

Safety knowledge sharing



Lab Safety

Jan. 2023

I. Case Sharing

Case I: On 30th Dec. 2022, while working in the laboratory, our research staff found that the portable flammable gas detector used to detect the working environment showed that the concentration of flammable gas in the cabinet reached 15 PPM.

After checking by EHS staff, a leak was found out of the **spool of the hydrogen cylinder outlet valve**, and the portable flammable gas detector also showed that the concentration of space near the valve reached **57% LEL** (lower explosive limit).

Case II: A similar case happened on 12th Jan. 2021, when lab was conducting an experiment in which the hydrogen consumption was much greater than the normal. After checking, it was determined that the leakage point was in the **outlet valve spool of the hydrogen cylinder** and the mixture cylinder, and the **connection** of the hose of H₂ cylinder.

Case III: On 5th Feb. 2021, gas leak at the main valve occurred from a nitrogen gas cylinder in the central supply room of research building after it had been replaced. It was confirmed on site that a **defective at connection thread** had caused leakage.



Figure 1 Heavy leakage from the bottle top



Figure 2 Flammable gas concentration of valve accessories

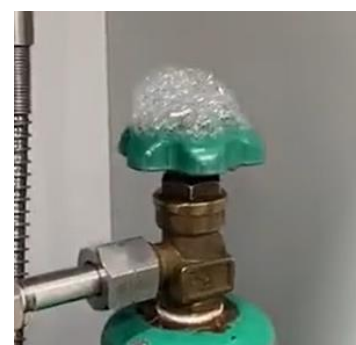


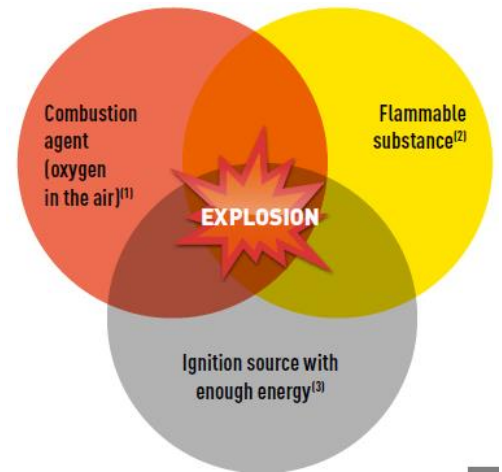
Figure 3 Outlet valve spool leakage

II. The conditions of the explosion

First of all, it is important to understand the basic conditions for explosion, in general, the gas explosion to achieve two conditions.

Three elements of explosion: flammables, explosive substances, ignition sources.

1. **Lower explosive limit** of flammable gases LEL is: The minimum concentration of flammable gas that can explode in a mixture of flammable gas and air.
2. Minimum energy **MIE** that can ignite a mixture of flammable material with air or oxygen, e.g. static electricity, an open flame or a hot surface with higher temperature.



III. What to do in cases of gas leakage

1. Cut off the leaking source immediately while ensuring the personnel safety.
2. Upon hearing the gas alarm, evacuate people in the affected area and carry out area control, notify the relevant departments for on-site inspection at the first opportunity, and cooperate with emergency response team.
3. If the leaking gas is flammable, avoid to generate sparks. Stop works with fire.

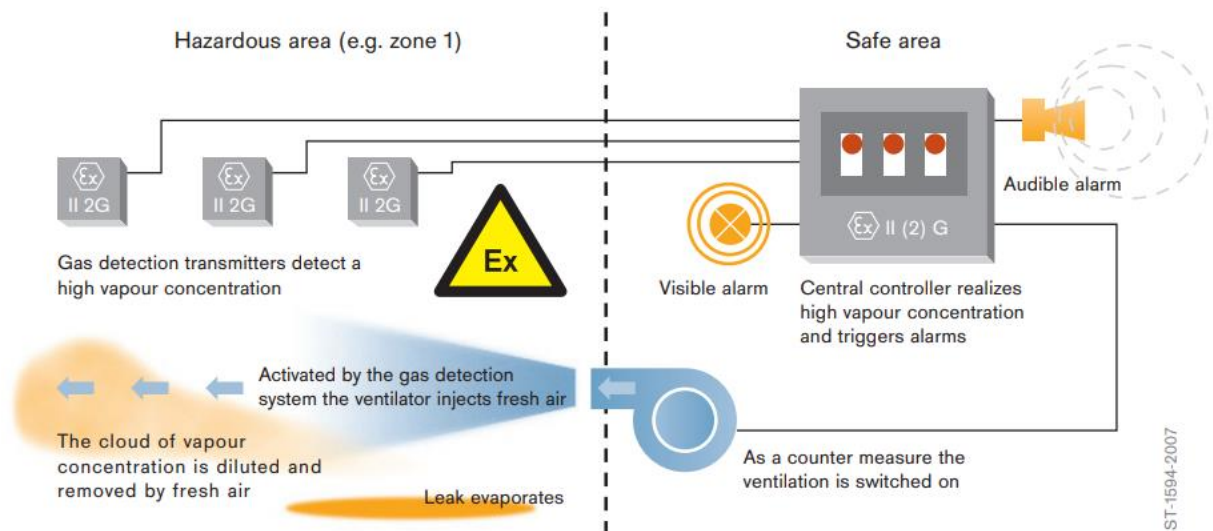


Figure 4 Emergency response for gas leakage

IV. How to prevent

1. Replacing gas cylinder

- Keep records of gas cylinder use and replacement, and after each cylinder replacement, leak testing must be carried out to check the connection points, valve ports and other leak-prone locations. Mark cylinders in different states (full, empty, in use, out of use).
- Labs using independent gas supply should choose a qualified supplier (it is recommended to contact the purchasing department).
- when receiving gas cylinders, check the inspection date and safety accessories of the cylinders.



2. Storage

- Cylinders must be stored in a cool and dry place, away from heat sources and secured well.
- Cylinders of flammable gases (e.g. H₂, C₂H₂) must be stored separately from cylinders of flammable gases, and be placed in a fire-proof cylinder cabinet.



3. Using

- Pressure reducing valves and gauges should be installed according to the pressure at which the equipment is used.
- Flammable gas cylinder (such as H₂, C₂H₂) valve screw for anti-filament (counterclockwise rotation around the spindle center).

Non-flammable or flammable gas cylinder (such as N₂, O₂) for positive filament (clockwise rotation around the spindle center).

These should be installed with attention.

- The various pressure gauges should not normally be mixed.



- The gas in the cylinder should not be fully used up, but some gas should be left behind to prevent outside air from entering the gas cylinder, and a residual pressure of 0.05MPa gauge pressure or more should generally be maintained.

(See [GTIIT_EHS_03_09 Gas Safety Management Procedure Gas Safety Management Procedure](#))

Nothing we do is worth getting hurt for !