CONFINED SPACE ENTRY

(Construction) Subpart C, 1926.21 (b)(6)(i-ii)
and
(General Industry) Subpart J, 1910.146

Introduction

Introduction

What is a Confined Space?

1. Limited or restricted means of entry or exit
2. Not designed for continuous human occupancy
3. Large enough and so configured that an employee can bodily enter and perform assigned work

Introduction

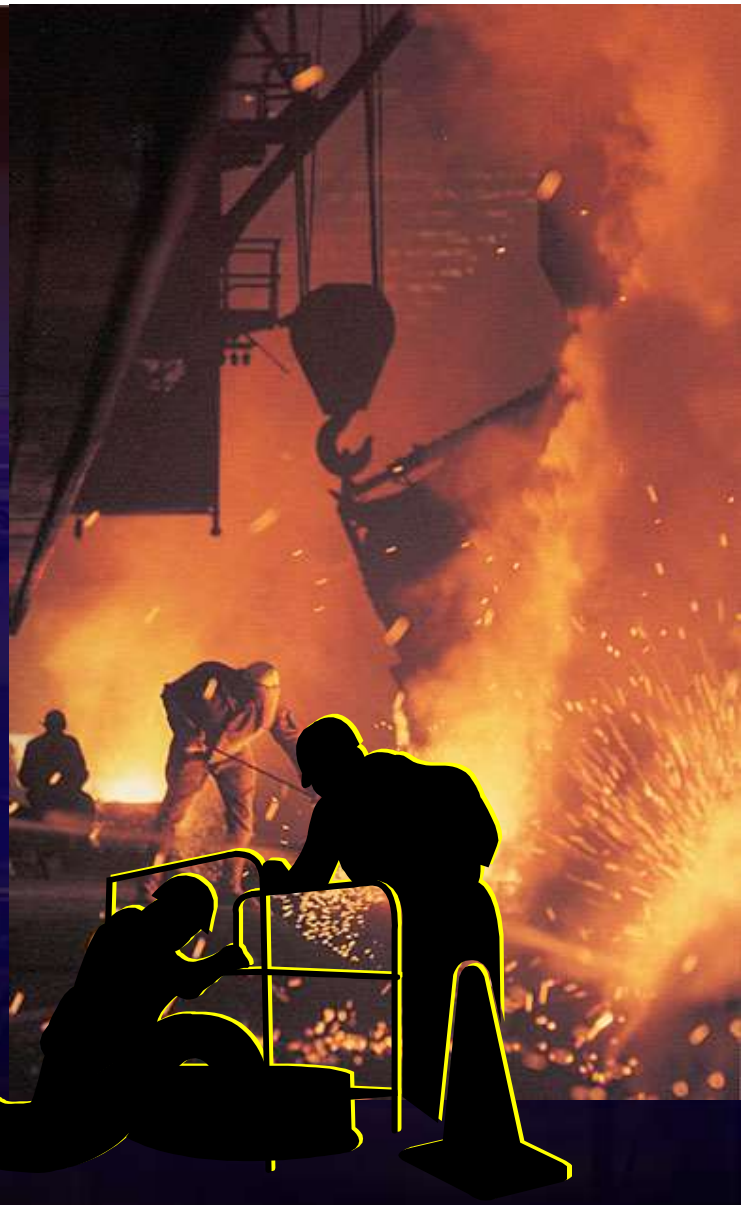
What makes it a Permit Required Confined Space?

1. Meets the definition of confined space
2. And, has one or more of the following conditions….

Introduction

The Final 4

1. Contains or has the potential to contain a Hazardous Atmosphere.
2. Contains material that has the potential for engulfing an entrant.
3. Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor which slopes downward and tapers to a smaller cross-section
4. Any other recognized safety or health hazard



Introduction

Examples of confined spaces include:

Underground Vaults

Tanks

Storage Bins

Pits

Diked Areas

Vessels

Silos

Introduction

Entry into a confined space can expose the entrant to hazards that include:

PHYSICAL

Englufment
Entrapment
Electrocution
Falls
Heat stress/burns

ATMOSPHERIC

Toxic gases/vapors
Oxygen deficiency
Oxygen enrichment

Introduction

Hazards specific to a confined space are dictated by:

1) The material stored or used in a confined space. *(Example: damp activated carbon in a filtration tank will absorb oxygen, thus creating an oxygen deficient atmosphere).*

2) The activity carried out inside a confined space. *(Example: welding work or use of hydrocarbon-based cleaning materials create on explosive or toxic atmosphere).*

3) A confined space's external environment. *(Example: sewer systems, they may be affected by heavier than air gases/vapors, or flash floods.*

Introduction

Most Common Violations

1. No testing of atmosphere.
2. Not classifying area as confined space.
3. No rescue provisions to retrieve unconscious employees.
4. No mechanical retrieval device for confined spaces greater than 5 feet in depth.

Definitions

Definitions

- **Acceptable Entry Conditions:**

  The condition that must exist in a confined space to allow entry and ensure that employees involved with a confined space entry can safely enter and work within the space.

- **Attendant/Observer:**

  An employee stationed outside one or more confined spaces who monitors the authorized entrants and who performs all attendant's duties as designated by their employer.

Definitions

- **Designated for Continuous Human Occupancy:**

  A space a person can occupy under normal conditions. The space is designated for employees to enter and work for prolonged periods of time without any additional safety and health considerations.

- **Double Block and Bleed:**

  The closure of a pipe, line or air duct by closing and tagging two in-line valves and by opening and tagging a drain or vent which is open to the atmosphere between the two tagged-closed valves.

Definitions

- **Entrant:**
  An employee authorized to enter a confined space. May enter as an attendant if this approved by the permit.

- **Entry:**
  The act by which an employee an employee intentionally passes through an opening into a confined space.

- **Entry Permit:**
  A written document established by an employer that authorizes employees to enter the permit confined space.

Definitions

- **Entry Supervisor:**

  The person responsible for determining if acceptable entry conditions are present at a permit space where entry is planned, authorizing entry, overseeing entry operations, and terminating entry as required

- **Immediately Dangerous to Life and Health (IDLH):**

  Any condition which poses an immediate threat or loss of life, may result in irreversible or immediate health effects, may result in eye damage, irritation, or other conditions which could impair escape from the permit space.

Definitions

- **Isolation:**
  The separation of a permit space from unwanted forms of energy by tag-out, double block & bleed, blanking or blinding and the removal of spool pieces for piping disconnects.

- **Limited/Restricted Means of Access:**
  Areas with a configuration that increases the employee risk by slowing egress, evacuation or rescue.

Definitions

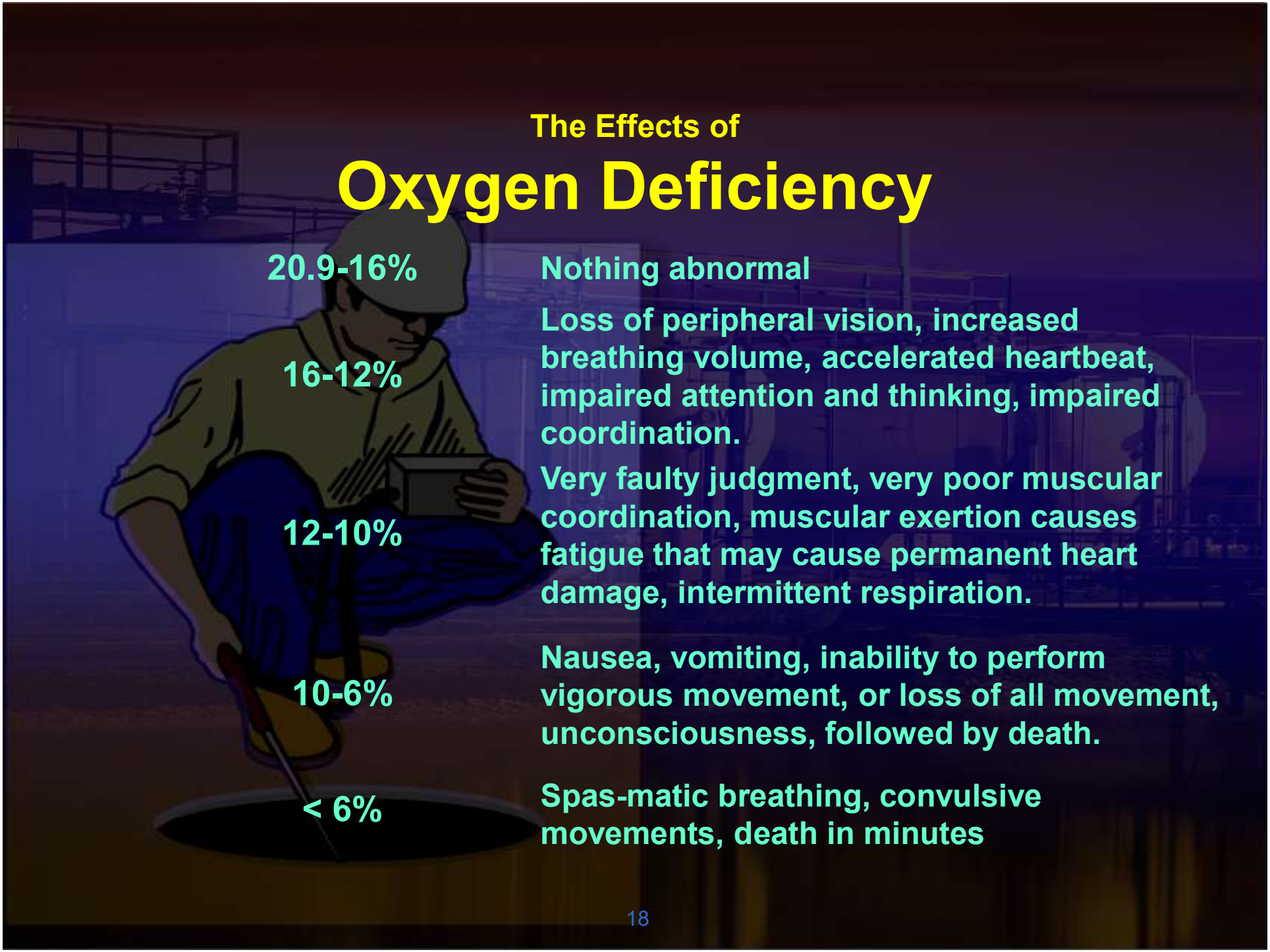
- **Non-Permit Required Space:**
  A confined space that does not contain or, with respect to atmospheric hazards, has the potential to contain any hazard capable of causing death or serious physical harm.

- **Oxygen-Deficient Atmosphere:**
  An atmosphere containing less than 19.5% oxygen by volume.

- **Oxygen-Enriched Atmosphere:**
  An atmosphere containing more than 23.5% oxygen by volume.

Oxygen levels

- 19.5% - 23.5%
  - Displacement
  - Consumption



The Effects of
Oxygen Deficiency

20.9-16%	Nothing abnormal
16-12%	Loss of peripheral vision, increased breathing volume, accelerated heartbeat, impaired attention and thinking, impaired coordination.
12-10%	Very faulty judgment, very poor muscular coordination, muscular exertion causes fatigue that may cause permanent heart damage, intermittent respiration.
10-6%	Nausea, vomiting, inability to perform vigorous movement, or loss of all movement, unconsciousness, followed by death.
< 6%	Spas-matic breathing, convulsive movements, death in minutes

Definitions

Permit Space:

- Contains or has the potential to contain a Hazardous Atmosphere.
- Contains material that has the potential for engulfing an entrant.
- Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor which slopes downward and tapers to a smaller cross-section.
- Any other recognized safety or health hazard.

Definitions

- **Re-Classified Confined Space:**

  A confined space that does not contain or, with respect to atmospheric hazards, has the potential to contain any hazard capable of causing death or serious physical harm.

- **Threshold Limit Value (TLV):**

  The airborne concentration of a material to which nearly all workers can be exposed day after day without adverse effects

- **Time-Weighted Average (TWA):**

  The allowable concentration for a normal 8-hour workday of a 40-hour week.

General Entry Requirements

General Entry Requirements

The employer must inform exposed employees to the existence, location, and the danger posed by confined spaces.

Appropriate danger signs should be posted to help make employees aware of confined spaces in their workplace.

If employees enter permit required confined spaces, the employers must develop and implement a written permit program for entry.

General Entry Requirements

The OSHA standard requires the employer's program to….

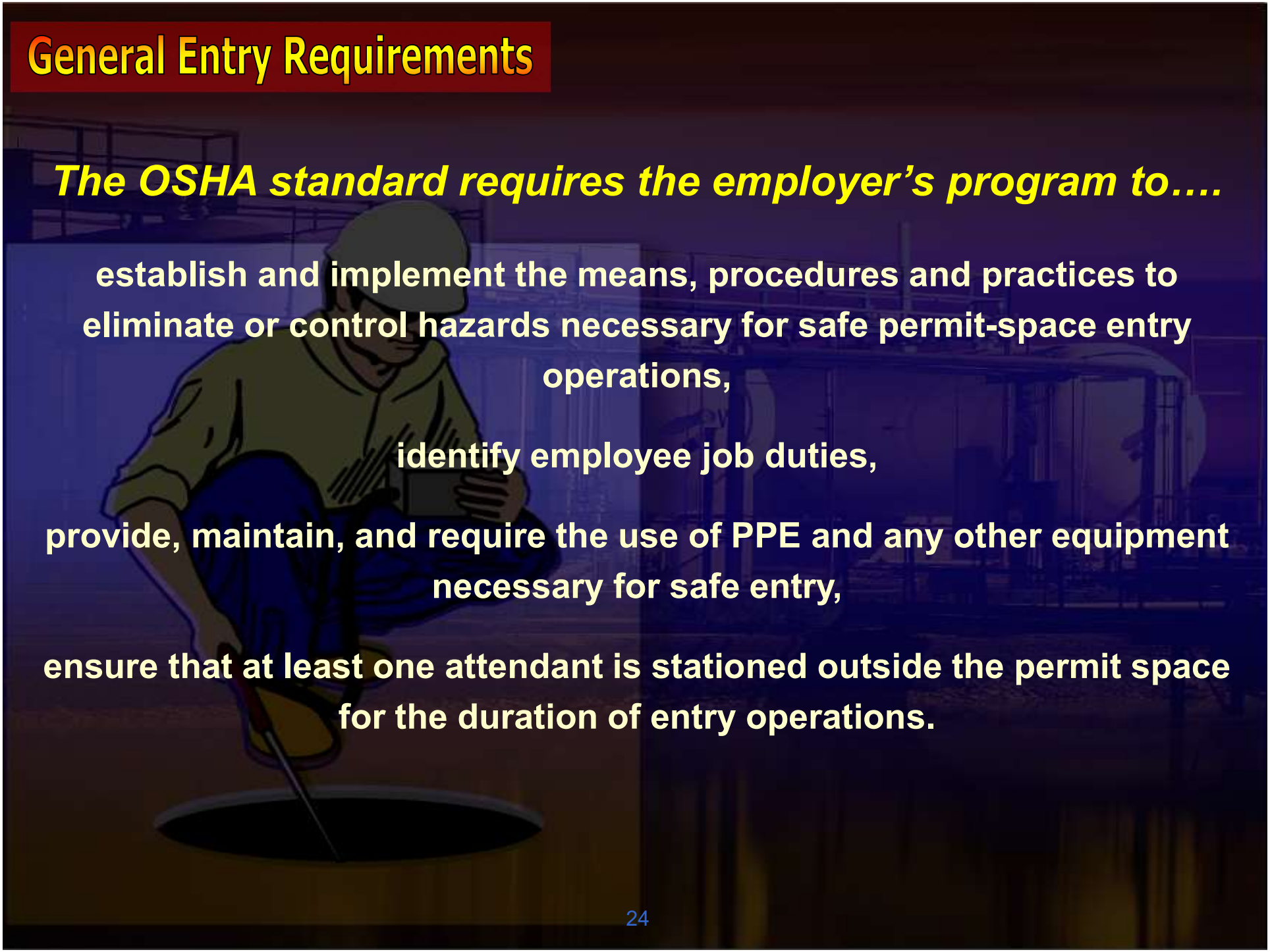
identify and evaluate permit space hazards before allowing employee entry,

test condition in the permit space before entry operations and monitor the space during entry,

perform, in the following sequence, appropriate testing for atmospheric hazards: oxygen; combustible gases or vapors, and toxic gases or vapors,

implement necessary measures to prevent unauthorized entry.

General Entry Requirements



The OSHA standard requires the employer's program to….

