MINISTÈRE DE LA TRANSITION ÉCOLOGIQUE ET SOLIDAIRE

ARIA NEWSFLASH
July 2018

BARPI
DGPR SRT

Mobile acetylene cylinders
Hazard potential not to be underestimated!

Mobile acetylene cylinders are present in all sectors of activity owing to their common use on welding machines. Five major accidents in France since the beginning of 2018 remind us that the risks associated with the instability of acetylene, a combustible gas, must not be underestimated. A cylinder that has been exposed to heat, but which has not yet caught on fire, may still present a risk. An exothermic reaction of the gas occurs as soon as gas decomposition is initiated, which can lead to an explosion. This news flash presents risk configurations encountered in Classified Facilities for the Protection of the Environment (French ICPE) and proposes recommendations.

In a fire situation, a cylinder explosion becomes a genuine risk:

ARIA 46216 - 29/01/2015 - MOSELLE
A fire broke out, at around 6:30 p.m., in a 5,000 m² automotive scrap yard on an end-of-life vehicle (ELV) prior to its depollution. The fire, fanned by a strong wind, spread to the 20 or so vehicles present in the yard. **A gas cylinder located nearby exploded,** and a large amount of smoke was produced.
Upon arriving at the scene**, the fire fighters evacuated three acetylene cylinders and then were able to put out the fire around 8 p.m.** The intervention was complicated by **the lack of information on the products and amount of gas in the cylinders** located at the entrance to the site, as well as the presence of an unknown tank.
The fire destroyed several vehicles and damaged the slab, the metal cladding of the building's facade next to the area on fire, part of the electrical installations and several containers holding tyres and car parts, etc.

Domino effects can have significant consequences:

If the cylinders are not quickly cooled down, cylinders in storage racks can lead to a series of explosions that may put third parties at risk.

ARIA 28286 - 11/10/2004 - LOIRE

In a glass factory, an acetylene leak occurred on an 8-cylinder, 6 Nm³ rack supplying the plant's distribution network.
A risk of explosion was feared, as 48 similar cylinders were located nearby.

A security perimeter of 500 m was set up; 2 schools, 1 daycare centre, 2 stores and the residents living around the site (300 people) were evacuated.
The emergency services sprayed down the leaking rack for more than 4 hours, then the cylinders were placed in tanks filled with water until they were completely emptied.
The operation was stopped 6 hours after the alert had been sounded.

Acetylene cylinder rack similar to the one involved in the accident © DRIRE RA/DCT

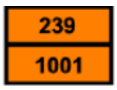
Acetylene specifications

Cas No.: 74-86-2
Chemical formula: C_2H_2
Explosivity range: 2.2% to 85%
Density: 0.9

Low toxicity
Hazard codes: H220, EUH006
Colourless gas, light and pleasant smell

Storage pressure: between 15 and 20 bar at 15 °C
Packaging: dissolved in a solvent, itself trapped in a porous material.
Colour of cylinders: brown

Transport code:
UN No.: 1001
ICPE section: 4719



The cylinders' valves may have collided with the upper part of the rack. Such an event may have occurred during transport, loading or unloading operations, and would have caused the valve to fail. Owing to the design of the rack, the cylinders were able to move vertically within the rack.

WARNING regarding blast effects:

ARIA 49640 - 08/04/2017 - ESSONNE: Fire in a site treating ELV: cylinders exploded, sending projections beyond the limits of the site, onto the property of local residents.

ARIA 42097 - 25/04/2012 - GERS: Flashback on a blowtorch in an agricultural cooperative: the blast from an acetylene cylinder explosion threw projections several tens of metres.

ARIA 30122 - 24/06/2005 - UNITED STATES: Fire and explosions at a gas cylinder filling and storage site: projection effects within the site and up to 250 m outside the site.

Operating risks: acetylene cylinders on welding machines:
Equipment that is used incorrectly, is faulty or damaged by an impact can sometimes lead to significant damage...

