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Risk Assessment

Handling Hydrogen and Design Standards

The extensive use of hydrogen in various applications such as the aerospace, food and petrochemical industries has led to in-depth knowledge and experience into its safe handling. Hydrogen is attracting much attention across the globe as a potential energy storage medium that can produce electricity using fuel cells or mechanical energy through combustion. As a result, this focus has introduced many new participants into the research, development, demonstration, and deployment of hydrogen technologies such as fuel cell vehicles and stationary fuel cells.

Ensuring a well-designed workspace is vital for any project involving the use of hydrogen. Although it may not always be possible to construct a building or laboratory suitable for the use of hydrogen, understanding the impact of hydrogen properties on a facility is crucial. Operators and designers of hydrogen storage facilities should be aware of the wide flammability range of hydrogen in comparison with methane and gasoline and of any potential ignition source.

Adequate ventilation can drastically reduce the chance of a flammable mixture of hydrogen forming from a leak in an enclosed space.

Hydrogen piping systems must be able to withstand more extreme conditions than those expected during operation. Measures should be in place to protect hydrogen pipelines buried beneath the surface. Pipes must be able to withstand weathering and endure thermal expansion and contraction.

Compressed hydrogen gas cylinders and storage tanks must be located outdoors maintaining a safe distance from structures, roads and ventilation intakes. They must be stored upright with their contents labelled.

Hydrogen in liquid form has to be stored under cryogenic conditions and so it is essential to know the associated hazards. It must be stored either vertically or horizontally in cylindrical tanks and for larger volumes in spherical tanks. These storage tanks are often vacuum-insulated and equipped with a pressure-relief valve.

In general, personnel working with hydrogen in its various forms should have ample training in order to operate in such environments safely. In addition to this, an emergency action plan must be in place that covers incident procedures to ensure safety of personnel.

At the minimum, an action plan must include the following:

- Evacuation procedures, exit routes and staging routes for non-responding personnel.
- Procedures for workers in charge of critical plant operation prior to evacuation.
- Procedures to account for all personnel once emergency evacuation is completed.
- Procedures for personnel responsible for rescue and first aid duties.
- Means of reporting incidences and emergencies including emergency contact numbers.
- Contact information for individuals responsible for providing additional information and explanation of procedures in this action plan.

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Links to additional resources for this topic				
Risk Management Student Powerpoint	Risk Management Extra Information for Teachers	Risk Management Official Document BOC Risk Management Official Document Ballard Risk Management Official Document Hyundai Risk Management Official Document Toyota	Distribution Case Study - Linde	Kahoot Quiz

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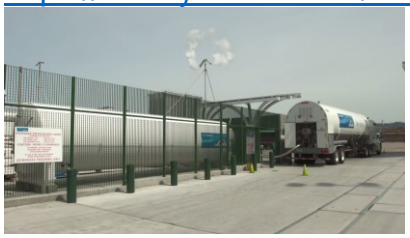
Risk management videos with descriptions

Risk Management – How to work safely with hydrogen - 16.05 start at 0.50 English
https://www.youtube.com/watch?v=HzQ_dtWa6tQ



Risk Management – Result of shooting a bullet at a hydrogen tank – 3.19 but only needed up to 0.40 Silent
https://www.youtube.com/watch?v=jVeagFmmwA0

Risk management – Simulation of a hydrogen and a combustion engine vehicle on fire – 1.05 English with all other subs
https://www.youtube.com/watch?v=IknzEAs34r0

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