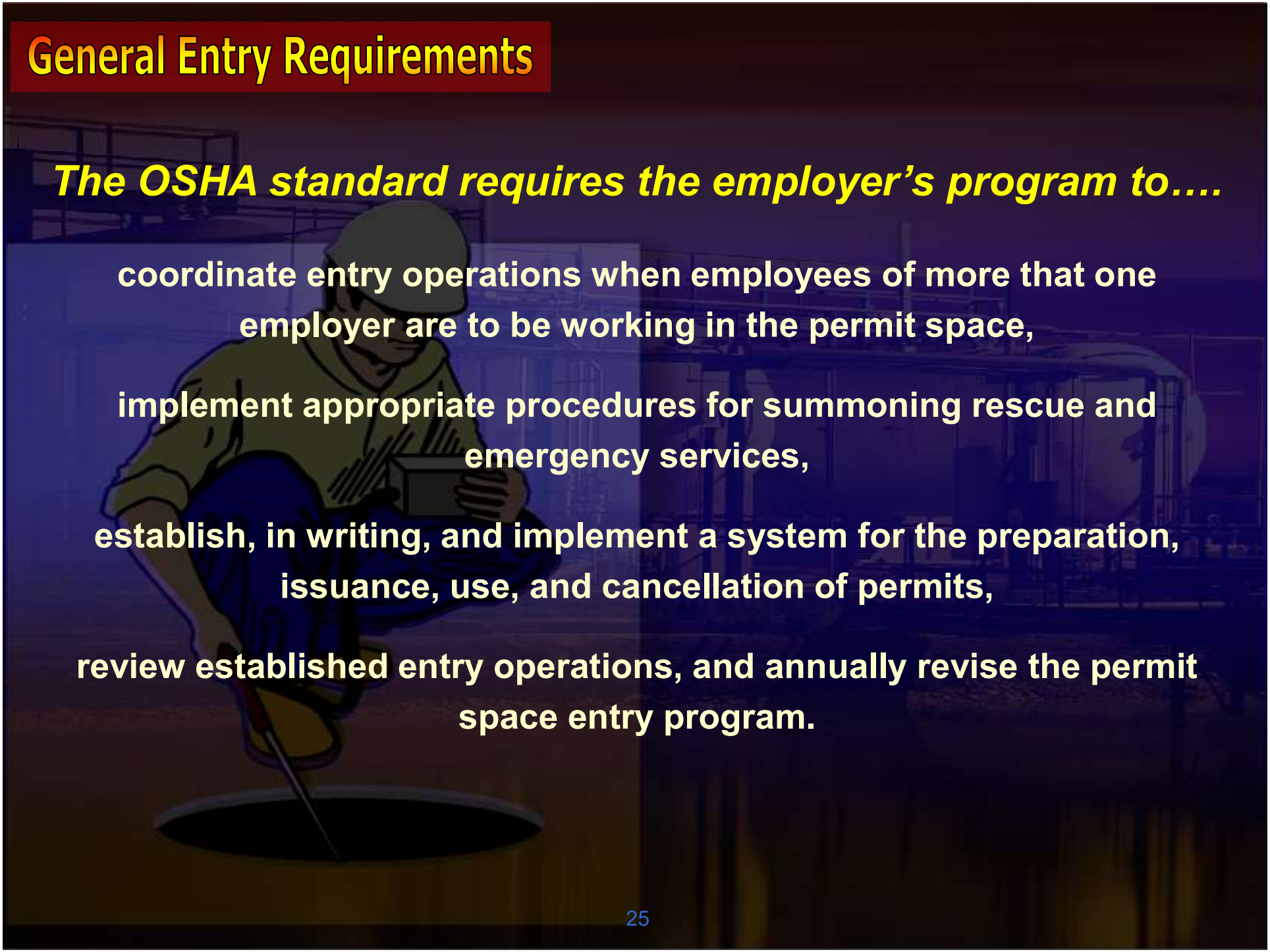
establish and implement the means, procedures and practices to eliminate or control hazards necessary for safe permit-space entry operations,

identify employee job duties,

provide, maintain, and require the use of PPE and any other equipment necessary for safe entry,

ensure that at least one attendant is stationed outside the permit space for the duration of entry operations.

General Entry Requirements



The OSHA standard requires the employer's program to….

coordinate entry operations when employees of more that one employer are to be working in the permit space,

implement appropriate procedures for summoning rescue and emergency services,

establish, in writing, and implement a system for the preparation, issuance, use, and cancellation of permits,

review established entry operations, and annually revise the permit space entry program.

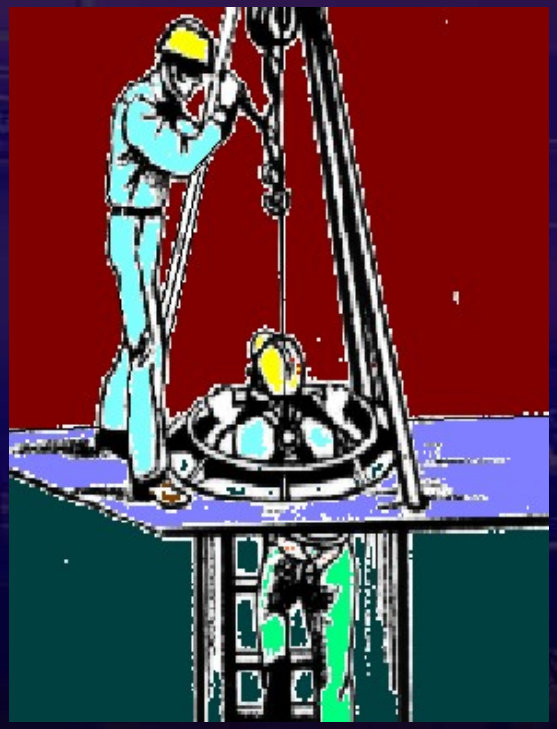
The Permit System

A permit, signed by the entry supervisor and verified that pre-entry preparations have been completed and the space is safe to enter, must be posted at entrances or otherwise made available to entrants before they enter a permit space.

The duration of entry must not exceed the time required to complete the assignment.

The Permit System

The entry supervisor must terminate entry and cancel permits when an assignment has been completed or when new conditions exist.



New conditions must be noted on the canceled permit and used in revising the permit space program.

General Entry Requirements

Entry permits must include…

air test results.

air tester's/monitor's initials or signature

name and signature of supervisor who authorizes entry

name of permit space to be entered in, authorized entrant(s),

eligible attendants, and individual(s) authorized to be entry supervisor(s).

General Entry Requirements

Entry permits must include…

name and telephone numbers of rescue and emergency services,

date and authorized duration of entry,

purpose of entry and known space hazards,

measures to isolate permit spaces and to eliminate or control Space hazards.

General Entry Requirements

Entry permits must include…

acceptable entry conditions,

communication procedures and equipment to maintain contact during entry,

additional permit(s), such as hot works, that have been issued to authorized work in the permit space,

special equipment and procedures.

General Entry Requirements

Sample Permit
(1910.146 Appendix D)

ARGUS GROUP • 15075 E. Eleven Mile Rd. • P.O. Box 689 • Roseville, MI 48066 • (800) 873-0456

PERMIT REQUIRED CONFINED SPACE ENTRY PERMIT ☐CONFINED SPACE ☐HAZARDOUS ENTRY

PERMIT VALID FOR ____ HOURS OR UNTIL FOLLOWING JOB IS COMPLETE.

Site Location and Description: _____

Purpose of Entry: _____

Unit Supervisor: _____

Name(s) of Authorized Entrant(s): _____

* Boldface type denotes minimum requirements to be considered, completed and reviewed prior to entry *

[NOTE: Enter N/A in the items that do not apply]

REQUIREMENTS COMPLETED	DATE	TIME	REQUIREMENTS COMPLETED	DATE	TIME
Lock Out/De-Energize/Try-out			Line(s) Broken-Capped-Blanked		
Full Body Harness with Lifeline			Purge-Flush and Vent		
Emergency Escape Retrieval Equip.			Fire Extinguishers		
Ventilation			Lighting (Explosive Proof)		
Secure Area (Post and Flag)			Protective Clothing		
Breathing Apparatus (SCBA)			Resuscitator - Inhalator		
Respirator: ☐ APR ☐ Airline ☐ SAR-EB			Burning and Welding Permit		
Breather Box			*BREATHER BOX CALIBRATION DATE:*		

* * CONTINUOUS MONITORING - RECORD RESULTS EVERY TWO (2) HOURS * *

CONTINUOUS MONITORING RESULTS	PERMISSIBLE ENTRY LEVELS		Pre-Entry Results TIME:	Continuous Monitoring Results				
Percent of Oxygen	19.5% to 23.5%							
Lower Flammable Limit	Under 10%							
Carbon Monoxide	35 PPM							
Formaldehyde	[a]0.75 PPM	[b]2 PPM						
Glycol Ethers		[b]25 PPM						
Hydrogen Sulfide	[a]10 PPM	[b]15 PPM						
Acetone	[a]750 PPM	[b]1000 PPM						
Other: _____								
Other: _____								

[a] Employee can work in the area for 8 hours at this concentration. [b] Employee can work in this area up to 15 minutes at this concentration.

Communication Procedure: _____

Rescue or Retrieval Procedure: _____

NAME OF PERSON DOING TEST	DATE CALIBRATED	INSTRUMENT USED	MODEL &/OR TYPE	SERIAL &/OR UNIT NO.

ATTENDANT IS REQUIRED FOR ALL CONFINED SPACE WORK

ATTENDANT(S)	SOCIAL SECURITY NO.	ATTENDANT(S)	SOCIAL SECURITY NO.

ENTRY SUPERVISOR NAME (Printed): _____

DEPARTMENT: _____ PHONE: _____

ALL ABOVE CONDITIONS SATISFIED
ENTRY SUPERVISOR SIGNATURE: _____ DATE: _____

Document1

Energy Isolation

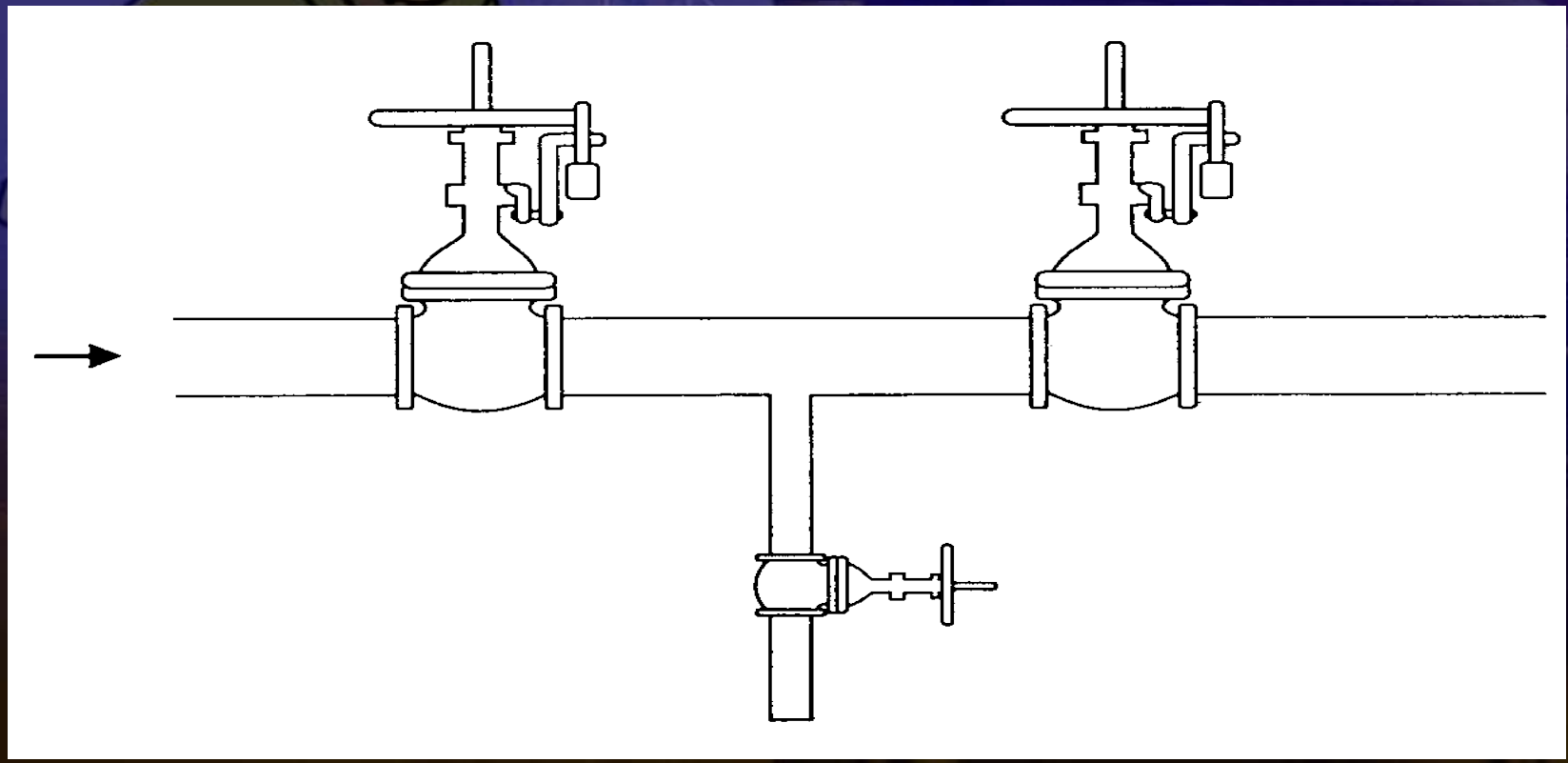
1) Identify and isolate all energy sources and need/discharge lines to the confined space (hazardous inflows).

2) Identify and isolate all sources of energy that potentially present a hazard to entrants in a confined space (lock-out/tag-out of electrical equipment).

3). Disconnect, bind, or double block and bleed lines that feed or discharge into the confined space.

