

DECREE of 7 July 2023

Technical rules for fire prevention for the identification of the methods for risk analysis and fire safety measures to be adopted for the design, construction and operation of plants for the production of hydrogen by electrolysis and related storage systems

THE MINISTER FOR THE INTERIOR

Having regard to Law No 186 of 1 March 1968 on provisions concerning the production of electrical and electronic materials, equipment, machinery, installations and plants;

Having regard to Legislative Decree No 139 of 8 March 2006 on the reorganisation of the provisions relating to the functions and tasks of the National Fire Corps, pursuant to Article 11 of Law No 229 of 29 July 2003, as amended, and in particular Article 15 thereof, which provides that the technical fire prevention standards shall be adopted by decree of the Minister for the Interior, in coordination with the Ministers concerned, after consulting the Central Scientific Technical Committee for Fire Prevention;

Having regard to Legislative Decree No 81 of 9 April 2008 on the implementation of Article 1 of Law No 123 of 3 August 2007 on workplace health and safety, as amended;

Having regard to European Parliament and Council Regulation (EC) 764/2008 of 9 July 2008 laying down procedures relating to the application of certain national technical rules to products lawfully marketed in another Member State and repealing Decision No 3052/95/EC;

Having regard to Directive (EU) 2015/1535 of the European Parliament and of the Council of 9 September 2015 laying down a procedure for the provision of information in the field of technical regulations and of rules on information society services;

Having regard to Legislative Decree No 26 of 15 February 2016 implementing Directive 2014/68/EU of the European Parliament and of the Council of 15 May 2014 on the harmonisation of the laws of the Member States relating to providing pressure equipment on the market;

Having regard to Legislative Decree No 85 of 19 May 2016 implementing Directive 2014/34/EU on the harmonisation of the laws of the Member States relating to equipment and protective systems intended for use in potentially explosive atmospheres;

Having regard to Regulation (EU) 2019/515 of the European Parliament and of the Council of 19 March 2019 on the mutual recognition of goods lawfully marketed in another Member State and repealing Regulation (EC) No 764/2008;

Having regard to Regulation (EU) 2020/852 of the European Parliament and of the Council of 18 June 2020 on the establishment of a framework to facilitate sustainable investment, and amending Regulation (EU) 2019/2088, setting out environmental objectives and the ‘*Do no significant harm*’ (DNSH) principle, and in particular Articles 9 and 17 thereof;

Having regard to Council Regulation (EU) 2020/2094 of 14 December 2020 establishing a European Union Recovery Instrument to support the economy's recovery after the COVID-19 crisis;

Having regard to Regulation (EU) 2021/241 of the European Parliament and of the Council of 12 February 2021 establishing the Recovery and Resilience Facility;

Having regard to Decree-Law No 77 of 31 May 2021, converted, with amendments, by Law No 108 of 29 July 2021 concerning ‘Governance of the National Recovery and Resilience Plan and

first measures for strengthening administrative structures and speeding up and streamlining procedures', and in particular Article 8 thereof, pursuant to which each central administration in charge of actions provided for in the NRRP shall coordinate the related management activities and the monitoring, reporting and control thereof;

Having regard to Commission Delegated Regulation (EU) 2021/2139 of 4 June 2021 supplementing Regulation (EU) 2020/852 of the European Parliament and of the Council by establishing the technical screening criteria for determining the conditions under which an economic activity qualifies as contributing substantially to climate change mitigation or climate change adaptation and for determining whether that economic activity causes no significant harm to any of the other environmental objectives;

Having regard to Decree-Law No 80 of 9 June 2021, converted with amendments by Law No 113 of 6 August 2021 on measures to strengthen the administrative capacity of public administrations functional to the implementation of the National Recovery and Resilience Plan (NRRP) and for the efficiency of justice;

Having regard to Legislative Decree No 199 of 8 November 2021 implementing Directive (EU) 2018/2001 of the European Parliament and of the Council of 11 December 2018 on the promotion of the use of energy from renewable sources;

Having regard to the ECOFIN Council Decision of 13 July 2021 on the approval of the assessment of the recovery and resilience plan (NRRP) for Italy and communicated to Italy by the General Secretariat of the Council with letter LT161/21 of 14 July 2021;

Having regard to Presidential Decree No 151 of 1 August 2011 regulating the simplification of guidelines for fire prevention procedures, pursuant to Article 49, paragraph 4c of Decree-Law No 78 of 31 May 2010, converted, with amendments, by Law No 122 of 30 July 2010, as amended;

Having regard to the Prime Minister's Decree of 9 July 2021 on the identification of central administrations in charge of actions provided for in the NRRP, pursuant to Article 8(1) of Decree-Law No 77 of 31 May 2021;

Having regard to the Decree of the Minister for the Interior of 30 November 1983 on terms, general definitions and graphic symbols for fire prevention, as amended, published in the Official Gazette of the Italian Republic No 339 of 12 December 1983;

Having regard to the Decree of the Minister for the Interior of 9 May 2007 on guidelines implementing the engineering approach to fire safety, published in the Official Gazette of the Italian Republic No 117 of 22 May 2007;

Having regard to the Decree of the Minister for the Interior of 7 August 2012 on provisions relating to procedures for the submission methods for requests relating to fire prevention procedures and the documentation to be annexed, pursuant to Article 2(7) of Presidential Decree No 151 of 1 August 2011, published in the Official Gazette of the Italian Republic No 201 of 29 August 2012;

Having regard to the Decree of the Minister for the Interior of 3 August 2015 on the approval of technical fire prevention standards, in accordance with Article 15 of Legislative Decree No 139 of 8 March 2006, published in the Official Gazette of the Italian Republic No 192 of 20 August 2015, as amended;

Having regard to the Decree of the Minister for Economic Affairs and Finance of 6 August 2021 and subsequent amendments on the allocation of the financial resources foreseen for the implementation of the measures of the National Recovery and Resilience Plan (NRRP) and allocation of the milestones and targets for six-month reporting deadlines published in the Official Gazette of the Italian Republic No 229 of 24-09-2021;

Having regard to the Decree of the Minister for the Interior of 1 September 2021 on general criteria for the control and maintenance of fire safety plants, equipment and other systems, pursuant to Article 46(3)(a)(3) of Legislative Decree No 81 of 9 April 2008, published in the Official Gazette of the Italian Republic No 230 of 25 September 2021, as amended;

