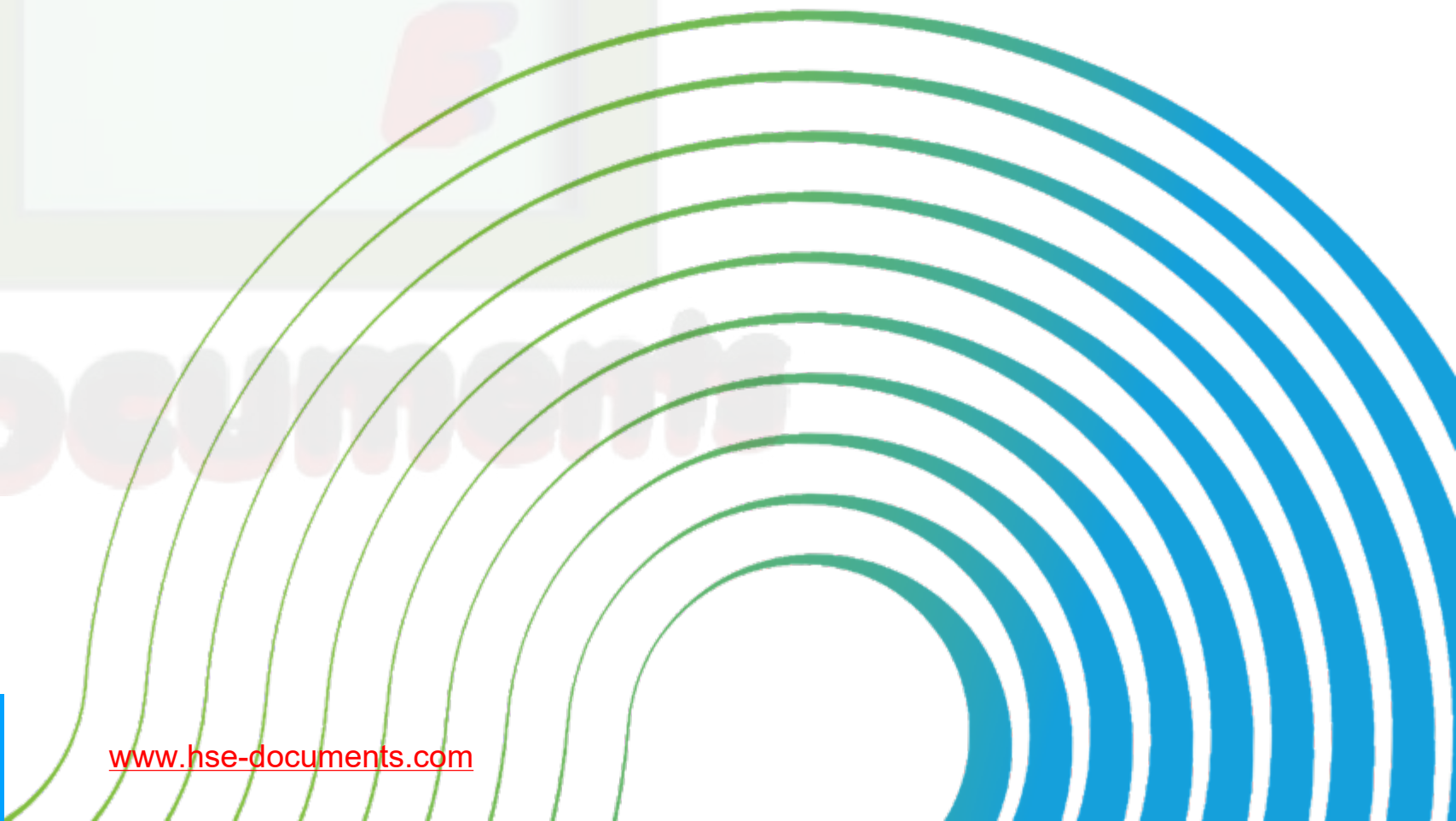




Hazard Recognition

Documents



Change record

Date	Reason
September 2020	First LTP edition



Documents

Developed by: Health, Safety, Environment Curriculum Development and Evaluation Group

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Hazard Recognition

Unit 1

Hazard recognition
and controls

HSECD & EG

September 2020



Module 1

Hazards & conditions that lead to incidents

Enabling objectives

On completion of Module 1, you will be able to:

- Describe the Stop Work Authority program.
- Identify practices, hazards and conditions that can lead to an incident.

Terminal objective

At the end of this course, you will be able to recognize common work site hazards and related controls when issuing or receiving work permits based on the information in General Instruction 2.100.

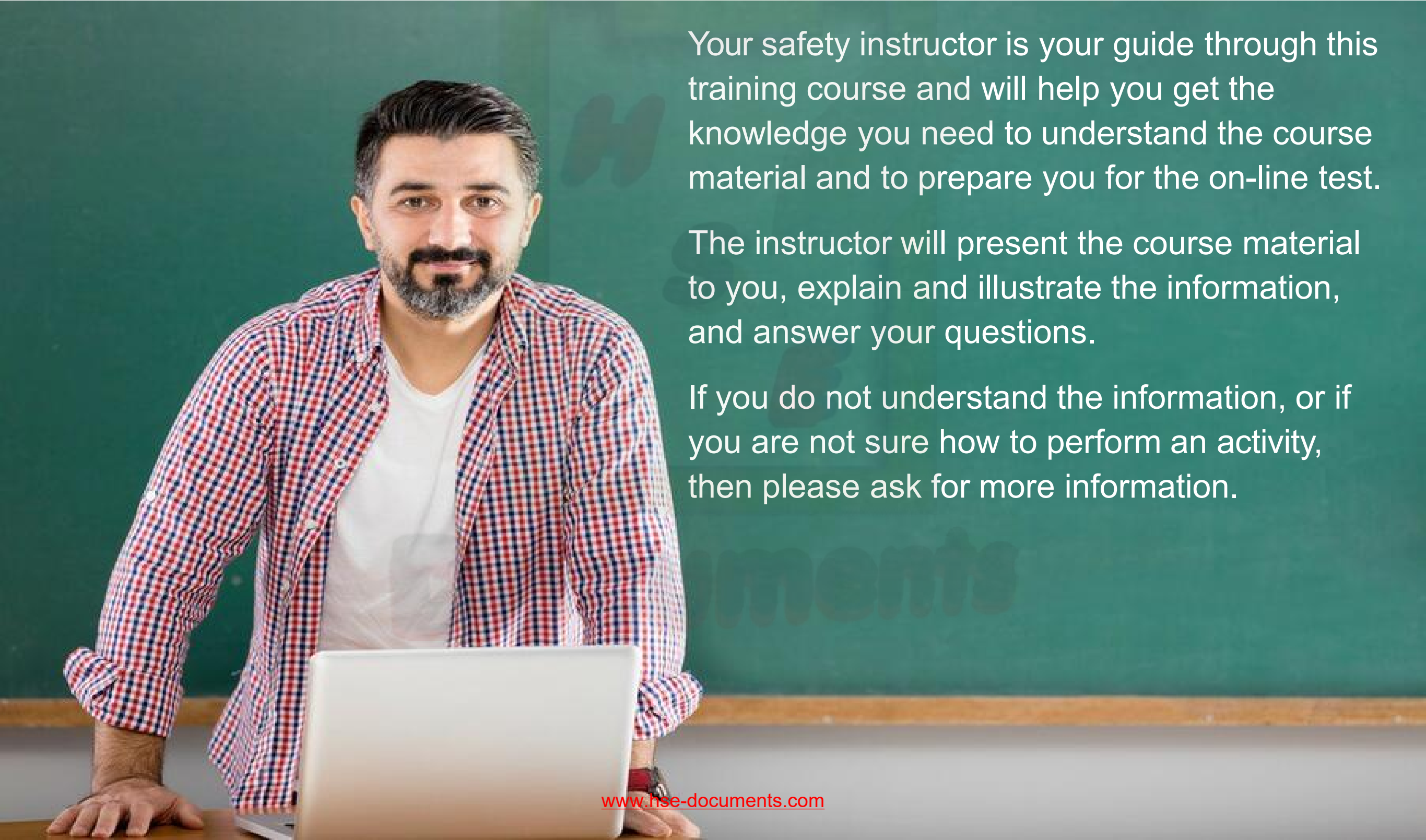
Introduction

The content this course is aligned to the 20 questions on the work permit hazard analysis checklist and will prepare you for becoming a certified work permit receiver.

Your work can be extremely hazardous and it is important for you to know and practice each task you do, to ensure it can be done safely.

This means you must learn to recognize possible worksite hazards and think about suitable precautions to ensure your safety.

Instructional staff

A man with a beard and a red and blue checkered shirt is leaning over a laptop in a classroom setting. He is looking at the camera with a slight smile. The background is a green chalkboard with some faint writing.

Your safety instructor is your guide through this training course and will help you get the knowledge you need to understand the course material and to prepare you for the on-line test.

The instructor will present the course material to you, explain and illustrate the information, and answer your questions.

If you do not understand the information, or if you are not sure how to perform an activity, then please ask for more information.

Stop Work Authority (SWA)

Before we start the Work Permit Hazard Recognition course, you must be fully aware of the Saudi Aramco Stop Work Authority (SWA).

The Stop Work Authority is a program designed to provide employees and contract workers with the responsibility and obligation to stop work when a possible unsafe condition or behavior may result in an incident.



Stop Work Authority

All personnel have the authority to stop any unsafe work.

If you observe any unsafe work that has the potential to injure personnel, damage equipment, or harm the environment, you are empowered to stop work and report your concerns to a supervisor.

Basic Safety Rules

Stop Unsafe Work

1. Immediately STOP any unsafe work that has the potential to injure personnel, damage equipment, or harm the environment.

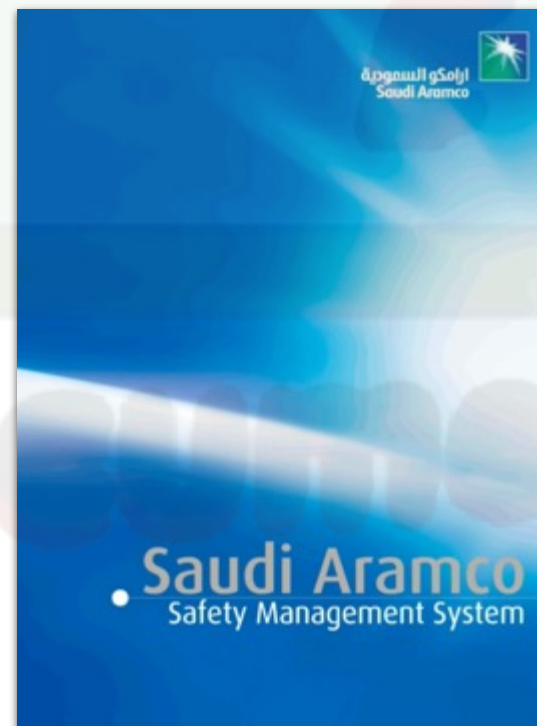
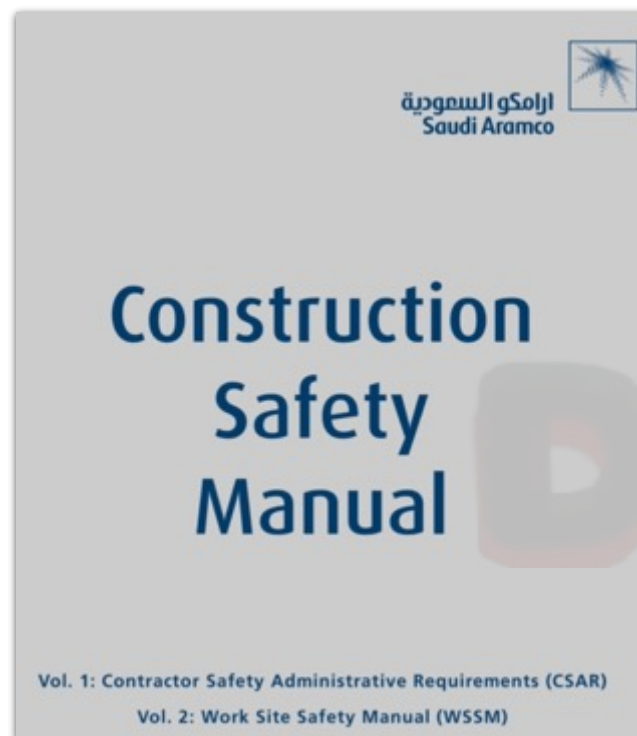
Report Incidents

2. Immediately report all work related injuries/illnesses, no matter how minor, to your supervisor.
3. Immediately report all fires, spills, or releases, no matter how small, to your supervisor.
4. Immediately report any unsafe condition, unsafe act, near miss incident, or vehicle collision to your supervisor.

