

OXYGEN DEFICIENCY



EUROPEAN INDUSTRIAL GASES ASSOCIATION

AVENUE DES ARTS 3 – 5 • B-1210 BRUSSELS

PHONE +32 2 217 70 98 • FAX + 32 2 219 85 14 • E-mail : info@eiga.org

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A SERIOUS HAZARD

It's a phenomenon

- ▶ **INSIDIOUS**
- ▶ **SUDDEN**
- ▶ **WITHOUT WARNING**

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3 WEEKS WITHOUT FOOD

3 DAYS WITHOUT DRINK

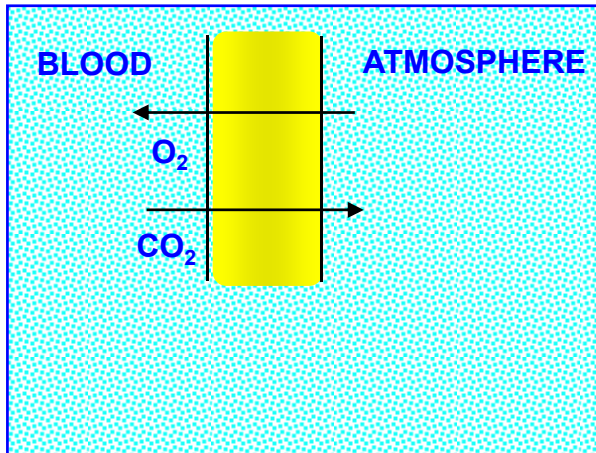
3 MINUTES WITHOUT BREATHING

2 BREATHS WITHOUT OXYGEN

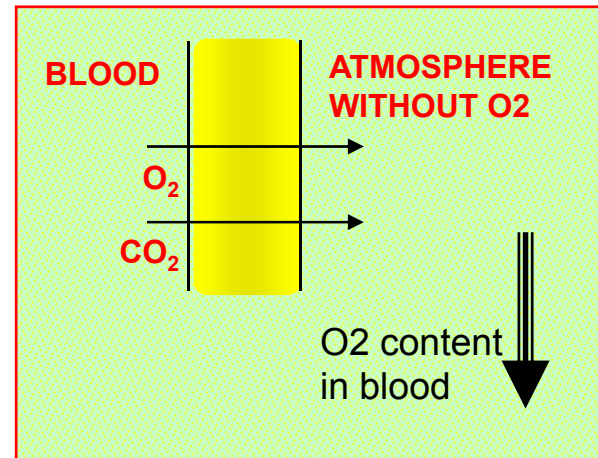
ENDANGER YOUR LIFE

IN CASE OF TOTAL OXYGEN DEFICIENCY the blood suddenly loses its oxygen

NORMAL CONDITION



SUDDEN O_2 DEFICIENCY



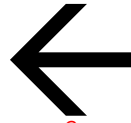
WITH 0% OXYGEN, THE SECOND BREATH WILL CAUSE
LOSS OF CONSCIOUSNESS **WITHOUT WARNING**

WITHIN A FEW MINUTES,
BRAIN DAMAGE MAY BE IRREVERSIBLE

IN CASE OF PROGRESSIVE OXYGEN DEFICIENCY

Oxygen content is decreasing in blood

O₂ content less than
18%



Progressive
asphyxiation

- ☞ *Vertigo*
- ☞ *headache*
- ☞ *speech difficulties*
- ☞ *reduction and loss of consciousness*
- ☞ *dulling of the mind*
- ☞ *loss of muscle control*

BUT

These symptoms are similar to those of general malaise and are not recognised as asphyxiation by the victim (inert gases are odourless, colourless, tasteless)

The victim tries to overcome this by himself
THE VICTIM DOES NOT CALL FOR HELP

OVER A CERTAIN THRESHOLD, THE VICTIM CAN'T REACT :
**THE LOSS OF CONSCIOUSNESS IS
SUDDEN**

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**In all cases:
THE VICTIM NEVER REALISES THE RISK**

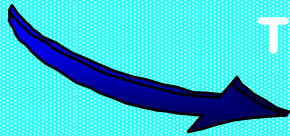
With less than 6% of oxygen :



immediate loss of consciousness

BUT

If the Oxygen atmosphere deficiency is only between 10 and 18% :



**THE VICTIM FEELS ONLY GENERAL MALAISE
AND DOES NOT RELATE THIS
TO THE ONSET OF ASPHYXIATION**

OXYGEN IS ESSENTIAL FOR :

HUMAN LIFE

and BRAIN PROCESSES

If the blood fails in bringing oxygen:

- ◆ **Cells don't operate anymore**
- ◆ **Loss of consciousness**
- ◆ **Irreversible consequences**
(paralysis, comatose state, ...)

..... DEATH



BUT REMEMBER :

Asphyxiation
is a phenomenon ...