Having regard to the Decree of the Minister for the Interior of 2 September 2021 on criteria for the management of workplaces in operation and in an emergency and characteristics of the specific fire prevention and protection service, pursuant to Article 46(3)(a)(4) and (b) of Legislative Decree No 81 of 9 April 2008, published in the Official Gazette of the Italian Republic No 237 of 4 October 2021;

Having regard to the Decree of the Minister for the Interior of 3 September 2021 on general criteria for the design, construction and operation of fire safety for workplaces, pursuant to Article 46(3)(a)(1) and (2) of Legislative Decree No 81 of 9 April 2008, published in the Official Gazette of the Italian Republic No 259 of 29 October 2021;

Having regard to Commission Notice 2021/C 58/01 on ‘Technical guidance on the application of the ‘do no significant harm’ principle under the Recovery and Resilience Facility Regulation’;

Considering that the transversal principles set forth in the National Recovery and Resilience Plan include the principle of contributing to the climate and digital objective (so-called ‘tagging’), the principle of gender equality, and the obligation to protect and empower young people, and that Mission 2 - Component 2 - Reform 3.1 of the same plan provides for ‘Administrative simplification and reduction of regulatory barriers to hydrogen deployment’;

In view of the obligations to ensure the achievement of milestones and targets and the financial objectives set out in the NRRP, as set out below, and in particular the M2C2-20 milestone due in Q1 2023, which provides for the entry into force of the necessary legislative measures, specifying that ‘The necessary legislative actions shall set out (i) security provisions in relation to the production, transport and storage of hydrogen, (ii) simplified procedures for building small facilities for the production of green hydrogen and (iii) measures in relation to the conditions to build re-charging stations based on hydrogen’;

Having considered appropriate to lay down homogeneous fire prevention requirements in the country for the design, construction and operation of hydrogen production plants using electrolyzers, including in order to facilitate the safe dissemination and use of alternative fuels, in line with the strategic objectives set out in the National Recovery and Resilience Plan;

Having consulted the Central Technical and Scientific Committee on Fire Prevention pursuant to Article 21 of Legislative Decree No 139 of 8 March 2006;

Having completed the notification procedure under Directive (EU) 2015/1535;

Hereby decrees

Article 1

Purpose and scope

1. The provisions of this Decree apply to the design, construction and operation, for fire prevention purposes, of hydrogen production plants using electrolysis and related storage systems for hydrogen gas.
2. Following a risk assessment, the provisions contained in this Decree may also be applied to production and storage activities for hydrogen other than those defined in paragraph 1.

Article 2

Objectives

1. For the purpose of fire prevention and for the purpose of ensuring safety requirements for the protection of persons and the protection of property against fire risks, the plants referred to in Article 1 shall be constructed and operated in such a way as to ensure the following objectives:
 - a) minimising the causes of accidental gas release, fire and explosion,
 - b) limiting, in the event of an accident, injury to persons;
 - c) limiting damage to buildings and premises adjoining the plant in the event of an accident,
 - d) ensuring that fire-fighter/rescue squads are able to work under safe conditions.

Article 3

Technical provisions

1. In order to achieve the objectives referred to in Article 2, the technical regulations referred to in Annex 1, which form an integral part of this decree, are approved.

Article 4

Application of technical provisions

1. The provisions of Annex 1 shall apply to hydrogen production plants using electrolysis (so-called electrolyzers) and related storage systems for hydrogen gas:
 - a) for new facilities;
 - b) existing on the date of entry into force of this Decree, in the case of changes relating to fire safety involving changes in the pre-existing fire safety conditions, limited to the parties concerned by the intervention.
2. No adjustments shall be required for activities that, on the date of entry into force of this Decree:
 - a) are in possession of authorisations including concerning the fulfilment of fire safety requirements, issued by the competent authorities, as provided for in Article 38 of Decree-Law No 69 of 21 June 2013, converted, with amendments, by Law No 98 of 9 August 2013;
 - b) comply with the requirements set out in Articles 3, 4 and 7 of Presidential Decree No 151 of 1 August 2011.

Article 5

Construction requirements

1. The pressure equipment and assemblies constituting the plant shall be specifically designed, constructed and equipped for installation in accordance with EU and national provisions in force. All pressurised systems shall be protected from overpressure.
2. Plants and related equipment shall be designed in such a way as to minimise the possibility of accidental releases of hydrogen.
3. The assemblies and equipment constituting the plant shall be properly installed according to the instructions given in the installation, use and maintenance booklet, provided by the manufacturer, or according to best practices or as defined by the designer.
4. In order to pursue the objectives set out in Article 2, the installer is required to verify that the plant is suitable for the type of use as well as for the type of installation envisaged and that the user has been informed of the specific obligations and prohibitions aimed at ensuring the safe operation of the plant and related storage.

Article 6
Use of fire-fighting products

1. Fire-fighting products used within the scope of this Decree are:
 - a) uniquely identified under the responsibility of the manufacturer, according to the applicable procedures;
 - b) qualified in relation to the performance requirements and intended use;
 - c) accepted by the person responsible for the operation, or by the person responsible for performing works by acquiring and verifying the identification and qualification documentation.
2. The use of fire-fighting products is allowed if they are used in accordance with the intended use, if they meet the performance required by this standard and if:
 - a) they comply with the applicable EU provisions;
 - b) where they do not fall within the scope of EU provisions, they comply with the specific applicable national provisions, which have already been submitted and approved in accordance with the information procedure referred to in Directive (EU) 2015/1535;
 - c) where not covered by points (a) and (b), they are lawfully marketed in another Member State of the European Union or in Turkey, or originate from an EFTA State that is a signatory to the EEA Agreement and are lawfully marketed there for use under the same conditions that guarantee a level of protection, for fire safety purposes, equivalent to that provided for in the standard annexed.
3. The equivalence of the level of protection guaranteed by fire-fighting products referred to in paragraph 2 shall be assessed, where necessary, by the Ministry of the Interior, by applying the procedures laid down in Regulation (EC) No 764/2008 of the European Parliament and of the Council and, as from 19 April 2020, those laid down in Regulation (EU) 2019/515 of 19 March 2019 on the mutual recognition of goods lawfully marketed in another Member State.