SWA references

These publications outline the expectations for all personnel to stop work in the event that an unsafe act or situation is observed.

- Construction Safety Manual, Chapter I-4, Work Permit System and Stop Work Authority.
- SMS Manual, Element 6, Safe Operations.
- Safety Handbook Rules 1 and 4.



SWA 5 step process



1. STOP unsafe work.

You are authorized to stop work immediately when coworkers, equipment or the environment are at risk.



2. Notify affected personnel and supervision.

Don't try to correct everything yourself. Notify your supervisor and any other organizations, as required.



3. Investigate the cause for intervention and correct the hazard.

After a stop work action is in place, the proponent organization and those involved should:

- Discuss the situation and come to an agreement on the harmful behavior or condition and a corrective plan.
- If needed, have an external subject matter expert evaluate the situation and confirm whether it is safe to proceed.

If the SWA concern is valid:

- Suspend work until a resolution is in place.
- Verify that all safety issues have been properly resolved.
- Modify work practices or procedures when necessary.

SWA 5 step process



4. Communicate findings and resume work.

Notify all affected personnel about corrective actions to prevent similar issues from occurring.



5. Follow-up.

Promptly review all stop cases to identify any need for additional investigation or follow-up.

Documents

SWA Signs

Stop work signage, shall be mounted in clearly visible locations at worksites as per CSM 4.11.4 to remind everyone of their SWA responsibilities.



Review questions



Identify hazards and conditions that lead to incidents

In Module 1 you will learn about the following:

- What is a hazard.
- What is safety.
- Unsafe acts and conditions.
- Safety policy, processes and programs.
- Safety hazards.



What is a hazard?

A hazard is anything that has the potential cause harm to:

- People.
- Environment.
- Assets.
- Business.

When we ask “Is it safe?” we are really asking, “What is the risk of me getting hurt or suffering a financial loss?”

Safety does not mean “no risk”. It means that we know there is a known and acceptable level of risk.

Some jobs will always have one or more hazardous components that cannot be eliminated or control completely.

For example, flying in an airplane will always have some level of danger and yet you accept the risks when you fly on vacation.

LP

Newsletter

LP Newsletter Number 3, March 2010

3

Three Steps to Risk Assessment and Management

By Faisal A. Basaffar, Loss Prevention Department, Planning and Technical Services Division

Risk assessment and management is an integral part of an organization's safety management system (SMS). It is a careful examination of what could cause harm or loss and how to develop the necessary measures to control them. It is a systematic approach that generally involves three simple steps: hazard identification, risk assessment, and risk reduction and control. Before proceeding with explaining these steps, let us first understand the words “hazard” and “risk.”

Hazard
A hazard is anything that has the potential to cause harm to people, the environment, assets and business. Examples of hazards include handling toxic chemicals and working at elevation.

Risk
Risk is the chance, either high or low, of being harmed by hazards, together with an indication of how serious that harm could be. Thus,

risk comprises two elements: the likelihood of the harm (incident) occurrence and the associated consequences.

Step 1: Hazard identification
The initial step in any risk assessment is the adequate identification of all credible hazards through the use of well-established techniques, such as:

- Hazard and operability (HAZOP) studies
- What-if analyses
- Checklists

For example, a HAZOP study at a gas-oil separation plant (GOSP) may identify the possibility of a toxic and flammable gas leak caused by a corrosion-related crack in a pipe. The resulting consequences of the leak could be one of the scenarios illustrated in the following diagram.

- No ignition, which may result in toxic gas impact (toxic cloud).
- Immediate ignition, which may result in a jet fire. If it is impinging on a nearby pressurized vessel, a boiling liquid expanding vapor explosion (BLEVE) may occur.
- Delayed ignition of the flammable cloud may result in a flash fire or a vapor cloud explosion (VCE) if there is considerable congestion and confinement.

These scenarios should be further analyzed to determine reasonable and practicable controls.

Step 2: Risk assessment
In this step, the identified hazardous scenarios are analyzed to determine their levels of risk by examining their likelihood or frequency of occurrence and the magnitude of the resulting consequences.

Continued on the next page

LP Newsletter March 2010

What is safety?

One definition of safety is:

‘Freedom from risk or harm’ (loss or injury)

Is it possible to do something 100% safely?

What about:

- Driving
- Flying an aircraft
- Scuba diving
- Crossing the street
- Working in an oil and gas plant



Programs and processes

To help you prevent injuries and illnesses, Saudi Aramco has many programs, processes, procedures and standards in place to protect you.

Programs, processes, procedures and standards	Examples
Safety standards	Employee evaluation.
Training programs	• Safety courses, hazard recognition, gas testing etc. • Safety orientations.
Observation processes	• Job safety analysis. • Joint site inspection. • Hazard analysis checklist.
Reporting processes	Injury reporting, incident reporting

Unsafe conditions and acts

You need to understand what causes incidents in order to prevent them.

Incidents are caused by:

- Unsafe **acts** (people chose to do something unsafe or not follow safety procedures)
- Unsafe **conditions** (equipment is not well maintain, missing safety guards)

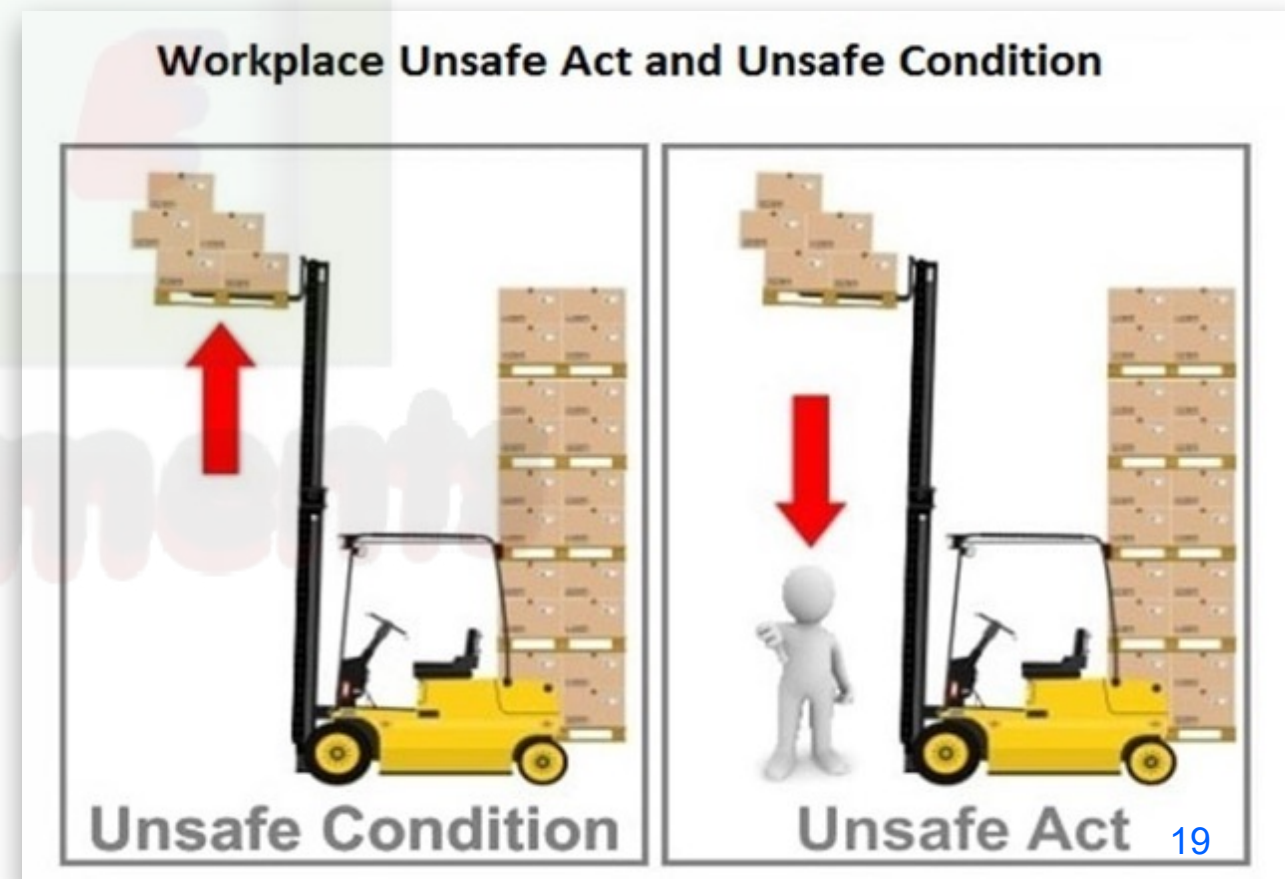
Unsafe act examples
Operating equipment without proper training or certifications.
Removing or disabling safety devices.
Using defective equipment.
Taking shortcuts and not following checklists or procedures.
Failure to secure (LOTO, fall protection).
Improper use of equipment.

Unsafe condition examples
Inadequate guards or safety devices.
Unsafe walkways and walking surfaces.
Damaged/defective/incorrect equipment.
Extreme weather.

Unsafe acts

Safety hazards and unsafe acts include:

- Operating equipment without authority or certification.
- Failure to warn.
- Failure to secure.
- Operating at an improper speed.
- Making safety device inoperable.
- Removing safety devices.
- Using defective equipment and poor maintenance.
- Using equipment improperly.



Safety policy

The Saudi Aramco Safety Policy reminds you that you are responsible to:

- Know your safety responsibilities
- Identify and eliminate hazards prior to starting a job
- Take safety courses
- Follow all safety procedures, standards and rules
- Be prepared to respond to emergencies
- Report incidents to help others avoid them in the future

Saudi Aramco Safety Policy

Saudi Aramco will conduct its business in a manner that prevents incidents or accidents which cause loss of life, bodily injury or illness, or damage to property, assets or the environment. As reflected in Saudi Aramco's Corporate Values, we operate safely and are committed to the well-being of our workforce. Accordingly, the company will:

- Advise all employees and contractors of their safety responsibilities and regularly measure their performance.
- Evaluate, identify and eliminate or manage safety risks prior to beginning any operation or activity and continue to review such risks, complying with all applicable laws and regulations.
- Communicate safety objectives and expectations regularly to employees and all affected parties.
- Train employees and provide resources to maintain job competencies, including loss prevention responsibility and accountability.
- Design and construct company facilities utilizing recognized best technology and practices to safeguard property and people.
- Operate and maintain company facilities to assure safe operations.
- Ensure that contractors, suppliers and others adhere to the company's safety policies and procedures.
- Prepare for emergencies and other contingencies and respond promptly and effectively to incidents.
- Report and investigate all incidents, take prompt action to prevent recurrence and communicate lessons learned.
- Promote off-the-job safety and community awareness.
- Review and improve the company's safety performance continuously.

Safety hazards

In the work place, an unsafe act is a task or a job done in a way that may threaten the health and/or the safety of workers.

- Knocking on a valve with a wrench to open it is an example of an unsafe act.
- Performing a job without the required certification, or not having a required work permit is also an unsafe act.
- Taking shortcuts, trying to accomplish work in a hurry or to try to save time.



Note:

Not following rules and procedures is the number 1 cause of incidents in Saudi Aramco.

Safety hazards

Why do people continue to take shortcuts on the job?

- Human nature to want to complete a task as quickly as possible.
- The demands of the job or the organization causing employees to act unsafely.
- The employee tries to impress the boss with their level of production.
- They are in a rush to get the job done.

Document



Safety hazards

Should you use safety checklists?

Yes....but !

- If you are in a rush, you may run through a safety checklist without actually stopping to evaluate each item properly.
- The hand and eye are checking off the boxes on the checklist, but the brain is not engaged or focused on the task.
- Checklists are not foolproof, they may not have checkbox for every possible variation or situations or for all safety hazard.
- Checklists and procedures can only work if they are followed and completed properly and with all your attention.



Safety hazards

Poor hazard identification and control results in:

- Nearly 3,000.000 non-fatal and 4,000 fatal workplace injuries.
- The direct costs of injuries at work (e.g. workers' compensation claims, medical costs) total approximately \$250 billion annually.



Safety hazards

We know that hazards exist in all that we do so to avoid incidents and injuries, we make sure that all appropriate barriers are in place.

