The Hydrogen Future for the North West

Background - The UK Government have set an ambitious target to achieve net zero carbon emissions by 2050. Several financial packages have been announced including the £240 million to support the production of "clean" hydrogen.

The North West region of England is at the forefront of the drive towards net zero and decarbonisation due to the presence of several petrochemical clusters. Several projects are ongoing in the region as part of this development including the HyNet North West project to produce hydrogen from methane with Carbon Capture Utilisation and Storage (CCUS) in the depleted gas reservoir rocks beneath Liverpool Bay. This scheme is intended to supply hydrogen fuel for industrial use, domestic heating, flexible power generation and transportation.

"Clean" hydrogen cannot be achieved overnight due to the lack of infrastructure and the technology needed for large scale electrolysis of water. The UK does not currently have the capacity to generate the electricity required for large-scale hydrogen production by electrolysis.

A staged approach is therefore required to phase-out the use of fossil fuel while allowing the advancement in technology for large scale production of hydrogen by electrolysis. Blue hydrogen is the bridge between the current status quo and the "clean" hydrogen future.

Hydrogen production

Large scale hydrogen production requires the development of the facilities for its manufacture, safe handling, storage, and distribution. Before hydrogen can become the fuel choice for domestic and industrial use, several factors require consideration including the human factor design associated with the use of hydrogen.

Hydrogen is a highly flammable and explosive gas with several hazardous properties associated with its use that require critical scrutiny. These include its wide flammability range, tendency to leakage and low ignition energy. The properties of hydrogen should be considered in the re-purposing and modification of existing equipment (e.g., burners, and combustion chambers) and pipeline in the chemical industry for hydrogen fuel usage.

An incident associated with the industrial use of hydrogen can result in major consequences such as injuries, fatalities, damage to property and delays to production. Operators of chemical plants must ensure that their employees and members of the public are adequately protected during an incident. A negative public perception of hydrogen fuel could hinder general belief to support the drive towards net zero using "clean" hydrogen. Therefore, there is a significant benefit in ensuring the safe use of hydrogen fuel by applying risk reduction measures to prevent, control and reduce the consequence of an incident.

Assessment of risk

A HAZID assessment is a useful tool that can be applied early in the design to identify potential hazards and threats in a process including potential for human error. Human errors are generally as a result of a mistake, lapse, slip or violation that can result in the failure to carry out a required duty which could subsequently lead to an accident.

Human factors can be significant and must be considered in the design of equipment handling hydrogen. As an example, hydrogen gas is odourless and hydrogen flame is almost invisible during daytime. To minimise potential for human error in detecting a leak or fire, preference must be given to automatic instrumented systems rather than relying on human intervention particularly for critical events or situations. If designed correctly, it ensures that protective measures are integrated to prevent foreseeable major accidents and helps to ensure that risks are reduced to ALARP.

Performing a consequence analysis of the worst-case hydrogen release can help understand the range of possible outcomes, ensuring that adequate safeguards are in place to reduce the severity of an incident. It also helps the emergency services to develop and put in place adequate recovery plan following an incident.

Axiom can support you by undertaking safety studies (HAZID, HAZOP), consequence modelling and human factors review for new technologies and feasibility studies. In collaboration with you, we can also deliver support as your technical partner throughout the project life cycle, providing safety assurance that your hydrogen project will be expertly managed to ensure that any residual risks are no greater than for conventional fossil fuels currently used today.

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