Article 7
Final provisions

1. This Decree shall take effect 30 days after its publication in the Official Gazette of the Italian Republic.

Rome, 7 July 2023

The Minister: Piantedosi

Annex 1
(Article 3(1))

TECHNICAL RULES FOR FIRE PREVENTION FOR THE IDENTIFICATION OF THE METHODS FOR RISK ANALYSIS AND FIRE SAFETY MEASURES TO BE ADOPTED FOR THE DESIGN, CONSTRUCTION AND OPERATION OF PLANTS FOR THE PRODUCTION OF HYDROGEN BY ELECTROLYSIS AND RELATED STORAGE SYSTEMS

Title I – General provisions

- 1. Terms, definitions, and dimensional tolerances.**

- 1.1 For terms, definitions and dimensional tolerances, please refer to the provisions of the Decree of the Minister for the Interior of 30 November 1983.
- 1.2. For the purposes of these technical rules, the following definitions apply:
 - 1.2.1 Relevant area of the hydrogen production plant:
the relevant area on which the constituent elements of the production plant are located.
 - 1.2.2 Cylinder wagon stop area:
an area used for the temporary parking of cylinder wagons when they are not connected to the plant, bounded by special horizontal signage, corresponding to the projection in plan of the maximum size of the cylinder wagon. -
 - 1.2.3 Loading bay:
hydrogen transfer system using gas delivery devices.
 - 1.2.4 Balance of stack:
auxiliary systems and components of the electrolysis stack (gas/liquid separators, cooling systems, recirculation pumps, water polishing, etc.).
 - 1.2.5 Box:
an area bounded by perimeter walls made of reinforced concrete, or other non-combustible material of adequate mechanical strength, with constructive characteristics of the artefacts such as to ensure only along the perimeter the mitigation of the effects due to release and fire scenarios and materials that are projected following a potential outbreak. The box can have one or two of the four sides completely open, provided that these openings are not directed towards areas where the presence of persons not belonging to the plant and/or vulnerable parts of the plant and its appurtenances is foreseen or allowed. The height of the boundary shall be at least 1 m higher than the highest point of the hazardous elements contained therein. The flooring and the roof, which if present must be light, are made of non-combustible materials. Suitable measures shall be adopted internally to prevent the formation and permanence of explosive atmospheres.
 - 1.2.6 Cylinder wagon (or battery-vehicle or battery-wagon):
a vehicle or wagon comprising elements connected with each other by a manifold and permanently attached to a transport unit; components of a battery-vehicle or a battery-wagon include: cylinders, tubes, bundles of cylinders and pressure drums as well as gas transport tanks with a capacity exceeding 450 litres.
 - 1.2.7 Electrolytic cell:
electrochemical cell that enables the conversion of electrical energy into chemical energy; in this case, electrolysis of water is carried out to obtain hydrogen and oxygen.
 - 1.2.8 Gas dispensing device:
a device mounted at the end of a semi-rigid pipe fitting that is connected to the load device placed on the cylinder wagon or other means of transport and capable of making the connection safely and in an airtight manner.
 - 1.2.9 Electrolyser:
a hydrogen and oxygen production system consisting of an electrolysis module, a transformer and a rectifier (hydrogen production plant using electrolysis).
 - 1.2.10 Manager or Person responsible for the activity:
any natural or legal person who owns or operates an establishment or plant, or to whom the decisive economic or decision-making power for the technical operation of the establish-

ment or plant has been delegated; the manager is the person responsible for the activity referred to in Annex I to Presidential Decree 151/2011.

1.2.11 Pressure reduction and stabilisation assembly:

a set of devices for reducing and stabilising the pressure of hydrogen and, where appropriate, oxygen intended for the user plant.

1.2.12 Hydrogen gas:

hydrogen that has been produced in gaseous form with a purity degree characterised by a minimum molar fraction of 98 %.

1.2.13 Hydrogen production plant using electrolysis:

a system consisting of one or more electrolyzers and any associated infrastructure such as: compressors, storage, purification, loading bays, pressure reduction and stabilisation.

1.2.14 Premises intended for ancillary services:

premises, inside the site, used for complementary activities such as, for example, offices, technical control room, toilets, warehouses, workshops without the use of open flames, etc.

1.2.15 Electrolysis module:

a system composed of one or more electrolysis stacks, a balance of stack and any hydrogen purification system; the module may also include water treatment (demineralised water production system).

1.2.16 Bundle of cylinders:

a set of interconnected cylinders placed in a horizontal or vertical position, supported by a steelwork structure and equipped with a single discharge manifold that collects the individual outlets from the cylinders; the definition of a bundle of cylinders may include MEGC “multi-element gas containers”, i.e. transport units comprising elements connected to each other by a manifold and mounted in a frame; components of a MEGC include: cylinders, tubes, pressure drums and bundles of cylinders, as well as gas tanks with a capacity exceeding 450 litres.

1.2.17 Staff in charge:

adequately informed and trained staff also authorised to intervene in the management of the plant, locally or remotely via a remote control room.

1.2.18 Rectifier:

electrical equipment whose function is to convert alternating current into direct current, which is needed for the electrolysis process.

1.2.19 Buffer tank:

a pressurised hydrogen tank whose function is to manage any load variations between the electrolyser and the compression system.

1.2.20 Compression system:

a system consisting of one or more compressors in series or parallel to compress the gas from the inlet pressure up to the pressure at which it is used, loaded into cylinder wagons, stored or otherwise used.

1.2.21 Hydrogen purification system:

a system that involves the removal of production residues contained in hydrogen, which in the case of the production of hydrogen from electrolysis consist mainly of water and oxygen.

1.2.22 Site:

the area in which the activity takes place.

- 1.2.23 Electrolysis stack:
a set of interconnected electrolytic cells forming a single physical element separated from any other sets of cells.
- 1.2.24 Storage of compressed hydrogen:
on-site storage of compressed hydrogen, via fixed tanks, which can also be implemented by means of bundles of cylinders.
- 1.2.25 Transformer:
a transformer receiving AC input, whose function is to provide the rectifier with the correct supply voltage.
- 1.2.26 Remotely controlled shut-off valve:
a valve kept open in operation that can also be operated from a predetermined point removed from the valve installation point; the components of the implementation system shall be designed in such a way as to determine the automatic closure of the valve in case of malfunction or breakage of one of the valves.
- 1.2.27 Safety valve:
automatically operated pressure relief valve whose purpose is to prevent a plant or part thereof, containing gas or vapours, from being subjected to a higher pressure than the design pressure.
- 1.2.28 Exhaust valve for emergency systems:
a valve kept closed in operation that can also be operated from a predetermined point removed from the valve installation point; the components of the implementation system shall be designed in such a way as to determine the automatic opening of the valve in case of malfunction or breakage of one of the valves.
- 1.2.29 Electrolyser efficiency:
the ratio of the electrical energy absorbed by the electrolyser [kWh] to the volume of hydrogen produced by the electrolyser itself [Nm³].