ARIA 47534 - 29/12/2015 - SEINE-ET-MARNE:
In a factory manufacturing parts of public works machinery, **a leak on a pressure regulator of an acetylene cylinder** caught fire. The fire then spread to the cylinder flange. **A worker was engaged in a cutting operation with a welding machine** when the fire broke out. The emergency services set up a safety perimeter of 200 m, thereby prohibiting physical access to the leak. As the factory was located in a residential area, **300 homes nearby were evacuated.**

After bringing the burning leak under control, firefighters continued to cool down the cylinder and monitored the temperature of the cylinder wall. **The cylinder was immersed in water for one week owing to residual gas leaks.**

Degassing of the acetylene cylinder (© DRIEE)

ARIA 51262 - 23/03/2018 - SAVOIE:
At around 3:40 a.m., explosions occurred and a fire broke out in a steel plant that had been shut down for three days for maintenance. The subcontractors heard an explosion and saw a curtain of flames coming from the lower floor. Several oxygen and acetylene cylinders had exploded.

It is assumed that **an acetylene cylinder had not been closed after work was completed on one of the furnaces.** A leak occurred and a cloud of acetylene spread across the floor. Acetylene, being lighter than air, made its way to the upper floors through the floor opening. An initial explosion occurred, **generating several fires: dust, then electrical cables and belts, then the movable floor caught fire after other gas cylinders exploded.**

Some recommendations from the feedback…
The first thing to do is **ensure that the regulations regarding these cylinders is respected**: Mobile acetylene cylinders are considered as **transportable pressure equipment** subject to the requirements of Directive 2010/35/EC of 16 June 2010, transposed into French law (texts available on the INERIS website in French). In particular, the Directive calls for marking that indicates the conformity of the cylinders. It also specifies the rules concerning conditions of use of the equipment and the obligations of the various operators.

Storage conditions:
- ✓ Have good knowledge of the cylinder storage facility, the cylinder **filling conditions** (*ARIA 13396*), and the product concerned (*ARIA 46216)*.
- ✓ To avoid domino and projection effects, the cylinders have to be stored away from other combustible products, in a dedicated location away from the site's property limits (*ARIA 30633, 32923, 44227, 49640*).
- ✓ Organise the storage location **so as to limit impacts during handling** (*ARIA 51135*) and **to facilitate the emergency response** in the event of fire (*ARIA 13396, 36695*).

Conditions of use:
- ✓ Avoid hot work near the storage location and issue a **fire permit** (*ARIA 46213, 42245*).
- ✓ Before use, check the condition of the cylinder, valve, regulator and hoses (*ARIA 13396, 42069, 42559 46408, 47534, 49237*).
- ✓ Close the valves after use (*ARIA 51262*).

Emergency response in case of fire:
- ✓ Evacuate the premises and establish a **safety perimeter** (*ARIA 28286, 36050, 39206, 42069, 39769*).
- ✓ Maintain a sufficient supply of water or a nearby supply to ensure **cooling** for at least 1 hour (3 hours for cylinder racks), check its internal extinguishing capacity and/or call on external assistance (*ARIA 49385, 33894, 41616, 43261, 48910, 49640*).
- ✓ Initiate the internal emergency plan if there is a risk of rapid spread (*ARIA 34845, 46274*).
- ✓ **Monitor the temperature for at least 1 hour** before handling the cylinder (*ARIA 46628*).
- ✓ When completely cooled, shut off the cylinders (*ARIA 50955, 45712, 44654, 50766*) and remove them. (*ARIA 46175, 46216, 47343, 51080*).
- ✓ If a leak persists, immerse the cylinders for degassing (*ARIA 32923, 46229, 47534*).
- ✓ Have a specialised company collect the cylinders for inspection (*ARIA 36737, 42788*).

For further information: *the BARPI report "Accidentology elements on pressure equipment" may be consulted on the ARIA web site.*