GAS CYLINDER PRESSURE SYSTEMS

Purpose

This Water Quality and Hydrology Group (ENV-WQH) procedure describes the process for utilizing compressed gas cylinders.

Scope

This procedure applies to all ENV-WQH personnel, including contract and subcontract employees and students who use compressed gas cylinders.

In this procedure

This procedure addresses the following major topics:

Integrated work management

Work using gas cylinder pressure systems is conducted with applicable Integrated Work Documents, in accordance with LANL IMP 300-00-00, Integrated Work Management for Work Activities.

Signatures

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General Information About This Procedure

Attachments

There are no attachments to this procedure.

History of revision

This table lists the revision history and effective dates of this procedure.

Revision	Date	Description Of Changes
0	4/04	New document
1	5/05	Level 2 Resumption Walkdown Changes: Added gas cylinder transport to procedure. Changes to reflect implementation of IMP 300-00-00, Integrated Work Management for Work Activities.
2	11/05	Revised to address SUP-5 audit findings.

Who requires training to this procedure

The following personnel require training before implementing this procedure:

- All ENV-WQH staff, contract personnel, and students who use gas cylinders and pressurized systems.

Training method

The training method for this procedure is "self-study" (reading), system setup review by the Operations Team Leader or Designee, and is documented in accordance with the procedure for training (ENV-WQH-QP-024, *Personnel Training)*.

Prerequisites

In addition to training to this procedure, the following training is also required for all personnel who conduct groundwater sampling using a pressure system:

- RRES-WQH-SOP-002, *General Field Work*
- RRES-ES-Field, *General Field Safety for All*
- Pressure System Orientation, Course # 769
- Gas Cylinder Safety, Course # 9518

References

The following documents were referenced in creating this procedure:

- Hazard Communication Plan, Attachment 2,of the Chemical Management LIR, 402-510
- Course Manuals, Pressure System Orientation, # 769 and Gas Cylinder Safety, Course # 9518
- LIR 402-1200-01.1, Pressure, Vacuum, and Cryogenic Systems

General information about this procedure, continued

Definitions

Maximum allowable working pressure (MAWP) is determined by the weakest component of a system or subsystem. The pressure-relief device protecting that part of the system is set to the MAWP; the highest pressure at which a system can operate safely.

Compressed gas is the gas stored and used at pressures greater than normal atmospheric pressure.

Pressure system described the containers, vessels, interconnecting hardware, instrumentation, and devices (such as valves, pressure- relief equipment, and flare systems) that contain fluids operating at pressures greater than normal atmospheric pressure.

Pounds per square inch gauge (psig) is the pressure of a system above ambient atmospheric pressure (also known as gauge pressure).

Note

Actions specified within this procedure, unless preceded with “should” or “may,” are to be considered mandatory guidance (i.e., “shall”).

Requirements for using gas cylinders

Policy

To work safely with gas cylinders, an understanding of cylinder markings, construction, and function is necessary. By using the correct components and connections for a particular gas and/or pressure to segregate materials that can react with each other, the possibility of cylinder-related accidents will be minimized. Also, it is necessary to follow all appropriate hazard-control measures related to cylinder handling, storage, transport, and procurement.

By following safe practices when working with gas cylinders, the risk of accidents will be minimized. Use cylinders only for their intended purpose. Never use them as rollers, supports, or for any purpose other than to contain their contents.

Personnel must be trained in the proper use of all pressurized systems. Employees should be able to recognize the hazards associated with the systems and the safety precautions necessary.

Safe work practices

When working on or around pressure systems, you must adhere to safe work practices, including the following:

- Wear safety glasses with side shields, or use a face shield.
- Follow all procedure and integrated work document requirements carefully.
- Use warning signs, and mark or label pressure vessels and systems to identify the operating pressure and contents.
- Restrict access to high-pressure areas.
- Handle and store gas cylinders safely.
- Avoid temperature extremes, which can cause pressure changes and component failure.
- Store cylinders that are not necessary for the current work activity in a safe location outside the work area.

Caution: Never, under any circumstances, work on a pressure system while it is under pressure. Instead, depressurize the system, and use lockout/tagout if appropriate.

Requirements for using gas cylinders, continued

Personal protective equipment

Compressed-gas systems can fail. When failure occurs, pressurized gas may be released and system components may shatter. When working with or around gas cylinders, wear safety glasses with side shields to protect your eyes.

Gas cylinders are heavy enough to crush feet and toes. If required to handle cylinders, wear safety shoes or shoe caps, and leather gloves.

Tasks involving compressed gases may pose hazards that require additional personal protective equipment. Follow all guidance specified in applicable integrated work documents for the task.

Safety systems

Overview

To prevent accidents, pressure-control devices are designed into any system that is pressurized above the ambient pressure. Many pressure systems, whether their energy source is a compressed gas cylinder or a compressor, use safety manifolds, relief devices, and pressure gauges to ensure that each portion of the system operates at safe pressures.

Safety manifolds

As a safety feature, safety manifolds regulate delivery pressure, protect from over pressurization, indicate pressure level, vent unused pressurized gas, and meter end-use pressure.