2. Classification of plants.

In view of the multiple applications of hydrogen production plants, these can be classified according to the operating pressures of hydrogen as shown below:

- $P \leq 0.5$ barg
- $0.5 \text{ barg} < P \leq 50$ barg
- $50 \text{ barg} < P \leq 100$ barg
- $100 \text{ barg} < P \leq 300$ barg
- $300 \text{ barg} < P \leq 500$ barg
- $500 \text{ barg} < P \leq 700$ barg
- $700 \text{ barg} < P \leq 1000$ barg

The first two hydrogen pressure levels ($P \leq 0.5$ barg; $0.5 \text{ barg} < P \leq 50$ barg) are typical of electrolyzers.

For operating pressures greater than 1000 barg or if storage systems other than those indicated in this decree are adopted, the designer, following a fire risk assessment, will have to implement specific fire safety measures also determined through the methods envisaged with an engineering approach to fire safety that are referred to in the Decree of the Minister of Interior of 9 May 2007.

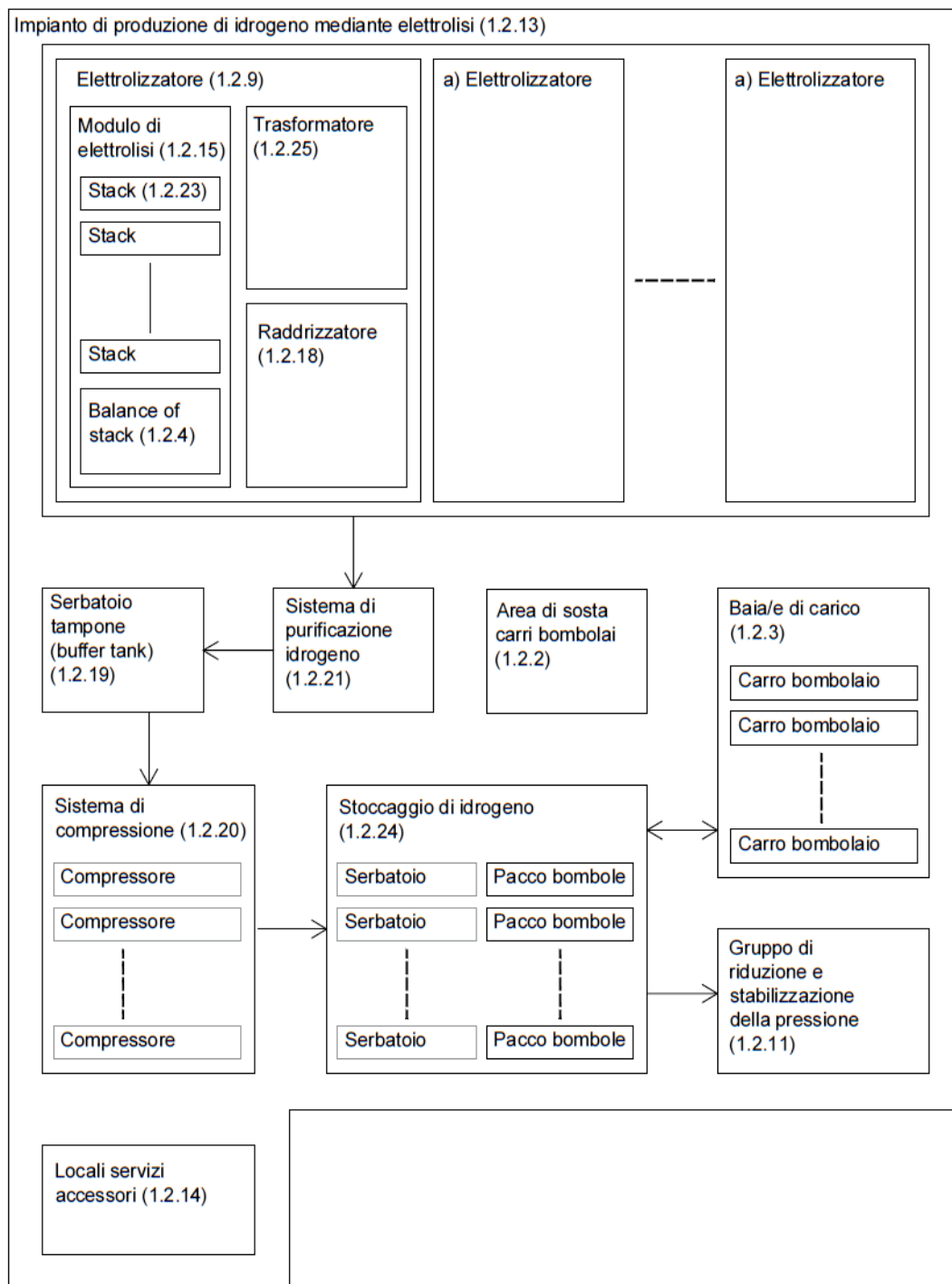
3. Plant components.

The various components constituting the production and storage facility shall have the characteristics, safety devices and equipment referred to in Title II below.

Hydrogen production and storage facilities are typically made up of the following elements:

- a) electrolyser;
- b) buffer tank;
- c) compression system;
- d) hydrogen storage;
- e) pressure reduction and stabilisation assembly;
- f) loading station (loading bays);
- g) connecting pipes (connecting elements between elements (a), (b), (c), (d), (e) and (f) for hydrogen transfer);
- h) cylinder wagon stop area;
- i) premises intended for ancillary services.

Below is a diagram, by way of example, of a typical plant.