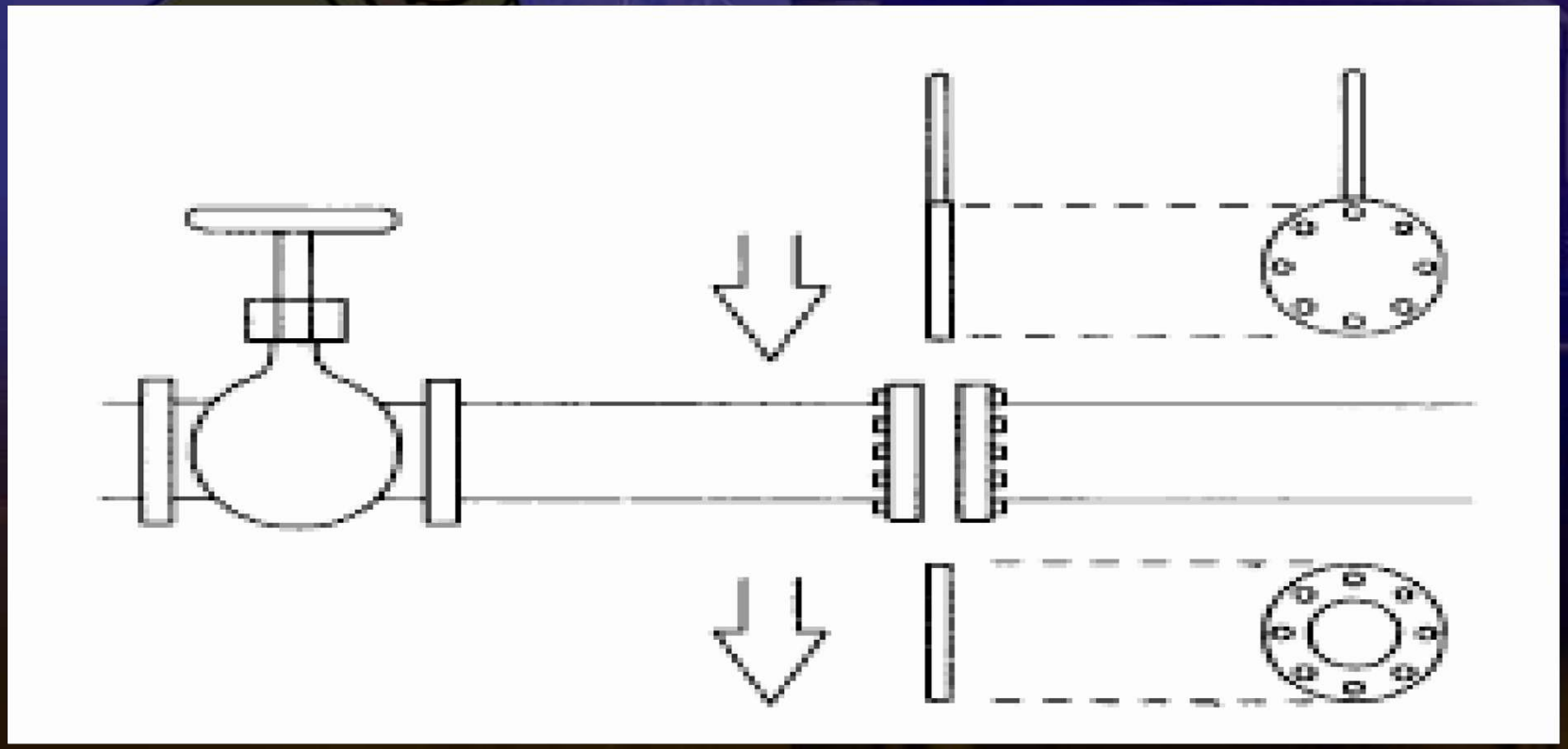
Energy Isolation

Double Block and Bleed



Energy Isolation

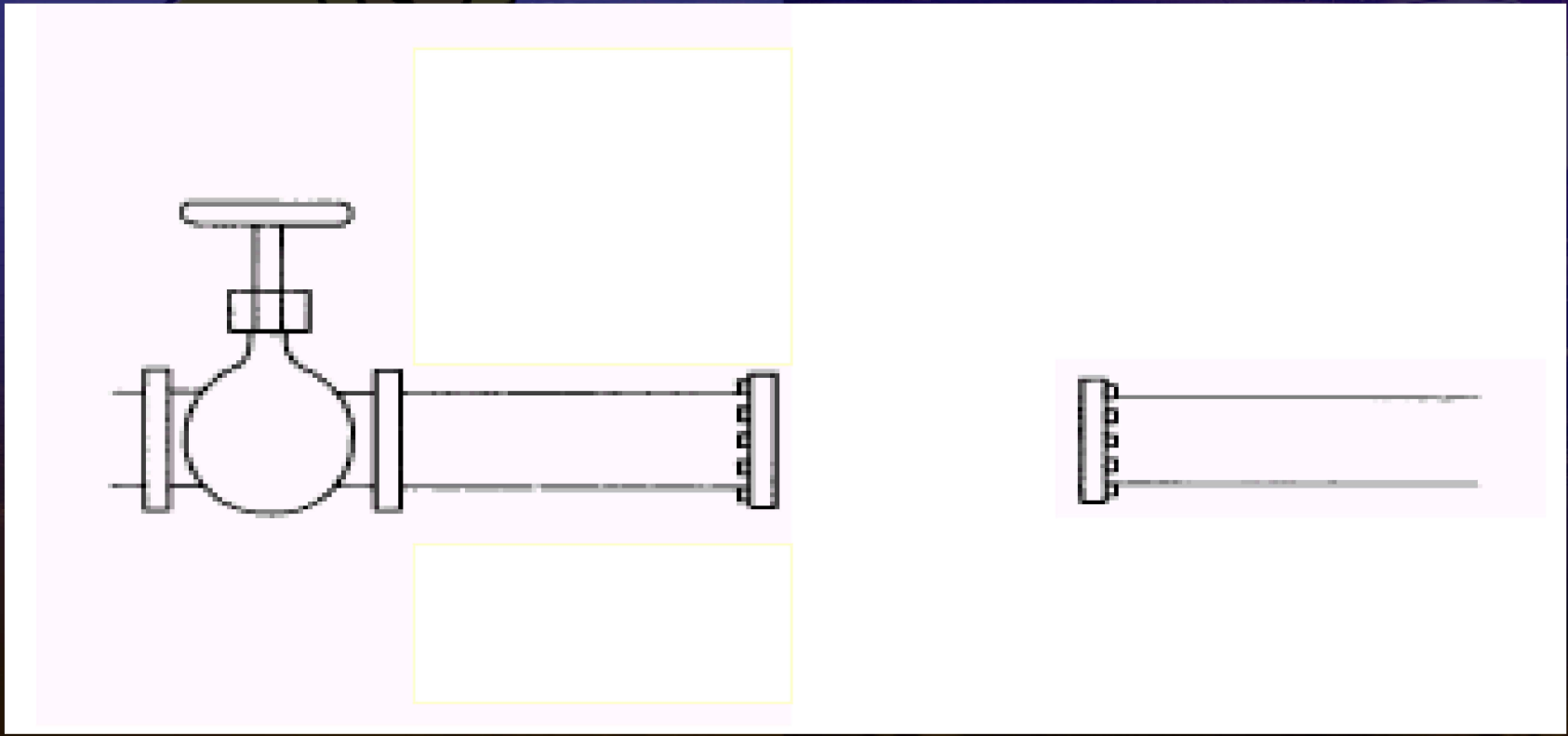
Blind / Blanking



General Entry Requirements

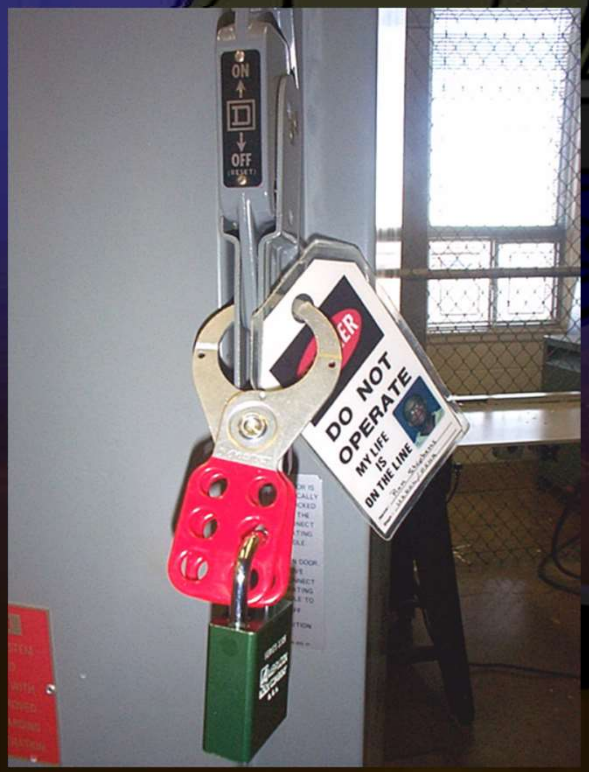
Energy Isolation

Remove Pipe Section



Lockout and Tagging Requirements
(1926.417)

Controls that are to be deactivated during the course of work on energized or de-energized equipment or circulation be locked and tagged.



Equipment or circuits that are de-energized shall be rendered inoperative and shall have locks and tags attached at all points where such equipment or circuits can be energized.

Locks and tags be placed to identify plainly the equipment or circuits being used.

General Entry Requirements

Lockout and Tagging Requirements
(1910.147)

LO/TO program requirements:

☒documented control procedures for isolating machines or equipment from energy sources.

☒affixing appropriate locks/tags to energy-isolation devices to prevent unexpected energization, start-up, or release of stored energy.

☒train all employees involved.

☒conduct periodic inspections of the procedures to maintain or improve their effectiveness.

Atmospheric Testing Procedures

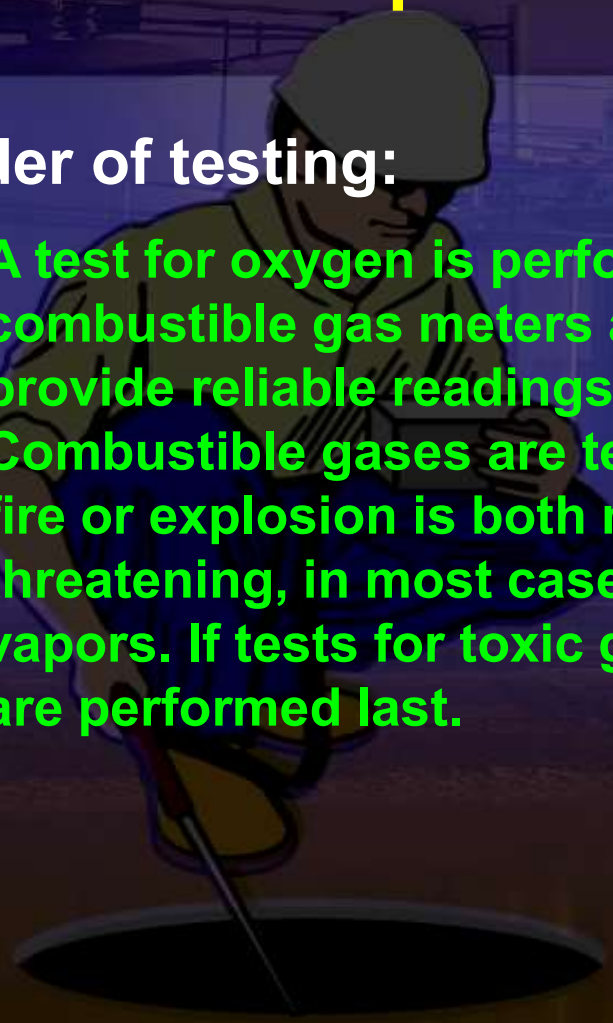
- **Evaluation testing:**
  - To identify and evaluate any hazardous atmospheres that may exist or arise
- **Verification testing:**
  - The atmosphere of a permit space which may contain a hazardous atmosphere should be tested for residues of all contaminants identified by evaluation testing using permit specified equipment to determine that residual concentrations at the time of testing and entry are within the range of acceptable entry conditions.

Atmospheric Testing Procedures

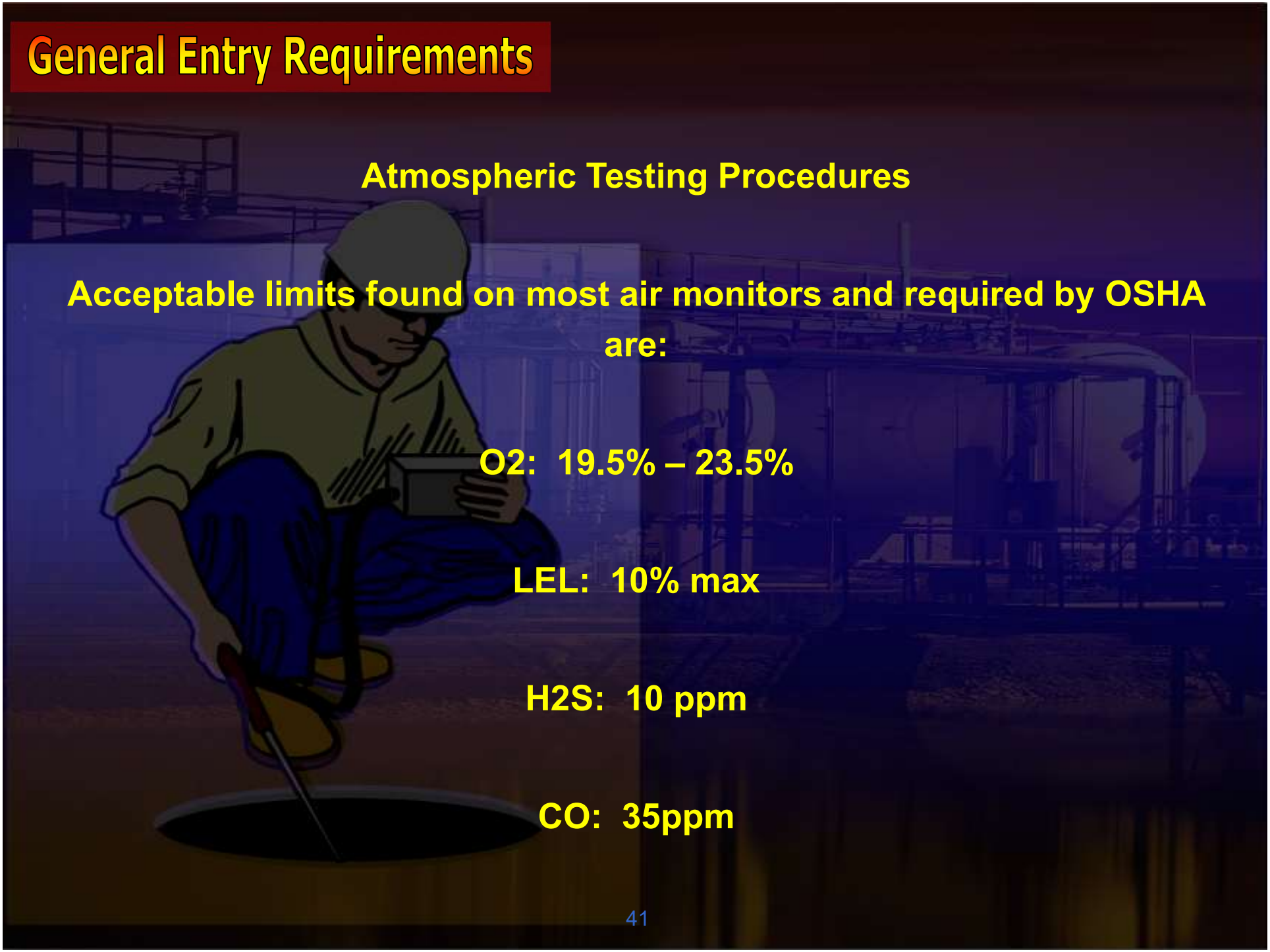
- Duration of testing:
  - Measurement of values for each atmospheric parameter should be made for at least the minimum response time of the test instrument specified by the manufacturer.
- Testing stratified atmospheres.
  - When monitoring for entries involving a descent into atmospheres that may be stratified, the atmospheric envelope should be tested a distance of approximately 4 feet (1.22 m) in the direction of travel and to each side. If a sampling probe is used, the entrant's rate of progress should be slowed to accommodate the sampling speed and detector response.

Atmospheric Testing Procedures

- **Order of testing:**
  - **A test for oxygen is performed first because most combustible gas meters are oxygen dependent and will not provide reliable readings in an oxygen deficient atmosphere. Combustible gases are tested for next because the threat of fire or explosion is both more immediate and more life threatening, in most cases, than exposure to toxic gases and vapors. If tests for toxic gases and vapors are necessary, they are performed last.**



General Entry Requirements



Atmospheric Testing Procedures

Acceptable limits found on most air monitors and required by OSHA are:

O2: 19.5% – 23.5%

LEL: 10% max

H2S: 10 ppm

CO: 35ppm

General Entry Requirements

Atmospheric Testing Procedures

Monitoring equipment shall be maintained and calibrated according to the manufacturer's instructions. Those responsible for monitoring and using the monitoring device must be properly trained in the operation and care of the equipment.

During confined space entry operations, periodically retest to verify that the atmosphere remains within acceptable entry conditions.

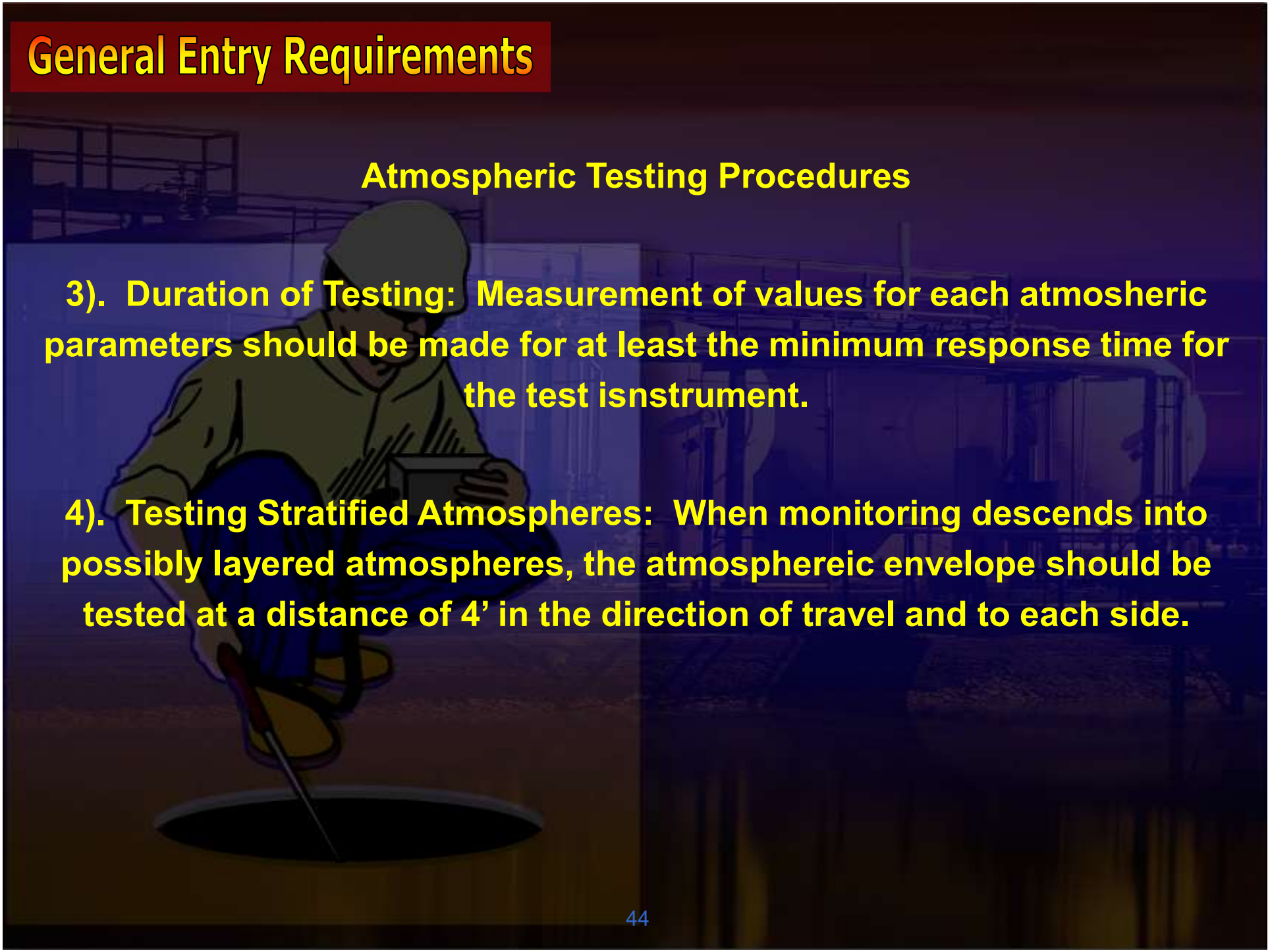
General Entry Requirements

Atmospheric Testing Procedures

1). Evaluation Testing: Analyze the confined space atmosphere using equipment of sufficient sensitivity. This will enable the development of appropriate entry procedures.