There are usually two types of barriers:

Equipment: all our facilities have barriers to incident and injuries such as fixed gas detectors, emergency shut-down valves, emergency alerts, sensors, helmets, harnesses and much more.

Human: the second barrier relies on people, in other words –YOU. Humans are the front-line of defense in normal operations and the last line of defense during non-normal operations. Both situations rely on the human to avoid incident.



Review questions



Summary

In Module 1 you were introduced to the Saudi Aramco Stop Work Authority and the practices, hazards and conditions that can lead to an incident.

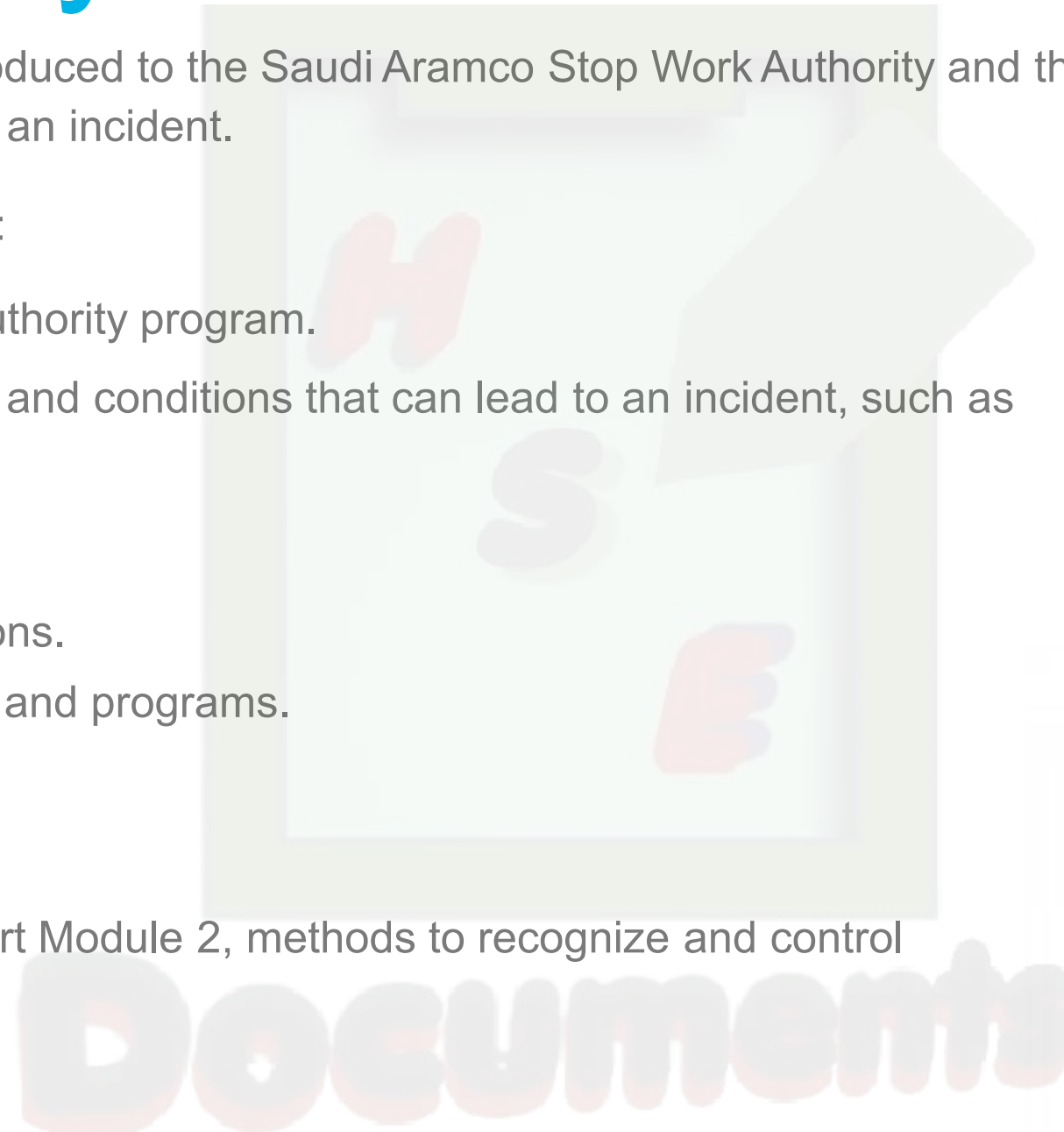
You should now be able to:

Describe the Stop Work Authority program.

Identify practices, hazards and conditions that can lead to an incident, such as

- What is a hazard.
- What is safety.
- Unsafe acts and conditions.
- Safety policy, processes and programs.
- Safety hazards.

Your instructor will now start Module 2, methods to recognize and control hazards.



Module 2

Methods to recognize & control hazards

Enabling objectives

On completion of Module 2, you will be able to:

- List the methods to recognize and control hazards.



Introduction

Hazards are everywhere.

They cause incidents, because we fail to see them or to control them.

Hazard recognition is required every day across Saudi Aramco.

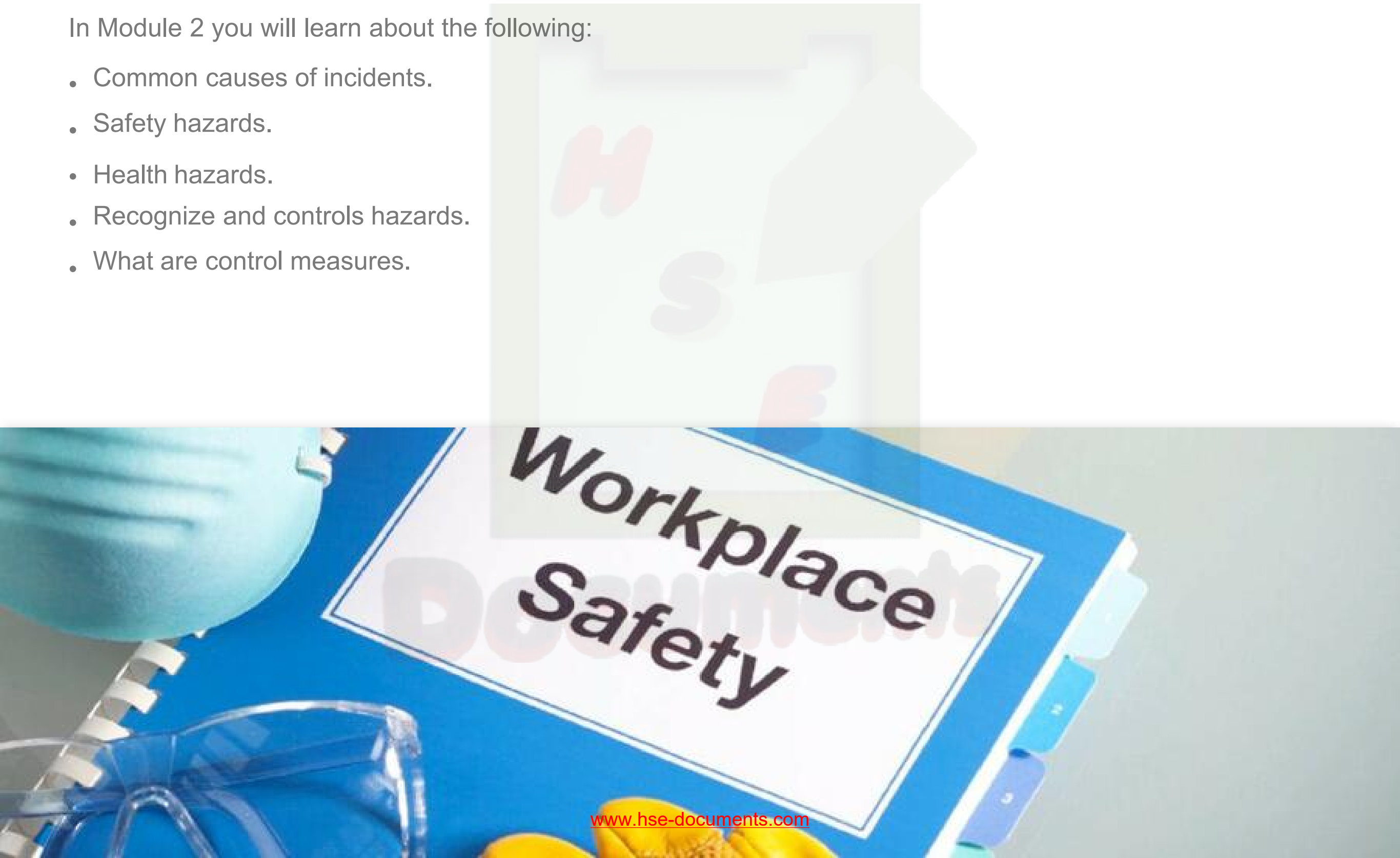
It is a critical safety activity.

Failing to recognize and control hazards can cause serious injury and even death.

Methods to recognize & control hazards

In Module 2 you will learn about the following:

- Common causes of incidents.
- Safety hazards.
- Health hazards.
- Recognize and controls hazards.
- What are control measures.



How to recognize and control hazards

In this part you will learn about:

- Categories of hazards
- Recognizing hazards
- Controlling hazards

Remember, the purpose of hazard recognition...

It is to find hazards and put in place controls and precautions to eliminate or reduce hazards to an acceptable level before they cause an incident.

Documents

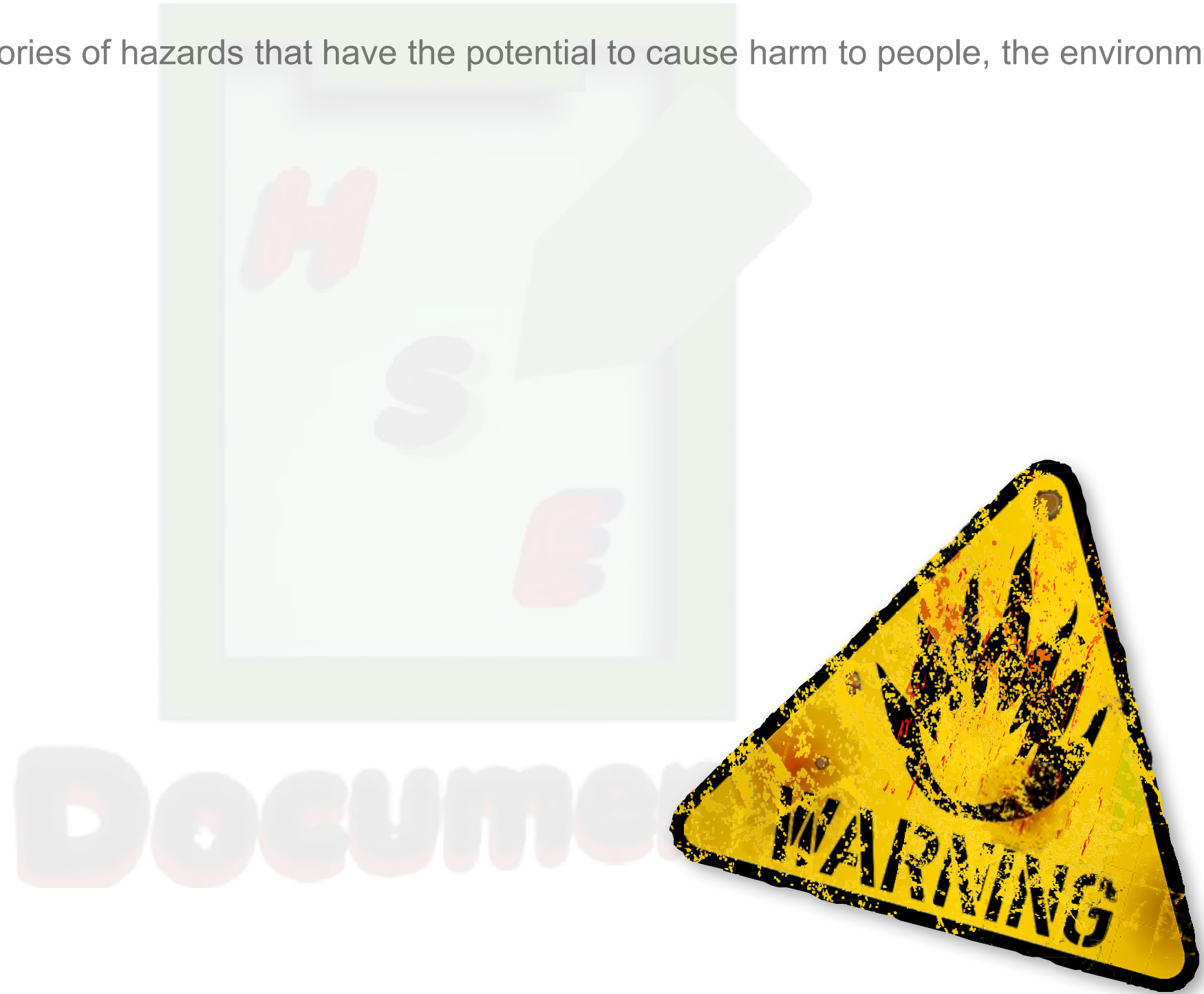
Common causes of incidents

Incident causes
Failure to follow rules and procedures.
Hazards not recognized or controlled.
Equipment is not properly isolated, powered off or depressurized.
Gas testing not performed or monitored.
No effective joint site inspection.
Improper responses when conditions change.