INSIDIOUS



SUDDEN



WITHOUT WARNING



**THE
DANGER
OF
ASPHYXIATION**

may arise



IN ALL THE CONFINED SPACES



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*How can you identify
a confined space ?*

**A confined space is a space which has any of
the following characteristics :**

- 🖱️ limited opening for entry and exit**
- 🖱️ unfavourable natural ventilation**
- 🖱️ not designed for continuous
worker occupancy**



*How can you identify
a confined space ?*

If you are required to construct or work in a :

- ▲ Boiler, cupola, degreaser, furnace, pipeline, pit, pumping station, reaction or process vessel, septic tank, sewage digester, sewer, silo, storage tank, ship's hold, utility vault, vat, or similar type of enclosure ...**

➔ You are working in a confined space



Attention !

***O₂ deficient atmospheres
can arise
also in normal working areas,
when gases are stored or
used***



You must :

- ▲ *Be aware of the risk,*
- ▲ *Always implement a safe system of work before allowing people to enter into a confined space*



You must :

- ▲ **Make operators aware of the risk**
- ▲ **Implement a procedure to authorise the access**
- ▲ **Warn people of the danger, place signs at entrances to areas where O₂ deficiency may arise**
- ▲ **Develop and apply safety measures**



You must also :



▲ **Develop and apply appropriate safety measures**

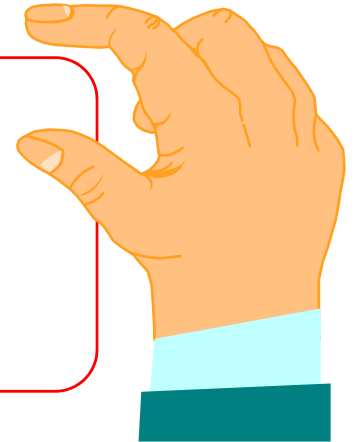
AND

▲ **Always monitor the oxygen content**



IN ALL CASES:

***PLACE SIGNS
TO WARN OF
THE DANGER***



TO ALERT THE OPERATORS

- ▲ Inform about the risk
- ▲ Train in the method to detect the danger



RESCUE

- ▲ Rescuers must be trained in and follow established emergency procedures and use appropriate equipment and techniques
- ▲ Rescue should be well planned and drills should be conducted frequently on emergency procedures

Remember :
an unplanned rescue will probably be your last

KEY WORD :



THINK !

- ▶ **When you design a gas installation**
- ▶ **When you install and commission a gas installation**
- ▶ **When you work on a gas installation**
- ▶ **Before acting in an emergency or abnormal event**
- ▶ **Before reacting to any accident or incident**

MISTAKES IN GAS USE :

Preventive measures

- ▶ **RESPECT PRODUCT SPECIFIC CONNECTIONS** designed to segregate product
- ▶ **IDENTIFY PIPES**
- ▶ **INFORM users :** Safety data sheets, safety notices
- ▶ **NEVER IMPROVISE REPAIRS** on installations

MISTAKES IN GAS USE :

Preventive measures

- ▶ **ALWAYS CHECK WHERE GAS RELEASES WILL GO:**
 - ◆ the cold vapour from cryogenic liquids
 - ◆ vent exhausts
 - ◆ the outlets of safety valves and rupture discs

- ▶ **VERIFY** periodically the extraction efficiency

- ▶ Install, if necessary, an **ANALYSER** with alarm

- ▶ **VENT** rooms where liquid gases are utilised or stored

SPACES WHERE INERTING IS CARRIED OUT :

- ♦ to protect a product, or
- ♦ to allow work, such as welding

- ▶ **EXPLAIN ASPHYXIATION DANGER**
- ▶ **CREATE A PROCEDURE TO ENTER : WORK PERMIT**
- ▶ **PREPARE FOR EMERGENCIES with appropriate equipment :**
 - ♦ self contained breathing apparatus
 - ♦ oxygen meter
 - ♦ safety harness
 - ♦ ropes
 - ♦ winch
- ▶ **TRAIN PEOPLE** to verify the equipment & procedures before issuing the permit



MEASURES FOR ENTERING A CONFINED SPACE

Before entering : assess risks and consequences to yourself and other

BEFORE AN ACCIDENT, THINK ABOUT :

- ☑ Pipe vents to a safe area
- ☑ Look for leaks
- ☑ Do not rely on a closed valve which may leak
- ☑ Always use physical isolation methods, e.g. blind flanges

ABNORMAL CIRCUMSTANCES, CONSIDER :

- ☑ Any noise indicating a possible leak
- ☑ Abnormal fluid flow

DON'T RUSH ... THINK !



CONCLUSION

- ♦ If you hear a gas leak,
- ♦ If you see cold vapours,
- ♦ If you have symptoms of general malaise,
- ♦ If a colleague lies unconscious

