H2 SAFETY Snapshot

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HANDLING COMPRESSED HYDROGEN GAS CYLINDERS

Proper training and procedures are key elements of a safe work environment. Compressed gas cylinders, as with other equipment, pose risks if they are not handled properly.

This issue outlines good practices for the safe handling of gas cylinders. The information will help you create a safer environment by minimizing the likelihood of an accident involving a gas cylinder.

For more information on compressed hydrogen gas cylinders, see the Pressure Safety module of "Hydrogen Safety Training for Researchers", a Web-based class developed by Lawrence Livermore National Laboratory. This module will assist you in recognizing general pressure system safety issues and introduce considerations specific to system components exposed to hydrogen.

www.h2labsafety.org

Personnel Handling Gas Cylinders

DO ensure that cylinders are handled only by trained personnel knowledgeable in the handling and use of pressurized flammable gas. The training should cover compressed gas safety, fittings and connections, and how to safely attach a regulator to the top of a cylinder. For compressed hydrogen, the specific nature and hazards associated with hydrogen should also be discussed.

DON'T allow untrained personnel to handle gas cylinders.

Transporting, Receiving and Staging Cylinders

DO ensure that gases are delivered with a valve protection cap on the top of each cylinder. This protective cap should remain on until the cylinder is delivered to its point of use, where a regulator is attached. See related lessons learned at www.h2incidents.org/incident.asp?inc=266.

DON'T accept any cylinder that is unmarked or has conflicting markings or labels regarding its contents. Never rely on the color of the cylinder to identify the contents. If there is any conflict or doubt concerning the contents, do not use the cylinder. Return it to the vendor.

DO use a cylinder cart with a restraining device to move large cylinders and specially designed cylinder holders to carry small cylinders.

DON'T transport a cylinder of compressed gases with a regulator attached to it.

DO secure cylinders from tipping over by using holders or restraints designed for such service. Double cylinder restraints (high and low) should be installed in a seismically active area.

DON'T pick up a cylinder by its cap.

References for Handling Compressed Gas Cylinders

H2 Safety Best Practices
www.h2bestpractices.org/lab_safety/lab_design/cylinder_safety.asp

Air Products Safetygram #10, *Handling, Storage, and Use of Compressed Gas Cylinders*
www.airproducts.com/nr/rdonlyres/8d35ea4f-b95f-42c6-9087-6125c1f4123a/0/safetygram10.pdf

Matheson Tri-Gas, *Safe Handling of Compressed Gases in the Laboratory and Plant*
www.mathesongas.com/pdfs/litCenter/SpecGas&EquipmentBrochures/Safe%20Handling%20of%20Compressed%20Gases.pdf

Matheson Tri-Gas, *Guide to Regulators*
www.mathesongas.com/pdfs/litCenter/SpecGas&EquipmentBrochures/Guide%20to%20Regulators.pdf

Connecting a Cylinder to Piping or Tubing

DO ensure that the cylinder contains the right gas for the system to which you are connecting it. See related lessons learned at www.h2incidents.org/incident.asp?inc=66.

DON'T change the regulator service from the particular gas or group of gases for which it was intended.

DO use a pressure-reducing regulator or device that will safely reduce the cylinder pressure to the pressure of your system. The pressure regulator should be designed for hydrogen and marked for its maximum cylinder and delivery pressure.

DON'T use an adaptor between a cylinder and a pressure-reducing regulator, and never use pipe dope or Teflon® tape to connect a regulator to a cylinder.

DO make sure that the piping system has its own pressure-relief device or that the entire piping system is rated for the maximum cylinder pressure.

DON'T rely on the relief device on the compressed gas cylinder's regulator; it is not designed to protect downstream systems. See related lessons learned at www.h2incidents.org/incident.asp?inc=23.

DO use flashback arrestors where hydrogen and oxidizing gases are connected to a common piece of equipment or where low- and high-pressure gases are connected to a common set of piping.

DON'T rely on a closed valve to prevent backflow.

DO perform an inert gas leak-test before using the piping or connected equipment. See related lessons learned at www.h2incidents.org/incident.asp?inc=27. For indoor installations, it is a good idea to perform an additional leak check of the downstream connections using a hand-held detector after hydrogen has been introduced into the system.

Storing Cylinders

DO store cylinders that are not in service or supporting current activities in a safe, properly ventilated and isolated

location. A compressed gas cylinder should be considered "in use" if it is:

- Connected through a regulator to deliver hydrogen gas to a laboratory operation.
- Connected to a manifold being used to deliver hydrogen gas to a laboratory operation.
- A single cylinder secured alongside the primary cylinder as the reserve cylinder.

DO put a cylinder cap on any cylinder that is being stored or is not in use.

DO close the cylinder valve and release all pressure from the downstream equipment connected to the cylinder any time an extended period of non-use is anticipated.

DON'T *ever* refill a cylinder. If gas is accidentally forced back or sucked back into a cylinder, clearly mark the cylinder and inform your gas supplier. Fatal accidents have been caused by users putting gas back into compressed gas cylinders and fillers at compressed gas plants. See related lessons learned at www.h2incidents.org/incident.asp?inc=245.

Topic for Next Quarter

Identification of Safety Vulnerabilities

PNNL-SA-75299

Topic suggestions? Comments?
Contact us at snapshot@pnl.gov

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