2) Verification Testing: The atmosphere of a permit space should be tested for any hazardous contaminants identified by the evaluation testing.

General Entry Requirements

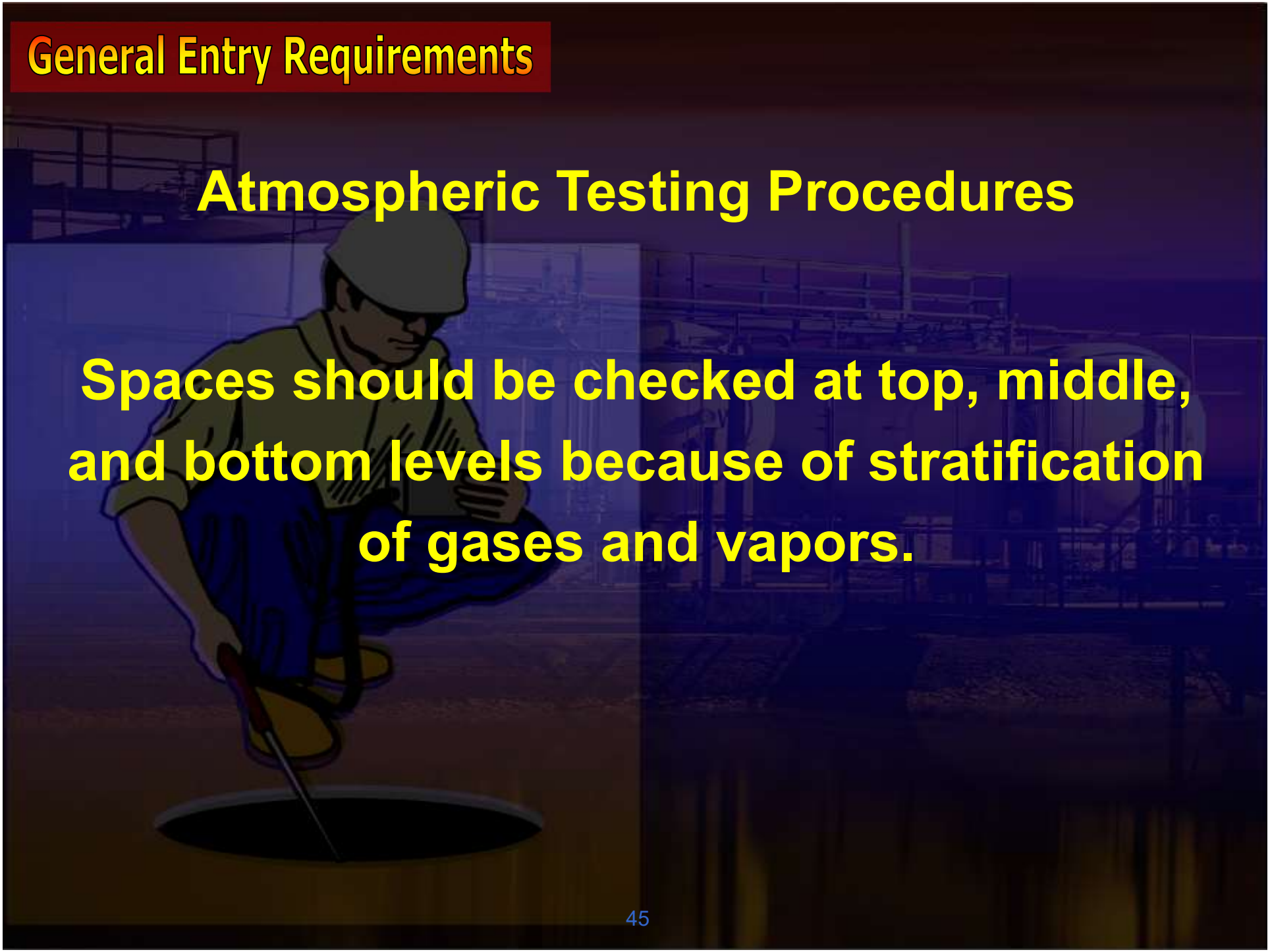


Atmospheric Testing Procedures

3). Duration of Testing: Measurement of values for each atmosheric parameters should be made for at least the minimum response time for the test isnstrument.

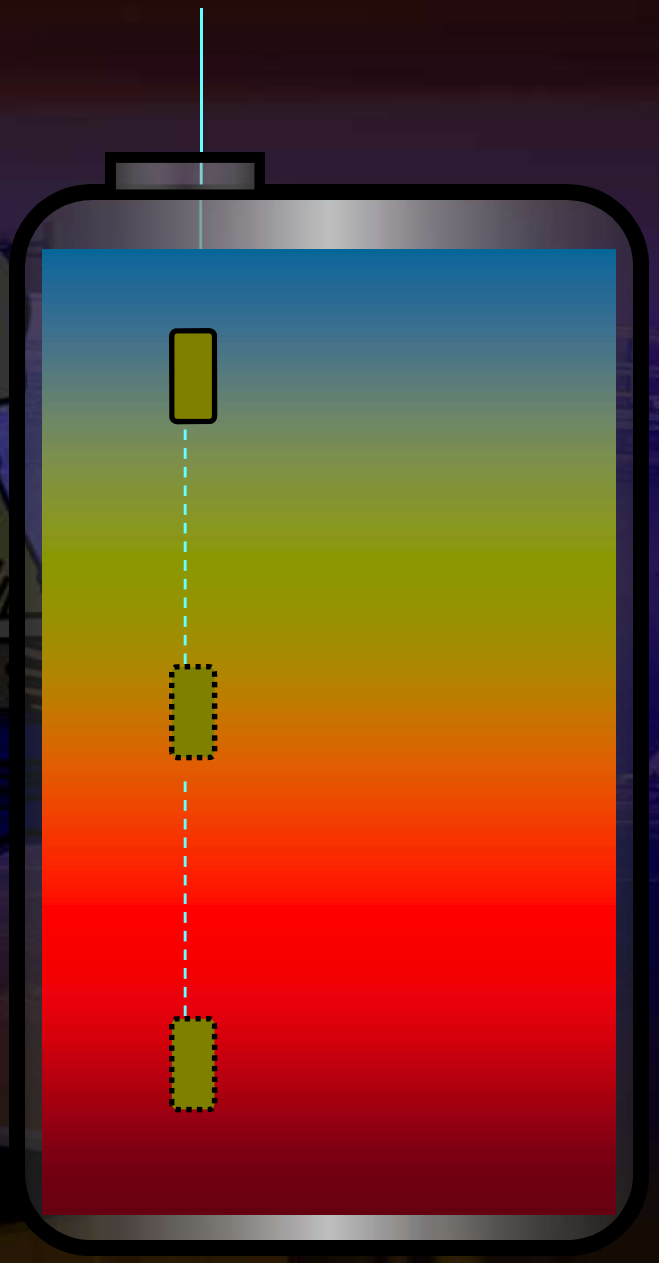
4). Testing Stratified Atmospheres: When monitoring descends into possibly layered atmospheres, the atmosphereic envelope should be tested at a distance of 4' in the direction of travel and to each side.

Atmospheric Testing Procedures



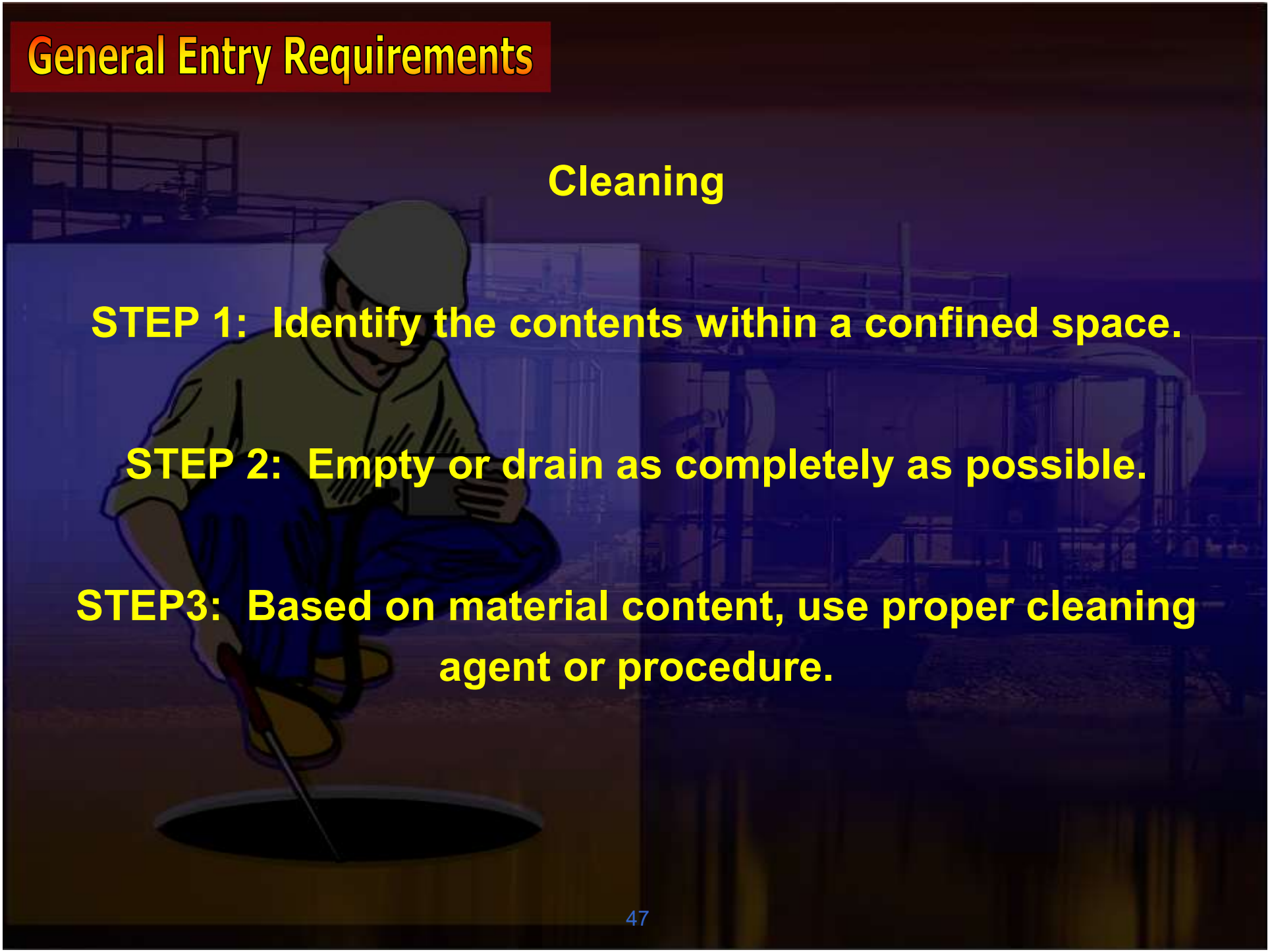
Spaces should be checked at top, middle, and bottom levels because of stratification of gases and vapors.

Always test the air at various levels to be sure that the entire space is safe.



Good air near the opening does NOT mean there is good air at the bottom!

General Entry Requirements



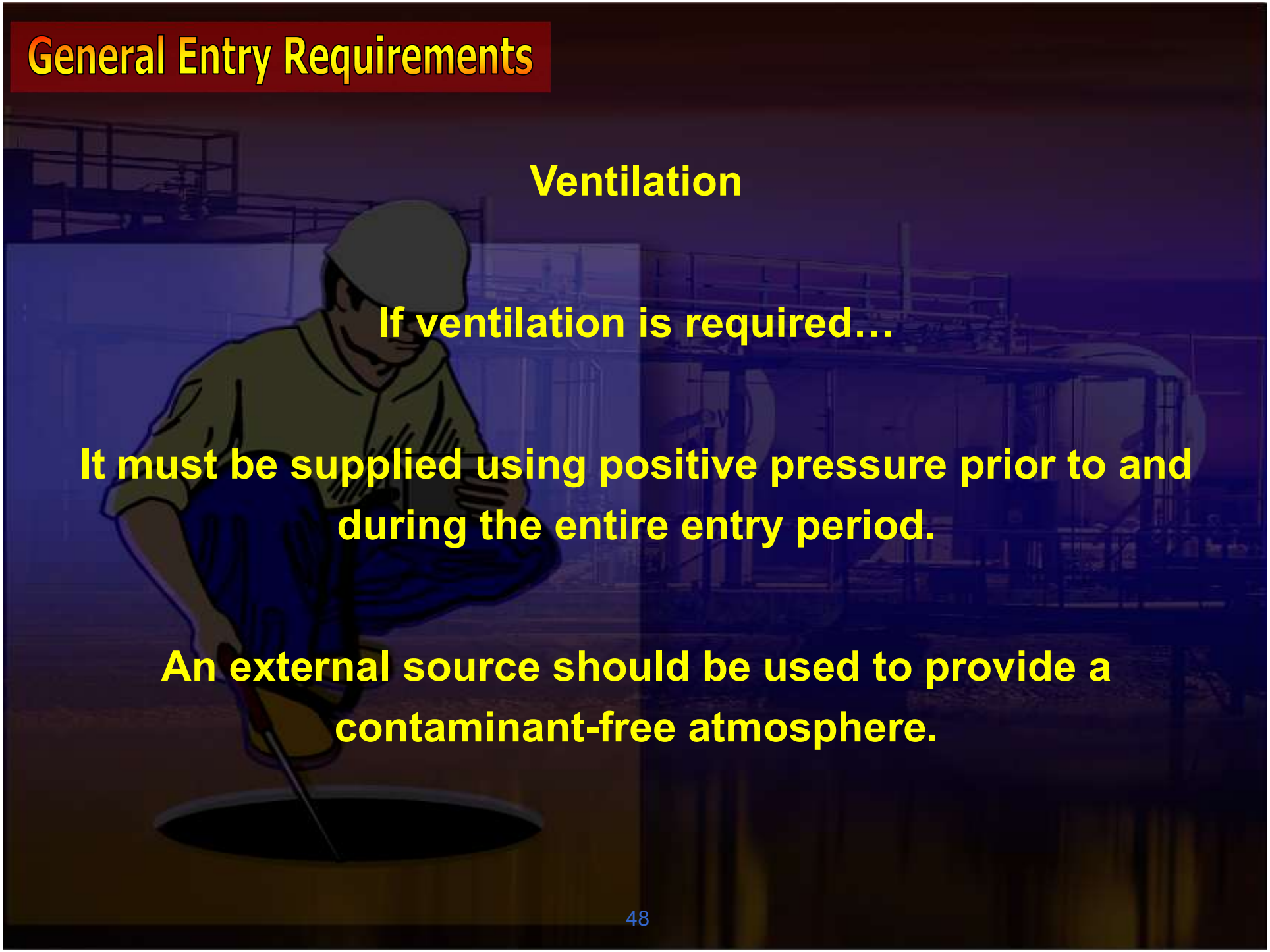
Cleaning

STEP 1: Identify the contents within a confined space.

STEP 2: Empty or drain as completely as possible.

STEP3: Based on material content, use proper cleaning agent or procedure.