Impianto di produzione di idrogeno mediante elettrolisi	Hydrogen production plant using electrolysis
Elettrolizzatore	Electrolyser
Modulo di elettrolisi	Electrolysis module
Stack	Stack
Balance of stack	Balance of stack
Trasformatore	Transformer
Raddrizzatore	Rectifier
Serbatoio tampone (buffer tank)	Buffer tank
Sistema di purificazione idrogeno	Hydrogen purification system
Area di sosta carri bombolai	Cylinder wagon stop area
Baia/e di carico	Loading bay(s)
Carro bombolaio	Cylinder wagon

Sistema di compressione	Compression system
Stoccaggio di idrogeno	Hydrogen storage
Compressore	Compressor
Serbatoio	Tank
Pacco bombole	Bundle of cylinders
Gruppo di riduzione e stabilizzazione della pressione	Pressure reduction and stabilisation assembly
Locali servizi accessori	Local accessory services

4. Hazardous elements.

For the purpose of determining safety and protection distances, the elements referred to in point 3, from letter (a), limited to the electrolysis module, to letter (g), of the same point, shall be regarded as hazardous elements of the plant.

5. Materials.

The materials used for the construction of the facility's elements must be compatible with the hydrogen at the temperatures and pressures of use. In particular, the materials are also chosen taking into account the specific problems arising from hydrogen embrittlement. In order to make the correct choice, reference can also be made to the provisions of ISO 11114-4.

When choosing materials, the problems of hydrogen permeability and porosity must also be considered.

For the choice of the materials used, the problems related to fatigue and ageing must also be considered, in relation to the conditions of use and the expected operating times.

The design, control, verification and maintenance activities must be defined and scheduled according to the indications outlined in this point as well.

6. Verification of whether an electrolyser is subject to Presidential Decree No 151 of 1 August 2011.

Hydrogen production facilities are not explicitly included in Annex I to Presidential Decree No 151/2011. The designer, however, shall assess which of the present activities are attributable to the points in Annex I (compression or decompression systems, installations and deposits of flammable gases compressed in cylinders or in fixed tanks, networks for the transport and distribution of flammable gases, fixed gas distribution plants, etc.).

In particular; electrolysers are attributable to activity no 1 of Annex I '*Establishments and plants where flammable and/or combustible gases are produced and/or used*', if the total cycle quantities of flammable gases are greater than 25 Nm³/h, as well as for the activity of storing flammable gases related to the quantities held.

In order to verify whether an electrolyser, of which the power expressed in kW is known, constitutes an activity referred to in point 1.1.C of Annex I to Presidential Decree No 151/2011, reference can be made to the value of its 'efficiency' expressed in kWh/Nm³, as defined in point 1.2.29.

By way of example, assuming an efficiency reference value of 5 kWh/Nm³ for an electrolyser, the threshold value of the power expressed in kW, exceeding which the activity is subject to fire prevention controls, can be calculated as follows:

$$25 \text{ Nm}^3/\text{h} \times 5 \text{ kWh/Nm}^3 = 125 \text{ kW}$$

Title II – Construction methods

7. Access to the area.

7.1 In order to allow the intervention of Fire Brigade rescue vehicles, the site must have at least one point of access with the following minimum requirements:

- width: 3.50 m;
- height clearance: 4 m;
- turning radius: 13 m;
- gradient: no greater than 10 %;
- load resistance: at least 20 tonnes (8 on the front axle, 12 on the rear axle, with a wheel base of 4 m).

7.2 In systems designed for the supply of cylinder wagons, paths within the plant area, or in the immediate vicinity, shall allow access to and enable the manoeuvre of the vehicles. The area shall allow the vehicles, in the event of an emergency, to move away in the direction of travel.

7.3 The areas on which the hazardous elements of the plant are located, as referred to in point 4, must be fenced, with a height of no less than 1.8 m, or otherwise constructed in such a way as to render these elements inaccessible and prevent tampering.

In the case of plants inside sites already equipped with their own fence, the aforementioned fence is not necessary. Where provided for, such a fence or any other measure taken to render those elements inaccessible shall be placed at a distance from the elements of the plant that allows for its safe operation and maintenance.

8. Hydrogen production plant.

The hydrogen production plant shall be subject to a specific risk assessment, to be carried out in accordance with the procedures set out in Annex I to the Decree of the Minister for the Interior of 7 August 2012.

The plant must be designed and manufactured in accordance with best practices. Plants complying with ISO 22734, where applicable, are considered to be in accordance with best practices.

The risk assessment includes that related to the formation of potentially explosive atmospheres. For this purpose, Chapter V.2 of the Decree of the Minister for the Interior of 3 August 2015 may be adopted as a useful reference by adopting, in addition to the measures contained in this Decree, the measures aimed at achieving the minimum level of protection referred to in point V.2.2.6.

9. Compressed hydrogen storage unit.

9.1 The accumulation of hydrogen gas, both in the middle of the process and for storage inside the plant, can take place in a storage unit, also consisting of several containers, with a variable operating pressure not exceeding 1000 barg.

Storage units, with the exception of buffer tanks, shall be placed in the appropriate box as defined in point 1.2.5 above.

If the total volume of the deposit exceeds 6000 Nm³, the box shall be divided into compartments (each one with a volume of no more than 6000 Nm³) bounded by walls made of reinforced concrete, or other fireproof material of adequate mechanical resistance, with construction characteristics of the manufactured articles such as to guarantee only along the perimeter the mitigation of the effects due to accidents.

9.2 Storage must be designed and manufactured in compliance with best practices.

Each hydrogen gas storage unit must have the following safety requirements:

- the supporting structure, if present, is not combustible and has at least R60 fire resistance characteristics or is protected in such a way as to ensure performance equivalent to R60;
- it has safety devices that prevent the pressure from exceeding the design value, regardless of the storage temperature. Such devices shall be positioned taking into account the type of storage adopted;
- it has a fire, temperature or flame detection sensor, which triggers the activation of a cooling system external to the container;
- each storage unit must be insulated from the rest of the plant by means of emergency shut-off valves.

Each storage unit shall also be equipped with a pressure measurement system.

Storage units shall be arranged inside each box in such a way as to limit the risks of direct impact of a possible release from one unit to the adjacent one.

The storage units shall be positioned at a distance from each other and from the walls of the box so as to enable the performance of surveillance and maintenance operations.

10. Compressors.

Compressors shall be designed and manufactured in accordance with best practices.

Each compressor shall be equipped with a safety system to prevent overpressure as well as with an exhaust valve system for emergency depressurisation; it shall also be connected to the rest of the system by means of appropriate vibration damping systems.

