AIGA 2007 MEETING

PACKAGED GASES SAFETY

Asia Industrial Gases Association

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PATTAYA, THAILAND

Learning from Gas Cylinder Incidents

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Air Products

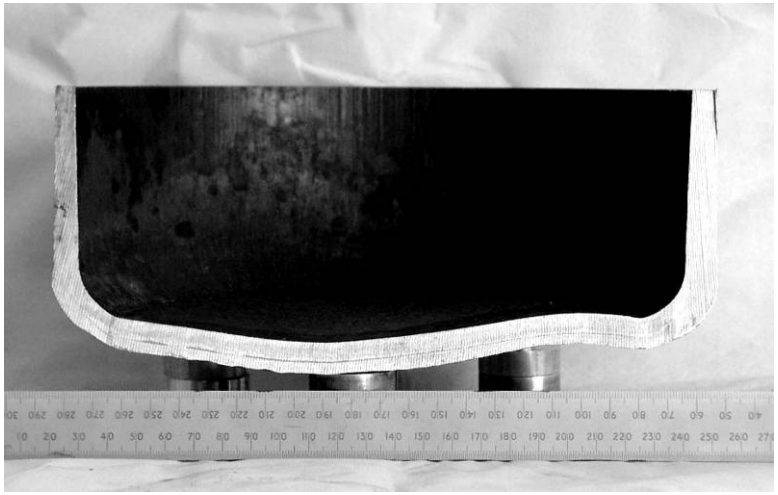
Some Points to Remember……

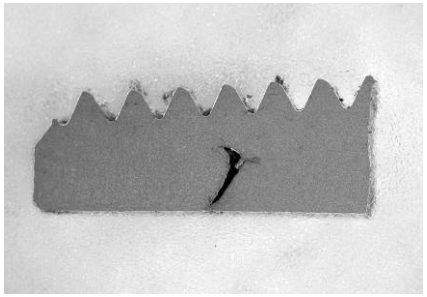
- The gas industry has a very good track record of being proactive to ensure a good safety performance is maintained
- When there is an incident the gas industry is responsive to ensure that any issues are identified, resolved and communicated to the gases industry

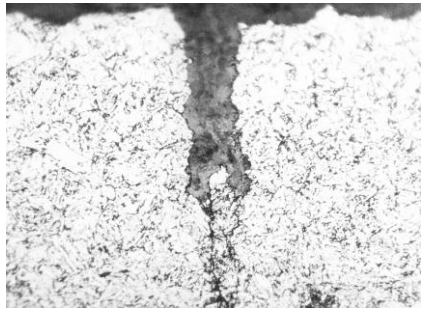
Incidents Involve…….

- **Equipment**
  - Design and/or Material
  - Operation
- **Activities within our Facilities**
  - Cylinder Filling
    - Pre Fill
    - Fill
    - Venting and Maintenance
- **Third Parties**

Equipment







Activities within our Facilities – Pre Fill

- **Pre Fill Inspections**
  - Key part of the Cylinder Operation
- **Our Cylinder Operators are on “the front line”.**
  - **They are the first to see problems**
- **Some examples of what our cylinder fillers see…**

Customer “Modifications”

Customer “Modifications”

Customer's "Improvement"

Disguised Cylinders

Damaged acetylene cylinder “repaired” with plaster

Disguised Cylinders

Disguised Cylinders

Originally 13.4 litre CO2 cylinder, base cut, barrel shortened and base welded to barrel to look like a 10 litre cylinder

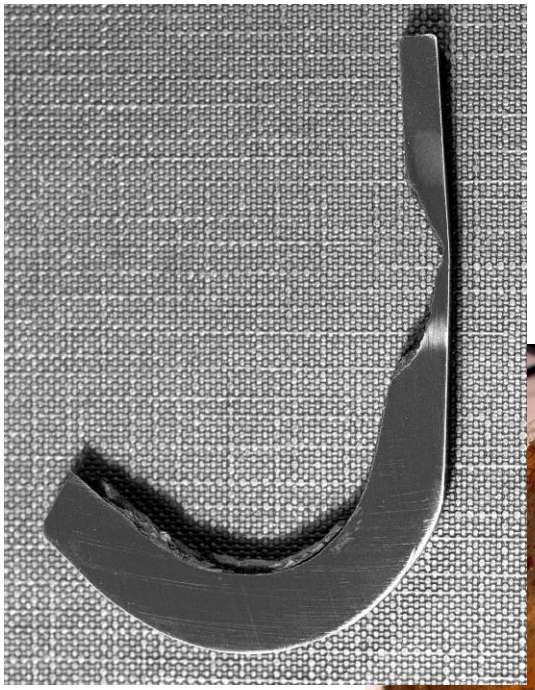
Cylinder Pre-Fill Checks

- **Ensure all who are involved with cylinder pre fill checks are trained and understand the importance of their job**
- **Look to AIGA, CGA and EIGA for guidance and training**
- **Refer to International Standards such as:**
  - ISO 24431: Inspection at time of Filling