Types of hazards

There are two main categories of hazards that have the potential to cause harm to people, the environment, assets and our business:

- **Safety** hazards.
- **Health** hazards.



Safety hazards

A safety hazard is anything that can have an adverse impact on your safety.

Safety hazards	Examples
Electrical	power lines, transformers, static charge, lightning, energized equipment, wiring and batteries.
Gravity	crane lifting operations, excavations, falling objects, collapsing roof, a body tripping or falling.
Mechanical	rotating shafts, belts, pulleys, saw blades.
Motion	vehicles, marine vessels, equipment movement, flowing water, wind, body positioning when lifting, straining or bending.
Pressure	pressure piping, compressed cylinders, control lines, vessels, tanks, hoses, pneumatic and hydraulic equipment.

Health hazards

A health hazard is anything that can have an adverse impact on your health.

Health hazards	Examples
Biological	animals, bacteria, viruses, insects, blood borne pathogens, improperly handled food, contaminated water.
Chemical	dust, fumes, gases, mists, vapors, liquids, hydrocarbons, solvents, lead.
Radiation	lighting issues, welding arcs, solar rays, microwaves, lasers, x-rays, NORM scale
Noise and vibration	equipment noise, impact noise, vibration, high pressure release, impact of noise on communication.
Temperature	open flame, sparks, hot or cold surfaces, liquids, gases, steam, friction, general environmental and weather conditions.

Recognize and control hazards

Methods to identify hazards in the work permit process are:

- Joint site inspection.
- Work permit system and forms.
- Hazard analysis checklist.



HOT WORK PERMIT
Saudi Aramco 9873-2 (12/15) Front No. 8
Complete this form in English and write clearly. Use ink pen, not pencil.

SECTION 1 – WORK DESCRIPTION
Month Day Year Duration

A. Identify plant/facility area:
B. Exact work location:
C. Work to be done:
D. Equipment to be used at the site:

SECTION 2 – HAZARD IDENTIFICATION & CONTROL
A. Identify and attach any supplementary forms required to perform/control the work:
Job Safety Analysis ☐ Gas test records ☐ Isolation plan ☐ Blind list ☐ Critical Lift Plan ☐
Excavation Checklist ☐ Hydrotest procedure(s) ☐ Other Other

B. Energy Types:
Hydrocarbon/gas/steam/chemicals ☐ Mechanical ☐ Electrical ☐ Hydraulic/pneumatic ☐
Potential energy (loaded, gravity) ☐ Automated extinguishing systems ☐ Other

C. Isolation:
Block ☐ Block valve ☐ Single block & bleed ☐
Disconnect ☐

D. Hazardous materials:
Flammable liquids/gases ☐ Hazardous/toxic materials ☐
Other
E. Other
F. Other

HAZARD ANALYSIS CHECKLIST
Any 'N' (NO) answers below shall initiate a "STOP" point where the Issuer and Receiver are to analyze the hazard(s) and develop methods to adequately control the hazard(s) and list the additional precautions on the permit.

	Y	N	N/A
Is the correct type of permit(s) issued for the work?	☐	☐	☒
Have the Job Safety Analysis (JSA) and other applicable supplementary forms been communicated to the work crew?	☐	☐	☒
Are weather conditions (e.g., wind speed, heat, lightning) acceptable to perform the work?	☐	☐	☒
Are slip and trip hazards controlled?	☐	☐	☒
Does the work crew have the correct tools/equipment for the job? Are they in good condition?	☐	☐	☒
Do personnel have the proper training/qualifications to perform the activity and use the equipment?	☐	☐	☒
Is the equipment to be worked on properly identified?	☐	☐	☒

Recognize and control hazards

You will need to complete work permit forms properly during the Joint Site Inspection for activities in:

- Construction
- Maintenance
- Inspection
- Repair

On Permit forms, you must identify and control hazards in the following sections:

- Section 2, hazard identification and control.
- Hazard analysis checklist.

HOT WORK PERMIT
Saudi Aramco 9873-2 (12/15) Front No. 8
Complete this form in English and write clearly. Use ink pen, not pencil.

SECTION 1 – WORK DESCRIPTION
Month _____ Day _____ Year _____ Duration _____
A. Identify plant/facility area: _____
B. Exact work location: _____
C. Work to be done: _____
D. Equipment to be used at the site: _____

SECTION 2 – HAZARD IDENTIFICATION & CONTROL
A. Identify and attach any supplementary forms required to perform/control the work:
Job Safety Analysis ☐ Gas test records ☐ Isolation plan ☐ Blind list ☐ Critical Lift Plan ☐
Excavation Checklist ☐ Hydrotest procedure(s) ☐ Other _____ Other _____
B. Energy Types:
Hydrocarbon/gas/steam/chemicals ☐ Mechanical ☐ Electrical ☐ Hydraulic/pneumatic ☐
Potential energy (spring loaded, gravity) ☐ Automated extinguishing systems ☐ Other _____
C. Isolation Method(s):
Locked switch/breaker ☐ Mechanical block ☐ Block valve ☐ Single block & bleed ☐
Double block & bleed ☐ Blinding ☐ Disconnect ☐
D. Potential Exposures:
High noise level ☐ Hydrogen Sulfide (H₂S) ☐ Flammable liquids/gases ☐ Hazardous/toxic materials ☐
Radioactive materials ☐ Temperature ☐ High pressure ☐ Other _____
E. Protective Equipment:
Personal H₂S monitor ☐ FR ☐ ARC rated PPE ☐ Goggles/face shield ☐ Chemical suit/coveralls ☐
Fall protection ☐ Barricades/warning signs ☐ Respiratory protection ☐
(Explain further in Additional Safety Precautions below)
F. Fire Protection Methods:
Fire extinguisher ☐ Fire monitor/hose ☐ Area wetted ☐ Fire barriers/shields ☐
G. Cover/water seal all sewers within 23 m (75 ft) of the Hot Work area ☐
H. Standby Man needed ☐ Badge No. _____ Fire Watch needed ☐ Badge No. _____
I. List any Additional Safety Precautions: _____
IN AN EMERGENCY: _____ ☐ SEE ATTACHED

SECTION 3 – GAS TESTING/MONITORING Gas testing frequency: _____
Periodic monitoring required: Yes ☐ No ☐ If yes, attach a supplemental form.
ONLY CERTIFIED GAS TESTERS PERFORM GAS TESTS

	UEL (%)	H ₂ S (ppm)	O ₂ (%)	CO (ppm)	Others	Badge No.	Signature

SECTION 4 – PERMIT AUTHORIZATION & CLOSURE
Additional approvals and countersignatures per GI 2.100 or local instructions:
Signature: _____ Position: _____ Org: _____ Badge No. _____
Signature: _____ Position: _____ Org: _____ Badge No. _____
Receiver Org: _____ Issuer Org: _____
PERMIT: _____ Badge No. _____ Cert. No. _____ Signature: _____ Badge No. _____ Cert. No. _____ Signature: _____
Open: _____
This permit is renewed: Date: _____ Time: _____ Countersigner(s) notified of permit renewal ☐
Renewed: _____
This permit is closed: Date: _____ Time: _____
I HAVE INSPECTED THE WORK SITE AND CONFIRM THAT IT HAS BEEN RETURNED TO A SAFE CONDITION.
Closed: _____

HAZARD ANALYSIS CHECKLIST
Any "N" (NO) answers below shall initiate a "STOP" point where the Issuer and Receiver are to analyze the hazard(s) and develop methods to adequately control the hazard(s) and list the additional precautions on the permit.

	Y	N	N/A
Is the correct type of permit(s) issued for the work?	☐	☐	☐
Have the Job Safety Analysis (JSA) and other applicable supplementary forms been communicated to the work crew?	☐	☐	☐
Are weather conditions (e.g., wind speed, rain, fog, heat, lightning) acceptable to perform the work?	☐	☐	☐
Are slip and trip hazards controlled?	☐	☐	☐
Does the work crew have the correct tools/equipment for the job? Are they in good condition?	☐	☐	☐
Do personnel have the proper certifications to perform the activity and/or operate the equipment?	☐	☐	☐
Is the equipment's inspection sticker valid?	☐	☐	☐
Have all requirements for working at heights (i.e., fall protection) been applied?	☐	☐	☐
Is the scaffold tag completed correctly, signed, and with a valid inspection date?	☐	☐	☐
Has the potential for contact with sharp objects, rotating equipment, hot/cold surfaces, or live electricity been eliminated?	☐	☐	☐
Is the system/equipment properly isolated and locked out? Did all workers apply their personal locks?	☐	☐	☐
Has the system/equipment been depressurized, drained, and/or purged before opening it?	☐	☐	☐
Has the potential for releasing flammable liquids and gases been controlled?	☐	☐	☐
Are all ignition sources eliminated or controlled?	☐	☐	☐
Does the fire watch have firefighting equipment readily available and know how to use the equipment?	☐	☐	☐
Has the potential for exposure to high noise levels, H ₂ S, hydrocarbons, asbestos, hazardous chemicals, or radioactive materials been controlled?	☐	☐	☐
Is the correct personal protective equipment (PPE) available for use by personnel?	☐	☐	☐
If the work may impact others nearby, or vice versa, have the work crews discussed their activities with each other (i.e., simultaneous operations [SIMOPS])?	☐	☐	☐
Is there an emergency contingency plan in place to respond to the work being performed?	☐	☐	☐
Does the work crew know what to do in the event of an emergency, such as evacuation routes, location of emergency equipment, and where assembly areas are located?	☐	☐	☐

Signatures:
Issuer or Designated Representative: _____
Receiver: _____

What is a control measure

Control measures are steps that you are going to take to remove or reduce a hazard by:

Engineering

- Eliminate (change solvent paint to water based paint)
- Isolate (noise enclosure), LOTO, blinding

Administrative

- Reduce, rotate crew, use warnings
- Rules, policies, procedures

Protective equipment

- PPE
- RPE (Respiratory Protective Equipment) such as SCBA and SABA



Review questions



Summary

In Module 2 you were introduced to the methods used to recognize and control hazards.

You should now be able to:

List the methods to recognize and control workplace hazards such as

- Common causes of incidents.
- Safety hazards.
- Health hazards.
- Recognize and controls hazards.
- What are control measures.

Your instructor will now start Module 3, common workplace hazards.

Documents



Module 3

Common workplace hazards

Enabling objectives

On completion of Module 3, you will be able to:

- List common Saudi Aramco workplace hazards and associated controls.



Introduction

In this module you will learn about some of the common hazards you may see in your workplace and what controls are used to eliminate or minimize the risk.



Common workplace hazards

In Module 3 you will learn about the following:

- Slips, trips and falls
- Tools and equipment.
- Noise and vibration.
- Machine guarding.
- Plant isolation.
- Confined space.
- Pressure testing.
- Weather conditions.
- Personal protective equipment.



Slips, trips and falls

Slips, trips and falls account for the largest percentage of workplace and “off-job” injuries in Saudi Aramco.

Below are listed the 4 main causes of slips, trips and falls.

Hazards:

- Uneven floor surfaces and changes in levels.
- Unsuitable floor coverings.
- Wet floors and trailing cables.
- Poor housekeeping.



While they may seem simple to identify and control, they are commonly overlooked, resulting in many injuries.



Slips, trips and falls

Simple steps, such as erecting warning signs near recently mopped floors, or using handrails when climbing or descending stairs reduces the potential of these slip, trip and fall injuries.

Below is the list the common control measures.

Controls:

- Use handrail when using stairs.
- Report hazards immediately.
- Wear correct footwear.
- Good housekeeping.



Tools and equipment

Using the wrong or defective tools and equipment results in many injuries.