General Entry Requirements



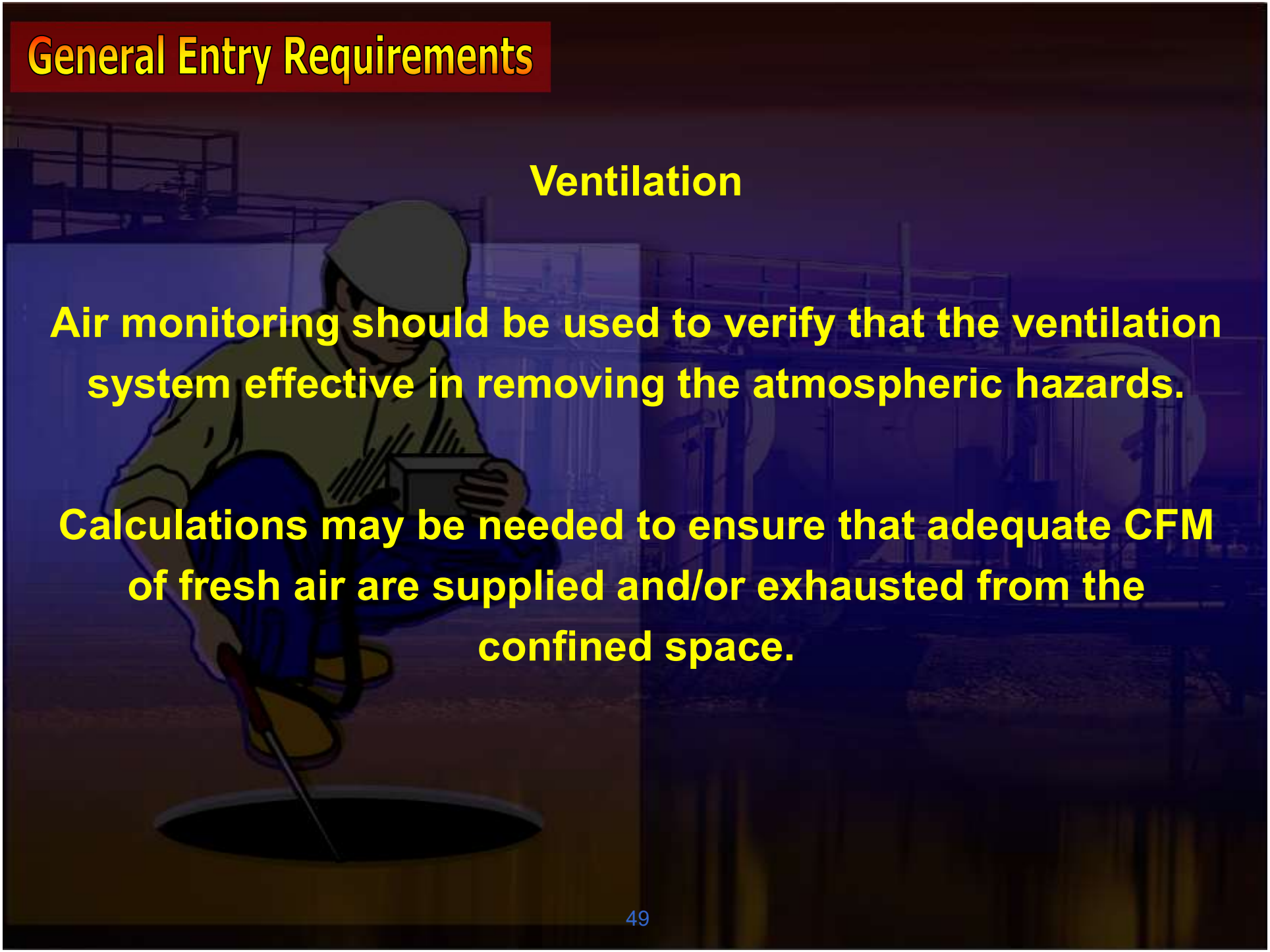
Ventilation

If ventilation is required…

It must be supplied using positive pressure prior to and during the entire entry period.

An external source should be used to provide a contaminant-free atmosphere.

General Entry Requirements

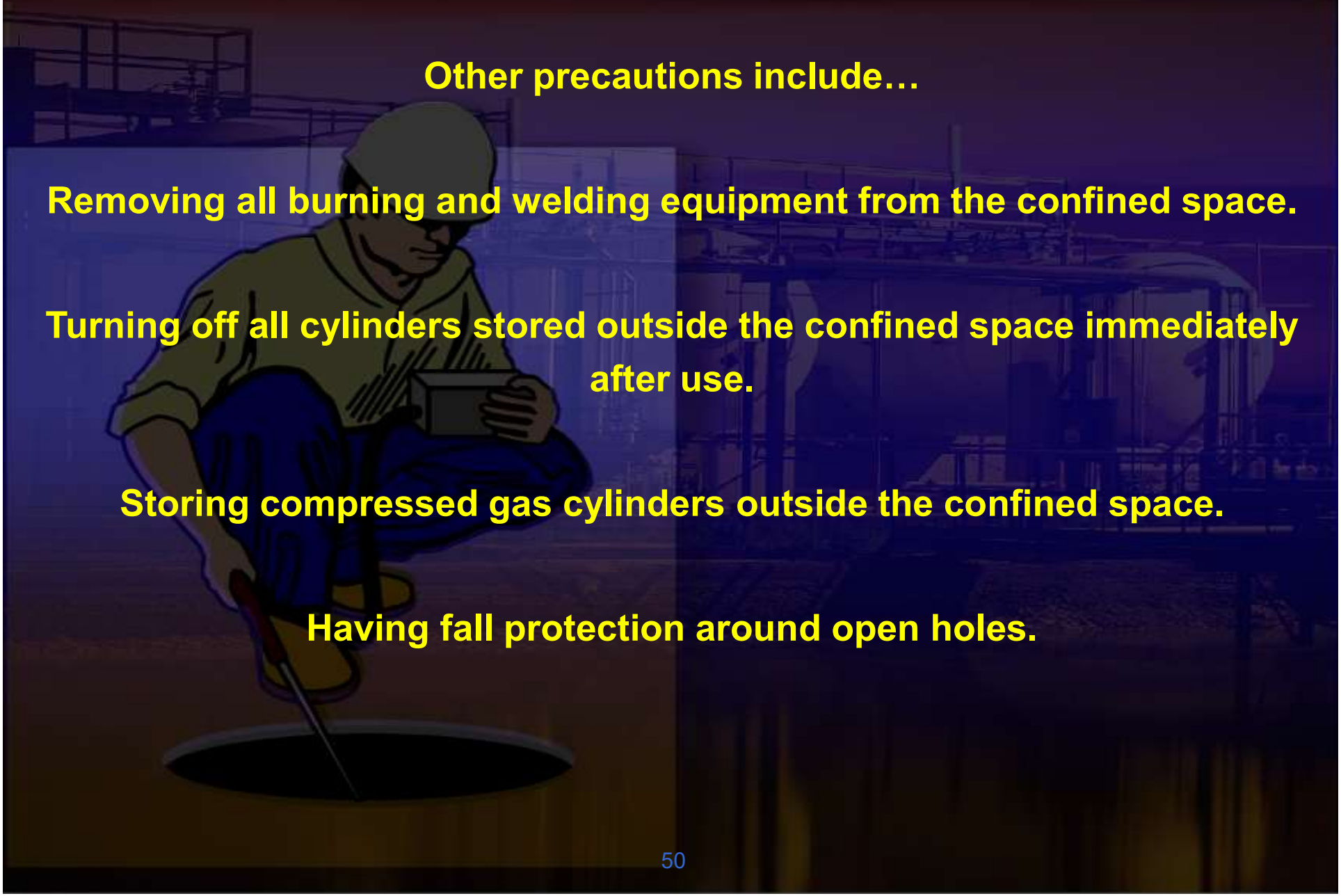


Ventilation

Air monitoring should be used to verify that the ventilation system effective in removing the atmospheric hazards.

Calculations may be needed to ensure that adequate CFM of fresh air are supplied and/or exhausted from the confined space.

General Entry Requirements



Other precautions include…

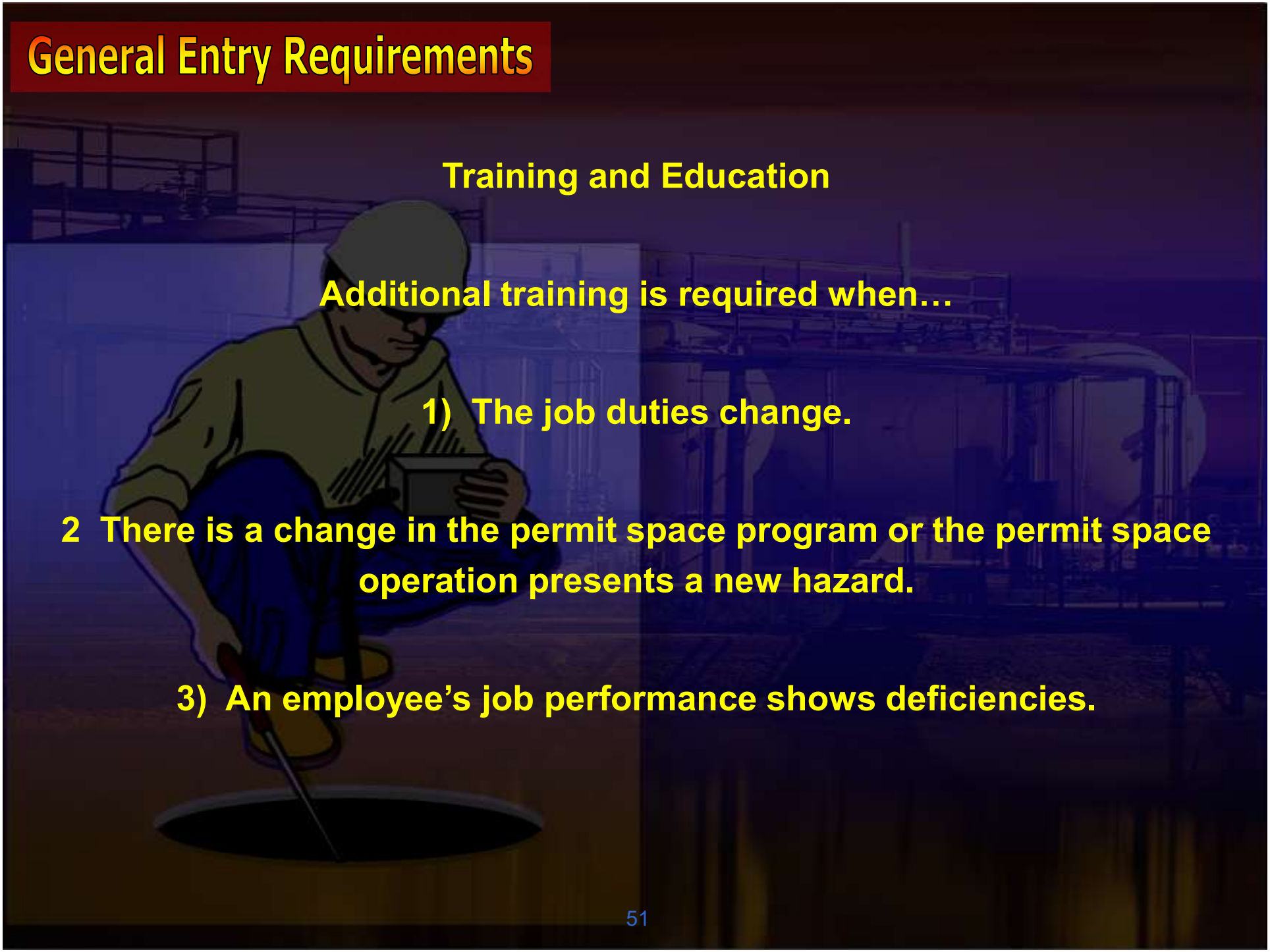
Removing all burning and welding equipment from the confined space.

Turning off all cylinders stored outside the confined space immediately after use.

Storing compressed gas cylinders outside the confined space.

Having fall protection around open holes.

General Entry Requirements



Training and Education

Additional training is required when…

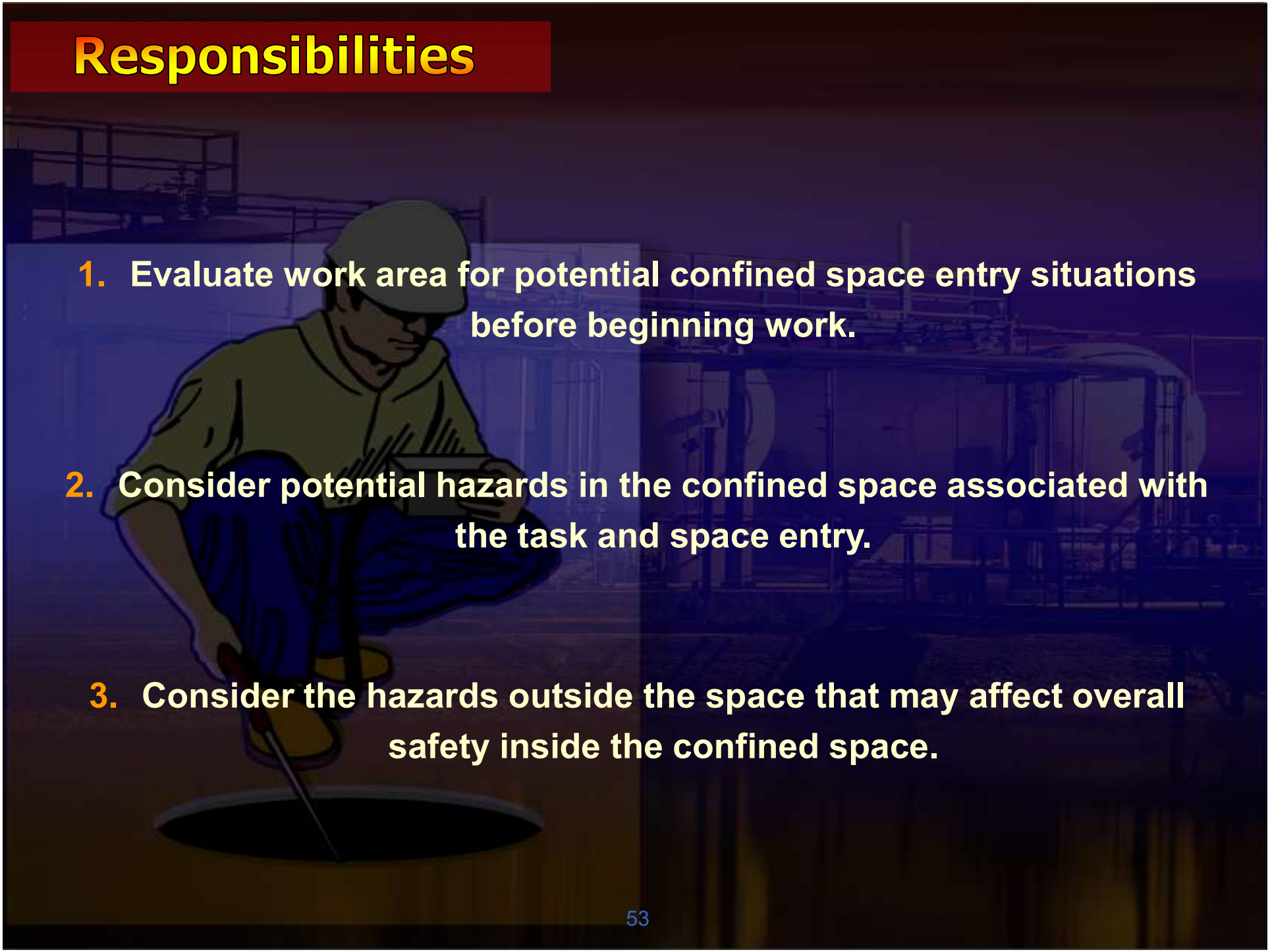
1) The job duties change.

2 There is a change in the permit space program or the permit space operation presents a new hazard.

3) An employee's job performance shows deficiencies.

