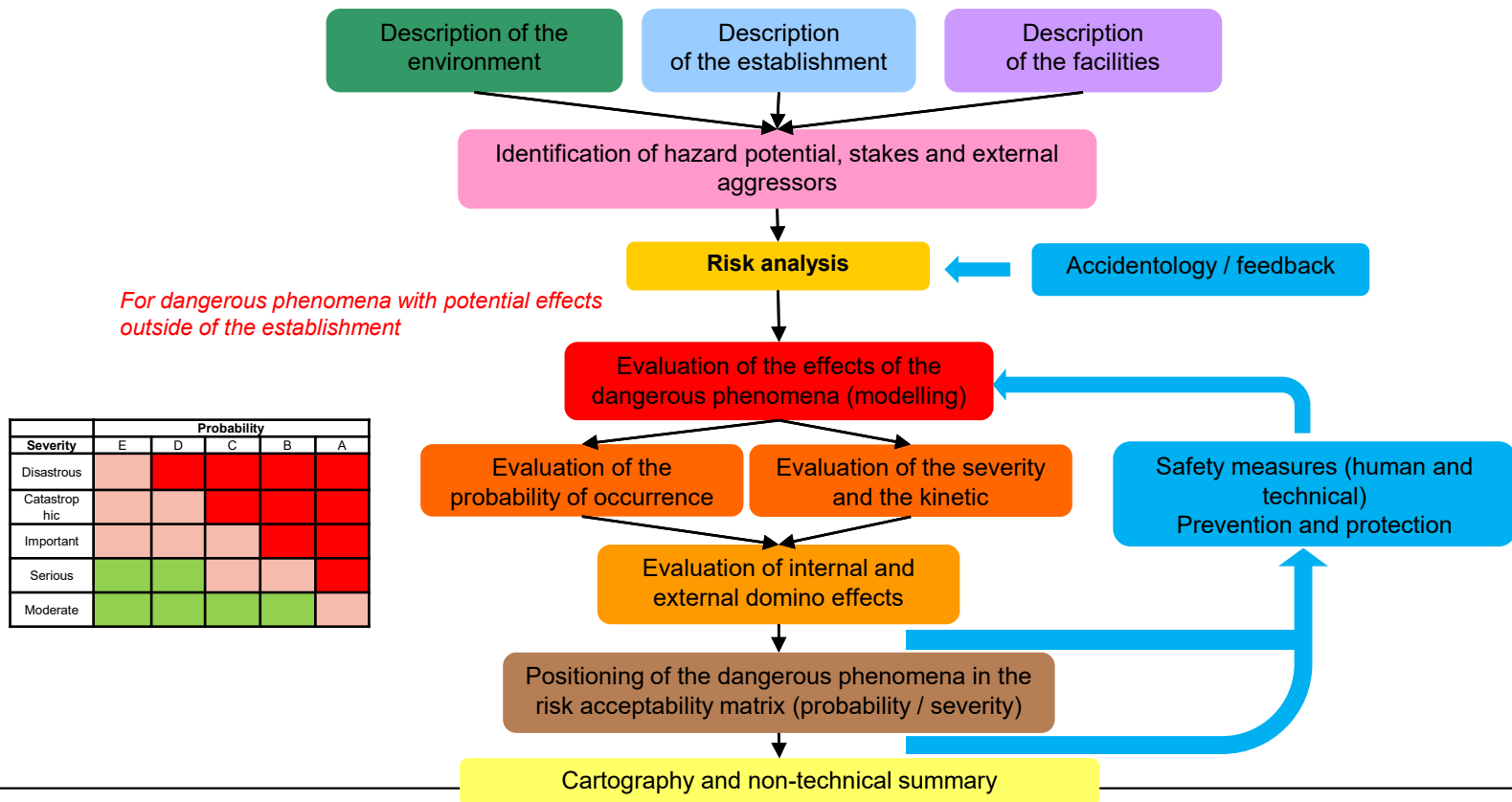
Based on a generic safety study => definition of safety measures to avoid unacceptable risk

Discussed with industry to ensure the relevance of requirements (not to negotiate the acceptable risk level) and to ensure the standardisation requirements