Cylinder Filling

- **Entirely within our control**
  - In house
  - Contracted out
- **Whoever does the filling, they are responsible for ensuring that the package is “Safe to Fill”. This includes:**
  - Pressure
  - Compatibility of materials
  - Quantity of gas to be filled

Corrosion in Cylinders



Corrosion in Cylinders

- **Corrosion in cylinders has been addressed by documents looking at:**
  - Corrosion in gas cylinders
  - Use of residual pressure valves
  - Avoidance of corrosion in CO and CO/CO2 mixtures

Overfilling of Cylinders with Liquefied Gases

Overfilling of Cylinders with Liquefied Gases

- **Pressures may be low, but consequences can be very serious**
- **How to avoid……..**
  - Look at published documents, e.g. CGA P-1, ISO 11162, NFPA 58, DIS/ISO 24431
  - Audit suppliers
  - Ensure clear instructions to fillers
  - Random check weigh

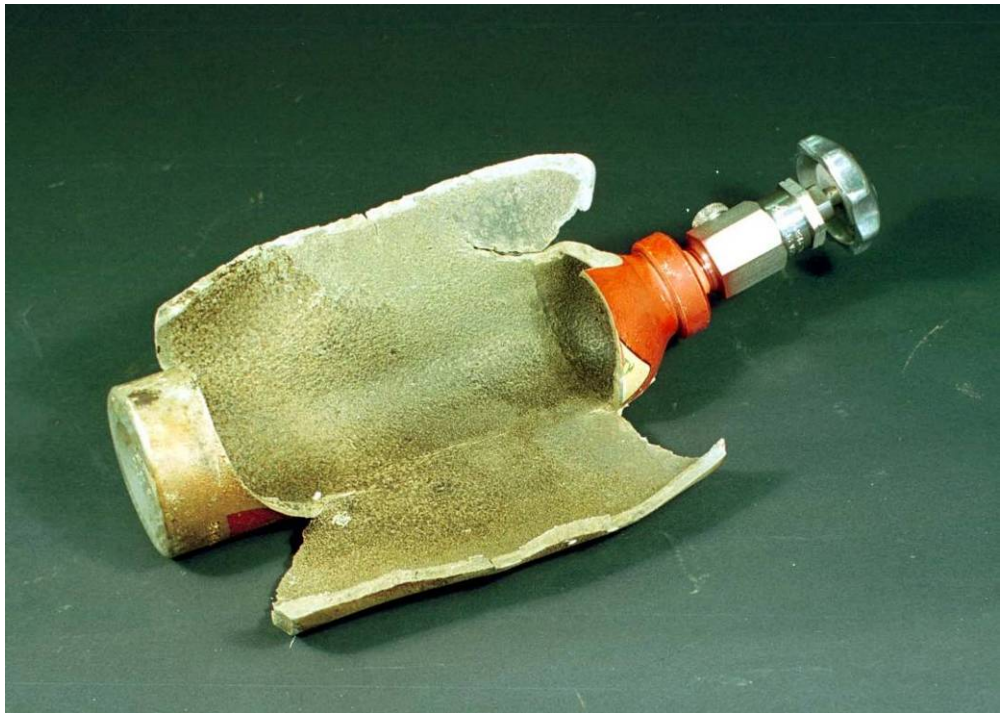
Change of Service Procedures

Change of Service Procedures

- **When changing service look at the ISO standard: 11621 Procedures for change of gas service**
- **Considers**
  - Material
  - Cleanliness
  - Pressure
  - Etc, etc.

Filling of Cylinders
Material Compatibility

- **Need to ensure that the correct cylinder and valve materials are used**
- **There is much guidance available……..**
  - See ISO 11114 series of documents