Resposibilities

Responsibilities

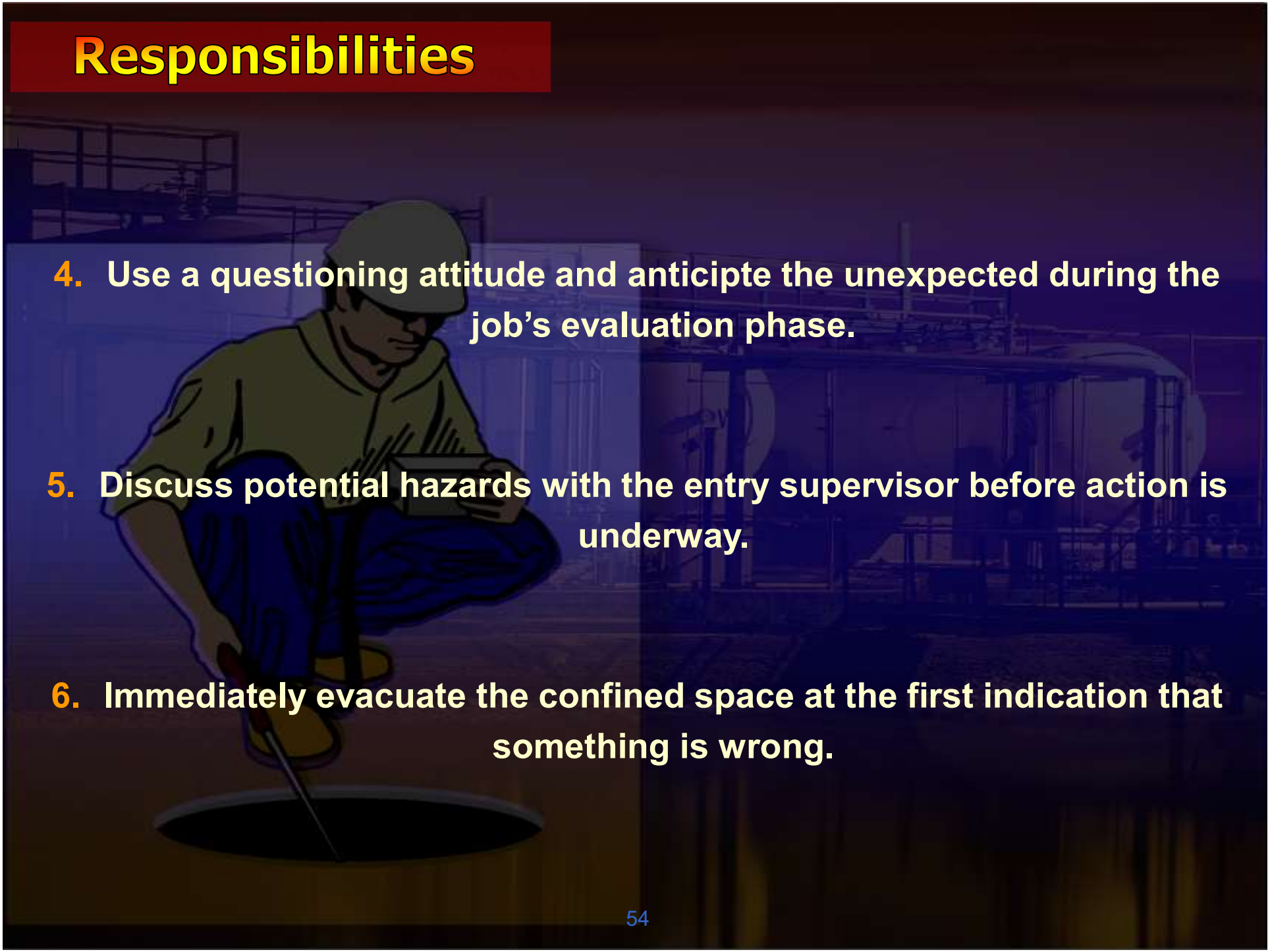


1. Evaluate work area for potential confined space entry situations before beginning work.

2. Consider potential hazards in the confined space associated with the task and space entry.

3. Consider the hazards outside the space that may affect overall safety inside the confined space.

Responsibilities



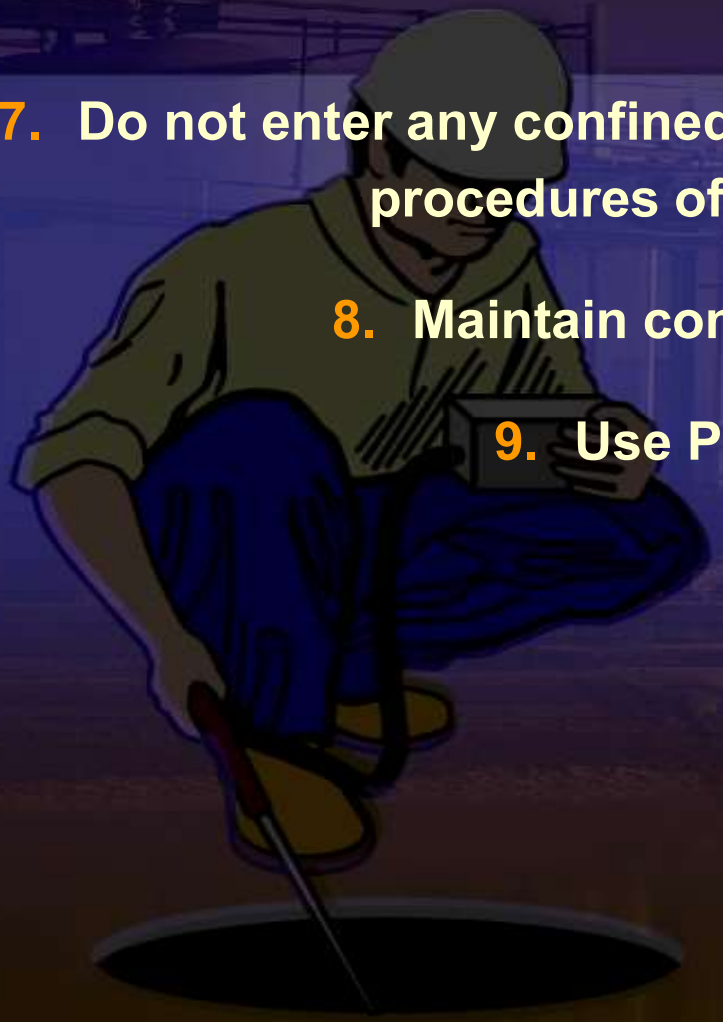
4. Use a questioning attitude and anticipte the unexpected during the job's evaluation phase.

5. Discuss potential hazards with the entry supervisor before action is underway.

6. Immediately evacuate the confined space at the first indication that something is wrong.

Responsibilities

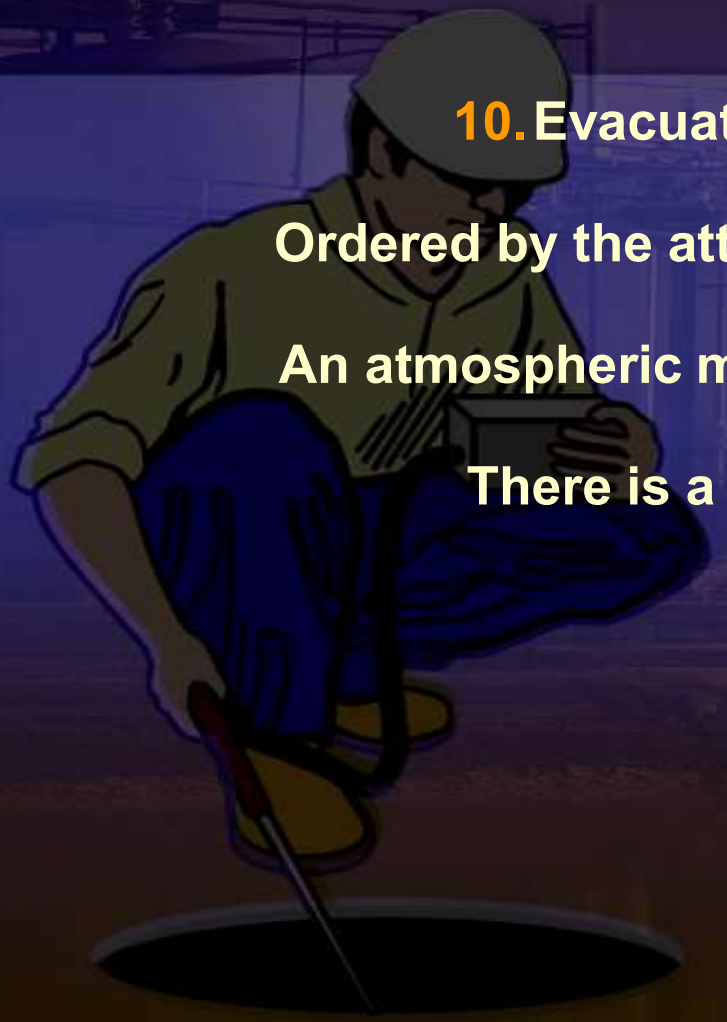
Authorized Entrant



7. **Do not enter any confined space without following the defined procedures of the employer's program.**
8. **Maintain contact with the attendant.**
9. **Use PPE as instructed.**

Responsibilities

Authorized Entrant



10. **Evacuate the space when:**

Ordered by the attendant or others present.

An atmospheric monitor alarm is activated.

There is a perceived danger.

Responsibilities

Outside Attendant/Observer

1. **Monitor personnel activities inside the permit space.**
2. **Monitor conditions inside and outside the permit space for potential hazards.**

Responsibilities

Outside Attendant/Observer

3. Order entrants to evacuate the permit space immediately when:

Conditions develop that are prohibited by the permit.

Abnormal behavior is detected.

Situations develop that could endanger entrants.

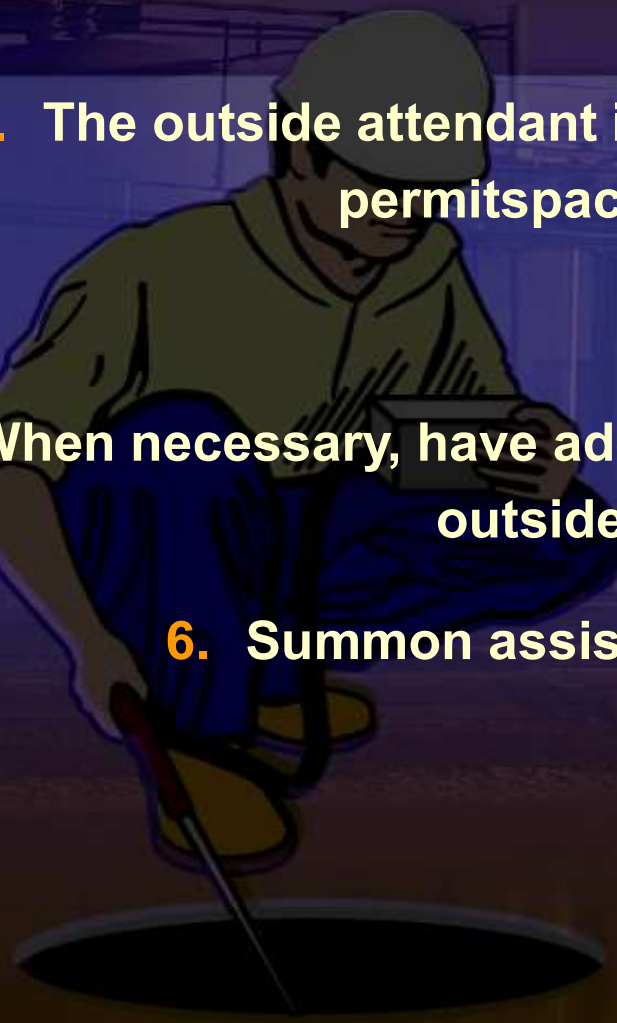
Responsibilities

Outside Attendant/Observer

4. **The outside attendant is not permitted to enter or leave the permitspace until properly relieved.**

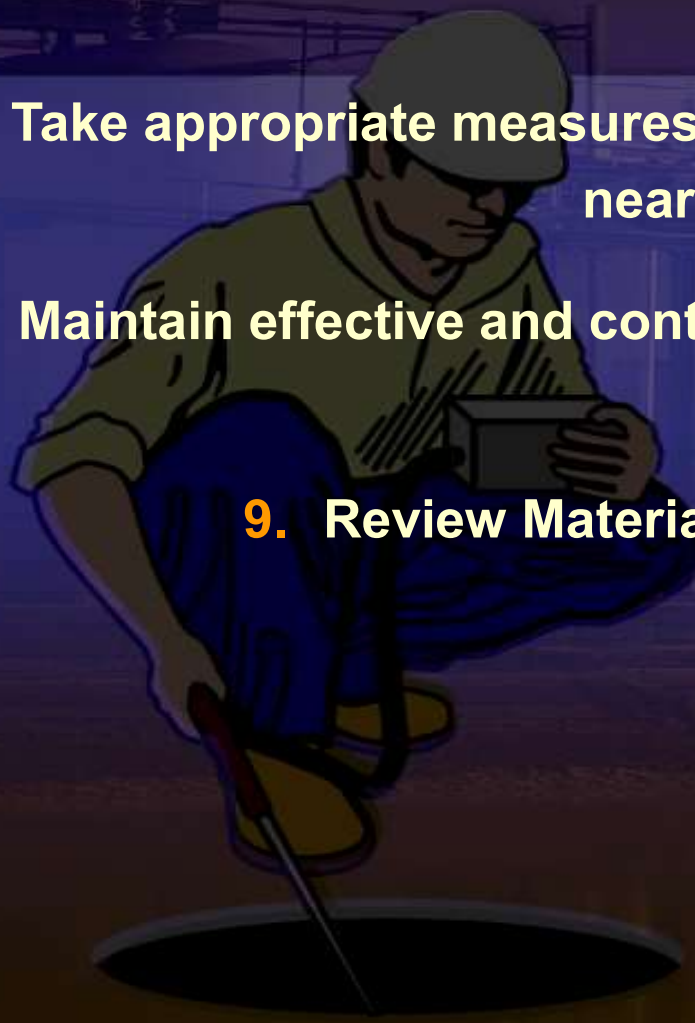
5. **When necessary, have adequate fire fightingequipment available outside the confined space.**

6. **Summon assistance in case of emergency.**



Responsibilities

Outside Attendant/Observer



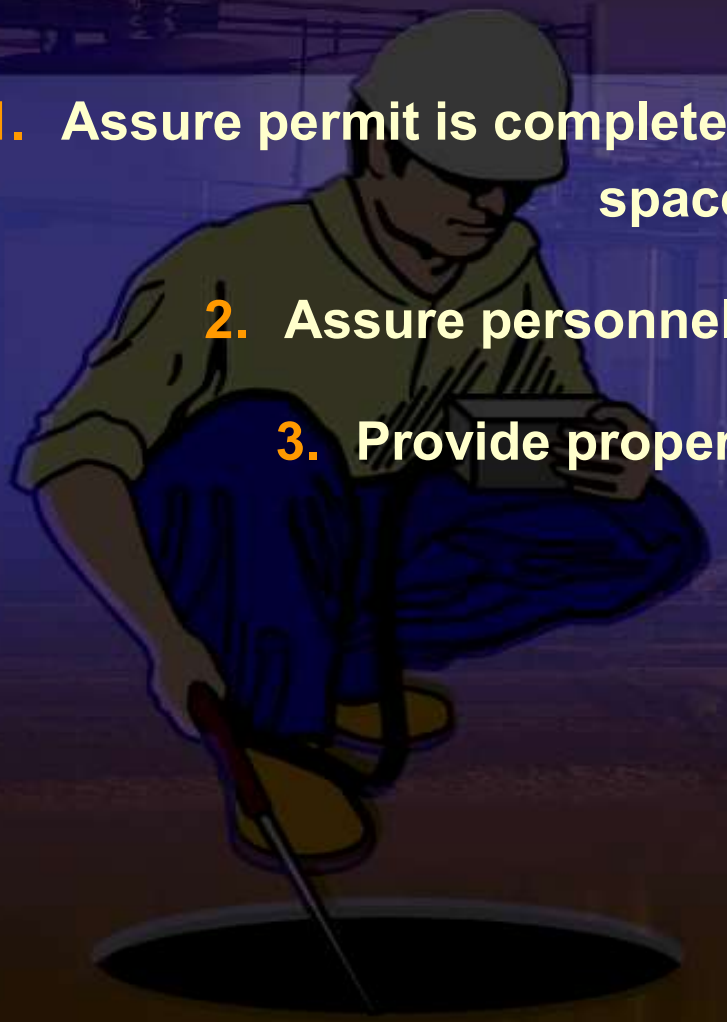
7. **Take appropriate measures to remove unauthorized personnel in or near the permit space.**

8. **Maintain effective and continuous contact with authorized entrants during entry.**

9. **Review Material Safety Data Sheet (MSDS).**

Responsibilities

Entry Supervisor

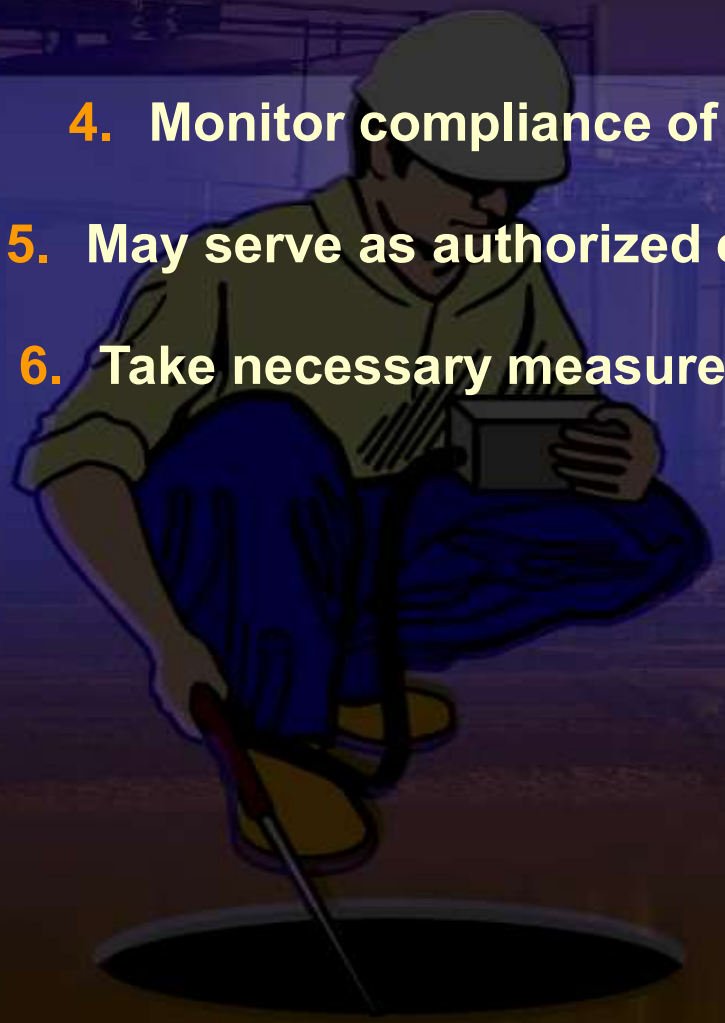


1. **Assure permit is completed, posted, and signed at the confined space entry opening.**
2. **Assure personnel have been properly trained.**
3. **Provide properly maintained equipment.**

Responsibilities

Entry Supervisor

4. Monitor compliance of confined space entry procedures.
5. May serve as authorized entrant or entry attendant if certified.
6. Take necessary measures for concluding an entry operation.

