Safety Information

Awareness Package

Events at Customer Premises

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Introduction

In the supply of industrial and medical gases to customers and their subsequent use and application, we regularly see critical incidents or near misses.

Lack of knowledge or risk awareness (and in a small number of cases, with bad intent) can result in wrong handling of equipment (for example cylinders or hoses), inadequate application of the product or even misuse of equipment / products and can lead to severe incidents or potentially high-risk scenarios.

This Awareness Package is intended to alert customers to these situations and provide some discussion points to be considered.

In any case of change of equipment/application it is strongly recommended to consult with your gas supplier.

Customer tank - Override of safety devices - Near miss

Summary of Incident

- The technical operator, who went to the customer for routine maintenance, found the shut-off valve up-stream of the safety valve - that protects the nitrogen tank - closed. The internal pressure of the tank was 18 bar (max working pressure 15 bar). The customer voluntarily broke the safety seal to close the valve.
- Near miss.

- Discussion points:
  - Never override or disable critical safety systems (for example safety valves).
  - In case of doubts, contact the gas supplier.

Customer tank - Override of safety devices - Near miss

Picture of the reported event showing the manual valve in closed position.

Safety valves shall always have an open connection to the tank!

Customer site – Override of safety devices - Near miss

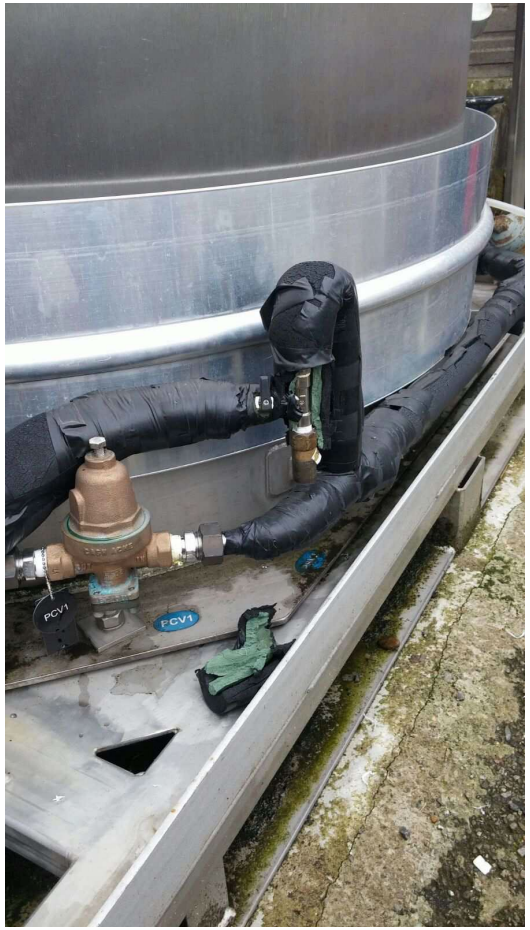
Summary of Incident

- At an industrial customer the bulk distribution driver found a liquid carbon dioxide installation with safety valves and bursting disks completely plugged.
- The driver identified the defect and risk and refused to fill the vessel.

- Discussion points:
  - Never override or manipulate safety devices
  - Always stop the work if it is not safe to proceed
  - In case of doubts, contact the gas supplier

Customer site – Override of safety devices - Near miss

ball valves were installed on the outlet of the PSVs in such a way that safety valves can be made in-operable



Customer site – compatible replacement of oxygen equipment

Examples of Incident

- Gas suppliers have often seen incidents after replacement of equipment by the customer with non-compatible parts. The majority of such cases are related to oxygen supply installations, and more specifically oxygen hoses and pressure regulators which have resulted in oxygen ignitions.

- Discussion points:
  - When supply line equipment for oxygen needs replacement, it is of utmost importance to choose oxygen compatible spare parts.
  - In case of doubts, contact the gas supplier that can provide information for a safe change.
  - Any replacement or addition of components should be aligned between the customer and the gas supplier.