For example, if you work near live electricity use the wrong hand tool, it could lead to an arc flash incident and even death.

Hazards:

- Using defective tools and equipment.
- Electrocution, electrical shocks and burns.
- Cuts, bruises and abrasion hazards.
- Flying objects.



Tools and equipment

Serious injuries have resulted from flying tool parts when they fail, choose the right tools for the right task and ensure your tools are in good condition.

Controls:

- Immediately report defective tools and equipment to your Supervisor.
- Homemade tools are prohibited.
- Use correct tools and equipment.
- Inspect tools and equipment before use.



Noise and vibration

Noise and vibration can cause serious long term health problems.

They are often overlooked as the ill-health effects are not immediately obvious and are commonly irreversible.

Identifying a noise hazard is relatively easy, if you have to shout to be heard by someone nearby, then the surrounding noise level is probably above **85 decibels (dB(A))**

Nerve damage in the hands and vibration white finger are very painful injuries and have significant long term quality of life effects.

Hazards:

- Noise induced deafness (**above 85dB**).
- Nerve damage due to vibration.
- Vibration white finger.



Noise and vibration

Reducing the noise or vibration at the source is always preferred method of control.

This might involve replacing a noisy piece of equipment with something less noisy or a vibrating tool with a tool that vibrates less.

When this is not practical, reducing worker exposure by limiting exposure time, or wearing PPE (i.e. ear plugs or muffs in high noise areas).

Controls:

- Noise reducing enclosures.
- Replace, equipment or processes with quieter ones.
- Limit employee exposure.
- Periodic breaks.
- Warning signs.
- Personnel protective equipment.



Machine (mechanical) guarding

Machine guarding prevents you from being pulled in, contacting hot or cold surfaces and prevents injuries when machines fail and parts are ejected. Very serious injuries have occurred when pulled into machinery, ranging from cuts and abrasions to amputations and even death.

Hazards:

- Entanglement (being pulled in).
- Cuts.
- Abrasions.
- Amputations.
- Hot surfaces.
- Cold surfaces.

Parts of machinery:

- Ejected.
- Striking workers.
- Impact with plant and equipment (e.g. fin fan blade failure).



Machine (mechanical) guarding

Machine guards prevent such injuries and must be maintained in good condition and be in place when you operate the machine.

Controls:

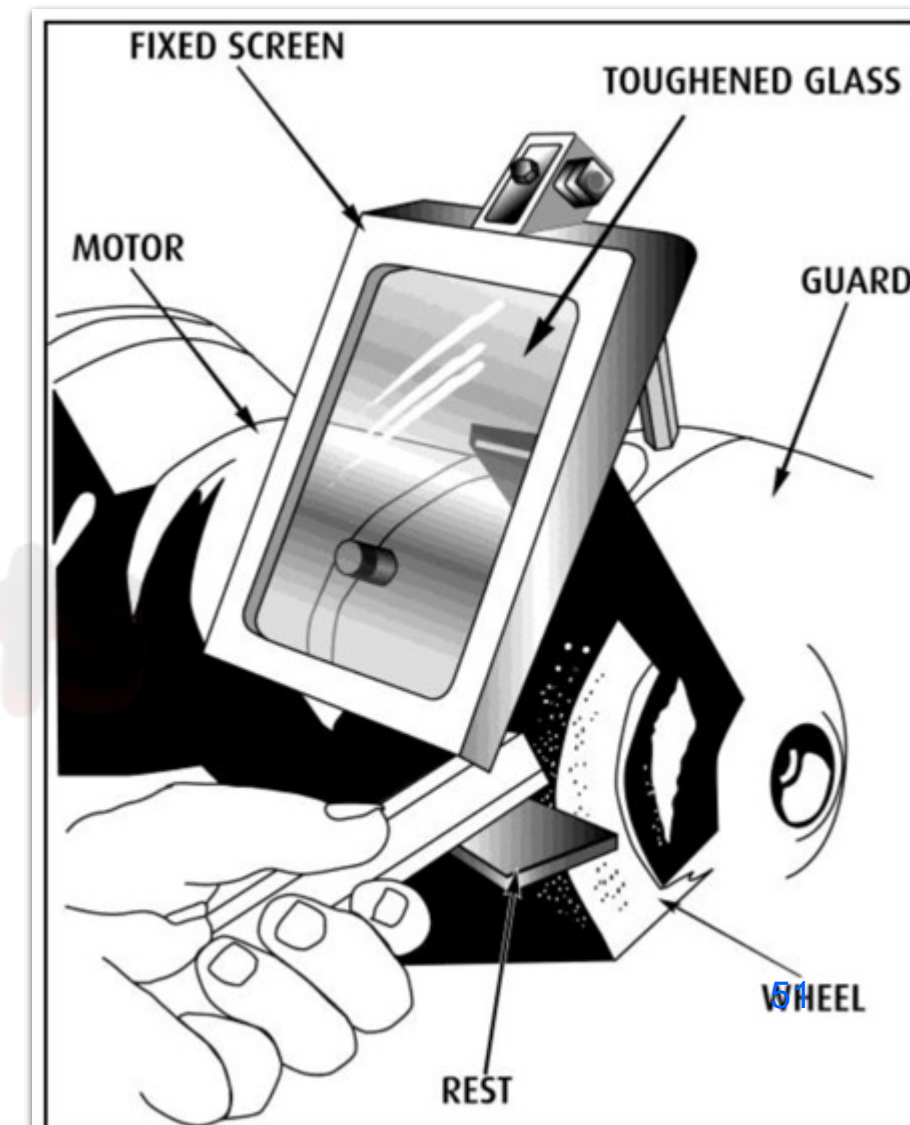
Moving parts to be guarded if less than 2.5m (8.2ft) above the working surface.

Examples:

- Flywheels.
- Belt/chain drives.

Guards shall be:

- Installed before arrival on-site.
- In position during operation.
- Reinstalled before the equipment is returned to service.



Plant isolations (LOTO)

All plant isolations must be conducted following GI.6.012 Isolation, Lockout and Use of Hold Tags.

Hazards:

Release of energy types

- Chemicals.
- Mechanical.
- Electrical.
- Hydraulic.
- Pneumatic.
- Spring loaded.
- Gravity.



Plant isolations (LOTO)

There are three requirements before opening closed systems or lines.

Controls:

Before opening closed systems or lines they shall be:

- De-pressured.
- Drained.
- Purged.

Further information can be found in GI.6.012 Isolation, Lockout and Use of Hold Tags.



Confined spaces

Confined space entry requirements are listed in GI 2.100, Work Permit System, as a mandatory critical activity requiring a confined space entry permit (this applies to both restricted and non-restricted areas).

The core hazards associated with confined space entry are listed below.

Hazards:

- Oxygen deficiency.
- Oxygen enrichment.
- Flammable materials.
- Toxic materials, H₂S, CO.
- Extreme temperature.



Confined spaces

You are not allowed into confined spaces without a Confined Space Entry Permit (CSEP).

There are specific training courses for this topic to ensure you have the in depth knowledge and skills required for entering and working in confined spaces.

The course covers the points highlighted in the previous page and covers the control measure listed below.

Controls:

- Confined space entry permit.
- Proper preparation.
- Use checklist.
- Proper isolation.
- Gas testing.
- Mechanical ventilation.



Pressure testing

Pressure testing is conducted for new and existing mechanical systems such as piping, pipelines, pressure vessels and power boilers.

Uncontrolled releases of energy from compressed air or other gases can explode. High speed streams of fluid can be created or piping and equipment can move if pressure testing goes wrong.

Hazards:

- Mechanical or brittle failure of equipment under test.
- Relief system failure.

Uncontrolled release of pressure testing material.

- Treated water.
- Inert gas.



Pressure testing

Specific pressure testing controls are listed in GI 2.102, Pressure Testing Safely, and include using the correct test medium, the correct test equipment and notifying others through barriers and signage.

Pressure testing of mechanical systems is listed in GI. 2.100, Work Permit System as a mandatory critical activity requiring a work permit.

Controls:

Use the correct:

- Test material.
- Test equipment.
- Notify others with barriers and signage.
- Stay out of “the line of fire”.



Weather conditions

The weather can significantly contribute to the hazards associated with a work activity.

For example, high wind speeds are great hazards when personnel are working at height or when using cranes.

Heavy rain can result in flooding, particularly in low lying areas and excavations, and an electrocution risk increases if you work with or near live electrical systems.

Hazards:

- High wind speeds.
- Extreme temperatures.
- High humidity.
- Heavy rain.
- Excavation collapse.
- Flooding.



Heat Index				
Danger Category	Heat Index	Heat Stress Illness/Symptoms	Work:Rest Periods (Minutes)	Min. Water Needed *
IV. Extreme Danger **	≥ 52	Heat stroke imminent.	20:10	1 cup every 10 minutes
III. Danger	39–51	Heat cramps, heat exhaustion or heat stroke <i>likely</i> with prolonged exposure and physical activity.	30:10	1 cup every 15 minutes
II. Extreme Caution	30–38	Heat cramps, heat exhaustion or heat stroke <i>possible</i> with prolonged exposure and physical activity.	50:10	1 cup every 20 minutes
I. Caution	25–29	Fatigue possible with prolonged exposure and/or physical activity.	Normal/Scheduled	1 cup every 20 minutes

Weather conditions

Many work permit activities are outdoors where weather, temperature and humidity can be serious health hazards to workers.

Ensure heat stress programs include managing work schedules during the hottest part of the day, and providing suitable rest/shaded areas and enough drinking water.

Controls:

Wind speed limits for use of:

- Crane (max **32kph**).
- Man-basket (**25kph**).
- Scaffolding (**65kph**).

Prevent entry into flooded excavations and remove water prior to entry.

Establish heat stress plans by providing sufficient drinking water.



Personal Protective Equipment (PPE)

PPE is equipment that will protect you against health or safety risks at work.

It can include items such as safety helmets, gloves, eye protection, high-visibility clothing, safety footwear and safety harnesses.

It also includes Respiratory Protective Equipment (RPE).

Even where safe systems of work have been applied some hazards might still remain, PPE/RPE may be needed in these cases to reduce the risks to an acceptable level.



RPE - breathing apparatus

Always wear **R**espiratory **P**rotection **E**quipment (RPE) when one or more hazardous airborne contaminants are present in the work area.

It is important to know the type of airborne contaminant and its quantity (or volume in air) so that you can choose the correct type of respiratory protection.

You must ensure that your RPE protects you against the identified hazards and that you are trained to wear and use it properly.



Self Contained Breathing Apparatus
(SCBA)



Supplied Air Breathing Apparatus
(SABA)

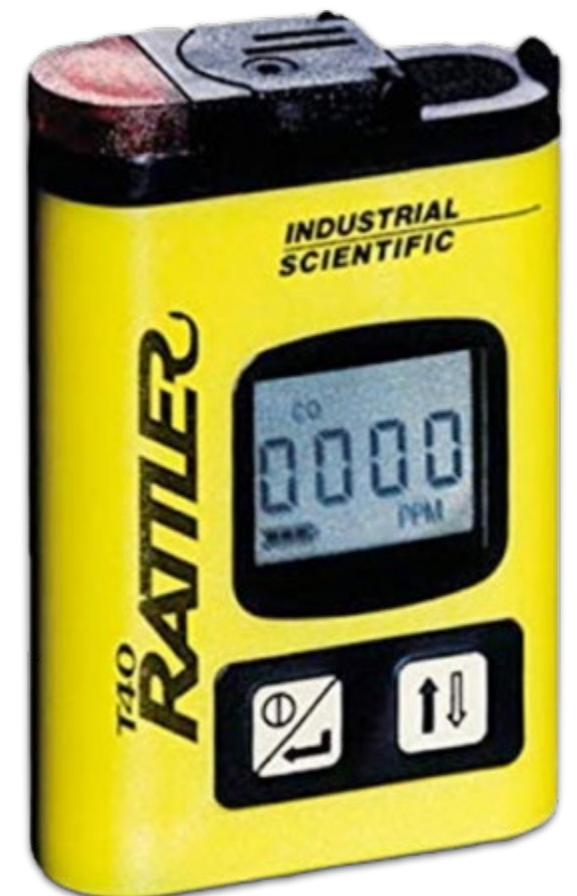
Personal Protection Monitor

If you work in areas where H_2S is present you must be trained on the hazards and effects of H_2S exposure and the proper use of PPE, this includes the use of a personal protection monitor.

Personal protection monitors, such as the T40 Rattler, warn the wearer of high levels of H_2S .