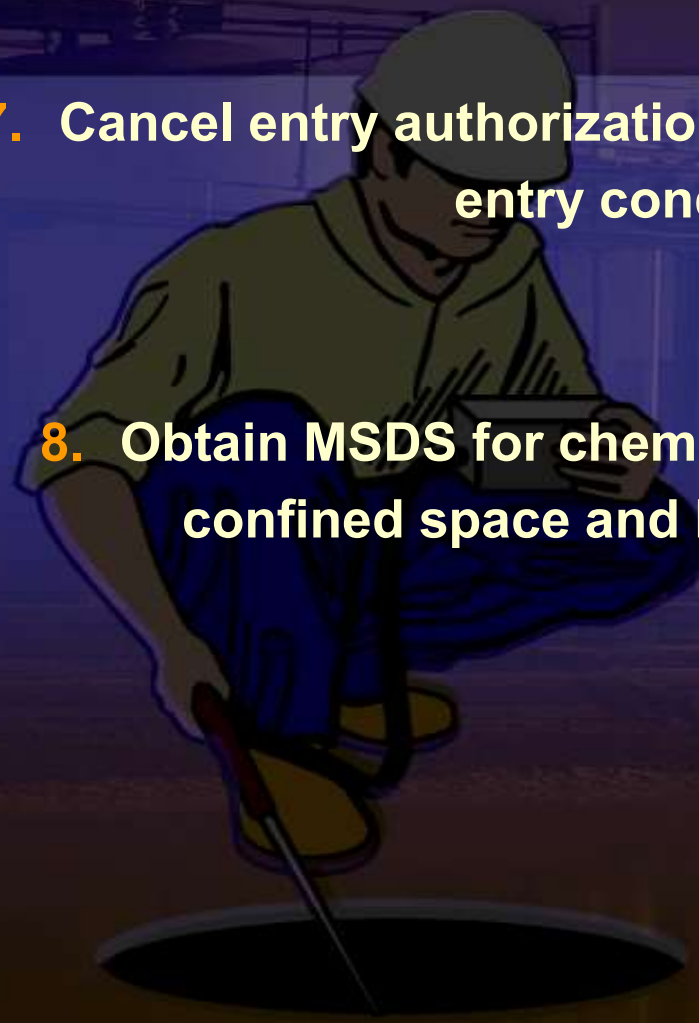


Responsibilities

Entry Supervisor

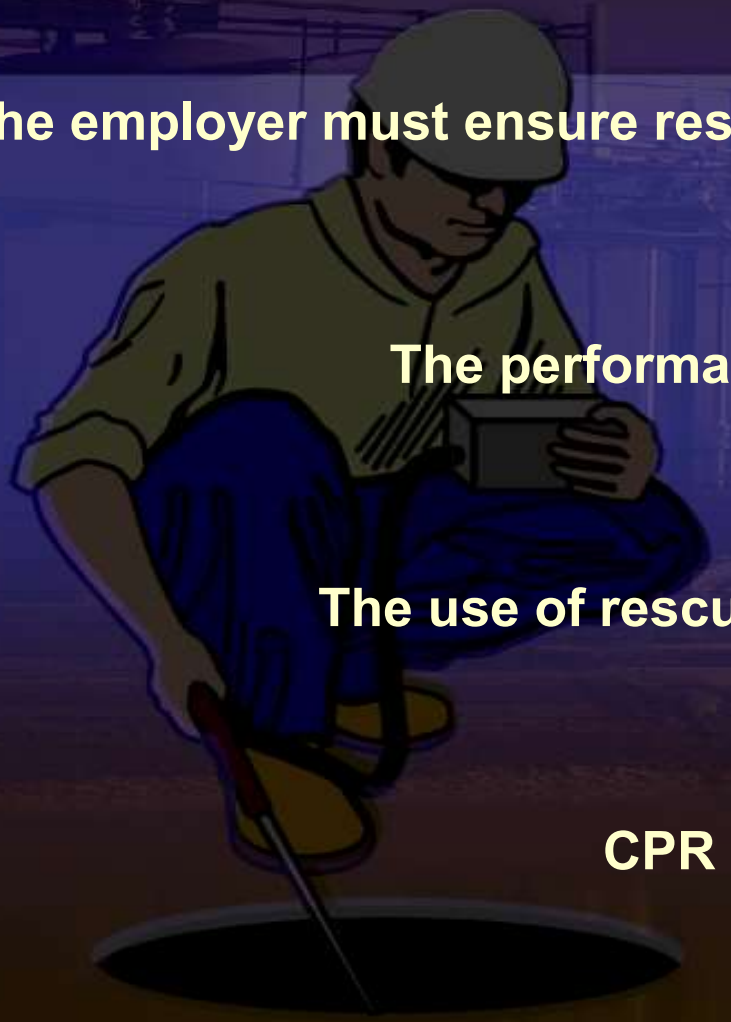
7. **Cancel entry authorization and terminate entry when acceptable entry conditions are not present.**

8. **Obtain MSDS for chemicals that may be encountered in the confined space and know the effects of overexposure.**



Responsibilities

Emergencies



The employer must ensure rescue personnel are properly trained in:

The performance of rescue duties.

The use of rescue PPE and equipments.

CPR and first aid.

The hazards of confined spaces.

Responsibilities

Emergencies

Authorized entrants, where appropriate, must wear a safety harness with retrieval line.

The other end of the retrieval line is attached to a mechanical device or fixed point outside the permit space.

A mechanical device must be available to retrieve personnel from vertical type permit spaces more than 5 deep.

Responsibilities

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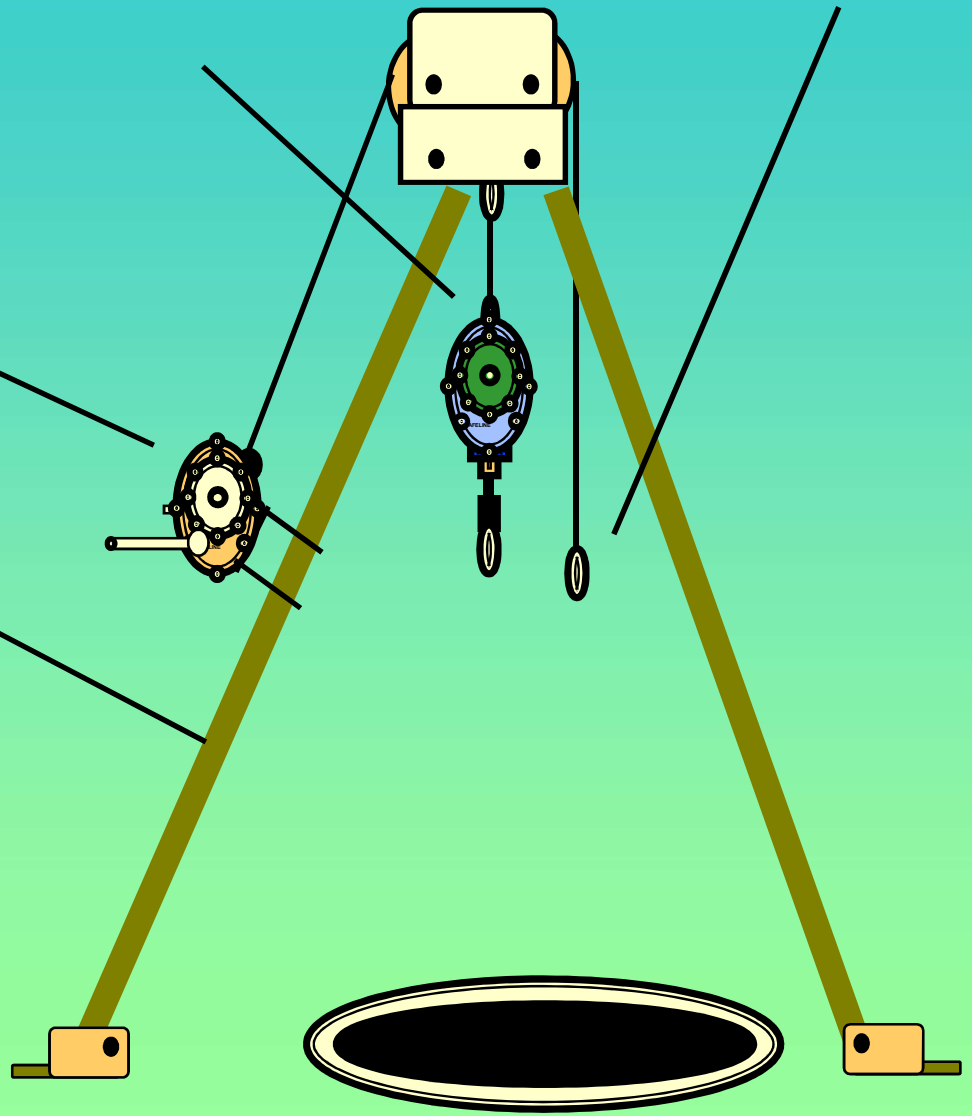
BACK-UP
FALL PROTECTION

TIE-OFF POINT

WINCH

TRIPOD



Rescue and Emergency Services

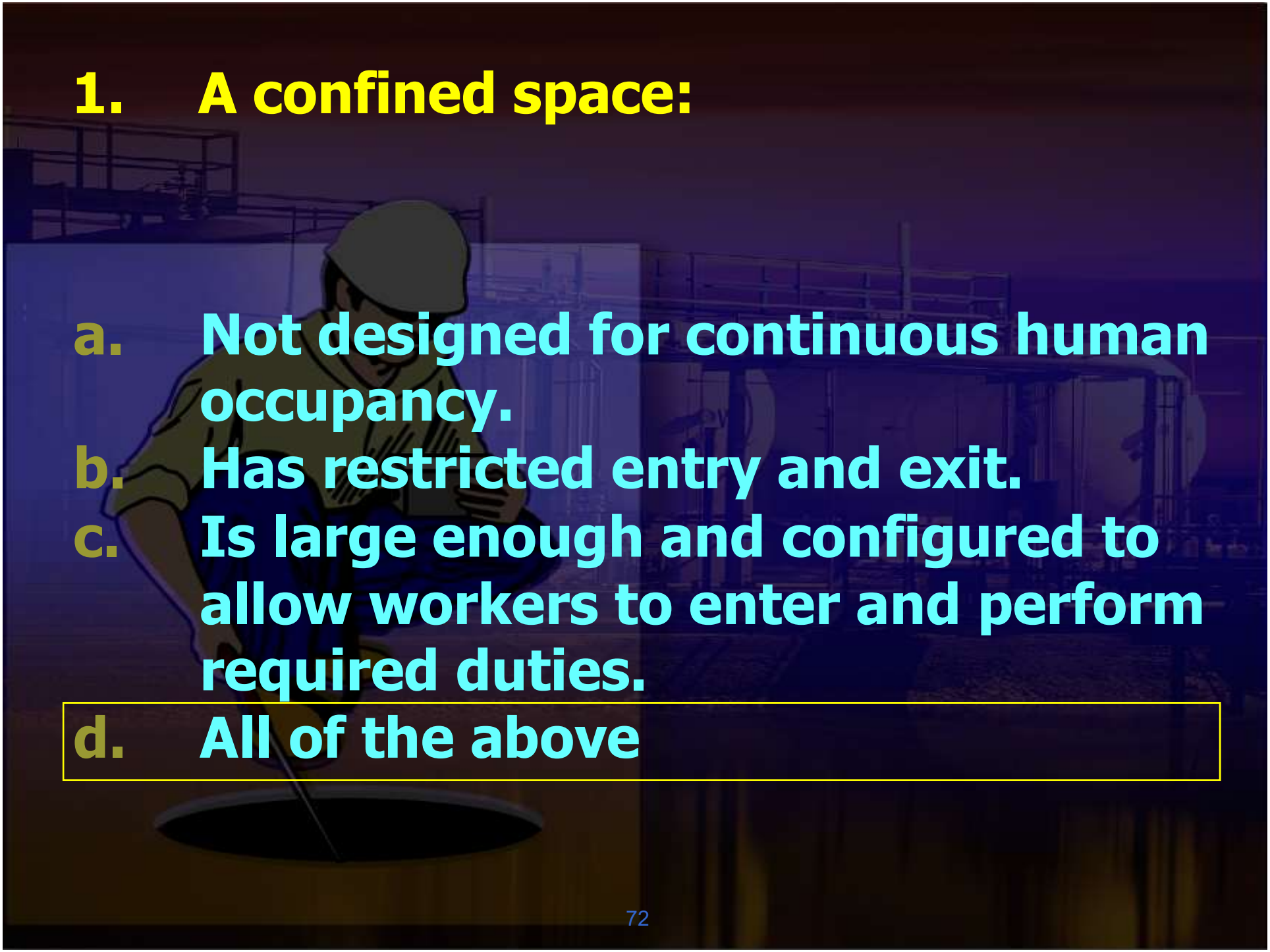
- Employer Responsibilities
  - Facilitate non-entry rescue: if it does not create a hazard
    - Entrants will wear full body harness
    - Wristlets may be worn
    - Retrieval line properly attached
      - Required for vertical permit spaces > 5ft. deep


SPARK
FIRE DEPT

Summary

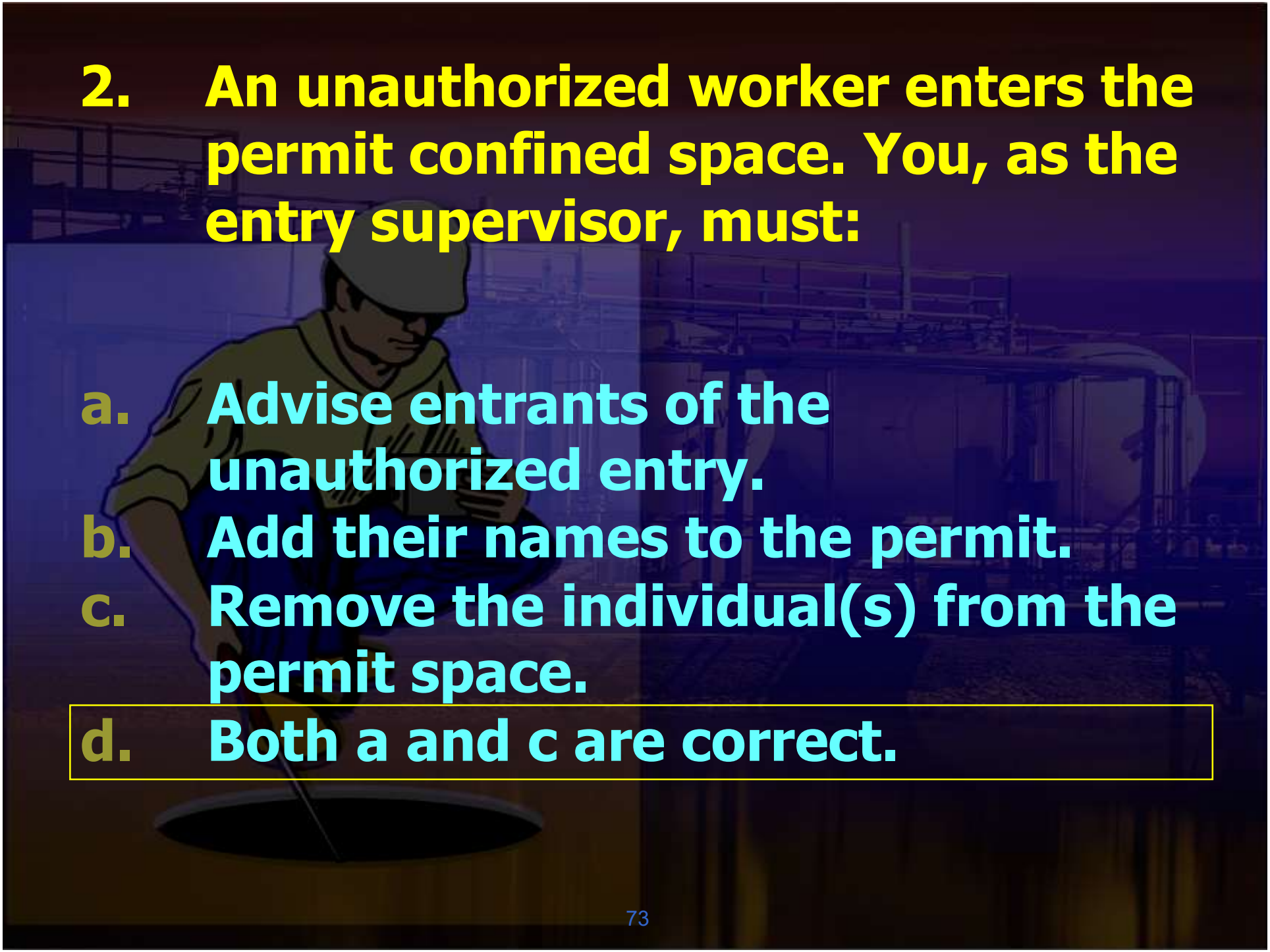
- Everyone should be able to define:
  - Confined space
  - Permit Required Confined Space
  - Employer responsibilities
  - Personnel roles
  - Atmospheric Testing
  - Non- permit space
  - Entry Requirements
  - Rescue Requirements