The compressors shall be equipped with suitable systems for emptying and inertisation to allow maintenance operations to be carried out.

Safety accessories (safety valves) installed downstream of the compressors, to ensure that maximum operating pressures are not exceeded, shall be installed independently of those inside or already on board.

The compressors, including any relevant devices (e.g. pressure pulsation dampeners) shall be placed in boxes, as defined in point 1.2.5 above. For compressors with an output pressure not exceeding 300 barg, barriers, if necessary, shall be identified using the fire and explosion risk assessment.

Vessels used to dampen pressure pulsations greater than 150 barg shall have a geometric volume not exceeding 0.4 m³. Specific risk assessments shall be carried out for vessels designed to dampen pressure pulsations with a geometric volume exceeding 0.4 m³.

11. Loading bays.

These are areas, as defined in point 1.2.3, which are used to house cylinder wagons.

During loading and unloading of hydrogen gas, the pipes connecting the cylinder wagon to the plant are considered part of the installation.

The planned route for the tank wagon, between the plant entrance and the loading and unloading point and then from this to the exit, shall have suitable paving with radii of curvature that allow the vehicle to move without manoeuvring. Any loading of the cylinder wagon without the trailer shall be carried out within the time strictly necessary; in this case, the cylinder wagon is parked so that the trailer can hook it up and tow it, even in the event of an emergency, towards the exit of the plant without the need for manoeuvres.

The loading bay shall be equipped with a stop device that stops the flow of hydrogen, both on the plant side and on the cylinder wagon side, as soon as the emergency button, located near the loading station, is pressed.

12. Gas plant.

This is the plant made up of the set of pipes, shut-off valves, discharge and safety valves, as well as equipment that make up the supply, compression, damping, accumulation, gas distribution network and the related emergency system. The materials used meet the safety requirements for pressure equipment.

The plant's design pressures must be at least 10 % higher than the maximum rated operating pressures and, in any case, not lower than the safety valve intervention pressures.

Overpressure in the supply line of loading bays with pressures exceeding 300 bar shall not exceed 1 % of the delivery pressure, with pressure pulsations not exceeding 4 %.

12.1. Rigid piping.

The rigid pressure piping shall be:

- a) designed, constructed and tested according to Legislative Decree No 26 of 15 February 2016;
- b) placed visibly, easily inspected, above ground, in a position protected from possible impacts; if this is not possible, they can be installed in suitable, vehicle passages that can be inspected and equipped with ventilation grids with a surface at least equal to the section of the passage, or they may be placed underground, at a depth of no less than 0.50 m;
- c) protected from external corrosion;
- d) free from significant stresses within the material caused by assembly, aftershocks or temperature differences;
- e) preferably made with welded joints and, in any case, able to be inspected;
- f) clearly marked and identified, even on the ground.

The choice of the method of laying the pipes must ensure that the inspection, control and maintenance activities are carried out correctly.

12.2. Flexible pipes.

Flexible pipes, which can be used for connections between compressors, cylinder wagons and bundles of cylinders, shall have a nominal pressure of no less than that of the duct system in which they are inserted.

Flexible pressure pipes shall be designed, constructed and tested according to Legislative Decree No 26 of 15 February 2016.

12.3. Pressure relief devices and safety accessories.

Pressure relief devices and safety accessories shall be designed and manufactured in accordance with the provisions of Legislative Decree No 26 of 15 February 2016.

12.4. Devices for shutting off and discharging the plant.

The following are the devices for shutting off and discharging:

- a) emergency shut-off valves with a hydrogen transfer stop function between the various parts of the plant, of the type normally open in operation and closed in an emergency (*fail close*); they are automatically operated under a security control system;
- b) emergency plant discharge valves with the function of allowing the rapid depressurisation of a part of the plant or the conveyance of the hydrogen into particular parts of the plant for safety purposes, of the type normally closed in operation and opened in an emergency (*fail open*); they are operated manually and automatically, possibly linked to a remote manual control and activation system;
- c) manual shut-off and discharge valves with the function of shut-off, isolation and discharge of parts of the plant for maintenance purposes.

The plant's shut-off and discharge devices, with both emergency and operating functions, shall be easily accessible for maintenance and inspection.

Emergency shut-off and discharge devices shall be designed in such a way as to operate in such conditions and to be clearly identified by appropriate signage.

Emergency shut-off and discharge devices shall be installed in such a way that equipment and piping sections can be shut-off and depressurised as a result of abnormal events or accidents.

All the manifolds of the discharge devices shall have adequate mechanical resistance to the stresses induced by the outflow of the gas.

The discharge into the atmosphere of the hydrogen must take place at a height sufficient so as not to constitute a danger to people and facilities in case of ignition.

13. Electrical constructions.

13.1. Electrical constructions shall be carried out in accordance with Law No 186 of 1 March 1968, taking into account the classification of the electrical hazard of the premises, according to the technical reference standards and ensuring the achievement of the following fire safety objectives:

- a) limit the probability of causing a fire or explosion;
- b) limit the spread of a fire through its components;
- c) allow occupants to leave the premises in safe conditions;
- d) allow rescue teams to work in safe conditions.

13.2. In order to achieve the objectives set out in point 13.1:

- a) the installations provided for in points 8, 9, 10 and 11 shall be protected against the risk of lightning and against the risk of the formation of electrostatic charges according to the reference technical standards;
- b) electrical systems shall comply with the following safety measures:
 1. be equipped with at least one emergency disconnecting device located in a protected position, such as to disconnect the entire system from voltage or, alternatively, be managed according to procedures reported in the emergency plan so as not to constitute a hazard during shutdown operations;
 2. be divided into several terminal circuits in order to guarantee the electrical independence of the power supply circuits of the safety services and of the power supply circuits of the other services;
 3. be equipped with circuits protected from fire for the supply of safety services intended to operate in the event of fire in accordance with the specifications laid down in the applicable technical reference standards and, in any case, not less than shown in the following table:

Type of system	Autonomy (min)	Switching times between ordinary and emergency supply (sec)
Safety lighting system	60	0.5
Control systems	60	15
Shut-off and cooling systems	120	15

13.3. Grounding system and system for protecting structures against atmospheric discharges

The plant shall be equipped with a grounding system and the necessary measures to protect against the direct and indirect effects of atmospheric discharges following the calculation of the probability of lightning in accordance with the provisions in force and the applicable technical standards; The filling point shall be equipped with an earthing terminal and clamps for the equipotential bonding between the fixed plant and the cylinder wagon, with suitable safety equipment for verifying that electrical continuity is obtained only after the clamp is connected to the moving vehicle (e.g. a safety switch incorporated into the clamp); the filling operations can only start with the prior consent of the earthing terminal.