You must wear these where you may be exposed to **10 ppm or higher of H_2S** .

You must wear a T40 rattler in areas such as oil/gas plants and facilities that store and process hydrocarbons and in non-hydrocarbon areas such as sewage treatment plants/sewer lift stations.



T40 Rattler for illustration/demonstration

Review questions



Summary

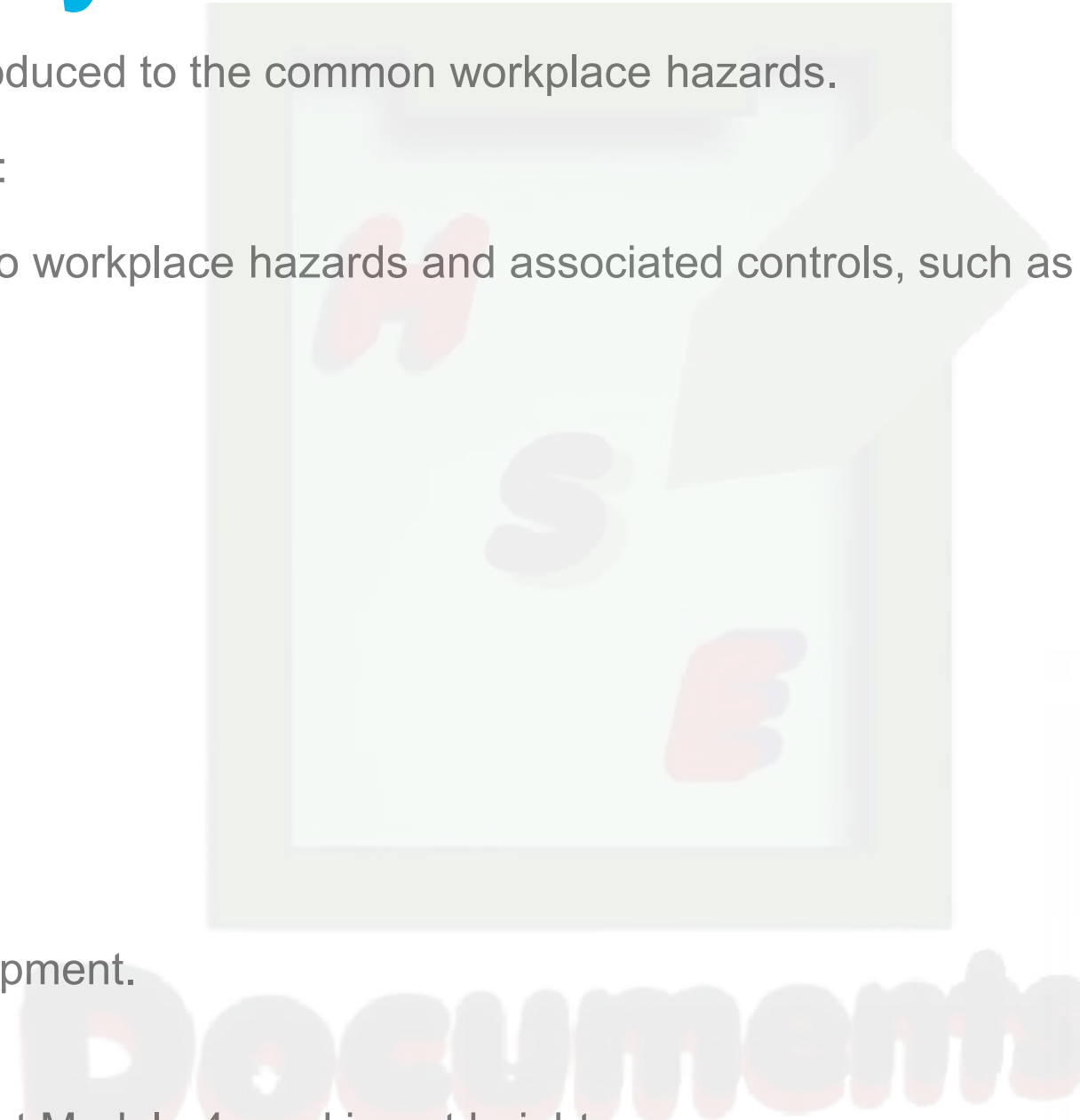
In Module 3 you were introduced to the common workplace hazards.

You should now be able to:

List common Saudi Aramco workplace hazards and associated controls, such as

- Slips, trips and falls.
- Tools and equipment.
- Noise and vibration.
- Machine guarding.
- Plant isolation.
- Confined space.
- Pressure testing.
- Weather conditions.
- Personal protective equipment.

Your instructor will now start Module 4, working at height.



Module 4

Working at height

Enabling objectives

On completion of Module 4, you will be able to:

- List common working at height hazards and associated controls.



Introduction

In this module you will learn about some of the common working at height hazards you may see in your workplace and what controls are used to eliminate or minimize the risks.



Working at heights

In Module 4 you will learn about the following:

- Elevated work platforms.
- Ladders.
- Scaffolding.
- Fall protection.



Elevated work platforms

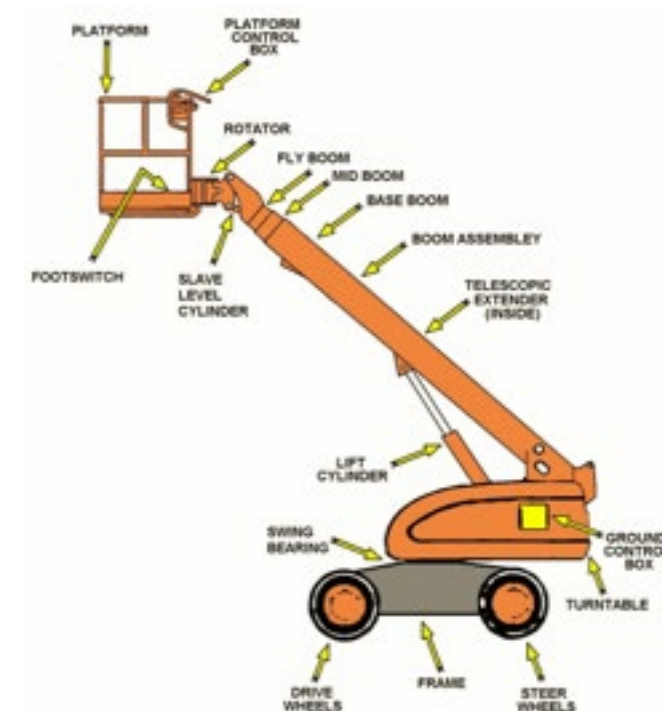
It is not the height that matters, it is the potential fall distance and what surface will brake your fall.

Working at ground level, but next to a deep excavation may also be considered as work at height.

The names of various elevated work platforms include cherry-picker, MEWP, scissor lift, or man-basket.

Hazards:

- Unauthorized use.
- Uncertified operators.
- Tipping over.
- Structural collapse.
- Mechanical failure.
- Falls from height.



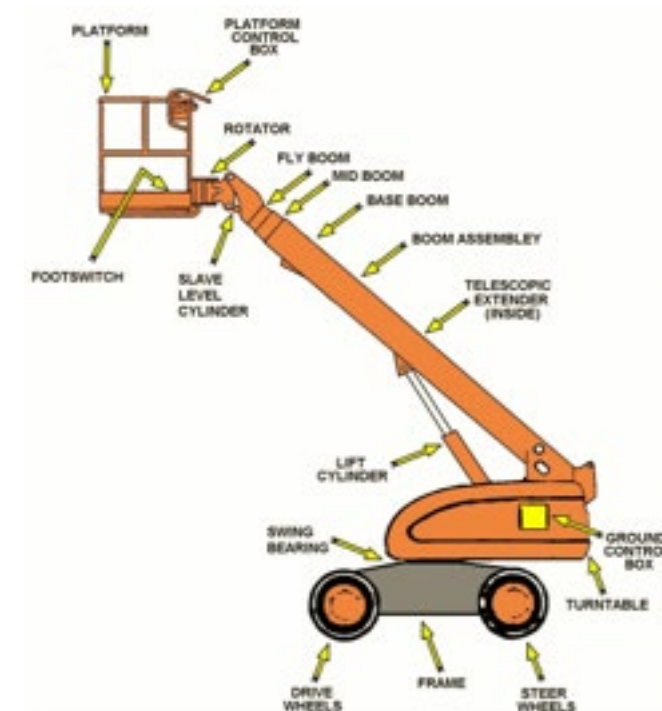
Elevated work platforms

As you can see from the previous page, regardless of the name or type of equipment, the hazards are generally the same.

Common control measures for elevated work platforms are listed below.

Controls:

- Certified operators.
- Inspection before use.
- Used only on even surfaces.
- Occupants must remain inside at all times.
- Harnesses worn and attached to anchor point.



Ladders

Ladders come in many shapes and sizes. However, if you use them incorrectly a fall from a ladder can be very serious.

Hazards:

- Ladder in poor condition.
- Falls from height.

Incorrect:

- Size.
- Type.
- Use.



Ladders

Basic control measures when using ladders include:

Controls:

- Inspect before use.
- Secure the top.
- Provide stable and secure footing.
- Slope ratio of 4 to 1.
- Face ladder when climbing.
- 3 points of contact when working from ladder.
- Never work off the top step of step ladders.



Scaffolding

Scaffolding, when built and used correctly, provide a temporary and safe means of access to elevated work areas.

If scaffolds are not built and used correctly, there is an increased risk of falls from height, the potential for being stuck by materials falling from scaffolds or scaffolding failure and collapse.

Hazards:

Falling:

- Objects.
- Equipment.
- People.

Scaffold collapse.



Scaffolding

GI 8.001 and the Construction Safety Manual specify requirements for all types of scaffold work.

They set out specific requirements for the safe design, erection, supervision, inspection, use, alteration, and dismantling of stationary and mobile scaffolds with fixed platform heights used for personnel access.

Some of the main controls and precautions are:

Controls:

Safe means of entry and exit:

- Gates.
- Drop bars.

Fall protection:

- Safety lines.
- Harnesses.
- Nets.

Tools and equipment secured.



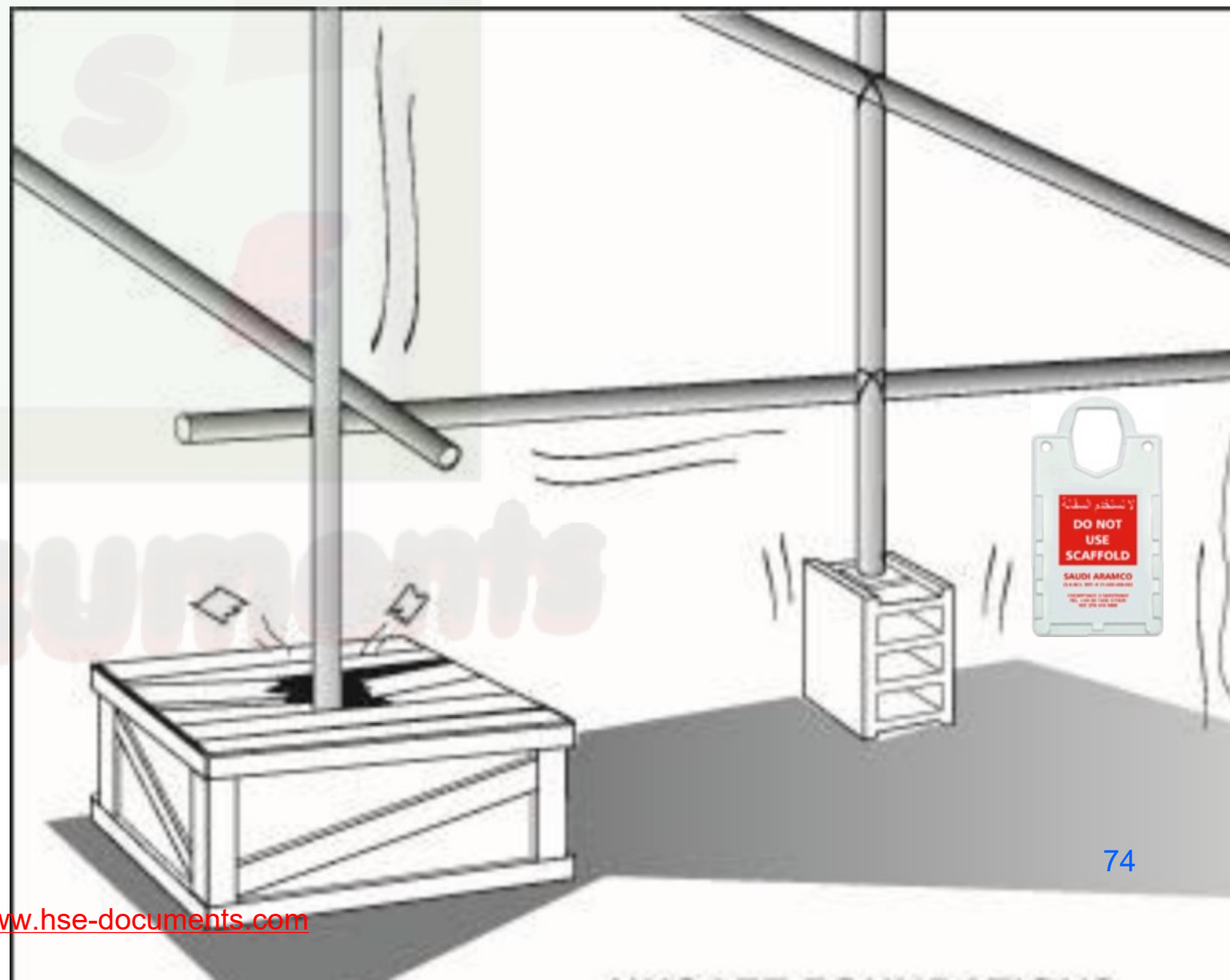
Scaffolding

Controls:

Regular inspection.