Flammable Oxidant Mixtures

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EIGA

THE SAFE PREPARATION OF GAS MIXTURES

IGC Doc 39/01/E

GLOBALLY HARMONISED DOCUMENT

First revision of IGC Doc 39/88

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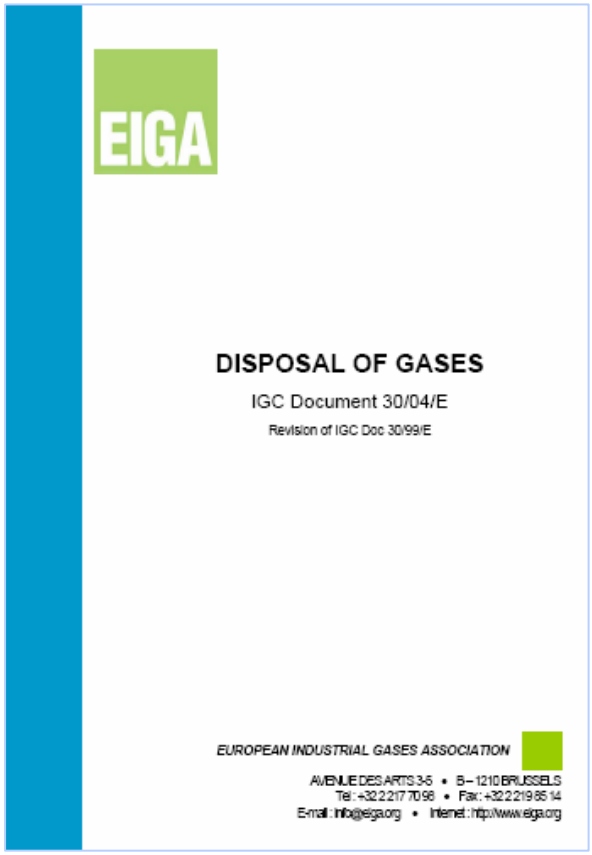
Uncontrolled Venting of Gases

Uncontrolled Venting of Gases

- **Consequences can be catastrophic**
- **Venting of gases may include:**
  - Toxic
  - Flammable
  - Oxidant
  - Inert
- **Must understand what is being vented and take appropriate steps**



Devalving Cylinders

EIGA Safety Information

Prepared by WG-2 Safety Info 10/04

Devalving Gas Cylinders

Precautions to be taken when devalving gas cylinders

Introduction

An accident occurred during routine maintenance work on a 20-litre capacity aluminium alloy medical oxygen cylinder.

The hand wheel of the valve of this cylinder was broken. The cylinder was placed inside a horizontal devalving machine. During the devalving process, a violent fire occurred destroying the top part of the cylinder. The cylinder and the valve were projected a considerable distance in opposite directions.

The operator died as a result of severe burns having been covered by the combustion products from the upper part of the cylinder. Most of the shoulder of the cylinder was consumed, with approximately 2 kg of the aluminium alloy having been lost.

It is believed that the cylinder was still filled with high-pressure oxygen when the devalving process took place with the resultant fire having started at the internal neck threads of the cylinder.

This document does not address the safe release of product and purging process of gas cylinders (see EIGA TN 505/86)

Recommendations

Although the exact causes of the accident are still under investigation, we would like to draw your attention to the following points:

1) Before devalving any cylinder (steel or aluminium alloy), it is essential to strictly apply the procedures for checking if gas pressure still remains in the cylinder. This may be performed by either introducing an inert gas or using a rubber bulb (except for flammable gases). A detailed written procedure is given in the International Standards for the Periodic Inspection of gas cylinders, see bibliography. For valves with a residual pressure function and valves incorporating an integrated pressure regulator, specific procedures are required.

2) Any cylinder with a blocked or inoperable valve shall be put aside and a specialist will take the necessary action.

For all cylinders (steel or aluminium alloy), with blocked or inoperable valves (see EIGA TN 505/86). Dealing with containers with blocked or inoperable valves), the recommendation is to put them aside and depressurise them only if the operator is protected from risks including severe fire. Special care needs to be taken for aluminium alloy cylinders in oxygen service!

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Cylinders Beyond our Control

- **When the cylinder leaves our facility they are beyond our direct control**
  - Incidents with customers impact our reputation
- There is a need to communicate to our customers information about the products
  - Labels
  - Safety Data Sheets
  - Simplified information
  - Verbal communication

Cylinders Beyond our Control
Transport in Closed Vehicles

Cylinders Beyond our Control
Transfilling by Customers

Cylinders Beyond our Control
Transfilling by Customers

Learning from Gas Cylinder Incidents
Key Messages

- **Equipment**
  - Always purchase to a specification that both the customer and supplier understand and agree on
  - Ensure equipment meets a “recognized” standard
  - Buy the appropriate equipment for the duty

Learning from Gas Cylinder Incidents
Key Messages

Cylinder Filling

- Ensure pre fill inspection is carried out
- Ensure when residual gases are vented that this is to a safe location
- Ensure the right cylinder and valve materials are selected
- Ensure that the cylinder is filled with the correct quantity of gas
- Ensure change of service is carried out in accordance with recognized industry practices

Learning from Gas Cylinder Incidents
Key Messages

- **Customers**
  - Ensure that customers are aware of the products and the potential hazards of the product
  - The purpose is to educate and not scare

Learning from Gas Cylinder Incidents

Thank you