Training Package
TP 08/11

Recent Incidents in the Gases Industry in Asia

AIGA *Asia Industrial Gases Association*

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Recent Incidents in Gases Industry

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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.

Case 1
Fatality accident during underground pipeline construction

What happened

- Underground O2 & N2 pipelines construction work was in progress on site from February 2011.
- To protect the pipelines under construction against ingress of humid air outside of working hours and during rainy periods, it was decided to plug the open ends with mechanical caps and inert the pipelines with nitrogen at 1 bar (g). The pipelines would be de-pressurized before work resumed.
- On 9 March 2011 after rain had stopped at around 5.30 pm two workers from the subcontractor company were in the trench doing housekeeping when the cap on the N2 pipeline suddenly came off. The ejected cap struck one of the workers in the trench and he was thrown off some 14 metres away.

  He suffered multiple injuries and died three hours later at the hospital.
- The other worker suffered slight injury on his back.

Pipeline and blank cap

The blank cap used to blind off the open-end of the pipeline uses a compressed rubber ring fitting design that is supposed to hold a pressure of up to 3 bar(g).

When the incident occurred the N2 pressure had probably risen to 7 bar (g) due to a malfunction of the pressure regulator used to regulate the pressure from the source.

N2 pipeline cap and O2 pipeline

Location of the accident

Pipeline Cap and Assembling Process

***Note*: Pictures taken after the accident**

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2

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Root causes

- **Blank cap design pressure exceeded**

  The blank cap used to seal off the open-end of the pipeline under construction was specified as *'to be able to hold a pressure of 3 bar'*.

  The pressure in the line was supposed to be maintained at 1 bar(g) Failure probably occurred when the pressure reached 7 bar (g).

- **Failure of pressure regulator**

  The upstream pressure before the regulator was in excess of 20 bar (g). The regulator's malfunction resulted in a much higher pressure in the pipeline section.

- **No protection for over-pressure in the pipeline**

  No pressure relief protection was installed to prevent the pipeline from exceeding the intended pressure.

Lessons to be learned

- Work Permit procedure – Was this well understood and correctly administered ?

- Management of Change – Was a risk assessment done for use of high pressure nitrogen regulated down to low pressure ?

- Necessity to inert pipeline?
  Was there a need to inert pipelines under construction and was there a need to have a pressure in the pipeline?

Note:

AIGA 021/05 – 'Oxygen pipeline systems' refers to pipeline cleanliness as follows**:**

'***6.5.5 Sealing, purging and monitoring***

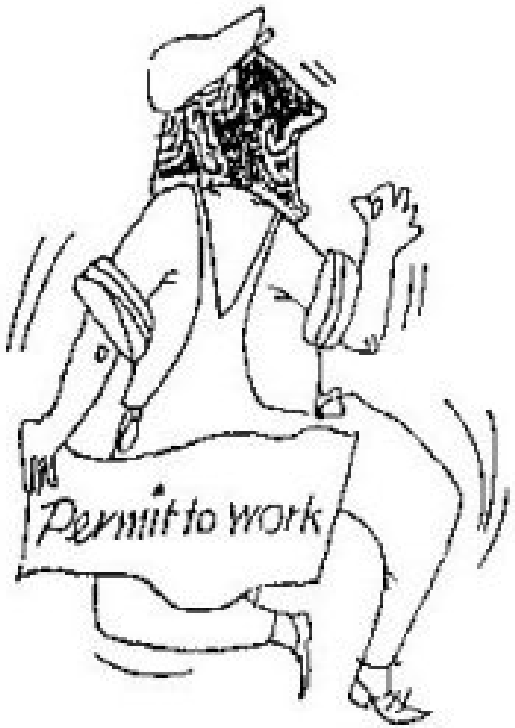
Following the pipeline inspection and acceptance of the standard of cleanliness, the pipeline will be sealed at all open ends with either welded caps or blind flanges and purged with dry, oil-free air or nitrogen (dew point no higher than 40°C) until the dew points of the inlet and exit gas are essentially the same.'

This applies to preservation of completed pipeline awaiting commissioning.

