



Process: Transportation of Gas Cylinders from Staging Area to CMEB Lab

Department/Faculty: Chemical and Materials Engineering, Faculty of Engineering

Location (Room # and Building): DICE L1-380ZZ, L1-382, L1-384, L1-386, L1-388

Scope:

This document will outline the steps required to use the **Self-Service Gas Staging Area** (DICE L1-380ZZ) and transport your gas cylinder from there, through CME L1, through the CME Chemical Use Elevator (ELV-68/CME West Elevator) to a lab.

This document should be followed for all faculty, staff and students within the Faculty of Engineering moving gas cylinders in CMEB, or throughout the Faculty of Engineering.

The use of the ICE freight elevator is out of scope, and is not to be used for this process or any chemical transportation, unless required by enggsafety@ualberta.ca

Hazard Identification:

- Crushing Hazard (Broken Bones) - If a gas cylinder falls onto, or if it is launched in your direction after shearing the valve, it can crush you, causing minor to potentially fatal injury.
- Asphyxiation Hazard (Oxygen displacement) - If the gas cylinder leaks, this can displace the oxygen in a space asphyxiation those near and involved.
- Burn and Explosion Hazards - If a flammable gas is ignited, it can cause burns or explosion of the cylinder, causing harm to all those near and involved.
- Chemical Incompatibility - If a gas cylinder is stored in the wrong location, or returned to the wrong location, this may cause chemical incompatibility issues if there is a gas leak.

Training Required:

To conduct this process safely, you must complete the CMEB Gas Transportation Training.

Control/Protective Measures:

Engineering Controls

- Use of gas cylinder cart for moving gas cylinders
- Use of gas cylinders racks and chains for storing gas cylinders and stopping them from falling.
- Blast proof fans and controls prevent potential explosions from electrical equipment within the flammable gas storage area.

Administrative Controls

- The CME Department will only allow access to the self-serve gas cylinder staging area after the CMEB Gas Transportation Training has been completed.
- Gas cylinders can only be moved when the valve cap is in place.
- Gas cylinders on carts can only be moved when the chain or strap on the cart secures the cylinder in place.

Tools, Materials, Equipment and PPE:

Equipment

- Gas Cylinder Cart - Found in the gas cylinder staging areas. To be returned to the gas cylinder staging area. To be used for cylinders larger than 25 lbs or over 24 inches high.

PPE

- Steel toed boots or boot caps are required when moving gas cylinders, to minimize crushing harm in case the cylinder or cart falls.
- Work Gloves (not made of nitrile, or just for chemical handling) are recommended when moving gas cylinders to minimize and reduce the consequences of pinching/crushing hands.
- Lab coats and safety glasses must be worn during gas transportation.

Emergency Procedures:

Gas Monitors in Gas Cylinder Staging Areas are below 18 or above 21%



Gas monitors (in the red circles) measure the oxygen levels within the rooms, and display that data on small monitors.

If the gas monitors in the gas cylinder are below 18% or above 21%, this likely means that there is a gas leak within the staging areas either displacing or creating oxygen. If this is the case:

1. Evacuate the gas staging area immediately.
2. Call 911 and then Protective Services (780-492-5050)
3. If instructed, leave the building, alerting others as you go.
4. Do NOT re-enter the building until permitted to do so by emergency responders.

Gas Cylinder Falls during transport

There are two main risks when a gas cylinder falls during transport: the risk of the gas cylinder rupturing or leaking, and the risk of the gas cylinder crushing a body part.

If the gas cylinder has fallen and has crushed a body part, consider whether this is a medical emergency (any injury, illness or medical event that requires immediate response to minimize the likelihood of death or permanent injury.) then:

1. Call 911 and then Protective Services (780-492-5050)
2. **DO NOT MOVE** the injured person unless there is a risk of additional harm.
 - a. If you hear the sound of gas leaking from the fallen cylinder, move the individual as far as is safely possible.

3. Administer first aid if you are trained and able to do so safely
4. Send someone to meet emergency responders at the entrance of the building
5. Stay with the injured person and try to reassure them
6. Keep the injured person warm with a blanket or coat
7. Stay there until released by emergency responders

Gas Cylinder Leaks during transport

If the leak cannot be immediately fixed by tightening fittings, or any other leak arises:

1. Exit the room immediately.
2. **Notify:** Call 911 and then Protective Services (780-492-5050.) Mention what building you are, the room, the type of gas that is leaking, and how much is inside.
3. **Evacuate:** If instructed, leave the building, alerting others as you go.
4. Do NOT re-enter the building until permitted to do so by emergency responders.

In every case, once the immediate hazards are dealt with, and it is safe to do so, report the incident on [arise](#).

