Training Package TP 12/12

Recent Incidents in the Gases Industry in Asia



Asia Industrial Gases Association

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Introduction

At the regular Safety Advisory Group (SAG) meetings, members exchange information on accidents/incidents that have occurred . Accident/Incident details discussed at the SAG remain confidential.

The SAG has decided to share the more notable accidents/incidents on a regular basis with the national associations and member companies via the Training Package publications.

These slides contain the summaries, pictures and other relevant information to highlight the root causes and lessons to be learned.

Further Information:

These Training Packages are posted only on the Members Page and are meant for distribution among Members only.

While the best effort is made to provide sufficient information on the accidents/incidents, please contact the SAG (through the Secretary General) if you need further clarifications.



<u>Case 1</u> Carbon Dioxide cylinder ejected from flatbed lorry onto road

What happened

• A carbon dioxide cylinder used in fire extinguishing duty was brought back to a service centre worksite on a weekend. The staff missed a routine test on the cylinder as it was late in the day. The cylinder was left on a flatbed lorry parked in the premises as it was supposed to be sent for testing at another location the following Monday.

- On Sunday morning, there was apparently a sudden release of CO2 gas from the cylinder and it was ejected from the lorry onto the main road outside the premises.
- It hit and pierced through the side of a passing by double- decker bus and caused a glass window to break. A passenger on board suffered cuts from the glass splinters.



Cylinder shot through the fencing onto the road



Contributing causes

The cylinder valve was found broken. A rupture disk failure could have resulted in a quick release of CO2 that caused the cylinder to take off like a projectile.

Other contributing factors:

- Cylinder was heated under the sun.
- Cylinder was not properly secured on the lorry bed.
- [In some other cases that occurred in the past, safety device (rupture disk) was altered].



Cylinder lying besides the bus



Point where it hit the bus



Key lessons

Preventive Measures:

Ensure:

- That CO2 cylinders are always secured in a truck during storage or transfer.
- Valve caps are installed (fixed or removable). (The use of valve cap is recommended to prevent valve shredding).
- Repture disks are in good shape
- Cylinders are at temperatures below 52 deg C



Case 2 Failure of 'disguised' (modified) cylinder during hydrotesting

What happened

A customer-owned medical oxygen cylinder supposedly to be a DOT 3AA type with a 2015 psi (137 bars) working pressure split into two sections at the mid-point during a hydrostatic test.

It was found that the cylinder was a 'disguised' cylinder with a new top section welded onto the bottom section.

The bottom section of the cylinder showed severe signs of corrosion when compared to the top section.

The cylinder was well disguised to avoid detection.



Cylinder split into 2 sections



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Contributing Causes

- Unauthorised modification of the original cylinder by a third party. Such practices have been found in the particular country due to poor regulatory controls.
- A less than adequate visual inspection of the cylinder was done before passing onto hydro testing. Cylinder inspection procedures to check cylinder valve and body are critical.
 - To perform a good inspection, paint layers in the cylinder shall be minimum.



Lower half showing severe corrosion and bevelled edge



Top half showing less corrosion



Key lessons

- Sharing of incident with test shop staff
- Reiterate the need for critical pre-fill inspection
- Contact the owner to communicate the risk of such modification
- Work with authorities to stop such modifications



<u>Case 3</u> Major fire & explosion at oxygen pipeline pressure reducing station

What happened



Fire and explosion broke out at a pressure reducing station on a new large oxygen supply pipeline at a steel mill during commissioning.

There were a large number of people (reported to be about 50) gathered at the control room at the time. The fire destroyed the control room and 19 people died from burns.

Picture shows damaged control room for pressure reducing station



Possible causes for the incident include:

- A partial blockage at the pressure reducing station (PRS) was indicated by inadequate flow of oxygen downstream of the station prior to the fire and explosion. Breakage of the filter element was found due to the high pressure drop across the filter.
- Trapped particles found in the filter at the PRS (after the fire) showed that particle impingement on the steel pipeline in the filter area could have occurred and resulted in ignition.
- Design practices to prevent excess oxygen velocity might not be properly followed.
- The presence of a large number of people which included those not associated with the operation of the PRS resulted in the high number of fatalities when the fire occurred.



Lessons learned

- It would appear that there was inadequate preparation of the pipeline system for oxygen service.
- The operational problem/s that arose during commissioning was not addressed correctly.
- Too many non-operation staff had gathered on site at the Pressure Reducing Station (PRS) without recognising the potential catastrophe that could occur at the PRS.
- Strict application of standard in design and operation of oxygen system should be followed.



<u>Case 4</u> Major leakage of hydrofluoric acid* during transfer at plant

What happened

Anhydrous hydrofluoric acid (HF) leaked from the liquid valve of an ISO tanker when two workers were preparing to connect the air hose to effect the transfer of the HF from the tanker.

They were working on top of the tank and had accidentally opened the product valve prior to connecting the air hose.

The two workers at the top of the tank, two workers at ground level repairing a pump and one worker at an office building close by died from injuries suffered. An estimated 8 tons of HF were released.

Besides the 5 fatalities, 18 others were injured and almost 3000 villagers from 2 villages downwind of the facility were treated for irritation and exposure.

* Hydrofluoric acid (hydrogen fluoride) is used to produce chemical precursors for the pharmaceutical industry and has other industrial applications. It is also used in the electronic gas industry as a etching/cleaning agent HF is highly corrosive and an acute poison; exposure can cause death and serious damage to the skin, lungs, heart, bones and nervous system.



Incident pictures



HF fumes seen from a distance



Trees turned brown by the HF fumes in the nearby area



Fire department responders at the scene

See also link to video clip: http://megaswf.com/s/2506308

PLEASE NOTE THAT DETAILS IN THIS VIDEO CLIP ARE GRAPHIC AND MAY BE DISTURBING.



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3 HarbourFront Place #09-04 HarbourFront Tower 2 Singapore 099254 Internet: http://www.asiaiga.org Possible contributing causes

- Error by workers when making the connection
- Shortcomings in the procedure for the transfer operation
- Lack of standard operating procedure



Lessons learned

Key issues to consider are:

- The system design is appropriate for the chemical being handled and has adequate safe guards.
- Personal protective equipment suitable for the chemical being handled are used.
- Emergency response procedures and equipment are in place.
- Medical treatment protocols are in place.
- Operating procedures and training are in place.
- Local responders are familiar with the hazards of the chemicals used and the proper emergency response protocols.

(MSDS on the safe handling of HF are available from gas companies websites)

