



Safety Human Factors Information

Prepared by WG-16

Safety Info HF - 14/24

Organisation

Human Factors in Hydrogen Applications



Hydrogen: Hydrogen is a unique gas that behaves in a different way to other flammable gases. People working with or near hydrogen installations need to understand and take extra care for these reasons.

Target Audience: Any professional organisation dealing with hydrogen and related installations including designers and suppliers.

Learning more about Hydrogen

If the answer to any of the questions below is 'no', then you need to take action

- | | | |
|----|---|--------------------------|
| 1. | Are personnel trained in the properties of hydrogen, e.g. flammability range, explosion limits, low ignition energy, lowest molecular weight, high diffusion speed, heating effect of expansion, that are relevant to their work? | ☐ |
| 2. | Are personnel aware of the implications of hydrogen's very low viscosity (leaks/permeates very easily)? | ☐ |
| 3. | Do all personnel understand the unique aspects of hydrogen fire and actions to be taken in an emergency? (e.g. almost invisible flame,...) | ☐ |
| 4. | Do employees and contractors understand the actions to take in the event of a hydrogen gas leak? | ☐ |
| 5. | Do employees and contractors understand the actions to take in the event of a fire involving hydrogen? | ☐ |
| 6. | Do employees and contractors understand the actions to take in the event of a liquid hydrogen leak or spill? | ☐ |
| 7. | Are personnel aware of the potential cross sensitivity of some (e.g. carbon monoxide) sensors in gas monitors to hydrogen? | ☐ |
| 8. | Has the need for a hydrogen personal gas monitor been defined for each role? | ☐ |

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9.	Do people understand that the vapour above an evaporating liquid hydrogen pool has approximately the same density as air?	☐
10.	Are all hydrogen scenarios included in the site emergency plan?	☐
11.	Is the limited compatibility of materials with hydrogen understood and applied in the selection or specification of equipment?	☐
12.	Are ATEX zones defined around hydrogen equipment?	☐
13.	Are all people in the vicinity of the installations made aware of the extent and shape of the ATEX zones?	☐
14.	Is all fixed, transportable or portable equipment taken into the zone ATEX compliant?	☐
15.	Do people entering the hydrogen ATEX zone wear appropriate PPE (e.g. antistatic, flash fire protective clothing and partially conductive safety footwear)?	☐
16.	Are the specific properties of hydrogen considered in the process hazard review for the installation?	☐
17.	Is the location and direction of all hydrogen vents assessed in the facility siting review?	☐
18.	Are the specific properties of hydrogen considered in all task risk assessments?	☐
19.	Do your design standards have hydrogen specific criteria for equipment selection?	☐
20.	Do your energy isolation procedures (LOTO) define specific isolation requirements for hydrogen or flammable gases?	☐
21.	Do you have a documented maintenance plan for your hydrogen installations?	☐
22.	Are earthing continuity requirements documented and periodically checked?	☐
23.	Are there documented purging/venting procedures that include clear definitions of safe level of residual oxygen before hydrogen is (re-)introduced?	☐
24.	Has the site inventory been evaluated to understand whether it is subject to Seveso Directives?	☐
25.	If yes are the Seveso obligations for sites which include hydrogen installations properly understood?	☐
26.	Do personnel understand that liquid hydrogen transfer hoses are cold enough to liquify air on the outside, creating a local oxygen enriched atmosphere?	☐

What can we do about it?

Management responsibility:

The factors that can lead to incidents and accidents in hydrogen installations and tasks are often related to the unique properties of hydrogen.

To avoid such incidents and accidents and improve the safety of people on hydrogen installations, it is important that management should, as a minimum, ensure that:

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