



# SAFETY BULLETIN 05/10

## ASIA INDUSTRIAL GASES ASSOCIATION

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## Recent cases of asphyxiation in confined spaces in Asia

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Asphyxiation takes place in confined spaces, such as process vessels, cryogenic enclosures, pump and expander enclosures/ducts, totally enclosed working areas and pits and in most cases result from ignorance of the properties of nitrogen or inert gases.

Recent cases of asphyxiation in Asia have highlighted the urgent need to communicate the risks of the use of inert gases especially nitrogen for testing/purging enclosures in ASU's (Air Separation Units) and the necessity to educate all, including experienced engineers who are involved in such activities.

### Case 1 (2009)

During the construction phase of an ASU, prior to the mechanical completion of the plant, an engineer with over 20 years of operation experience in the industry was found asphyxiated in one section of the cryogenic enclosure.

#### **Accident circumstances:**

- The ASU was under construction. The Work Permit system was apparently not implemented during construction work.
- Nitrogen was used to pressurize and leak test sections of the ASU and piping.
- The engineer did not carry a personal atmospheric monitor with him.
- The engineer was found missing after about 4 hours and colleagues started to look for him.
- He was found lying in a section of the pump enclosure among piping. A set of drawing was beside him and it was assumed that he was in the enclosure to check on the piping system.
- He had died when they found him.

Case 2 (2009)



ASU column

Interconnecting duct to turbine unit where engineer was found dead



Piping in the interconnecting section

Engineer was found dead in the interconnecting duct between the ASU column and the turbine expander while carrying out a leak check on the piping works and equipment in the enclosure. The plant was undergoing cold test. Engineer was from Operations and was working with the engineering

construction company for the commissioning of the plant. He had about 3 years of experience in the industry.

### **Accident circumstances**

- In the morning, engineer had carried out checks on the compressor and piping works.
- Between 3 to 4 pm he informed the shift engineer in the control room he was going to check on the pipings in the cryogenic enclosure. He was reminded to put on warm clothing as the column was undergoing cold test.
- No Work Permit was issued and no gas check or gas monitoring equipment was deployed for this work.
- At around 4.50 pm another engineer came to the control room to look for him. The engineer and the shift engineer proceeded to the ASU area to check.
- At 5.20 pm the shift engineer went on to the top of the interconnecting box where there is a manhole and saw a person lying inside. Two other operators were enlisted to pull the unconscious engineer out and he was sent to the hospital. He was ascertained to have died around 4 pm.
- The interconnecting section is 4m (length) x 1.5m (width) x 2m (height).

### **Learning Points:**

- Safe systems of work are required at all times.
- Confined space entry permits should be used for all vessel/enclosure entries.
- Avoid the use of nitrogen for pressure testing/purging/flushing unless under very specific and exceptional circumstances. Strict authorization requiring specific hazard controls has to be put in place before the use of nitrogen (or any inert gas) for such purposes is sanctioned. Hazardous Work Permit/Confined Space Entry system should be enforced. This appears to be lacking during the construction phase and also during the construction-commissioning interface.
- Gas check, personal atmospheric monitors are required when entry is necessary into enclosures where nitrogen is used or could become present inside the system.
- If an unsafe atmosphere is detected, steps should be taken to withdraw all personnel working inside such environment/atmosphere and detect and remove the hazard. A buddy system and self-contained breathing apparatus (SBA) should be utilized in areas where nitrogen leakage is detected (including any rescue situation)

### **References**

AIGA 008/04 "Hazards of Inert Gases"  
 AIGA 011/04 "Work Permit Systems"  
 AIGA TP 01/04 "Oxygen Deficiency"  
 EIGA Safety Newsletter NL 77/03 "Campaign against asphyxiation"  
 EIGA Safety Newsletter NL 78/03 "Asphyxiation and others"

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