Step by Step Procedure of the Process

Phase 1: Self-Serve Gas Staging Area

1. Head down to DICE L1 and move towards the DICE Loading Dock.
2. Head towards the leftmost door on the far wall of the DICE Loading Dock.
3. Use your OneCard to enter the Self-Service Gas Cylinder Staging Area.
 - a. If your OneCard does not open the door, AND you have completed the training and contact shaofeng@ualberta.ca (CME User) or enggsafety@ualberta.ca (non-CME User)
 - b. Do not enter the Self-Service Gas Cylinder Staging Area without training.
4. Ensure you have appropriate PPE.
 - a. Please bring your own safety glasses, long pants and labcoat.
 - b. Bring work gloves and steel toe caps/shoes. They may be able to be made available to you if you do not have any.
5. There are three gas staging areas. Enter the correct area.
 - a. L1-382 - Inert Gasses - i.e. Nitrogen, Argon, Helium, Etc.
 - b. L1-384 - Flammable Gasses - i.e. Hydrogen, Acetylene, Natural Gas, Etc.
 - c. L1-386 - Oxidizing Gasses - i.e. Oxygen, Nitrous Oxides (NO, NO₂)
6. To enter the correct area, use the lockbox beside the door, and enter the correct code (9729), to get access to the key.
7. Use the key to open the door to the appropriate gas staging area.
8. Put the key back in the lockbox.
9. **Do not** move more than one gas cylinder at a time, unless the cart used is designed for the purpose.

- a. If doing so, do not move two incompatible cylinders together (i.e. an oxidizer + a flammable)
10. If the cylinder you plan to pick up is less than 25 lbs and less than 24 inches (2 feet) high, you may pick it up by hand. If the gas cylinder is heavier or larger than that, a gas cylinder cart must be used.
11. When entering the area, check the gas cylinder cart you plan to use. Ensure that the gas cylinder cart does not have any obvious defects. The Equipment Maintenance Procedures (at the end of this SOP) has a checklist.
 - a. If the gas cylinder cart does not have a chain or strap, or has obvious visual concerns, **DO NOT USE the gas cylinder cart** and contact enggsafety@ualberta.ca to let them know maintenance is required, and use another cart from that room.
 - b. If there are no carts in that room, use one from another room. If there are no other carts available, contact enggsafety@ualberta.ca to let them know of this issue.
12. Check the label on the gas cylinders in the area
 - a. Confirm that the one you are picking up is for your lab.
 - b. Confirm that you understand its contents and hazards associated with its contents.
 - c. Check for any cylinder damage.
13. Ensure that the valve cap is on the cylinder, and that it is tightened.
 - a. The valve cap is there to reduce the likelihood of the valve shearing off during the fall, turning the gas cylinder into a projectile.
14. Undo the chain keeping the gas cylinder in place on the storage rack.
15. Bring your gas cylinder cart closer to the gas cylinder.
16. Move your cylinder onto the gas cylinder cart. **DO NOT** lift it by the neck.
 - a. Bring it to an angle, and rotate it slowly below the neck.
 - b. Ensure that the gas cylinder is moved as close to the back of the cylinder cart as possible, to prevent it from moving or wiggling during transport.
17. Secure the cylinder with the chain or strap provided by the gas cylinder cart.
18. Gently tilt the cart back and push the cart to your destination.
 - a. **DO NOT pull the cart behind you. A sudden stop will hurt the back of your legs, or worse.**
19. Before leaving the gas staging area, look back:
 - a. Ensure the door to all the rooms are closed
 - b. Ensure the lockbox is closed, with the key inside and the code reset.

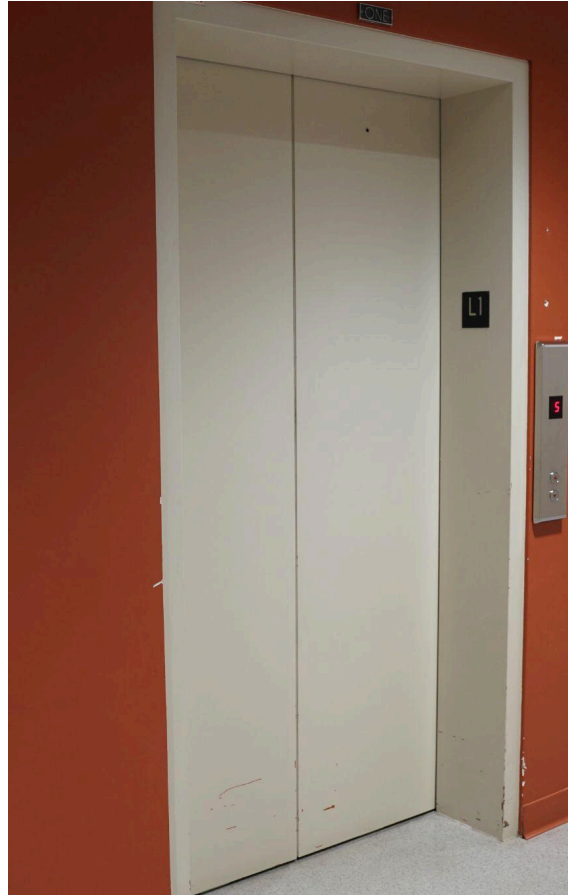
Phase 2: Gas Cylinder Transportation through Elevator