14. Prevention of the formation of explosive mixtures.

In order to minimise the risk of the formation of potentially explosive hydrogen-air mixtures, a risk assessment shall be carried out and the consequent protective measures shall be taken in accordance with the provisions contained in Chapter V.2 of the Decree of the Minister for the Interior of 3 August 2015.

The following further measures shall also be taken:

- a) in case of deviation of the flow and pressure of hydrogen gas from the regular operating limits of the plant as declared by the manufacturer, a process control system shall be installed that interrupts the power supply of electrical equipment not classified in accordance with Directive 2014/34/EU (ATEX) and starts ventilation; the ventilation system shall be sized in such a way as to maintain an average concentration of hydrogen gas within the electrolyser room (and any box with hydrogen-containing equipment) below 1 % by volume, including in accordance with the criteria described in ISO 22734;
- b) a hydrogen detection system shall be installed in the room containing the electrolyser capable of triggering automatic ventilation if there are concentrations equal to or greater than 1 % by volume; the selection of the number, location and type of hydrogen detectors shall be done in accordance with best practices, with particular reference to IEC EN 60079-29-1 or an equivalent technical standard; the installation, use and maintenance of hydrogen gas detectors shall comply with IEC EN 60079-29-2 or an equivalent technical standard.

In addition, in order to avoid the formation of oxygen-enriched atmospheres (with an oxygen concentration in the air greater than 23.5 % by volume), if the electrolyser is designed to release oxygen inside areas or indoors, an oxygen detection system shall be provided, which activates the ventilation system.

Title III – Active protection measures

15. Detection and alarm systems.

The hazardous elements of the plant referred to in point 4 shall be monitored by installing the following systems:

- a) a system for detecting, controlling and monitoring the temperature of hazardous elements of the plant, if high temperature values can be reached;
- b) a gas leak detection and control system in all areas of the plant likely to be affected by the possible formation of an explosive atmosphere, according to the results of the risk assessment to be carried out in accordance with the provisions contained in Chapter V.2 of the Decree of the Minister for the Interior of 3 August 2015; the plant shall, as far as possible, be constructed in accordance with the reference technical standards;
- c) a flame detection system must be provided in all areas of the plant that are likely to be affected by the ignition of any hydrogen leaks; the plant shall, as far as possible, be constructed in accordance with the reference technical standards.

The installation of a fire detection and alarm system is also required in order to protect the entire activity, with the following main functions:

- A, automatic fire detection;
- B, control and signalling function
- C, fire alarm function;
- L, safety power function;
- D, manual signalling function.

Functions B, C, L, D are extended to the entire activity, while function A can be provided only in areas or premises where a fire can be triggered.

The system signals are reported to a special control centre located in a technical room inside the plant, with the possibility of their repetition outside as well, and reported to the emergency system referred to in the next point; a light and sound signalling device, connected to the activation of the control systems, shall be installed outside.

16. Shut-off and cooling systems.

The hazardous elements of the plant shall be protected by a fire hydrant network designed, installed, tested and managed according to best practices and in accordance with the directives referred to in the Decree of the Ministry of the Interior of 20 December 2012. For the design of the network, reference can be made to UNI 10779, assuming a hazard level of no less than 2 for the activity.

Compressed hydrogen storage, with the exception of bundles of cylinders with a geometric volume of less than 1 m³, shall also be protected by sprinkler cooling systems.

17. Fire extinguishers.

To promptly extinguish an outbreak of fire, fire extinguishers with a minimum extinguishing capacity of not less than 27A 89B and a minimum load of not less than 6 kg or 6 litres shall be installed in sufficient numbers to ensure a maximum reach distance of 20 m.

As a result of the fire risk assessment, fire extinguishers shall be installed for other specific risks, appropriately positioned at a distance of not more than 15 m from the risk sources.

Fire extinguishers must always be available for immediate use, so they shall be placed:

- in an easily visible and accessible location, along the evacuation routes close to the exits from rooms, floors or the building;
- in the vicinity of any specific risk areas.

For indoor workplaces, in the event of a Class A or Class B fire starting, water-based fire extinguishers should be used (water fire extinguishers).

Should the use of fire extinguishers on high tension electrical installations or equipment be envisaged, the appropriate fire extinguishers for this purpose must be installed.

18. Emergency system (ESS).

18.1 The production plant shall be equipped with an Emergency Shutdown System (ESS) that immediately stops supplying power to the hazardous elements of the plant in case of serious and immediate danger and cannot be deactivated with the intervention of the process control systems alone.

The ESS may be activated following the intervention of the automatic detection systems or the fire detection and alarm system referred to in point 15. In any case, there are emergency buttons (Emergency Shutdown Device, ESD), manually reset, placed near the hazardous elements of the plant.

The ESS shall intervene at least in the following cases:

- a) the concentration of hydrogen in the atmosphere reaches 1 % or more by volume;

- b) the fire alarm is activated by the fire detection and alarm system;
- c) stop or lack of mechanical ventilation in the electrolyser room, or if the flow rate is less than 75 % of the design flow rate;
- d) an ESD emergency button is activated;
- e) there is a differential pressure within cells (stack) between oxygen and hydrogen above the limits specified by the manufacturer;
- f) high pressure and high temperature output from compressors;
- g) low intake pressure at compressor inlets.

18.2 Once activated, the ESS shall provide at least the following functions:

- a) stop the production of hydrogen (electrolyser);
- b) depressurise equipment containing pressurised hydrogen, conveying it to a safe place, except for cylinder wagons and storage in general;
- c) completely isolate the pipes supplying the loading bays;
- d) completely isolate the low pressure line from the suction and the compressor discharge line;
- e) completely isolate the storage;
- f) interrupt the electrical circuit of the plant and ancillary installations, excluding the lines that supply the safety systems.

The ESS shall be equipped with restart locking devices, which require a deliberate restart of hydrogen generation. In any case, the system shall be designed in such a way that it does not create a hazard at the time of restart.

