Health effects of hydrogen and methane

Technical note

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Contact

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ABOUT MARCOGAZ

Founded in 1968, MARCOGAZ represents 29 member organisations from 21 countries. Its mission encompasses monitoring and policy advisory activities related to the European technical regulation, standardisation and certification with respect to safety and integrity of gas systems and equipment, rational use of energy as well as environment, health and safety issues. It is registered in Brussels under number BE0877 785 464.

DISCLAIMER

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1. Introduction

In the last decades the gas industry has been focusing on new gases, among which hydrogen, to meet the European decarbonization and sustainable development objectives.
The aim of the present technical note is to give an overview of the health effects of hydrogen and natural gas and provide a comparison between them. This document intends to raise awareness on the subject.
In the present document, health related data of methane have been used for natural gas, given that natural gas mainly consists of methane.
MARCOGAZ has issued several documents on safety aspects of hydrogen and natural gas which can be consulted on the Association dedicated section of the website[1].

2. Classification of substances

The Classification, Labelling and Packaging (CLP) Regulation ((EC) No 1272/2008)[2] is based on the United Nations' Globally Harmonised System (GHS) and its purpose is to ensure a high level of protection of health and the environment, as well as the free movement of substances, mixtures, and articles.
The CLP Regulation is the only legislation in force in the EU for classification and labelling of substances and mixtures.
CLP is legally binding across the Member States and directly applicable to all industrial sectors. It requires manufacturers, importers or downstream users of substances or mixtures to classify, label and package their hazardous chemicals appropriately before placing them on the market.
One of the main aims of CLP is to determine whether a substance or mixture displays properties that lead to a hazardous classification. In this context, classification is the starting point for hazard communication.
When relevant information (e.g. toxicological data) on a substance or mixture meets the classification criteria in CLP, the hazards of a substance or mixture are identified by assigning a certain hazard class and category. The hazard classes in CLP cover physical, health, environmental and additional hazards.
The scope of the present document is limited to health hazards.

3. Health hazards

[1] https://www.marcogaz.org/technical-work/sustainability/health-labour-safety/
[2] REGULATION (EC) No 1272/2008 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 16 December 2008 on classification, labelling and packaging of substances and mixtures, amending and repealing Directives 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No 1907/2006

European Chemicals Agency (ECHA) has prepared a table containing all updates to the harmonised classification and labelling of hazardous substances, which are available in Table 3 of Annex VI to the CLP Regulation.

The harmonised classification and labelling of hazardous substances are updated through an "Adaptation to Technical Progress (ATP)" which is issued yearly by the European Commission. Following the adoption of the opinion on the harmonised classification and labelling of a substance by the Committee for Risk Assessment (RAC), the European Commission takes a decision and publishes the updated list in an ATP.

Annex VI to CLP_ATP18[3] (in force from 1 December 2023) contains data on hydrogen. This Annex does not contain data on natural gas. For purpose of comparison the data of methane are used.

International Chemical Identification		Hydrogen	Methane
Index No		001-001-00-9	601-001-00-4
EC No		215-605-7	200-812-7
CAS No		1333-74-0	74-82-8
Classification	**Hazard Class and Category Code(s)**	Flam. Gas 1 Press. Gas	Flam. Gas 1 Press. Gas
	Hazard Statement Code(s)	H220	H220
Labelling	**Pictogram, Signal Word Code(s)**	GHS02 GHS04 Dgr (dangerous)	GHS02 GHS04 Dgr (dangerous)
	Hazard statement Code(s)	H220	H220

Table 1 – Summary of information for methane and hydrogen derived from CLP_ATP18

[3] https://echa.europa.eu/information-on-chemicals/annex-vi-to-clp

It is crucial noting that these gases can also be hazardous to health because, at high concentrations, they displace oxygen and have a suffocating effect, especially in a closed room environment.
The following intense (short-term) health effects may occur shortly or immediately after exposure to methane and hydrogen. These related hazards are listed in the safety data sheets, in fact inhalation may cause mood changes, slurred speech, vision problem, memory loss, nausea, vomiting, facial flushing, headache, loss of coordination, breathing difficulties, dizziness and drowsiness, loss of consciousness and death.
Should liquefied methane and hydrogen escape from their tank, due to their low temperature, and come in contact with skin they can cause severe cryogenic burns, hypothermia and frostbite to the skin and eyes and even loss of limbs.[4]

3.1 Hazard and precautionary statements for hydrogen and methane

Here below an extract of *Section 2: Hazards identification Safety Data Sheet – Hydrogen, compressed – Version 1.1* and of *Section 2: Hazards identification* from-*Safety Data Sheet – Methane, compressed – Version 3.0.*

GHS02: Flammable gases

GHS04: Gas cylinder

Signal words: Danger

Hazards Statements
H220: Extremely flammable gas.
H280: Contains gas under pressure; may explode if heated.

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[4]

- Safety in storage, handling and distribution of liquid hydrogen. European Industrial Gases Association EIGA. Doc 06/19
- Methane, General Information. Public Health England Centre for Radiation, Chemical and Environmental Hazards
- New Jersey Department of Health – Hazardous Substance Fact Sheet - Hydrogen

Precautionary Statements

Prevention

P210: Keep away from heat, hot surfaces, sparks, open flames, and other ignition sources. No smoking.

Response

P377: Leaking gas fire: Do not extinguish unless leak can be stopped safely.

P381: In case of leakage, eliminate all ignition sources.

Storage

P403: Store in a well-ventilated place.

4. Conclusions

Based on the information gathered by the European Chemicals Agency an identification is made of health hazards of hydrogen and methane. Both hydrogen and methane and their mixtures are not classified with health hazards, in fact hydrogen and methane are not classified as toxic.

It is crucial noting that gases can still be hazardous to health because they can displace oxygen and can affect the circulatory, respiratory and central nervous systems.