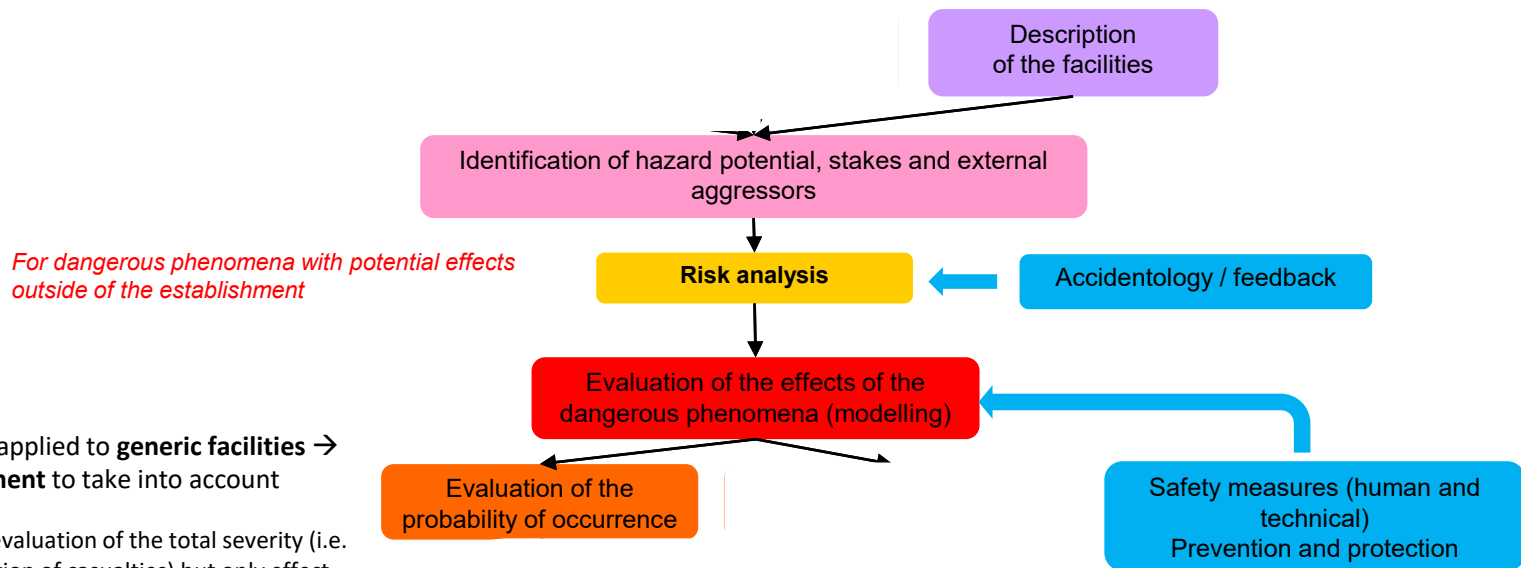
Ineris can be involved in the safety studies either directly or as a third-party reviewer

The regulation is currently being updated to take into account evolution of refuelling technologies

Methodology of a French safety report for Seveso establishment



Methodology applied for a new order



The study is applied to **generic facilities** →
No environment to take into account

→ No evaluation of the total severity (i.e. evaluation of casualties) but only effect distances of hazardous phenomena

→ Risk acceptability can't be evaluated

Examples of evolutions

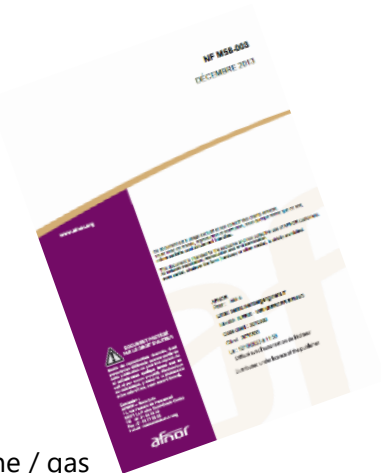
New requests from the industry, evolutions of the technology or of safety knowledge are currently being studied and a new regulation is in preparation

- Higher flowrate up to 300 g/s => bigger safety distances (as they are based on hose break hypothesis)
- Evolution of refuelling protocols (300 g/s covered by the new SAE J2601-5)
 - Issues with the verification (certification) of the proper application of a valid refuelling protocol
- Mobile refuelling stations
- Slow fuelling without human supervision (e.g. for busses)
- Generalized use of tube trailers as storage units
 - Need for safe safety barriers (automatic shut-off valves) on trailer's side in relation with the potential rupture of the flexible hose
 - Issues with the protection of tube trailers equipped with Type III or Type IV tanks against fire scenarios (some are not equipped with TPRD, not required in ADR)
 - If tanks are not protected against burst, burst is taken as the reference scenario for safety distances
- Issues with the ventilation requirements of containers : what release scenario to consider for the design of ventilation (normal and emergency)
- Multifuel service stations
-Liquid hydrogen refuelling stations

<https://multhyfuel.eu>



Revision of the french standard NF M58-003 2013 Installation of hydrogen related systems



The revision will be based on different priority axes:

Updated normative references pointing to the ISO standards ecosystem.

Updated the list of exclusions to be reviewed: by-products / vehicle / aircraft / micro cells / internal combustion engine / gas turbine.

Taking into account new uses: liquid H₂.

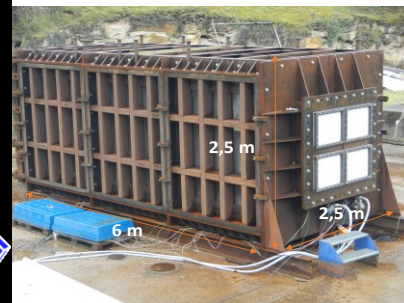
Change and addition of chapters: Risk management / Safety framework strategy / European H₂ safety panel guide / Safety barriers / Detection / Risk overview / Liquid hydrogen.

Simplification of the annexes and refers to the ATEX approach.

Focus on the classification of premises and the associated ventilation rules relating to the use of hydrogen in confined environments.

Focus on the categorization of leaks: continuous leak / predictable leak / possible leak

Testing methods to meet challenges and support the industry and public authorities



Large scale

Re...



Defaut
montage

 Fatigue

 Mauvais
usage

Usure

 Corrosion

 Desserrage



Thanks for your attention