Customer site – compatible replacement of oxygen equipment

Customer Site - Driver Fall - Injury

Examples of Incidents

- Drivers making liquid deliveries to customers encounter different situations. Those regularly pose a risk for trips and falls that may result in injuries. Examples of these situations:
  - Barriers to step over to get to the valves that need to be operated
  - Materials left around unattended
  - Bad pavement conditions

- Discussion points:
  - Ensure proper design of access
  - Keep the area clean and accessible

Customer Site - Driver Fall - Injury

Customer Site – Bad housekeeping

Load of trip hazards close to the vessels; Unloading area is risky to access

Customer Site – Bad housekeeping

Constrained truck access to delivery point

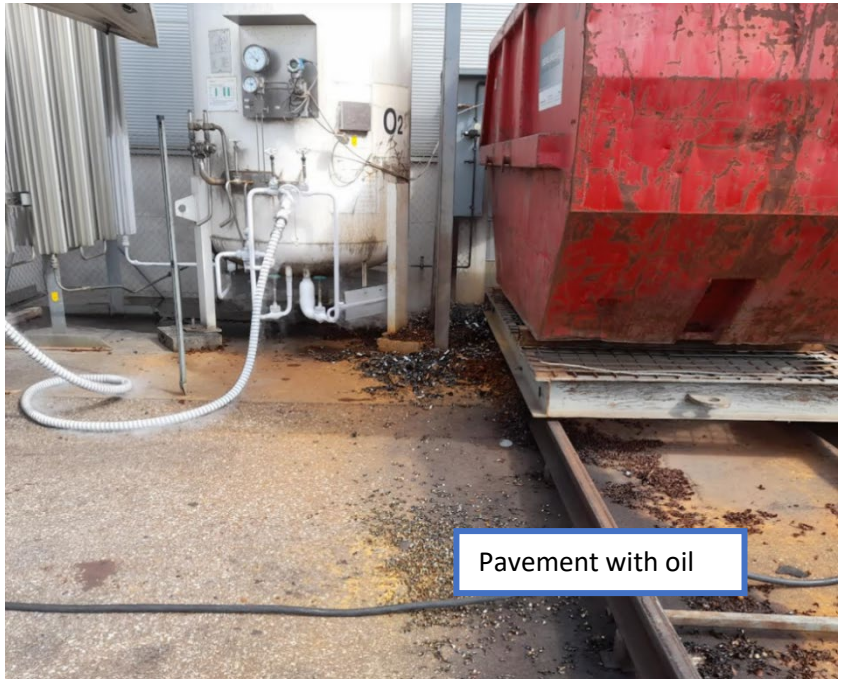
Customer Site – Poor design of installation – Near miss

Summary of Incident

- Contractor driver was delivering LOX to the customer when he noticed that customer had put new asphalt on the vehicle unloading bay. Asphalt can ignite in the presence of oxygen. He informed the gas company about the change at the customer site and the customer about the hazard.
- Gas company formally informed the customer and stopped the LOX delivery. The customer replaced the asphalt in the LOX transfilling area with concrete.

- Discussion points:
  - Follow the safety requirements defined for installations as specified by gas company
  - In case of doubts, contact the gas supplier
  - Notify any change to the gas company for alignment

Examples of poor design of installations and maintenance



Customer site – Wrong installation – Near miss

Summary of Incident

- A metal treatment customer had increased his production and decided to install new acetylene distribution piping from bundles to each point of use (previously, each equipment had a single acetylene cylinder connected). The design and installation of acetylene distribution system was made by a company chosen by the customer and the gas company was not involved in the selection process. At the occasion of the first delivery of acetylene bundles, a salesperson from the gas company went to the customer site to verify that everything was okay with the new deliveries and found that the acetylene distribution system was made entirely with copper (which is incompatible with acetylene because of the formation of acetylides).
- No consequences. The wrong design of the distribution system was detected at the first use.

Customer site – Wrong installation – Near miss

- Discussion points:
  - Remind customer about good management of change practices
  - Keep a proactive behaviour with the customer and inform them about possible risks when applying for changes
  - Basic gas safety knowledge should be shared as widely as possible in gas companies (not only technical staff)

Customer Site – Non standard Installations

Examples of Incidents

- In some cases cryogenic vessels might be installed with "non standard" design, also following requirements stated by competent authorities in technical rules. These extra requirements and "non standard" design impose a dedicated risk assessment to take into consideration possible new emerging risks and define new safety measures. A typical case may be the request from the Fire Brigade to install oxygen or flammable gases vessels in "pits" in order to reduce the effect of a fire or explosion.

