جامعة الشارقة UNIVERSITY OF SHARJAH	Policy Main Title	Central Labs	Effective Date	01-Nov-19
	Policy Subject	Compressed Gas Cylinders & Cryogenic Liquids Management	Last Review date	01-Nov-22
	Policy Number	UOS/CLD/MS/05	Next Review date	01-Nov-23
	Responsible Entity	Central Laboratories Directorate - Maintenance Section	Approved By	Deanship of Academic Support Services

Overview

Pressurized gases and cryogenic liquids have potential hazards in labs and if preventive measures are not available on site it may impact huge loss in the form of financial/ environmental/ human health/ product. It is important to put controls during transportation and store pressurized gases and cryogenic liquids and manage their database to secure the labs and users. Central Labs Directorate is committed to ensuring compressed gas cylinders are handled, used, transported, in a manner which avoids damage, does not pose safety hazards and incidents, and trigger environmental concerns due to leakage. Also, it will help to create a safe and hazard free environment by safely storing, moving, and using compressed gas cylinders and cryogenic liquid containers.

Scope

This procedure applies to all faculty, staff, students, visitors, and contractors working with compressed gas cylinders & cryogenic liquids in laboratories that fall under Central Laboratories Directorate, University of Sharjah.

Purpose

The purpose of this policy is to:

a. Ensure that all the compressed gas cylinders used in labs are stored properly and secured professionally to avoid any hazard.
b. Defines the key roles and responsibility of the Maintenance gas Technician, lab officers, students and all other staff related to the use of compressed gas cylinders and cryogenic liquids.
c. Protects the staff and students to handle and use the compressed gas cylinders and cryogenic liquids safely.
d. Ensure that the contents and identification of the compressed gas cylinders are properly mentioned for clear and easy understanding for all related personnel.
e. Make sure that all necessary gases and cryogenic liquids are readily available for routine usage.

Definition

1. **Compressed Gas:** A compressed gas is any gas which when enclosed in a container gives:
    a. an absolute pressure reading greater than 276 kPa (40 psi) at 21°C (70°F); or
    b. an absolute pressure greater than 717 kPa (104 psi) at 54°C (129.2°F); or
    c. any flammable liquid having a vapor pressure greater than 276 kPa (40 psi) at 38°C (100.4°F).
2. **Corrosive Gas:** A gas that in contact with living tissue causes destruction of the tissue by chemical action.
3. **Cryogenic Liquid**: A liquid with a normal boiling point below -150°C (-238°F).

4. **Cylinder Valve:** A mechanical device attached to a compressed gas cylinder that permits flow into or out of the cylinder when the device is in the open position and prevents flow when in the closed position.
5. **Dewar**: Is an open-mouthed, non-pressurized, vacuum-jacketed container used to hold cryogenic fluids
6. **Flammable Gas:** A substance that meets the definition of a compressed gas which:
    a. is flammable in a mixture of 13% or less (by volume) with air, or
    b. has a flammable range with air wider than 12%, at atmospheric temperature and pressure, regardless of the lower limit.
7. **Gauge Pressure:** The pressure above or below atmospheric pressure. Therefore, absolute pressure minus local atmospheric pressure equals gauge pressure and is usually abbreviated as psig or kPa.
8. **Handling**: Moving, connecting, or disconnecting a compressed, liquefied gas and cryogenic liquid container under normal conditions of use.
9. **High-pressure Cylinders**: as defined by international standards are those marked with a service pressure of 900 psi or greater." The term "high pressure" can therefore be any level prescribed for the equipment or system in use. For incident prevention purposes, any pressure system shall be regarded as hazardous.
10. **Highly Toxic Gas**: A compressed gas that has a median lethal concentration (LC50) in air of ≤ 200 ppm. A NFPA Health Hazard rating of 4 is given to gases having an LC50 in air ≤ 1000 ppm. An example of a highly toxic gas is fluorine with a LC50 of 185 ppm.
11. **High Pressure Gas:** A gas in a container that has a pressure of 3448 kPa (500 psig) or higher at 21.1°C (70°F).
12. **Inert Gas:** A gas which is chemically inactive.
13. **Liquefied Gas:** A fluid within a pressurized container, other than in solution, which exists both as a liquid and gas at 20°C (68°F). Examples include propane, butane, ammonia, carbon dioxide, and sulfur dioxide.
14. **Low Pressure Tank:** A tank designed to operate at pressure above 0.35 kg/cm2 but not to exceed 1.055 kg/cm2.
15. **Nonflammable Gas:** A gas which, within the packaging, exerts an absolute pressure of 280 kPa (40 psi) or greater at 20°C (68°F) but is not a flammable gas as defined previously.
16. **Oxidizing Gas:** A gas that can support and accelerate combustion of other materials.
17. **Pressure Vessel**: A tank designed to operate at pressure above 1.055 kg/sq. cm.
18. **Pressure Regulator**: A mechanical device used to safely control the discharge pressure of a compressed gas from a container.
19. **Pressure Relief Device**: A pressure and/or temperature activated device used to prevent the pressure from rising above a predetermined maximum and thereby prevent rupture of a pressurized container.

