



Hydrogen sector – safety rules

Is the hydrogen economy the future of our energy sector? This issue is becoming increasingly important in the face of the environmental and energy challenges of our time. As we face the challenges of hydrogen production, we are faced with the urgent need to assess its role in the energy future. While hydrogen may seem less practical and more expensive compared to conventional fossil fuels, which have long dominated our energy sector and are easy to use and transport, their negative impact on the environment cannot be ignored. Fossil fuels are harmful, toxic, and contribute to climate change through greenhouse gas emissions. Therefore, there is growing pressure to switch to more sustainable alternatives, such as hydrogen, despite potential challenges such as higher costs and reduced convenience. Investments in environmental protection are becoming essential, even if they involve additional financial outlays.

Understanding and adhering to safety rules is crucial in the hydrogen sector. Hydrogen, being a gas with a high energy content, exhibits highly flammable and explosive properties under specific concentrations and conditions. Therefore, working safely with hydrogen requires in-depth knowledge of its characteristics and potential hazards. Incorrect manipulation of hydrogen

can result in serious incidents such as explosions, fires or leaks, endangering the life and health of workers as well as public safety. In addition, although hydrogen as a gas is non-toxic, its emissions into the atmosphere in large quantities can affect local atmospheric conditions, highlighting the need to closely monitor and control leaks.

In the hydrogen sector, there are a number of safety standards and guidelines, the observance of which is crucial both to protect personnel and the environment, and to avoid potential legal and financial consequences for companies operating in this industry. In both Poland and the European Union, the hydrogen sector is subject to regulations aimed at ensuring safety, efficiency and sustainable technological progress in this field. Although regulations for the hydrogen sector in Poland are still being developed, they include provisions for the safe storage, transport and use of hydrogen. They are often combined with general regulations on industrial safety, environmental protection and the energy sector. The Energy Law regulates issues related to the production, distribution and consumption of energy, including hydrogen as an energy carrier. The Hazardous Substances Regulations classify hydrogen as a hazardous substance, which means that the regulations for the storage and transport of hazardous substances apply to it. At the EU level, hydrogen regulations are more extensive and detailed, often with a focus on promoting hydrogen technologies as part of the energy transition, including:

-  **The Alternative Fuels Infrastructure Directive (AFID)**, which sets out the framework for the deployment of hydrogen refuelling stations in Member States.
-  **Safety and technical standards**, such as ISO and CEN standards for hydrogen, which specify requirements for the safe storage, transport, production and distribution of hydrogen.
-  **In 2020**, the European Commission presented the "Hydrogen Strategy for Europe", which aims to support the development of clean hydrogen technologies and create an integrated hydrogen market in the EU.

In addition, across Europe, standards such as ISO 14687 specify specifications for the purity of hydrogen used in fuel cell vehicles, and ISO 22734 standards apply to hydrogen generators using water electrolysis. In the hydrogen sector, it is also important to comply with international regulations, such as those contained in the international codes for maritime and road transport (e.g. IMDG, ADR), which regulate the transport of hydrogen. These regulations are crucial to ensure the safety, environmental protection and efficient development of hydrogen technologies, and compliance with them is essential for companies operating in this sector. Hydrogen technologies are often complex and require expertise to operate them safely.



Understanding technological processes, potential failures and intervention procedures is crucial for safe operation.

PROPOSAL FOR A SAFETY TRAINING AND POLICY PROGRAMME FOR THOSE STARTING OUT IN THE HYDROGEN SECTOR

Purpose of the training: To provide new employees in the hydrogen sector with comprehensive knowledge of safety, operational principles and best practices so that they can perform their duties safely and efficiently.

Learning Outcomes:

- Understanding the properties and risks of hydrogen.
- Ability to handle hydrogen safely and follow safety procedures.
- Knowledge of the regulations governing the hydrogen sector.
- Ability to respond to hydrogen-related emergencies.