- Discussion Points:
  - In case of "non standard" installations, always conduct a detailed risk assessment to define all the necessary preventive/mitigative measures
  - In case of doubts, contact the gas supplier

Customer Site – Non standard Installations

Customer Site – Non standard Installations

Customer site – Fire during LOX transfilling – Injury

Summary of Incident

- During transfilling of LOX into the cryogenic vessel at the customer site (hospital), greenery lying all around the transfilling area ignited. Contractor driver tried to stamp out the fire and suffered minor injury (burn) on his legs.
- The driver extinguished the fire with the fire extinguisher

- Discussion points:
  - Areas in proximity of gas installations shall be kept free from foreign materials and clean as organic material can easily ignite in oxygen enriched atmospheres

Customer site – Fire during LOX transfilling – Injury

Customer site – Misuse of gas – Near miss

Summary of Incident

- A pipeline customer discovered high nitrogen content in their Compressed Dry Air (CDA) system during a plant outage of their nitrogen generator plant which supplies both nitrogen and CDA to their factory. The customer noted to the gas company that they sometimes filled breathing air cylinders from the CDA system. The gas company was unaware of this change and confirmed that under no circumstances can this be permitted. Only dedicated systems should be used for Breathing Air.
- No injuries occurred.

- Discussion points:
  - Use equipment only for the intended use; any change shall be notified to the gas company and agreed
  - Clearly mark instrument gas lines with the text "Instrument Gas" and avoid a marking that mentions "Air"!
  - Never use compressed air for breathing purposes. See also EIGA Position Paper 24 “Abuse of Gases

Customer site – Misuse of gas – Near miss

Customer site – Misuse of equipment – Product leak

Summary of Incident

- At the customer site (hospital) an unknown person tried to test his new climbing shoes by climbing the iced LOX vaporiser. Ice climber damaged the output piping of the vaporiser.
- No injury, leak of oxygen.

- Discussion points:
  - Inform supplier if something abnormal is observed, like ice
  - Gas equipment shall not be misused.

Customer site – Misuse of equipment – Product leak

Picture of climbing shoes is illustrative.

Customer site – Access road

Summary of Incident

- The normal access road was blocked. The customer sent the driver on an alternative road. This road was not designed for heavy loads
- Truck got stuck

- Discussion points:
  - Ensure that access roads to the delivery point are suitable for truck delivery
  - In case of doubts, contact the gas supplier

Customer site – Examples of unsuitable access road

Customer site – Acetylene Fire – Damage

Summary of Incident

- An acetylene cylinder caught fire at a customer site. The fire occurred during welding activities. The surrounding fire was extinguished by the fire brigade and the cylinder was left to burn out, under constant cooling.
  When the fire was extinguished, the cylinder was placed into a water tank. Nobody was injured.
- No flashback arrester was installed on the equipment.

- Discussion points:
  - Ensure that safety equipment required by EIGA and international standards are installed
  - Ensure that flashback arrestors are replaced within the defined time-span defined by the supplier
  - In case of doubts, contact the gas supplier

Customer site – Acetylene Fire – Damage

Customer site - Missing protection against cold embrittlement

Summary of Incident

- A customer supply pipeline ruptured due to cold embrittlement. The ruptured part was the customer's internal installation. The pipeline at customer's side was made of carbon-steel and a Cold Temperature Protection was not installed in the supply set-up. The installation was identified for retrofit of the cold temperature-protection according to new safety standards. Because of ongoing discussion with the customer about suitable timing for the retrofit, this was not yet executed.
- Nobody was injured and the equipment damage was moderate

- Discussion points:
  - Prioritisation of safety related retrofits should be agreed between customer and gas supplier in a timely manner
  - In case of doubts, contact the gas supplier

Customer site - Missing protection against cold embrittlement

The risk of cold embrittlement rupture of supply-pipelines has a potential to be fatal

Customer site – Traffic plan – Lost Time Injury

Summary of Incident

- A cylinder truck driver went to a customer for a delivery. After he had finished his work he had to go to the office to get the delivery note signed by the customer. On his way back to the truck he recognized a busy forklift and therefore he kept an additional buffer distance to it (no footpath was marked on the pavement). After he had passed the customers forklift, he didn't notice that the forklift (not equipped with acoustic warning) reversed and followed his route. He was struck and injured by this forklift.
- He was brought to hospital. He suffered a broken elbow and sprained toes.