20. **Pyrophoric Gas:** A gas that will spontaneously ignite in air at or below 54.4°C (130°F). Examples include silane and phosphine.
21. **SCF:** One standard cubic foot of gas at 21°C (70°F) and 14.696 Psi.

Abbreviation

CLD – Central Laboratories Directorate
CLDMT – Central Laboratories Directorate Maintenance Team
DCLD – Director Central Laboratories Directorate
GT– Gas Technician (Central Labs Directorate)
MMO – Maintenance Management Officer
MTENG – Maintenance Engineer
LSO – Labs Safety Officer
DASS – Dean of Academic Support Services
AP – Authorized Person: Trained & Authorized to transport, receive & fix gas cylinders.
LS – Lab Staff: (Lab Supervisors, Lab Officers, Lab Engineers, Clinical Tutors, Lab Technicians, and research assistant)
LFM – Labs Faculty Member (Professor, Associate Professor, Assistant Professor, Lecturer and Researchers)
LTL – Lab Team Leader
SDS – Safety Data Sheet

Reference

- Education Sector Environment, Occupational Health & Safety Management System General Framework Version 2.0 / January 2020 (Risk Management Program for Scientific Laboratories).
- OSHAD- Version 3.0 July 2016. Clause: 5.5.3; OSHAD-SF CoP 49.0 – Compressed Gases
- ISO 9001:2015, Clause-8.1 (Operational Planning and Control).
- UAE Fire and Life Safety Code of Practice Sep-2018.
- Stipulation 7: Health, Safety and Environment, CAA Standards for Institutional Licensure and Program Accreditation Dec 2019.

Policy

a) Maintenance team should ensure all compress gas cylinders and Cryogenic tanks are secure and safe.
b) Maintenance team maintain the proper identification and inventory of gas cylinders in labs.
c) Maintenance team should manage and support for emergency leakage or breakdown.
d) Maintenance team is committed to provide best services for the gas cylinders and cryogenic liquid safety.

e) Maintenance team should follow and adhere to the safety guidelines, CL policy and procedures, Civil defense authority, CAA standards and local legal authorities to avoid any legal obligation.

Procedure

RESPONSIBILITY		ACTION
	1.0	**General**
CLD	1.1	Responsible to manage policy and procedure related to compressed gas cylinders and cryogenic liquids under their control.
CLD	1.2	Has provided guides and / or cautions all interested parties regarding safe use of compressed gas cylinders on university website.
CLD	1.3	Responsible to handle issues that arise due to mishandling or damage or determination of compressed gas cylinders and cryogenic liquids.
CLD	1.4	Responsible for arranging and provision of compressed gas cylinders and cryogenic liquids as and when needed based on an official request from lab staff either by cash purchase or blanket order for gas suppliers.
CLD	1.5	Complies with any new plan generated by Central Labs Directorate or University of Sharjah due to any pandemic situation.
	2.0	**Compressed Gas Cylinders and Cryogenic Liquids Management Procedure**
	2.1	**Requisition of Compressed Gas Cylinders & Cryogenic Liquids**
LS/LFM/LTL	2.1.1	Sends request only to CLD for any compressed gas cylinder & cryogenic liquid whenever needed. Note: It is not allowed to purchase or arrange any gas cylinder, regulators, or related accessory & cryogen liquid directly.
MMO/MTENG/DCLD	2.1.2	MMO will inform the requirement to MTENG, after reviewing the request final approval is required from DCLD to procure the same
	2.2	**Training**
CLD	2.2.1	As and when needed, organizes training for LS/LFM/LTL and GT & CLDMT to ensure they have attended relevant training for handling of compressed gas cylinders.
LS/LFM/LTL, CLDMT & GT	2.2.2	Ensure they have attended necessary training required for handling compressed gas cylinders. In case no training is attended, highlight to the DCLD, when needed.
LS/LFM/LTL, CLDMT & GT	2.2.3	In case no training has been attended for compressed gas cylinders handling, respective staff is not allowed to handle them as it is extremely risky.

