

MODULE 1

SAFETY AND RISK ASSESSMENT IN HYDROGEN LOGISTICS

Knowledge Assessment for Module 1

Select one accurate answer for each question.

Question 1: What distinctive characteristic of hydrogen renders it challenging for human senses to perceive?

- A. It is denser than air and possesses an unpleasant odor.
- B. It possesses a vivid, distinctive hue.
- C. It emits smoke to indicate its presence.
- D. It is devoid of odor, color, and taste.

Question 2: What is the range of explosive concentrations of hydrogen in air as stated in the mini-lecture?

- A. Ranging from 1% to 25% by volume.
- B. Ranging from 5% to 50% by volume.
- C. Ranging from 4% to 75% by volume.
- D. Exceeding 80% by volume.

Question 3: What is the sufficient ignition energy required to ignite hydrogen, as stated in the podcast?

- A. Substantial, exceeding 1 J.
- B. Medium, approximately 0.5 J.
- C. Extremely small, approximately 0.02 millijoules.
- D. Hydrogen ignites without the need for energy.

Question 4: Which international standard delineates specific quality requirements for hydrogen utilized as fuel?

- A. IEC 60079
- B. ISO 14687
- C. Seveso III Directive
- D. IMDG Code

Question 5: What is the primary objective of the Seveso III Directive concerning hazardous substances, including hydrogen?

- A. Regulation of hydrogen road transport.
- B. Establishing quality requirements for hydrogen.
- C. Preventing significant industrial accidents and mitigating their impacts.
- D. Global regulatory harmonization.

Question 6: Which Polish authority is responsible for issuing permits for the operation of pressure equipment and hydrogen tanks?

- A. National Fire Service (PSP)
- B. Hydrogen Europe
- C. Technical Inspection Authority (UDT)
- D. International Energy Agency (IEA)

Question 7: What is the primary disadvantage of hydrogen accumulation in confined, unventilated areas?

- A. Results in the installation freezing.
- B. Hydrogen becomes hazardous.
- C. Can produce a highly explosive mixture.
- D. It complicates transportation.

Question 8: What is the primary hazard linked to prolonged exposure of materials (particularly steel) to high-pressure hydrogen?

- A. Electrolytic corrosion.
- B. Hydrogen Embrittlement.
- C. Mold development.
- D. Enhanced material strength.

Question 9: In the case of a liquid hydrogen (LH2) leak, which phenomenon could cause a rapid expansion of both the liquid and vapor, potentially resulting in an explosion?

- A. Jet Fire
- B. Deflagration
- C. BLEVE (Boiling Liquid Expanding Vapor Explosion)
- D. Detonation in Open Space

Question 10: Based on the Case Study "Hydrogen Leak at H2 Transshipment Terminal," what was the immediate cause of the hydrogen leak?

- A. Human error during refueling.
- B. Fatigue fracture of the gasket in the pressure relief valve (PRV) flange.
- C. Excessive pressure resulting from a malfunctioning compressor.
- D. Tanker truck colliding with the valve.

Question 11: In the case study "Hydrogen Leak at H2 Transshipment Terminal," how swiftly did the Emergency Stop System (ESD) engage following the detection of the alarm?

- A. Within one to two seconds.
- B. Following a duration of 10 seconds.
- C. Within five seconds.
- D. After a brief delay of a few minutes.

Question 12: What error made by operator Mr. Kowalski was identified in the Case Study "Hydrogen Leak at the H2 Transshipment Terminal"?

- A. He did not trigger the alarm.
- B. He absconded from the location.
- C. He attempted to manually close the emergency valve even though the ESD system was activated.
- D. He failed to inform the shift manager.

Question 13: In the podcast "How to Respond to Emergency Situations in Hydrogen Logistics?", what is identified as the initial and essential step in addressing a hydrogen emergency?

- A. Prompt extinguishment of the flame.
- B. Rapid and accurate threat identification and notification.
- C. Awaiting the arrival of emergency services.
- D. Immediate evacuation of all individuals without evaluating the circumstances.

