



SAFETY TRAINING LEAFLET 05 INERT GASES (NITROGEN & ARGON)

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1 Introduction

1.1 Safety leaflets

Safety training leaflets summarise the basic operational safety knowledge which needs to be known by employees working in the gas industry.

Refer to EIGA Doc 23 *Safety Training of Employees* for the various combinations of leaflets which define the scope of safety training for a variety of specific jobs.

Each leaflet addresses a specific topic as identified in the title.

1.2 Comprehension tests

There is a comprehension test for each leaflet, included in **Appendix 1**.

Each test comprises several questions. To pass the test it is suggested that the employee should score 75% at the first attempt. Incorrect answers should be discussed to confirm understanding.

Appendix 2 includes the list of correct answers.

2 Inert gases

Inert gases are non-flammable, non-toxic, do not support human breathing, and under normal circumstances do not react with other substances.

2.1 Introduction to Nitrogen and Argon

The most common inert gases are Nitrogen and Argon. These are essential ingredients of atmospheric air which normally contains 79% inert gases (78% nitrogen + 1% argon); the balance, 21%, is mainly oxygen.

An atmosphere with not enough oxygen for life, caused for example by excess inert gas, is described as "Oxygen Deficient".

Nitrogen is often referred to by its chemical symbol N₂, Argon by its chemical symbol Ar. Nitrogen is slightly lighter than air, while Argon is heavier than air.

Other inert gases include Helium, Neon and Xenon.

Oxygen is NOT inert, (see *Safety training leaflet 23.03 Oxygen*.)

See also *Safety training leaflet 23.06 Carbon Dioxide*

2.2 Hazards of inert gases

- The inert gases are not toxic but do not support life. If allowed to accumulate indoors or in confined or enclosed spaces, they displace or dilute oxygen and act as asphyxiants.
- Inert gases are colourless, odourless and tasteless, so humans have no ability to sense or detect excess inert gases.
- When very cold (cryogenic) liquids such as nitrogen or argon evaporate, the gas produced is very cold and so is much heavier than air (see *Safety training leaflet 23.12 Cryogenic liquids*). Therefore, the cold gas can collect in low lying areas such as pits, cellars, trenches, confined spaces, drain/ sewer systems or deep excavations, where the gas may be slow to disperse.
- A person will become unconscious immediately when entering an atmosphere which contains excessive proportions of inert gases (and, therefore, a shortage of oxygen).
- If the oxygen concentration is too low, death will follow rapidly.

2.3 General precautions to prevent build-up of inert gases

- Fixed or portable gas detection devices are the only way to measure safe (breathable) oxygen concentrations.
- Before entering vessels, confined or and enclosed spaces in which an accumulation of inert gases may have occurred, ensure that the atmosphere has been tested and that the oxygen content is within safe limits (19.5 - 23.5 %). When entering any confined space, a work permit is always required - see *Safety Training Leaflet 23 Work Permit*. Rooms or enclosed spaces where inert gases are stored, handled or transfilled, are called “hazardous enclosures” and must have either good ventilation or constant atmospheric monitoring for oxygen content. The ventilation and/or oxygen monitoring are critical safeguards that must not be deactivated or impaired.

2.4 Inert gases cylinder filling specific hazards and prevention measures.

- There are no specific hazards for cylinder filling of inert gases, there are hazards from high pressure – see *Safety Training Leaflet 23.09 Cylinders for Compressed and for liquefied Gases.*

2.5 Liquid inert gases storage hazards and prevention measures

- Liquid inert gases are stored in pressure vessels designed for this purpose or in dewars. There is an identification plate that provides relevant information about the vessel properties (e.g. max. pressure). Tank pressure monitoring and control is critical, overpressure protections must be kept in good condition, operating instructions must be known and, uncontrolled deviations must be reported.
- It is hazardous to overfill liquid storage tanks, level in the tank must be monitored.
- A liquid inert gas release in the atmosphere may generate - depending on the weather conditions - a thick cloud made of condensed moisture. Do not expose yourself to this and go out of/away from the cloud. - see *Safety Training Leaflet 12 Cryogenic Liquid spills and Vapour clouds*.
- Transfilling of liquid Nitrogen, Argon or other inerts shall only be carried out in designated areas which are designed for the purpose, i.e. well ventilated.

Appendix 1 – Inert Gases (Nitrogen & Argon) – Test Questions

Tick the correct answer (s) or write in the blank spaces as requested.

1. The inert gases are not toxic but do not support life and act as....?

2. Atmospheres in which nitrogen or argon accumulates are recognised by their characteristic smell:
A. True **B. False**
3. If a cryogenic tank is filled with an inert cryogenic liquid, it must be done _____
_____ to avoid overfilling.
4. Tick at least three items of personal protection equipment that must be used when handling cryogenic liquids.
A. Cryogenic gloves **D. Protective footwear**
B. Face shield **E. Antistatic footwear**
C. Safety harness **F. Long-sleeved shirt**
5. Which risks could be caused by spilled cryogenic inert gases?
A. Oxygen enrichment **C. Risk of explosion**
B. Embrittlement of materials **D. Asphyxiation**
6. Tick at least three characteristics of nitrogen:
A. Tasteless **E. Flammable**
B. Colourless **F. Toxic**
C. Combustible **G. Odourless**
D. Inert **H. Similar density to air**
7. The minimum percentage of oxygen in air for a safe environment is 19.5%
A. True **B. False**
8. State three common properties of argon and nitrogen:

Appendix 2 – Inert Gases (Nitrogen & Argon) – Test Answers

1. Asphyxiants
2. B
3. "Slowly and the level monitored"
4. A, B, D and F
5. B and D
6. A, (tasteless), B (colourless), D (inert), G (odourless) and H (similar density to air)
7. A
8. * Inert. * Colourless.
* Tasteless. * Compressed gases.
* Odourless * Cryogenic liquid