RESPONSIBILITY		ACTION
	2.3	**Identification of Compressed Gas Cylinder Contents**
LS/LFM/LTL, CLDMT & GT	2.3.1	Familiarizes with the followings: • Properties of the contents of gas cylinder. • The hazards involved. • Precautionary Measures are taken as per SDS. • Emergency measures are taken as per SDS.
LS/LFM/LTL	2.3.2	Identifies contents of compressed gas cylinders. The identification is stenciled or stamped on the cylinder itself. **Note:** Compressed gas cylinders with no / missing label and whose contents cannot be identified, are reported immediately to the Maintenance Team Leader and/or Gas technician in Central Labs Directorate.
LS	2.3.3	Ensures that appropriate warning signs are posted in areas where compressed gas cylinders are stored and/ or used.
	2.4	**Inspection of Cylinder / Dewar**
GT/CLDMT/AP & MMO	2.4.1	Upon receiving a new cylinder/Dewar from supplier, ensures followings are provided: • Certificate of analysis for each gas. • Gas content information is stamped or stenciled on each cylinder and should not be removable. • All cylinders are in good condition. • All cylinders must have a protective cap. • Cylinder Hydrostatic Test Report (upon request). • MMO must file the delivery note/invoice for processing
LS/LFM/LTL	2.4.2	Performs visual inspection of the cylinder or Dewar before use.
LS/LFM/LTL	2.4.3	Inspects followings before Dewar is placed on the elevator for transporting: • No frost, sweating, or venting of Dewar contents; • The pressure building valve must be closed; The pressure of any Dewar to be loaded into an elevator must be less than 1/2 of the pressure setting of the Dewar's main relief valve.
LS/LFM/LTL	2.4.4	In case of any defect, reports it to the Maintenance Team Leader/Gas technician in Central Labs Directorate.
	2.5	**Handling and Use of Compressed Gas Cylinders**
LS	2.5.1	Ensures Safety Data Sheet (SDS) is readily available in hard copy for each gas in the labs and lab users must be familiar with SDS contents.
LS	2.5.2	Ensures that gas cylinders must be secured in the top 1/3 of the tank at all times to prevent tipping.

RESPONSIBILITY		ACTION
LS	2.5.3	Cylinders may be attached to bench top, individually to a wall with chains or sturdy straps and or placed in a holding cage.
LS/LFM/LTL & GT/CLDMT	2.5.4	In case leaking cylinder is discovered, then • Close the valve immediately if possible. • Make sure that nearby place is evacuated. • Call Maintenance Team Leader/Gas technician in Central Labs Directorate for removing the cylinder from the building. In case of LPO follow the instructions in document UOS/CLD/SS/02- Labs Emergency Preparedness Policy & Procedure. For other gases refer to relevant SDS.
LS/LFM/LTL & GT/CLDMT	2.5.5	Be cautioned; do not attempt to repair or modify a cylinder or valve in any circumstances.
LS/LFM/LTL	2.5.6	Cylinders shall be always placed with the valve accessible.
LS/LFM/LTL	2.5.7	Cylinder valves shall be closed whenever not in use or unattended.
LS/LFM/LTL	2.5.8	When opening the valve of the cylinder, the end user will open it slowly and position the cylinder with the valve pointing away from the face and others nearby.
LS/LFM/LTL	2.5.9	When a cylinder is empty, informs Maintenance Team Leader/Gas Technician in Central Labs Directorate.
GT/CLDMT/AP	2.5.10	Removes the gas regulator from empty cylinder and put safety cap on it.
LS/LFM/LTL	2.5.11	During handling cryogenic liquids, makes sure that the place is properly ventilated.
LS/LFM/LTL & GT/CLDMT & AP	2.5.12	Must use appropriate PPE when handling compressed gas cylinders and cryogenic liquids. Note: Using PPE while handling compressed gas cylinders and cryogenic liquids is mandatory for relevant staff.
	2.6	**Storage of Cylinders / Canisters**
LS/LFM/LTL	2.6.1	Cylinders and canisters containing flammable gases such as oxygen or acetylene, must not be stored closer to open flames, electrical sparks, other sources of ignition, next to elevators, stairwells, or in walkways.
LS/LFM/LTL	2.6.2	Oxygen cylinders, full or empty, must not be stored in the same vicinity as flammable gases (including acetylene). **Note**: The proper storage of oxygen cylinders requires a minimum of 20 feet between flammable gas cylinders or the areas be separated, at a minimum, by a 5 feet-high wall with a fire rating of 0.5 hours.