Question 14: What is the primary concern in the event of a hydrogen ignition when there is no immediate danger to individuals or essential infrastructure?

- A. Direct flame suppression.
- B. Cooling of adjacent components (tanks, pipelines) using water.
- C. Extinguishing the flame with sand.
- D. Permitting the fire to extinguish.

Question 15: What information from industry organizations (e.g., Hydrogen Europe) underscores the significance of operator training?

- A. Training has minimal influence on the frequency of incidents.
- B. Over 70% of incidents could be prevented through improved procedures and training.
- C. Incidents are invariably the result of technical defects.
- D. Training elevates the frequency of incidents.

Question 16: In Worksheet 1 "Analysis of Failure Cases," the hypothetical incident pertained to a terminal managing which type of hydrogen?

- A. Compressed hydrogen gas (CGH₂)
- B. Hydrogen in ammonia form (NH₃)
- C. Liquid hydrogen (LH₂)
- D. Hydrogen in metal hydride form

Question 17: What was the manufacturer's suggested replacement interval for the valve seal that developed a crack leading to the leak in Work Sheet 1 "Failure Case Analysis"?

- A. Biennially.
- B. Every three years.
- C. Every five years.
- D. Every seven years.

Question 18: In reference to Worksheet 2 "HAZOP Risk Map," what is the significance of the keyword "NONE" within the HAZOP methodology?

- A. No chance of failure.
- B. Total absence of a flow or parameter.
- C. No data is available for analysis.
- D. Insufficient staffing.

Question 19: Based on the mini-lecture, which of the following hazards is linked to contact with liquefied hydrogen (LH2) and can result in the immediate freezing of tissues?

- A. Hypoxia.
- B. Cryogenic injuries.
- C. Mechanical Injuries.
- D. Hydrogen embrittlement.

Question 20: Calculation: A production facility generates 5 tons of hydrogen daily. How many kilograms of hydrogen will be produced in a month (assuming 30 days)?

- A. 500 kilograms
- B. 5,000 kilograms
- C. 15,000 kilograms
- D. 150,000 kilograms

Question 21: Based on the mini-lecture, which risk analysis method serves as a qualitative, systematic approach for identifying deviations from the intended operational parameters?

- A. Failure Mode and Effects Analysis
- B. Quantitative Risk Assessment
- C. Hazard and Operability Study
- D. Fault Tree Analysis

Question 22: What is essential in collaborating with emergency services within the framework of hydrogen logistics, as discussed in the podcast?

- A. Furnishing them with comprehensive information regarding the company.
- B. Acquainting them with the particulars of hydrogen threats and collaborative exercises.
- C. Anticipating that they will independently acquire all the knowledge.
- D. Refrain from contact until a significant accident transpires.

Question 23: Based on the mini-lecture, what percentage of incidents in the hydrogen industry could be prevented through improved procedures and enhanced operator training?

- A. Approximately 30%
- B. Approximately 50%
- C. Exceeding 70%
- D. Nearly 100%

Question 24: Calculation: If a hydrogen detection system has a lower alarm threshold established at 1% by volume and the upper explosive limit of hydrogen is 75%, what percentage of the space remains outside the explosive range when the concentration reaches this upper limit?

- A. 25%
- B. 75%
- C. 25% (as a concentration exceeding 75% hydrogen in air renders the mixture excessively rich to ignite)
- D. 99%

Question 25: What is the fundamental basis for the advancement of the hydrogen logistics sector, as outlined in the Mini-Lecture Summary?

- A. Solely global harmonization of regulations.
- B. Enhancing hydrogen production at the cost of safety.
- C. Implementation of robust security protocols, comprehensive risk assessment, and preparedness to address failures.
- D. Decrease in operating expenses irrespective of other variables.

ANSWER KEY

1.D / 2.C / 3.C / 4.B / 5.C / 6.C / 7.C / 8.B / 9.C / 10.B / 11.C / 12.C / 13.B / 14.B / 15.B
 16.C / 17.C / 18.B / 19.B / 20.D / 21.C / 22.B / 23.C / 24.C / 25.C /

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