Use of SCAFF-TAGS:

- Valid inspection date.
- 2 weeks maximum between inspections.



Scaffolding

Basic checks:

- Scaffolding materials in good condition.

Scaffolding looks:

- Straight.
- Not leaning.
- No evidence of collision damage.
- No gaps in the planks.
- Toe boards fitted.
- Materials or tools not stored close to open edges.



Scaffolding

Basic checks:

Ladder:

- In good condition.
- No damage or missing parts.
- Correct length.

Safe means for getting on/off the ladder:

- Gate.
- Drop bar.
- Posts (standards) on level surface and on sill boards.



Scaffolding Tags

Scaff -Tags are required at all scaffold access points.

Red tag: do not use scaffold.

Yellow tag: full body harness required.

Green tag: scaffold complete, no harness required.

Document



Scaffolding Tags

Tag Checks:

Ensure scaffold tags (Scaff -Tags) are present and they are clearly visible at all access points. Using tags properly requires the following:

- The tag and holder number should match and not be re-used.
- Mount the holders through a component of the scaffold.
- The **scaffold supervisor** must **sign** the tags for all scaffolds **above 1.8m**.
- The **scaffold inspector** must **sign** the tags for all scaffolds **above 6m**.
- Scaffolds must be re-inspected every two weeks or after any alteration.



Fall protection

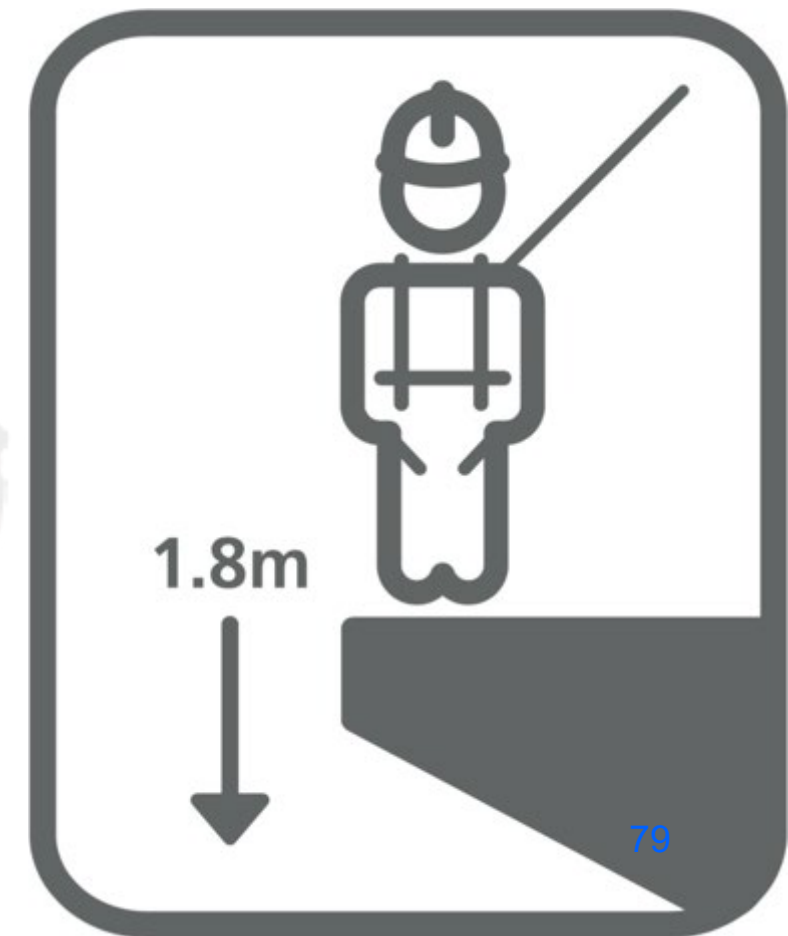
Sometimes work permit activities mean working where a potential to fall exists.

This might be when working close to unprotected edges, in mobile elevated work platforms, or when erecting a scaffold.

In these cases approved fall protection controls are required if the potential fall is greater than **1.8m, (6ft)**.

Hazards:

- Failure to wear.
- Failure to secure to a fixed point.
- Poor quality equipment.
- Damaged harness or line.



Fall protection

Controls:

- Users trained in wearing and fitting.
- Inspect before each use.
- Protect from sharp edges.
- Remove damaged equipment.
- Waist belts are prohibited.
- Shock absorbing lanyards, must be attached at least 5.5m (18ft) above the impact surface.
- Use suspension trauma straps (foot stirrups) with body harness



Fall protection

Wearing the correct fall protection equipment might save your life.

Lanyards must be either a “Y” lanyard (i.e., two lanyards sharing a common deceleration device) or double- leg lanyard (i.e., two lanyards each with their own individual deceleration device).



Review questions



Module 5

Heavy equipment

Enabling objectives

On completion of Module 5, you will be able to:

- List common heavy equipment hazards and associated controls.



Introduction

In this module you will learn about some of the common heavy equipment hazards you may see in your workplace and what controls are used to eliminate or minimize the risks.

Heavy equipment

In Module 5 you will learn about the following:

- Movement of heavy equipment.
- Certification.
- Cranes.
- Fork lifts.



Movement

Common hazards associated with the of the movement of heavy equipment are listed below:

Hazards:

- Run over by heavy vehicle.
- Struck by or crushed by material being moved.
- Crushed: Caught between equipment and object.

Electrocution by contact with:

- Overhead power lines.
- Buried cables.



Movement

The information below lists heavy equipment controls for both the operator and the equipment itself.

Controls:

- Equipment inspected.
- Operated by certified operator.
- Maintain safe distance.
- Keep eye contact with operator.
- Exclusion zones.
- Spotter (or a signal person).
- Wear high-visibility clothing.



Certification

Many types of heavy equipment require certification by Saudi Aramco.

GI. 7.025, specifies the requirements for testing and certification of Saudi Aramco and contractor heavy equipment operators.

It also identifies personnel authorized to operate and/or drive Heavy Equipment and Industrial Vehicles, as well identifies personnel authorized to rig/sling loads in support of lifting operations.

Hazards:

- Equipment used by uncertified operators.
- Loads rigged incorrectly resulting in dropped objects.

Review Report

Saudi Aramco 6979-1 (3/96) Front
الرسالة السعودية

SAUDI ARAMCO

Certificate No. **CAH001000**

Name _____

Is certified to operate equipment **ARAMCO**
listed on Reverse Side

THIS IS NOT A
SAUDI ARABIAN
GOVERNMENT LICENSE

PHOTO

Date of Expiration **06/21/2018**

Examiner _____ Date 06/21/2015
Supt. _____ Date 06/23/2015

SAUDI GOVT. License # _____

COMPANY **Saudi Aramco** EMP. # **270484**

ISSUED AT DHAHRAN, TEL: 876-1157

EXAMINER/DATE	HEAVY EQUIPMENT	REMARKS
_____/____/____	BULLDOZER	
_____/____/____	TRACTOR	
_____/____/____	TRACTOR - SCRAPER	
_____/____/____	GRADER	
_____/____/____	WHEEL - LOADER	
_____/____/____	SIDEBOOM - PIPELAYER	
_____/____/____	BACKHOES	
_____/____/____	GRADALL	
_____/____/____	FORKLIFT	UP TO 7 TON
_____/____/____	BOSCH	
_____/____/____	MANLIFT	

Certification

If you are a heavy equipment operator, you must immediately provide your heavy equipment operator certificate and SAG license (if license is required), to any authorized Saudi Aramco representative (e.g. the work permit issuer) on request.

Controls:

- Authorizations for higher risk activities.

Examples:

- Man-basket.
- Tandem lifts.
- Critical lifts.

Preview (front)

SAG No. 2 X CAT000100

This is to certify that:

has successfully completed the

TELESCOPING BOOM TRUCK

Evaluator _____

Validity **06/24/2018**

Authorized Signature & Title _____ Supervisor, Driver/HEOPTU

Preview (back)

PHOTO

2273716932

HEAVY TRUCK OPERATOR CERTIFICATION PROGRAM

CAUTION

This certificate is not a Saudi Government License. This certificate is issued as indication that the bearer is capable of performing the duties highlighted by his job description as approved by his department and reflected by the course material covered.

Cranes

Crane operations can cause significant incidents if specific hazard controls are not established.

Some of the outcomes from improper crane operations might be:

Hazards:

- Failure of rigging, ropes and slings.
- Contact with overhead power lines.
- Toppling over.
- Contact with people and equipment.
- Overloading.



Cranes

GI.7.028 specifies the crane lifts types and procedures to be followed when using various types of cranes.

Some common hazard controls measures include:

Controls:

- Inspection by operator.
- Barriers and signs.
- Valid inspection sticker.
- Certified crane operators.
- Critical lift plans.



Critical lift plans

- Loads of 40 tons or greater.
- Loads that exceeds 85% of the crane's rated capacity.

Any crane lift with hazards from:

- Explosion.
- Fire.
- High heat.
- Any crane working near energized power-lines.

Note:

Saudi Aramco certified Rigger 1 approves critical lift plans

The form is titled 'Critical Lift Plan' and includes the following sections:

- A) Load Description & Weight (Tons):** Includes fields for Load Description, Weight, and other load-related details.
- B) Weights (Base, Hook, etc.):** Includes fields for Base Weight, Hook Weight, and other weight-related details.
- C) Crane Information:** Includes fields for Crane Model, Capacity, and other crane-related details.
- D) Rigging:** Includes fields for Rigging Description, Rigging Weight, and other rigging-related details.
- E) Crane Configuration:** Includes fields for Crane Configuration, Crane Capacity, and other crane configuration-related details.
- F) Rigging:** Includes fields for Rigging Description, Rigging Weight, and other rigging-related details.

A red box highlights the 'Approved by Rigger 1' section at the bottom right, which includes fields for Name, Signature, and Date.

Fork lifts

Some of the common hazards from fork lifts and their operation include:

Hazards:

- Unauthorized use.
- Uncertified operators.
- Roll-over.
- Impact with personnel or equipment.
- Dropped materials.



Fork lifts

Some of the common control measures for fork lifts and their operation include:

Controls:

- Trained and certified operators.
- Daily inspection checklist.
- No standing or riding on forks.
- No walking under the raised forks or loads.
- Backup warnings.
- Seatbelt and safety devices operational.



