View in Web Browser

Hydrogen's Emergency Isolation/Shutdown

The implementation of a hydrogen emergency isolation/shutdown system is imperative to swiftly contain unintended hydrogen releases. Addressing hydrogen's unique characteristics, such as its high flammability and wide flammability range, demands specialized designs and firefighting techniques to mitigate potential repercussions, especially considering its storage under high pressure. Isolation serves as a fundamental safety strategy by stopping the hydrogen release at its source, curbing the volume of flammable gas and averting potential re-ignition after fire suppression, which could lead to hazardous explosions.

Strategically placing hydrogen isolation/shutdown points within the hydrogen distribution system is essential, and the recommended approach is to cease hydrogen flow as close to its storage vessel as feasible. This minimizes the quantity of confined hydrogen within system components and piping, effectively mitigating downstream flammability concerns following ignition. These isolation points can be situated within storage vessels, immediately after storage sources, or at the ingress of hydrogen piping into indoor usage areas. Locating the optimal isolation point is informed by hazard reviews, considering factors like stored hydrogen volume, equipment for vaporization and processing, and the storage location itself.

Emergency isolation/shutdown systems encompass equipment that can be activated either manually or automatically. Manual activation requires operator response, often involving actions like pressing an emergency stop (Estop) button connected to a remote valve or manually closing a valve. This process necessitates sensory and notification capabilities for operators, such as handheld flammable/infrared meters, heat or flame alarms, hydrogen detection tape, or sound sensors. However, manual methods can be challenged by operator proximity and safety concerns during ongoing releases. Automated isolation, in contrast, is engineered to halt hydrogen flow without operator involvement. This approach requires intricate sensing devices like flammable or hydrogen gas detectors, fire alarms, dedicated flame sensors for hydrogen, flow meters, and pressure transmitters. These sensors interface with shutdown devices such as spring- or air-operated automated shutoff valves, measures to isolate electrical ignition sources, hydrogen compressor isolation, and even meltable plastic tubing for pneumatic lines leading to fail-closed valves. Ensuring redundancy through multiple shutdown devices safeguards against equipment failures, enabling the hydrogen isolation/shutdown system to remain effective even if other emergency systems are activated.

Read more about this and other hydrogen safety topics at www.h2tools.org.
Please contact us at chs@aiche.org if you have a suggestion for a future topic.