- Discussion points:
  - Rules for internal vehicle and pedestrian movements shall be defined with road marks and signage, and people made aware of the rules

Customer site – Traffic plan – Lost Time Injury

Customer Site – Emergency procedures – Near Miss

Summary of Incident

- Prior to entering customer production room for work the customer Installation technicians noticed that the rotating lights of Oxygen detector alarm were activated. They verified that the room was Oxygen deficient. The ventilation system was down due to a power supply shutdown and the N2 vent was sent into the room. Measures were taken to increase ventilation and continuous monitoring of O2 level before start of work. After the O2 level went back to a safe level the work began with monitoring of O2 level as well as portable detectors.
- Nobody was injured

- Discussion points:
  - Always respect warning devises and have a clear procedure on how to act in case alarms are activated
  - In case of doubts, contact the gas supplier

Customer Site – Emergency procedures – Near Miss

Customer Site – Improper lifting operation

Summary of Incident

- At a customer site an operator, handling an oxygen bundle using a bridge crane, wrongly connected the hook to a metal part not designed for that purpose. When the operator tried to lift the bundle the hook disconnected, causing the rupture of the collector pipework. The customer reported that to stop the oxygen leakage the operator, wearing a greasy leather glove, tried to close the valve causing an ignition.
- Customer Lost Time Injury due to burns to a hand. Three cylinders of the bundles suffered heavy damage (melting of the cylinder valve, pigtail, cylinder neck and shoulder).

- Discussion points
  - Handle equipment in a correct way and as per design
  - Grease and oxygen have an explosive relationship

Customer Site – Improper lifting operation

Customer site – Misuse of cylinder - Damage

Summary of Incident

- At customer premises, a quarter of an hour before the beginning of the working activity, an R290 (propane) cylinder, installed in a customer equipment for filling refrigeration circuits and subjected to heating with heating bands from the night before, exploded.
- Damage to surrounding equipment.
  No injuries.

- Discussion points:
  - Follow safe storage instructions provided by the gas company
  - Consider the risks of overheating and hydraulic filling when heating a liquefied compressed gas. When heating is required, ensure that the heating systems provides an effective temperature control
  - In case of doubts, contact the gas supplier

Customer site – Misuse of cylinder - Damage

Customer site – Disguised cylinder – Near Miss

Summary of Incident

- Customer sent a cylinder for filling H2 mixture. The cylinder was found not to be compatible for H2 flammable mixtures (no H stamp marking) and returned back to customer. After a while, the customer sent the same cylinder for filling the same mixture. The “H” stamp had been marked meanwhile. The unit discovered the anomaly and stopped the cylinder before filling.
  Customer sent an acetylene cylinder for refilling. During preliminary inspection, the plant operator noticed a drilled hole in the bottom part of the cylinder.

- Discussion points:
  - Do not modify cylinders/equipment
  - Use cylinders only for their designed purpose and compatibility

Customer site – Disguised cylinder – Near Miss

Customer installation – Removed vessel – Near Miss

Summary of Incident

- A 1000 L liquid nitrogen vessel had been installed in the basement of a customer facility (confined space); the filling connections were outside the building.
  The customer removed the tank without informing the liquid nitrogen supplier or implementing any log out – tag out measures at the transfilling point. At the transfilling point there was a cabinet with connections, safety valve and a level indicator, but no pressure indicator.
  As the level indicator showed the value “zero” the driver started with the filling procedure and LIN was released to the basement. A confined space atmosphere control sensor switched on an alarm. The driver could not hear it but a customer employee ran out of the building to warn the driver. He stopped the filling procedure.

- Discussion points:
  - Before removing vessels, inform the gas supplier

Customer installation – Removed vessel – Near Miss

Work Safely!

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