Things to consider:

Don’t start work without a

Permit-to-Work (reference AIGA 011/04)



Appendix 1 EIGA/IGC **WORK PERMIT** **n° ……..**

Any attached document or log sheet ? YES NO HOW MANY ……..
List of attached documents ……

1. WORK ACTIVITY

Plant / Unit :……
Description of work to be done……
Permit valid from :……Hours/date To :……Hours/date
Have all relevant departments/personnel been consulted ? YES NOT APPLICABLE

2. POTENTIAL HAZARDS & HAZARDOUS JOBS

	YES	NO		YES	NO
. Jobs performed by contractors or temporary workers			. Maintenance or repairs in areas, or to equipment or lines, containing or supposed to contain hazardous materials or conditions		
. Potential oxygen deficiency or enrichment			. Manual or powered excavations		
. Potential flammable / explosive atmosphere			. Use of mobile cranes		
. Potential high temperature / pressure			. Insulation or catalyst handling		
. Potential exposure to hazardous chemicals (toxic, reactive, acid, caustic….)			. Use of adapters		
. Confined space entry			. Product conversion of stationary or mobile or portable vessels and containers		
. Bypassing or removing/altering safety devices and equipment			. Temporary or permanent changes, alterations, modifications of equipment or processes		
. Elevated work			. Exposure to traffic (road, mail)		
. Introduction of ignition sources where not permanently allowed (fire permit)			. Exposure to moving / rotating machinery		
. Electrical troubleshooting or repair on live circuits					

Others (state) ……

3. SAFETY PRECAUTIONS

	YES	NO		YES	NO		YES	NO
. Draining			. Remove hazardous materials			. Standby man		
. Depressurising			. Fresh air ventilation			. Elevated work		
. Physical Isolation			. Atmosphere analysis :			. Contractors trained		
. Electrical Isolation			. Oxygen			. Eliminate ignition sources		
. Safety tags and locks			. Flammable			. Fire hose		
. Flushing with water/solvent			. Toxic			. Fire screen		
. Steaming out			. Other			. Wet surrounding area		
. Purging with inert gas/air			. Area marked off			. Audible/visible warnings		
. Temperature normalisation			. Warning notices			. Clear area of combustibles		
						. Fire extinguishers		

Things to consider:

Is MOC(Management of Change) required?

- To ensure that safety, reliability & quality of process is maintained
- To manage the entire change from start to finish
- Compliance with company procedures and standards

Reference from AIGA 010/04 – Management of Change

MANAGEMENT OF CHANGE PROCEDURE

Location : Date : Product:

Modification description : Equipment : 0 new 0 modified 0 relocated

Process : 0 change 0 extension 0

Max/Min pressure: Max/Min temp :