CONFINED SPACE
QUIZ



1. A confined space:

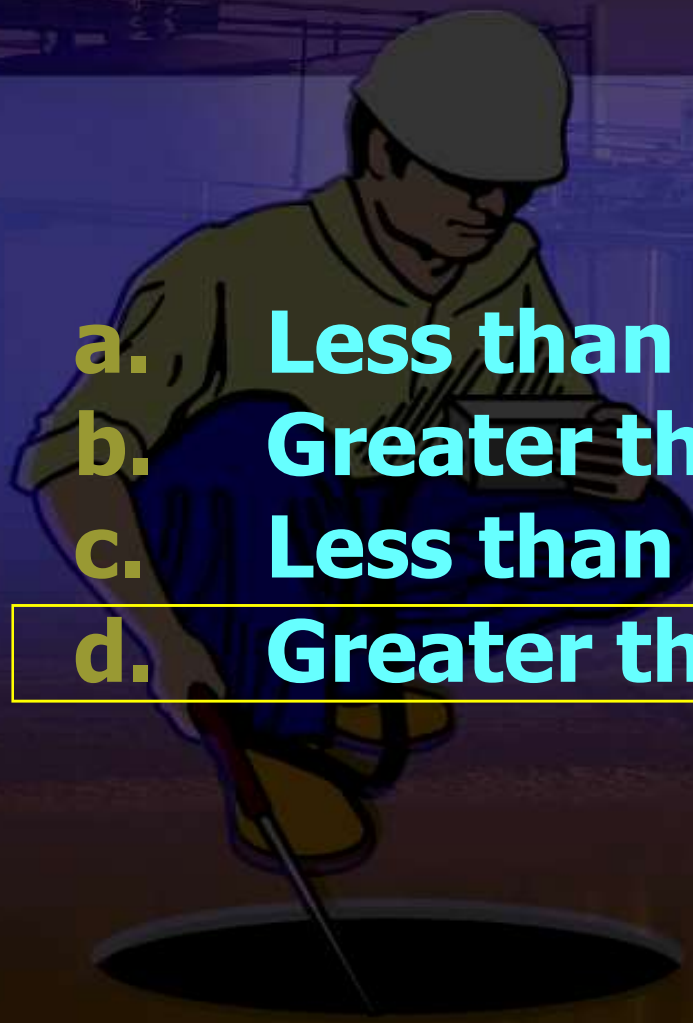
a. Not designed for continuous human occupancy.
b. Has restricted entry and exit.
c. Is large enough and configured to allow workers to enter and perform required duties.
d. All of the above



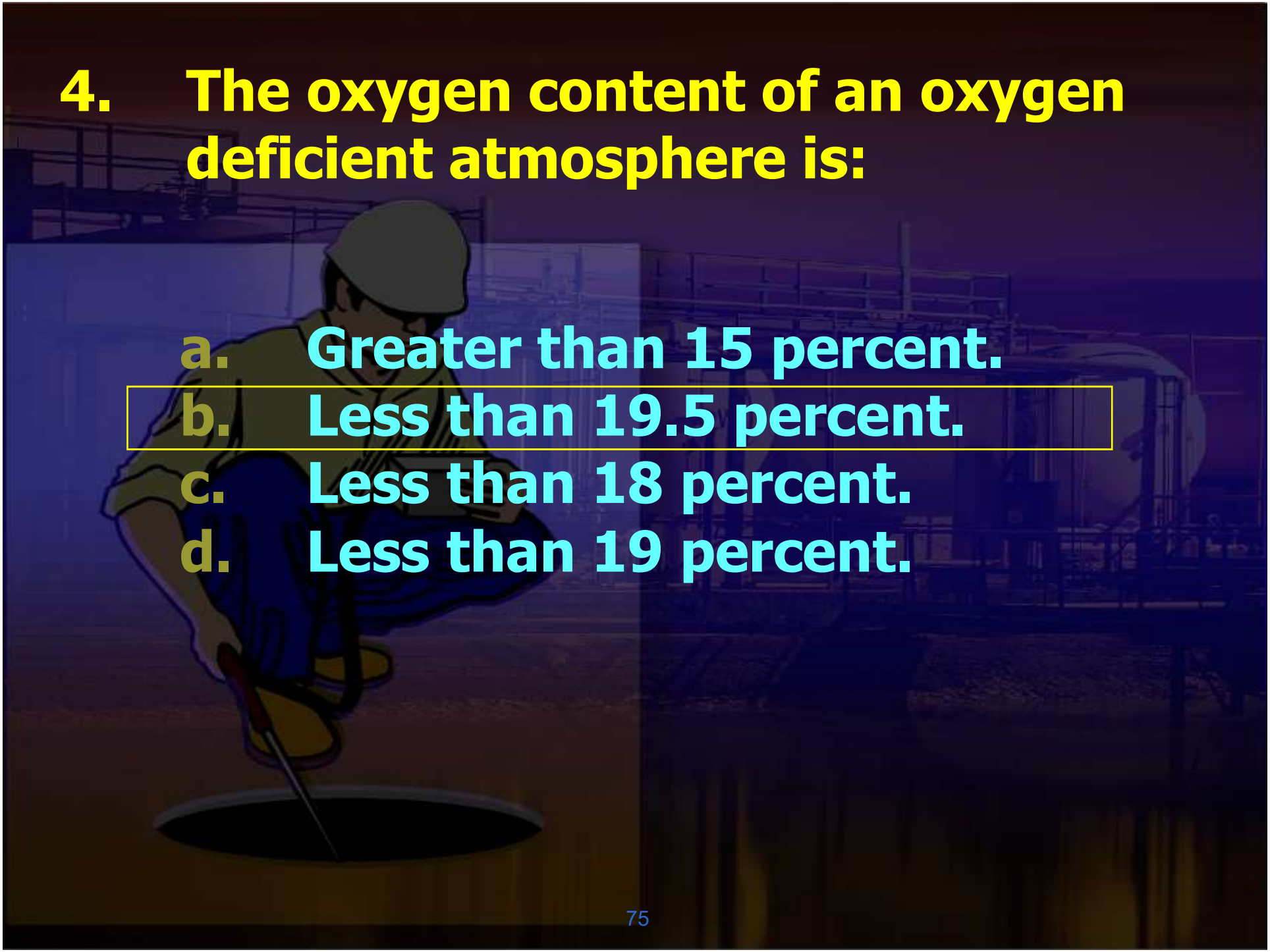
2. An unauthorized worker enters the permit confined space. You, as the entry supervisor, must:

a. Advise entrants of the unauthorized entry.
b. Add their names to the permit.
c. Remove the individual(s) from the permit space.
d. Both a and c are correct.

3. The oxygen content of an oxygen enriched atmosphere is:



a. Less than 21 percent.
b. Greater than 21 percent.
c. Less than 19 percent
d. Greater than 23.5 percent.



4. The oxygen content of an oxygen deficient atmosphere is:

a. Greater than 15 percent.
b. Less than 19.5 percent.
c. Less than 18 percent.
d. Less than 19 percent.

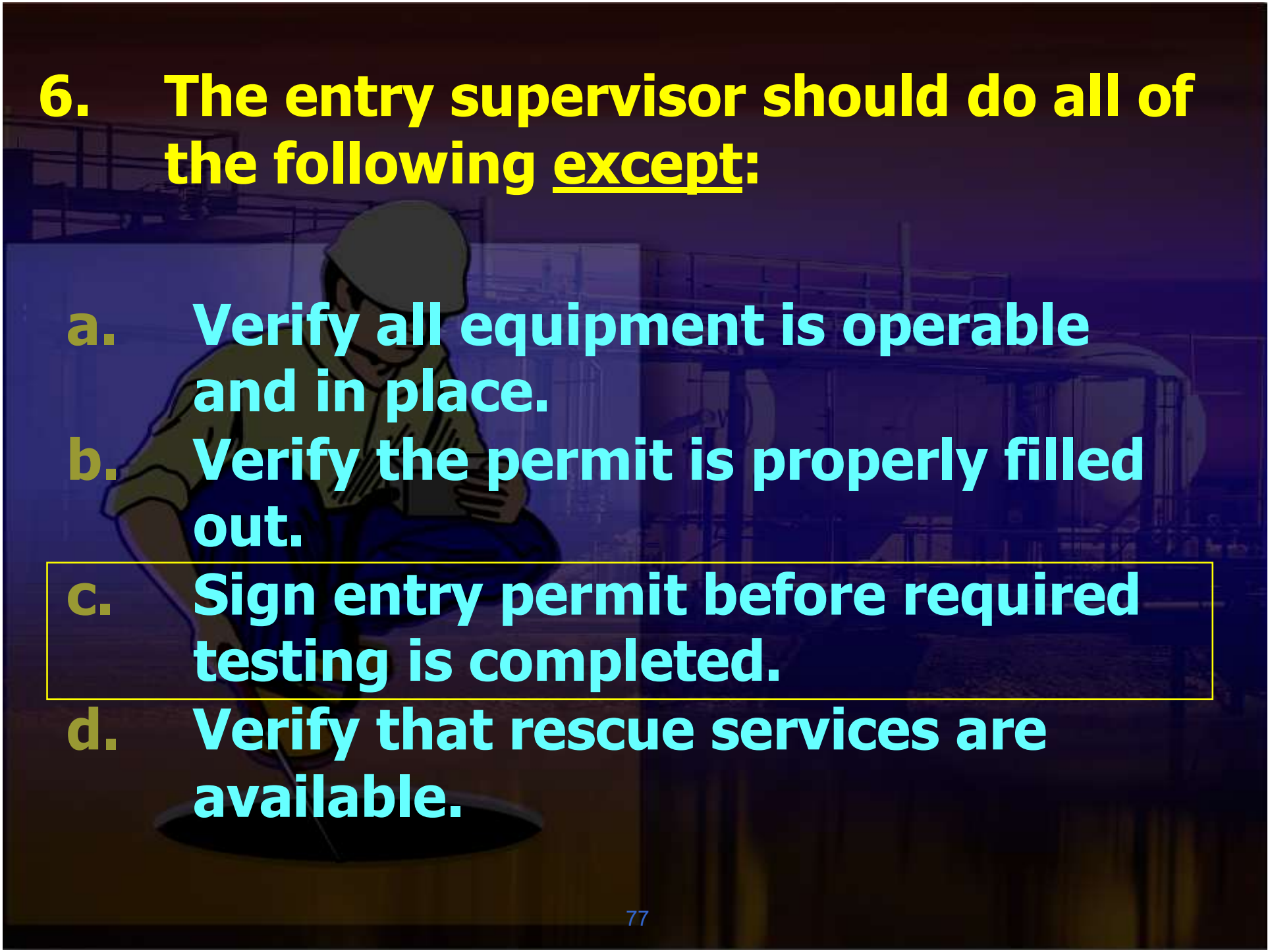
5. Monitoring during the entry in the permit-required confined space shows an atmosphere with 5 percent of a flammable gases LEL. The permit allows for less than 10 percent of the LEL. The entry should:

a. Be terminated.

b. Be continued because this is an acceptable condition.

c. Be further evaluated to determine acceptability of entry & adequacy of PPE.

d. None of the above.

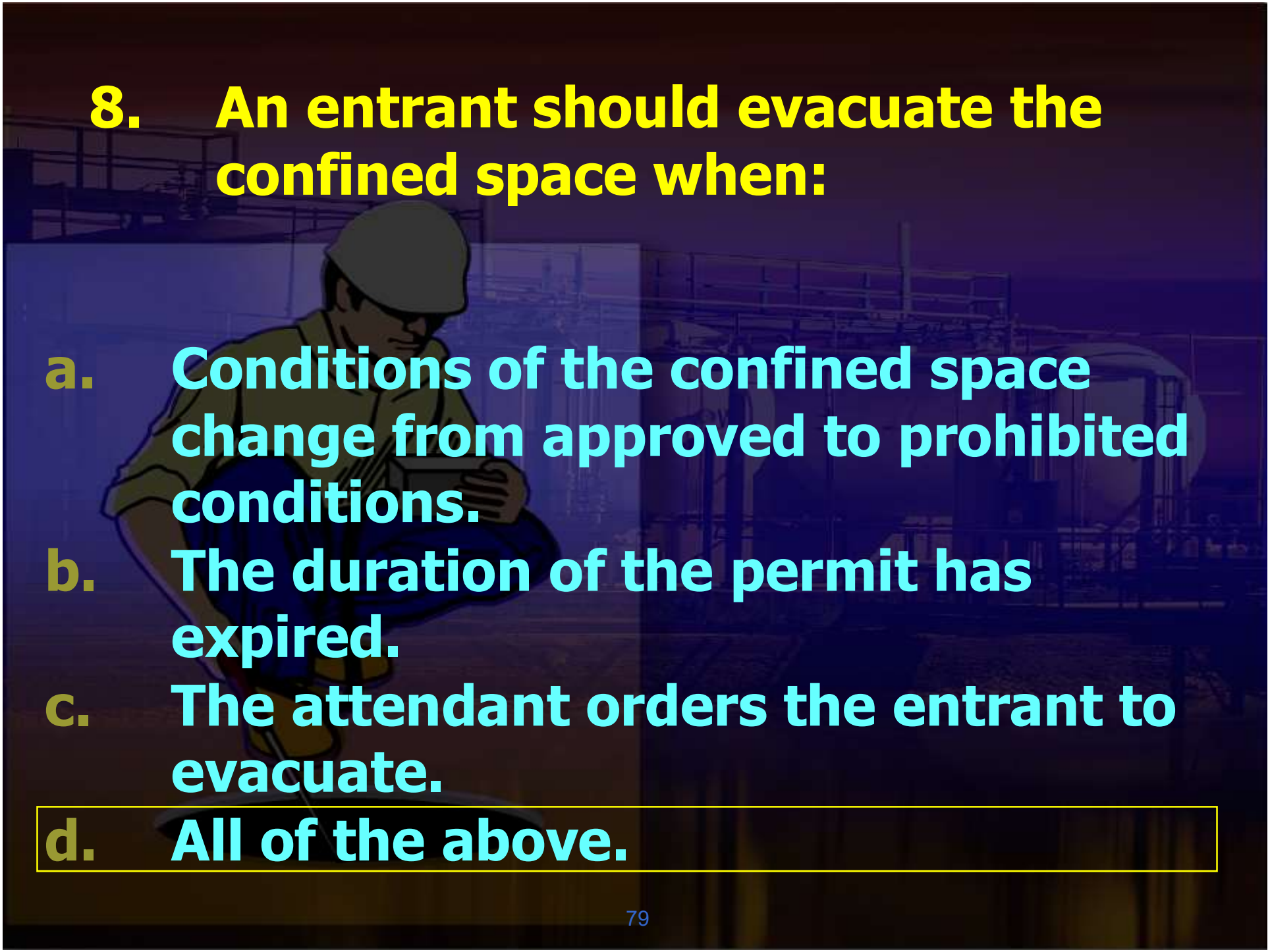


6. The entry supervisor should do all of the following except:

a. Verify all equipment is operable and in place.
b. Verify the permit is properly filled out.
c. Sign entry permit before required testing is completed.
d. Verify that rescue services are available.

7. An entry supervisor walks past the full permit confined space he/she is responsible for. The entrant is welding in the permit space and no hot work permit was issued. The entry supervisor should:

a. Ignore it.
b. Cancel the permit and order evacuation.
c. Add the hot work permit.
d. None of the above.



8. An entrant should evacuate the confined space when:

a. Conditions of the confined space change from approved to prohibited conditions.
b. The duration of the permit has expired.
c. The attendant orders the entrant to evacuate.
d. All of the above.

9. Which of the following is <u>not</u> appropriate retrieval equipment for a non-entry rescue?

a. Full body harness with retrieval line attached at the center of entrant's back near the shoulders.

b. Wristlets attached to retrieval line when full body harness creates a greater hazard

c. A body belt with retrieval line when full body harness creates a greater hazard.

d. Tri-pod and wench utilized for vertical entry.

10. A valid entry permit contains all of the following except:

a. The names of authorized entrants, attendants, authorizing supervisor and signature of authorizing supervisor.
b. The pre-entry results.
c. The purpose of entry, date and duration of permit, the hazards and the measures to control the hazards, and the PPE to be worn.
d. The name of the authorizing supervisor but not his signature.