Transporting gas cylinders to different floors using elevators exposes the people transporting it to additional hazards, or increases the hazards already present. To minimize the exposure to other people, the **West Elevator** in CME has been designated as the elevator where all chemicals, biological, gasses and other hazardous material will be transported.

The largest and most dangerous hazard you expose yourself to, while being in the elevator is that of asphyxiation. If the gas cylinder were to rupture or leak while you are inside the space, it is very likely to

displace all the oxygen in the elevator, where you would quickly asphyxiate. This is why you must **not be in the elevator with a gas cylinder that is not empty.**

All gas cylinders, no matter the size or weight, must go through the West CME Elevators.



Transporting the gas cylinder will require the use of two people. One to move the cart. One to keep the elevator open.

1. When moving gas cylinders to floors other than L1-CME, this will require the use of an elevator.
2. Press the button to call the elevator.
3. Once the elevator opens, ensure everyone inside has exited.
4. Have one person hold the open door button for the elevator. This is to ensure that while setting up, the elevator does not go anywhere.
5. Head into the elevator and put the gas cylinder cart and cart into the corner.
6. Attach the chain to the gas cylinder cart, to ensure the gas cylinder does not move in place.
7. Extend the retractable wall barrier and attach them to the other side of the cylinder. This should prevent anyone from entering the elevator while the gas cylinder is being moved.
8. Press the button for the floor you wish to get the gas cylinder to.
- 9. DO NOT RIDE THE ELEVATOR UP WITH THE GAS CYLINDER.**
10. Have someone get up to that floor, to pick up the gas cylinder from the elevator.

11. Remove the retractable wall barriers, remove the chain and take the gas cylinder from the elevator.
12. Push it to your lab

Phase 3: Reaching your lab/Setting it up

Once you've reached your lab:

- Bring your gas cylinder cart as close as possible to where you will chain up your gas cylinder.
- Remove the chain from the gas cylinder cart.
- Move your gas cylinder to the correct location.
 - Utilize similar 'walking' techniques as before
- Wrap or chain your gas cylinder to the area.
- BEFORE removing the old gas cylinder, ensure that the regulator is removed, and the gas cap is secured.
 - Whenever the gas cylinder is being moved, the gas valve cap must be on.
 - **NEVER** move a gas cylinder with the regulator on. This increases the likelihood of the valve shearing when the gas cylinder falls, causing gas leak and additional physical harm.
- Once secured, Keep the valve cap on.
- Once the cylinder is in use, remove the valve cap, install the regulator and do a leak test. Once it is in use, remove the portion of the tag that says full, to ensure everyone knows it is in use.

REMEMBER: RETURN THE GAS CYLINDER CART WHEN YOU ARE DONE.

Phase 4: Returning the Gas Cylinder Cart to your lab

Once the gas cylinder is almost empty and ready to be returned:

- Close the valve, and ensure it is closed.
- Remove the regulator, re-install the valve cap.

Continue by doing the phases in reverse.

1. Phase 3. Transport it from your lab to the elevator.
2. Phase 2: Transport the empty gas cylinder on the elevator.
3. Phase 1: Transport it from the elevator to the gas staging area.

Hazardous Waste Disposal Procedures

Any and all gas cylinders that were removed from the gas staging area, when empty, will be returned to the gas staging area, to the appropriate room.

The [Linde Cylinder Return form](#) must be filled out and attached to the gas cylinder that is returned

If you have purchased a lecture bottle, these are not returnable and will incur a cost to the researcher for disposal through Chematix.

If you have purchased a propane cylinder **not** from our preferred vendor, reach out to that vendor regarding disposal.

Equipment Maintenance Procedures

Pre-use checklist for Gas Cylinder Cart

- Are there any cracks in the chassis? If yes, do not use the cart.
- Are there any cracks in the tire? Do they look deflated? If yes, do not use the cart.
- If you move the cart around, without a gas cylinder on it, do you feel any issues with turning it? Does it feel unstable? If yes, do not use the cart.
- Does the gas cylinder cart have a strap or chain to secure the cylinder in place during transport? (A bungee cord does not count.) Does the strap or chain look damaged?

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Changelog	Responsible for Change	Date of Change