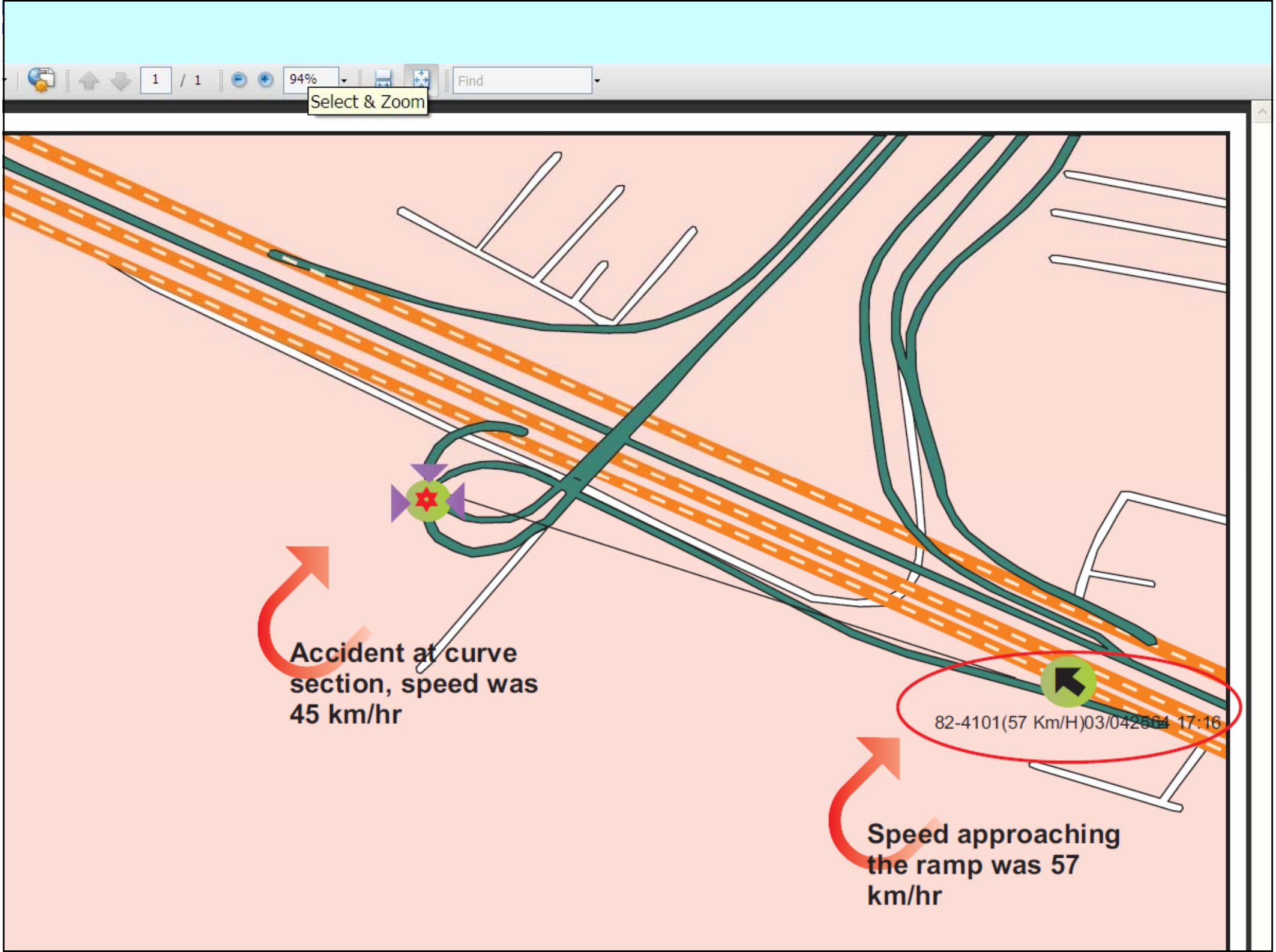
Chemical react. : Misc. (toxic) :

Check off all items carefully. Use enclosed MOC Guideline.

Case 2
Rollover of liquid carbon dioxide tank trailer

What happened

- A fully loaded liquid CO2 tank-trailer was on its way to deliver the product to the customer at around 5 pm on a Sunday. Traffic condition was light. The vehicle had approached the entrant ramp to an elevated road intersection at a speed of 57km/hr (as recorded by the GPS Black Box). At the curve section of the slip road to the ramp the speed was recorded as 45 km/hr. The driver suddenly lost control of the vehicle and the tank trailer rolled over and hit the roadside guard.
- Due to the impact, some portion of polyurethane insulation foam on the tank broke out and pushed against a gas valve handle (quick opening type valve). The valve was thus opened and resulted in some LCO2 release.
- The emergency response team arrived at the accident scene later and was able to stop the release safely.
- The driver had his seatbelt on and received slightly injury on his face due to the broken windscreen. He received first-aid treatment at a nearby hospital.
- Total liquid CO2 release - around 3 tons.
- Estimated repair cost to tanker - US$ 42,000.


1 / 1
94%
Select & Zoom
Find
Accident at curve section, speed was 45 km/hr
82-4101(57 Km/H)03/042564 17:16
Speed approaching the ramp was 57 km/hr

Root Causes

- Safe speed exceeded

  The driver was travelling at a higher speed than he should due to the light traffic condition when he was approaching the slip road to the elevated intersection.

- Failure to adopt correct driving technique

  He did not slow down sufficiently when he negotiated the curve up the ramp. He had exceeded the speed limit to prevent the rollover from occurring.

- Driver's behaviour

  Driver was not fully acquainted with the factors that would trigger off a vehicle rollover. The company had not conducted detailed training on the techniques to prevent rollover incidents.

Lessons learned

- Incident details are shared with drivers – to highlight the data on the actual speeds in the incident and the speed limit which should be adhered to when negotiating a road curve.
- Drivers are reminded to keep to safe speed limit even when traffic condition is light and not to be over confident.
- Company to re-emphasize training for all drivers on the causes of rollover and the driving techniques to prevent it.
- Use of quick opening valves on liquid CO2 tanks should be re-viewed as they tend to be opened when there is an impact on the handles in an accident.
- Useful link on rollover prevention:

  http://www.fmcsa.dot.gov/about/outreach/cargo-tank-video.aspx