Title IV – Safety distances

19.1 Safety distances.

The design shall respect the following safety distances:

- A) Hazardous elements of the plant.

HYDROGEN PRESSURE (barg)	SAFETY DISTANCES (m)		
	EXTERIOR	PROTECTION	INTERIOR
$700 < P \leq 1000$	30	15	15
$500 < P \leq 700$	25	15	15
$300 < P \leq 500$	20	15	15
$100 < P \leq 300$	17	12	12
$50 < P \leq 100$	12	8	8
$30 < P \leq 50$	8	6	6
$10 < P \leq 30$	7	5	5
$P \leq 10$	5	3	3

For the compressor room, the external safety distance, with the exception of the one calculated in relation to buildings for the community, can be reduced by 50 % if continuous shielding, consisting of walls made of concrete or other fireproof material with an adequate mechanical strength, is built between the openings, where present, and the external constructions of the plant in order to ensure

that any shrapnel projected towards the external constructions are contained. In any event, this distance may not be less than the smaller of the internal safety distance and the protection distance, provided for the same pressure value.

Piping sections (both high and low pressure) are considered hazardous elements and the safety distances indicated in the table, corresponding to the relevant pressure value, shall apply, with the exception of internal safety distances to closely connected process elements.

With respect to buildings intended for the community such as schools, hospitals, offices, buildings for worship, public entertainment venues, sports facilities, tourist accommodation complexes, supermarkets and shopping centres, barracks, and in respect of places where there is an influx of people such as stations of public transport lines, areas for fairs, markets and the like, the external safety distances are doubled. In the calculation of external safety distances, the widths of roads, rivers, streams and canals can also be included. Moreover, when the external safety distance refers to building areas, it is permissible to include in it the prescribed buffer distance, in cases where local building regulations prohibit construction on the border.

B) Other safety distances.

The following internal safety distances shall be respected between the hazardous elements referred to in point 3(a) to (g) and the premises listed below intended for ancillary services:

- a) premises intended for ancillary services: safety distances referred to in point (A) above;
- b) electrical power supply cabin: 22 m.

The openings of the premises containing the hazardous elements of the plant referred to in point 3(a) to (f) shall be screened with shielding walls, if they face premises intended for ancillary services.

Between the hazardous elements of the plant and the overhead power lines, with voltage values greater than 1000 V in alternating current and 1500 V in direct current, a distance of 45 m shall be observed in relation to the projection in plan.

The plant yards are in any case not traversed by overhead power lines with voltage values higher than those indicated above.

19.2 Alternative methods for determining safety distances.

Safety distances different from those in this title may be identified by applying the methodologies of the engineering approach to fire safety provided by the Decree of the Minister for the Interior of 9 May 2007.

Where the hazardous elements exceed the pressure values indicated in the table in point 19.1, the safety distances shall be determined by applying the engineering approach to fire safety referred to in the Ministerial Decree of 9 May 2007.

Title V – Operating rules

20.1. Overview.

In addition to the obligations set out in Article 6 of Presidential Decree No 151 of 1 August 2011 and the provisions set out in the decrees of the Minister for the Interior of 1 September 2021, 2 September 2021 and 3 September 2021, the requirements specified in the following points shall be complied with in the operation of hydrogen production plants.

The manager of the activity shall ensure the maintenance of the plant in accordance with best practices.

20.2. Operation of the plant.

Operation is allowed only under the supervision, even if remotely, of the manager of the activity or of one or more persons formally designated by them. The person responsible for the activity and the designated personnel must receive specific training regarding the operation of the plant, the dangers and drawbacks that may arise from the products used or stored and the safety measures to be taken in the event of an accident. This training is also extended to maintenance personnel.

In the areas of the plant and, in particular, in the boxes, the storage of flammable or combustible materials is prohibited, except for flammable materials or fuels necessary for the operation of the plant.

20.3. Operation of loading and unloading of cylinder wagons.

During the loading and unloading of cylinder wagons, as well as during the normal operation of the plant, the personnel involved shall observe and ensure that the following requirements are complied with:

- a) at least one fire extinguisher supplied to the system, ready for use, is placed in the vicinity of the loading bay concerned;
- b) the engines of the vehicles carrying the cylinder wagons are switched off and at least 15 minutes are allowed to elapse from their switching off before loading and unloading;
- c) during loading and unloading, the prohibition on smoking shall be respected and enforced, including on board the vehicle, and in any case the burning or circulation of open flames shall be prevented within a radius of at least 6 m from the perimeter of the loading bays; the prohibition on ignition and on the use of mobile phones or other Wi-Fi systems shall also be respected, including on board the vehicle and within a radius of at least 2 m from the perimeter of the loading bays;
- d) the connection between the cylinder wagon and the tank shall be implemented in such a way as to ensure electrical continuity; at the place where the filling operations are carried out, a socket for the equipotential bonding between the tanker and the fixed plant shall be installed.

The staff must be present during loading and unloading.

20.4. General emergency requirements.

The authorised personnel must:

- a) be aware of the rules contained in this annex, on the internal safety regulations and on the prepared emergency plan;
- b) intervene immediately in the event of a fire or hazard by operating devices and emergency equipment supplied at the plant, as well as preventing, through warnings, barriers and any other suitable means, that other vehicles or people access the system;
- c) alert the rescue services.

20.5. Technical documents.

The following documents must be available at the plant:

- a) an operating manual containing instructions for operating the plant;
- b) an emergency plan containing the procedures for securing the plant;
- c) a simplified flow diagram of hydrogen storage, production, measurement, compression and distribution plants;

- d) a plan showing the location of the fire fighting systems and equipment, as well as the indication of the areas protected by the individual fire fighting systems;
- e) diagrams of electrical, signalling and alarm systems;
- f) the plant's maintenance log, indicating the planned maintenance frequency and showing the activities carried out.

20.6. Safety signs.

The provisions on safety signs set out in Legislative Decree No 81 of 9 April 2008 must be observed, among others. In addition, suitable signage must be displayed in a clearly visible position, reproducing a flow chart of the plant indicating the valves, equipment and storage units, so as to make them easily identifiable.

A plan of the plant must be visible and instructions attached for the employees involved on:

- a) behaviour in the event of an emergency;
- b) the position of the safety devices;
- c) the manoeuvres to be performed to secure the plant (e.g. activation of the emergency buttons, operation of the fire fighting equipment).