Regulators

Regulators are devices that control the pressure of the system contents. Regulators reduce pressure; they do not act as positive shutoffs. When they malfunction, gas can creep through them at a slow rate and increase downstream pressure beyond the MAWP.

- Always use a fill valve to shut off gas flow completely.
- Store compressed gas regulators that are not in use in plastic bags and label the regulator as to what gas they regulate.
- Verify that the regulators for use with nitrogen are stamped with a “CG” number. Dispose of regulators without a “CG” number stamp.
- Use regulators appropriate for the gas or gas mixture in question. Protect regulators and associated pressure system components from potential damage.
- Use pressure-reducing regulators when withdrawing the contents of a compressed gas cylinder into a pressure system. For manifolded multi-cylinder systems, the regulator must be as close to the gas cylinder as possible. Only use regulators approved by a national recognized testing laboratory or other quality organizations.

Safety systems, continued

Regulators (continued)

Note: Many regulators contain built-in relief devices to protect the regulator. These devices do not protect the system.

Single-stage regulators are used when constant regulation is not important, as in a building's air system. These regulators provide high flow rates at moderate pressures and allow output pressures to drop as cylinders empty.

Two-stage regulators maintain constant delivery pressures as cylinders empty. These regulators generally allow lower flow rates.

Vent valves

Tightening or adjusting any pressure-system component while it is under pressure places undue strain on the threads and can lead to failure. Opening a threaded connection to release or vent pressure is also unsafe. Therefore, vent valves must be provided to relieve pressure in all parts of the system where pressure can build up.

Depending on the type of gas, vent valves must discharge safely away from personnel, often directly to the outdoors. These discharge paths must be maintained as originally designed.

Pressure gauges

Pressure gauges are often required to provide more accurate system-pressure readings than regulator gauges can provide. Pressure gauges

- are most accurate if graduated to about 2 X MAWP;
- should not be used if they read less than 1.2 X MAWP;
- must be made from materials that are compatible with system contents and pressures;
- must be safety-type gauges if used in high-hazard applications (for example, the gauge must have safety glass and a blowout back);
- should be protected with a snubber (ex, whipping chains) against surges or oscillating pressures; and
- should be protected with a pressure-relief device.

Caution: Never use oil in an oxygen gauge.

Safety systems, continued

Maintenance Ensure pressure system is legibly and durably marked with labels that identify:

- maximum operating pressure (MOP)
- maximum allowable working pressure (MAWP)
- temperature range
- flow directions
- contents

A detailed schematic posted nearby the system shall satisfy this requirement provided the actual components shown on the schematic are readily identifiable.

Accidental or uncontrolled releases

Responding to a release

Release of inert gases displaces breathable air and can result in unconsciousness. Release of poisonous gases can be immediately dangerous to life or health, and release of flammable gas can result in a fire or explosion.

In the event of an accidental or uncontrolled release of gas cylinder contents, evacuate the area and notify supervisor for further instructions.

Using LANL Compressed Gas Processing Facility services

Gas cylinder procurement

The Laboratory's Compressed Gas Processing Facility, or gas plant, is operated by the Materials Management Group (SUP-4). Gas plant personnel are responsible for all gas cylinder deliveries and returns.

Gas cylinder transport

Transport only 3 full-size (125-140 pounds) cylinders of nitrogen at a time; total combined weight of all cylinders must be less than 440 pounds.

If transport of additional cylinders is warranted, WQH Operations Team Leader will coordinate with SUP-5 to schedule specific Department of Transportation training and appropriate shipping papers.

Gas plant services

Gas plant provides the following services:

- gas cylinders
- supply larger volumes of gases in trailers
- supply specialty gases from vendors
- deliver gas cylinders to your facility
- pick up "empty" cylinders.

Using LANL Compressed Gas Processing Facility services, continued

Cylinder handling practicies

Gas plant personnel have established the following cylinder-handling practices:

- Cylinder delivery to the facility should be to a clean, snow-free, accessible outside dock, on a regular schedule.
- "Empty" cylinders should contain at least 25 psig of pressure to prevent contamination.
- Cylinders for return should be disconnected, standing, and secured, with their caps in place.
- Cylinders for return should be tagged with standard "return" tags (available from Fisher Scientific).
- Special notations should be made on the tags. Do not use tape on the cylinders.
- Cylinders containing poisonous and flammable gases should have their valve-outlet plugs in place.
- Cylinders used at facilities with radioactive contamination must be monitored and white-tagged by an RCT.

Contact information

The following table lists contacts for information and assistance regarding gas cylinder safety and procedures.

For information or assistance on…	call…	at…
the packaging and transportation of gas cylinders	the SUP-5 gas plant	7-4406
the design, installation, inspection, and safe use of pressurized systems	the HSR-5 Institutional Industrial Hygiene and Safety	7-5231
on-line signature authorization	Lab-Wide Systems Support	7-9444
training on pressure safety and related topics	the Environment, Safety, and Health Training Group (PS-13)	7-0059

Click here to record self-study training to this document.