



# STORAGE OF HYDROGEN IN SYSTEMS LOCATED UNDERGROUND

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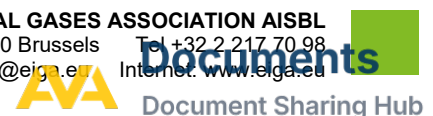
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## Amendments to 171/12

| Section | Change                          |
|---------|---------------------------------|
| 2       | Updated scope                   |
| 3       | New term and definition added   |
| 5.6     | Major update in leak prevention |
|         |                                 |
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|         |                                 |
|         |                                 |
|         |                                 |

Note: Significant technical changes from the previous edition are underlined

## 1 Introduction

This document addresses the safety issues that are specific to the storage of hydrogen in systems located underground.

This form of installation may be needed when it is beneficial to keep above ground areas free of equipment, such as may be the case for hydrogen vehicle refuelling stations.

However, it is preferable that wherever possible, hydrogen storage and related equipment is located above ground in the open air in a well ventilated area.

## 2 Scope

This document covers the requirements specific to the installation of a hydrogen storage system covering

- liquid hydrogen storage and ancillary systems,
- compressed hydrogen storage composed of a single container, or multiple cylinders or tubes in an underground space with top or side access, hereafter called a vault or directly buried in the ground.

Periodic inspection of buried gaseous storage systems is not addressed in this document.

This document does not address the generic design, materials and construction aspects of hydrogen pressure vessels.

This document does not address the following cases:

- massive storage of hydrogen in caverns
- underground pipelines
- underground parking of hydrogen vehicles
- any hydrogen system used for mining application
- tunnels for vehicles traffic
- hydrogen systems used under water

## 3 Definitions

**Double block and bleed isolation:** isolation system that consists of two block valves plus a bleed valve connected to the pipe section between the two block valves.

**Fail-close isolation valve:** valve that will go to closed position in case of control signal or instrument air failure.

**Lock-out/tag-out:** safety procedure to ensure that equipment is shut off, isolated from power sources and not started up again before the completion of maintenance work.

**Safety ventilation:** ventilation activated upon detection of hydrogen to prevent the hydrogen concentration from exceeding a specified limit.

**Lower Flammability Limit (LFL):** the lowest concentration of a gas or vapor in air that is capable of producing a flash of fire in presence of an ignition source.

## 4 Buried liquid hydrogen storage

The following means of protection should be assessed in the design of a buried liquid hydrogen storage system. UKLPG *Code of Practice 1: Part 4 - Bulk LPG Storage at Fixed Installations: Buried/Mounded LPG Storage Vessels (January 2021)* provides detailed guidance on installation requirements.

- Protection against corrosion including cathodic protection: design and monitoring;
- Inspection of tank condition before burial;
- Precautionary measures during burial;