RESPONSIBILITY		ACTION
LS/LFM/LTL	2.6.3	Never store cylinders in poorly ventilated rooms.
LS/LFM/LTL, GT/CLDMT & AP	2.6.4	Greasy and oily materials must never be stored around oxygen cylinders and fittings must never be greased or oiled.
LS/LFM/LTL, GT/CLDMT & AP	2.6.5	Gas cylinders shall not be placed in direct sunlight.
LS/LFM/LTL, GT/CLDMT & AP	2.6.6	Cylinder always should be kept in upright position
	2.7	**Transportation of Cylinders & Cryogenic Containers**
GT/CLDMT, AP	2.7.1	Cylinders shall not be handled roughly or abused.
GT/CLDMT, AP	2.7.2	Gas Cylinders shall be kept in upright position while transporting. Note: LS/LFM/LTL is not allowed to transfer
GT/CLDMT & LS/LFM/LTL	2.7.3	Cylinder caps must be in place to protect the valve assembly, for cryogenic liquids Dewar's the lid should be tight firmly while transporting.
GT/CLDMT & LS	2.7.4	Cylinders and Dewar's shall not be rolled or dragged. Always use a cart for shifting the gas cylinder.
GT/CLDMT & LS	2.7.5	Cylinders shall be properly strapped or chained to designed carts or trucks.
GT/CLDMT & LS	2.7.6	Only one cylinder/ Dewar shall be handled at a time.
GT/CLDMT & LS	2.7.7	Cylinders shall not be transported in the passenger portion of a vehicle.
GT/CLDMT & LS	2.7.8	Open wide mouth (a.k.a. open-flask style) Dewar's are not to be used for transporting liquid in elevators.
GT/CLDMT & LS/LFM/LTL	2.7.9	Do not travel with Dewar in the elevator or allow anyone else to be present in the elevator. Instead use other appropriate means to transport and receive the Dewar from an elevator e.g., a buddy system, use a key lock for the elevator or a warning sign while transporting cylinder.
GT/AP	2.7.10	Only the Gas Technician or Trained Central Lab staff are allowed to transport Cylinders & Cryogenic Containers.
	3.0	**Monitoring and Control**
LS/LFM/LTL/ GT/CLDMT, AP	3.1	Prepares "Incident report" in case of emergency and / or incident occurs and submits to the Lab Safety Officer or DCLD
Lab Safety Officer &	3.2	Review report and act as deemed necessary.

RESPONSIBILITY		ACTION
DCLD		
	4.0	**Records**
GT/MMO	4.1	Ensures that electronic version and / or hard copy of following records are maintained for a period of three years. • Routine Work Schedule for Gas Technician (Daily Checklist) (MS/FR/02) • Routine Work Schedule for Gas Technician (Weekly Checklist) (MS/FR/03) • Purchase Request Form (Form ref. TS/FR/01) • Supplier's delivery note. • Relevant SDS for each gas
Lab Safety Officer/MMO	4.2	Ensures that electronic version and / or hard copy of "Incident Report" is maintained for a period of three years.
DCLD, GT, CLDMT, MMO & Lab Safety Officer	4.3	Disposes records after expiry of retention period. Disposal may include: • Send to store • Destroy the records • Shred the records • Archive the records

Document Amendment Record

Date	Description of Amendment	Page/s Affected
28-06-2022	Add Overview, Purpose, Scope, Reference, and Policy statements	1-2
	Adding new statement for Pandemic/Emergency situations in clause no. 1.5.	3
	Add new Work schedule form in Records clause no. 4.1	8
	Add new forms in Record clause 4.1	8