What to look out for in safety training in the hydrogen sector:

- **Hydrogen storage and transportation:** Know and use appropriate methods for storing and transporting hydrogen, including appropriate containers and safeguards.
- **Leak Detection & Alarm Systems:** Install and maintain hydrogen leak sensors and alarm systems that can quickly warn of potential hazards.
- **Emergency procedures and response plans:** Develop and train employees in emergency procedures such as evacuation, first aid, and what to do in the event of a fire or hydrogen leak.
- **Staff training and awareness:** Regular safety training, not only for new employees, but also as part of the ongoing development and maintenance of safety awareness among all employees.
- **Risk management:** Assess the risks associated with various aspects of hydrogen operations and implement measures to mitigate these risks.

TRAINING MODULES:

Introduction to Hydrogen

- Characteristics of hydrogen and its application in the energy sector.
- An overview of the hydrogen sector and its importance for sustainable development.

Hydrogen safety

- Physicochemical properties of hydrogen relevant to safety (e.g. flammability, explosive concentration ranges).
- Typical hazards and risk scenarios in working with hydrogen.

Regulations & Standards

- National and international regulations for the safe storage, transport and use of hydrogen.
- Review of industry standards (np. ISO, CEN) for hydrogen.

Operational Security Practices

- Safe procedures for the storage and distribution of hydrogen.
- Use of safety equipment and systems in working with hydrogen.

Disaster Response

- Procedures to be followed in the event of a hydrogen leak, fire or other incidents.
- First aid in the event of hydrogen-related accidents.

Hands-on training

- Hands-on exercises on simulators or in a controlled laboratory environment.
- Emergency scenarios and incident response exercises.

TRAINING METHODS:

- Lectures and presentations to convey theoretical knowledge.
- Discussions and case studies to analyze real-world incidents and develop response strategies.
- Hands-on exercises and simulations to allow participants hands-on experience in the safe handling of hydrogen.

The implementation of effective safety rules and appropriate training in the hydrogen sector are an important element in ensuring not only the protection of employees and the environment, but also the sustainable and sustainable development of a dynamically developing industry. By following proper procedures, identifying hazards, and using safe working practices, we can minimize the risk of incidents and increase the efficiency and efficiency of hydrogen operations.

Ultimately, the hydrogen sector faces challenges, but also abounds with opportunities. Through consistent application of safety principles, innovative approaches to technology, appropriate training and cooperation at an international level, we can shape a future in which hydrogen plays a key role in the energy transition, leading to a more sustainable and greener society.

Literature:

<https://polskiprzemysl.com.pl/przemysl-energetyczny/gospodarka-wodorowa/>

<https://dise.org.pl/Raport-Zielony-Wodor-z-OZE.pdf>

<https://bank.pl/wodor-bedzie-katalizatorem-ryнку-rozproszonego-energii-odnawialnej-a-co-z-wykorzystaniem-w-transportcie/>

<https://www.scienceinschool.org/pl/article/2012/hydrogen-pl/>

https://www.draeger.com/pl_pl/Safety/hydrogen-safety-for-the-industry

<https://seshydrogen.com/technologie-wodorowe-bezpieczenstwo/>

<https://www.great.gov.uk/campaign-site/Innovating-Energy-Europe/hydrogen/?>

[utm_source=google&utm_medium=paidsearch&utm_campaign=energy-transition&utm_content=energy-transition&gad_source=1&gclid=EAIaIQobChMIjvWXvaSuhQMVdKBoCR2c8gaPEAAYASAAEgKOjFD_BwE](https://www.great.gov.uk/campaign-site/Innovating-Energy-Europe/hydrogen/?utm_source=google&utm_medium=paidsearch&utm_campaign=energy-transition&utm_content=energy-transition&gad_source=1&gclid=EAIaIQobChMIjvWXvaSuhQMVdKBoCR2c8gaPEAAYASAAEgKOjFD_BwE)

<https://www.h-tec.com/en/scaling-up-green-hydrogen/?>

[gad_source=1&gclid=EAIaIQobChMI-veFsqWuhQMVHsZ5BB1WIg8QEAAAYAiAAEgJ_RPD_BwE](https://www.h-tec.com/en/scaling-up-green-hydrogen/?gad_source=1&gclid=EAIaIQobChMI-veFsqWuhQMVHsZ5BB1WIg8QEAAAYAiAAEgJ_RPD_BwE)

<https://yadda.icm.edu.pl/yadda/element/bwmeta1.element.baztech-36aa7dd2-4e78-4e96-990b-924e70ee3a3a>

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