OXYGEN DEFICIENCY

ASPHYXIATION DANGER
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It's a phenomenon

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

**A SERIOUS HAZARD**
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 O2 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

$O_2$ content less than 18%

- Vertigo
- Headache
- Speech difficulties

Progressive asphyxiation
- Reduction and loss of consciousness
- Dulling of the mind
- Loss of muscle control

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
In all cases:
THE VICTIM NEVER REALISES THE RISK

With less than 6% of oxygen:
- immediate loss of consciousness

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
Asphyxiation is a phenomenon ...

BUT .... REMEMBER:

Asphyxiation is insidious, sudden, without warning...
THE DANGER OF ASPHYXIATION may arise IN ALL THE CONFINED SPACES
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!

$O_2$ 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 \( \text{O}_2 \) 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
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

CONSIDER the ASPHYXIATION RISK

LEAVE the DANGER AREA

IMPLEMENT the APPROPRIATE PROCEDURE