Review questions



Summary

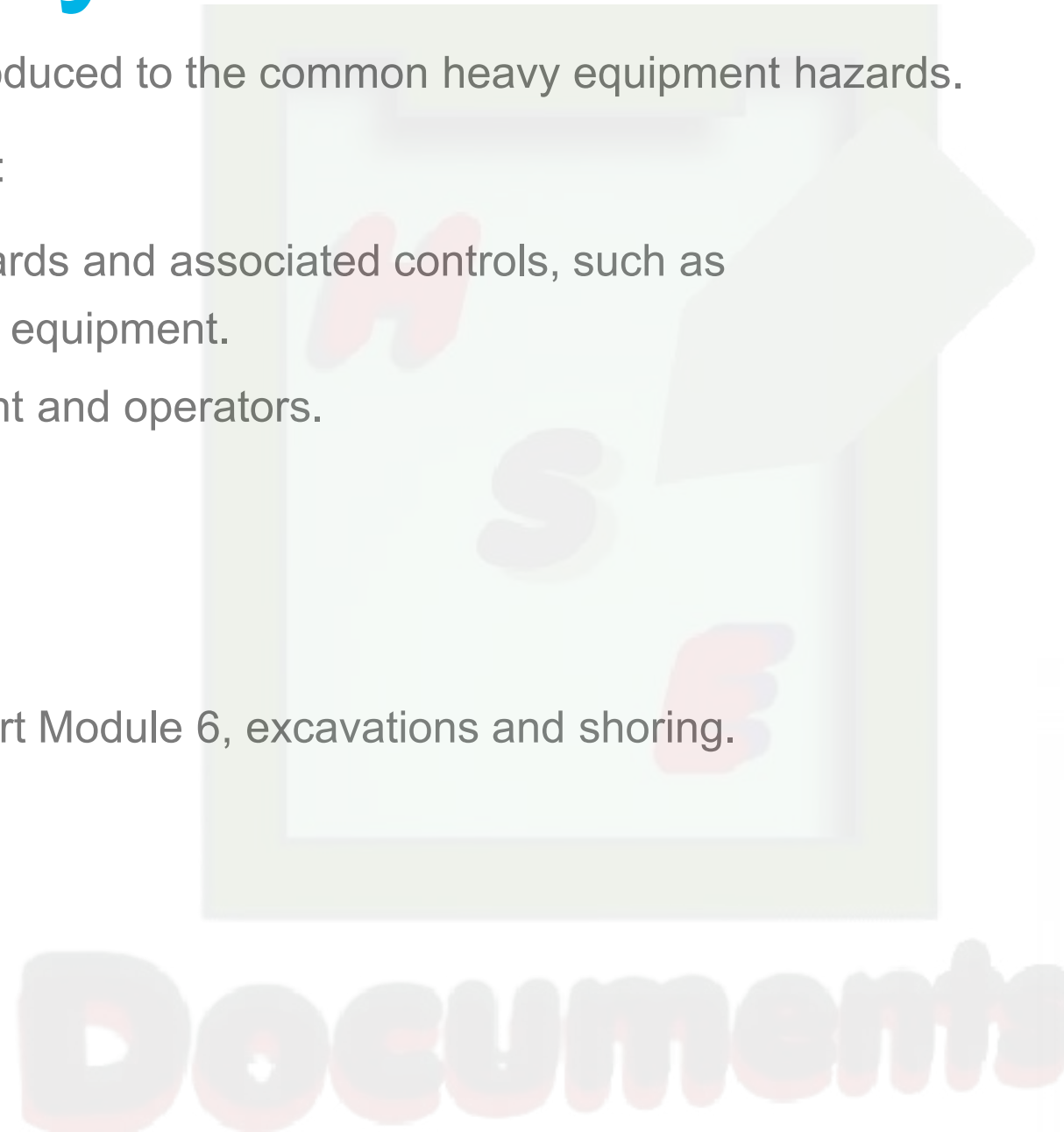
In Module 5 you were introduced to the common heavy equipment hazards.

You should now be able to:

List heavy equipment hazards and associated controls, such as

- The movement of heavy equipment.
- Certification of equipment and operators.
- Cranes.
- Fork lifts.

Your instructor will now start Module 6, excavations and shoring.



Module 6

Excavations & shoring

Enabling objectives

On completion of Module 6, you will be able to:

- List common excavation and shoring hazards and associated controls.



Introduction

In this module you will learn about some of the common excavation and shoring hazards you may see in your workplace and what controls are used to eliminate or minimize the risks.

Excavations and shoring

In Module 6 you will learn about the following:

- Excavations.
- Shoring.
- Types of soil.
- Buried cables.



Excavations

Unsafe excavations have caused many accidents and even death, common excavation hazards are listed below:

Hazards:

- Collapse or cave in of side walls.
- Oxygen deficiency.
- Toxic gas.
- Flammable gas.
- Striking underground cables or pipes.
- Flooding.



Do not operate mechanical excavators within **3 m (10ft)** of underground pipes, cables or other obstructions.

CONFINED SPACE ENTRY PERMIT

Sample Number: M079-4-7(2)15 Permit No. 0

Complete this form in English and write clearly. Use ink pen, not pencil.

الهيئة العامة للغذاء والدواء
Saudi Vigilance

SECTION 1 - WORK DESCRIPTION

Month: _____ Day: _____ Year: _____ Duration: _____

A. Identify priority/ safety area:

B. Exact work location: _____

C. Work to be done: _____

D. Equipment to be used at the site: _____

SECTION 2 - HAZARD IDENTIFICATION & CONTROL

A. Identify and attach any supplementary forms required to perform/control the work:

Confined space entry tag (mandatory) ☐ LHM Plan (mandatory) ☐ Job Safety Analysis ☐

Gas test record ☐ Isolation plan ☐ Blind list ☐ Critical Lift Plan ☐ Excavation Checklist ☐

(nitrated procedures) ☐ Other: _____

B. Energy Types:

Hydrocarbon/gas/flammable chemicals ☐ Mechanical ☐ Electrical ☐ Hydraulic/pneumatic ☐

Potential energy (spring loaded, gravity) ☐ Automated self-loading systems ☐ Other: _____

C. Isolation Method(s):

Locked switch/master ☐ Mechanical block ☐ Blinding ☐ Disconnect ☐

Positive isolation blind or disconnect shall be used for all piping connections to the confined space.

D. Potential Exposures:

High noise level ☐ Hydrogen Sulphide ☐ High Pressure ☐ Flammable (liquids/gases) ☐ Hazardous/toxic materials ☐

Radioactive materials ☐ Temperature (high/low) ☐ Other: _____

E. Protective Equipment:

Personal safety monitor ☐ HRC ☐ ARC rated PPE ☐ Goggles/face shield ☐ Chemical submittals ☐

Fall protection ☐ Flammable/warning signs ☐ Mechanical ventilation/blow ☐

Respiratory protection ☐ Bunker/boiler in Addition to/Rescue before ☐

F. Confined Space Entry Supervision (CSE) tag Number:

G. Confined Space Entry Standby Man tag Number:

H. List any Additional Safety Precautions:

IN AN EMERGENCY:

☐ SEE ATTACHED

SECTION 3 - GAS TESTING/MONITORING

Gas testing frequency: _____

Periodic monitoring required: Yes ☐ No ☐ If yes, attach a supplementary form.

Additional gas tests required prior to entry, after breakdown/condition of work, if site conditions change, and at intervals (periods) as required. Record results or use a supplemental form.

ONLY ONE GAS TESTER PERFORM GAS TESTS

	OS, PH, H ₂ S ppm	CO ppm	CO ppm	Others	Badge No.	Signature
Initial						
Revised						
Additional						

SECTION 4 - PERMIT AUTHORIZATION & CLOSURE

Additional approval per ID 3.130 or tag instructions

Signature: _____ Position: _____ Org: _____ Badge No.: _____

Signature: _____ Position: _____ Org: _____ Badge No.: _____

Signature: _____ Position: _____ Org: _____ Badge No.: _____

Signature: _____ Position: _____ Org: _____ Badge No.: _____

Signature: _____ Position: _____ Org: _____ Badge No.: _____

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Signature: _____ Position: _____ Org: _____ Badge No.: _____

Signature: _____ Position: _____ Org: _____ Badge No.: _____

Signature: _____ Position: _____ Org: _____ Badge No.: _____

Signature: _____ Position: _____ Org: _____ Badge No.: _____

HAZARD ANALYSIS CHECKLIST

Any 'W' (WOS) answer below shall initiate a "STOP" point where the Issuer and Receiver are to analyze the hazard(s) and develop methods to adequately control the hazard(s) and list the additional precautions on the permit.

	Y	N
Is the correct type of permit(s) issued for the work?	☐	☐
Have the Job Safety Analysis (JSA) and other applicable supplementary forms been submitted to the work crew?	☐	☐
Are the weather conditions (e.g., wind speed, rain, fog, heat, lightning) adequate to perform the work?	☐	☐
Are slip and trip hazards controlled?	☐	☐
Does the work crew have the correct water equipment for the job? Are they in good condition?	☐	☐
Is personnel having the proper certification to perform the activity under operate the equipment?	☐	☐
Is the equipment's inspection label valid?	☐	☐
Have all requirements for working at heights (i.e., fall arrest lines been applied)?	☐	☐
Is the scaffold tag completed correctly, signed, and with a valid inspection date?	☐	☐
Has the potential for contact with sharp objects, rotating equipment, hazardous materials, or live electricity been eliminated?	☐	☐
Is the system/component properly isolated and locked out? If not, what are your personal lock?	☐	☐
Has the system/component been depressurized, drained, and/or purged before opening?	☐	☐
Has the potential for releasing flammable liquids and gases been controlled?	☐	☐
Are all ignition sources eliminated or controlled		

Excavations

Everyone working in an excavation must be properly trained for an emergency.

Make sure that safety or rescue equipment, if needed, is nearby and working properly. Some examples include SCBAs, safety harnesses, lifelines, basket stretchers, and mechanical lifts.

Excavation work should be carried out carefully and follow Saudi Aramco Standard and Work Permit requirements for safe digging practices.

Saudi Aramco Standard excavation safety checklist is required.

Checklists to be used for all excavations.

- Pre-excavation checklist.
- Excavation inspection checklist.
- Attach checklists to the work permit.

Excavation Inspection Checklist			
Project or WOI#		Excavation location	
This checklist must be completed and posted on site by the excavation Competent Person. Inspections shall be performed before workers are initially allowed to enter the excavation, after a change in site condition (e.g. rain storm, groundwater, sidewall deterioration or adjacent ground fissuring) And daily for excavation greater than 2.4 m (8 ft) deep. At the end of workday, this checklist shall be given to the contractor's safety supervisor for review and filing. The contractor's safety supervisor shall maintain a consolidated list of all excavations and conduct random inspection of excavations during the course of the workday. All of Saudi Aramco's safety requirements shall be complied with at all times. The excavation Competent Person shall be knowledgeable of Saudi Aramco's safety requirements and have the necessary training and experience to ensure the work is performed safely.			
Depth of Excavation:	meters / feet	Width of Excavation:	meters / feet
Has a Pre-Excavation Checklist been completed prior to digging?	Yes	No	N/A
Have all relevant departments been notified prior to digging?			
Are underground utilities, cables and pipelines located and marked prior to digging?			
Is a Work Permit required, issued and available on site?			
Is a Confined Space Entry Permit required, issued and available on site?			
Is gas testing required and performed; e.g. excavations deeper than 1.2m (4 ft)?			
Is a Stand-by Man and/or Fire Watch required and available on site?			
Are pedestrian crossovers required and provided (with guardrails)?			
Is access to plant/process equipment maintained?			
If excavation is near a roadway are flagmen with bright orange vest present?			
Is the shoring/sloping/benching acceptable to prevent sidewall cave-in?			
Is shoring material in sound condition and free of damage/defects?			
Is shoring installed/maintained by qualified personnel?			
Are adequate ladders provided within a travel distance of 7.5m (25ft)?			
Are ladders properly secured and do they extend 1m (3ft) above surface?			
Is the excavation free of tension cracks or other evidence of sidewall failure?			
Is excavation free of water, Hydrocarbons or other toxic substances?			
Are materials and spoils set back at least 0.6m (2ft) from the excavation's edge?			
Are underground utilities and piping located, marked and protected from damage?			
Are pedestrian barricades/lights placed at least 1m (3ft) from excavation's edge?			
Are hard barricades for vehicles placed at least 2m (6.5 ft) from excavation's edge?			
Are cranes not closer than the depth of excavation to the edge of the excavation?			
Are scaffolds erected no closer than 1.5 times the depth of excavation from its edge?			
Are overall conditions acceptable and safe for work?			
All deficiencies shall be corrected immediately.			

PRE-EXCAVATION CHECKLIST				
PROJECT OR WORK ORDER NUMBER	EXCAVATION LOCATION			
SPONSORING ORGANIZATION (e.g., Project Management, Community Services)	Arrange and review excavation drawing		DONE	INITIALS
	Arrange demarcation of excavation site			
	Survey excavation site with proponent operation's rep.			
	Arrange sign-off of this checklist by all parties			
	Provide Work Permit (WP) Issuer's organization with this checklist and excavation drawing			
	Provide notifications as required			
SPONSORING ORGANIZATION'S REPRESENTATIVE (Name, phone, signature & date)				
PROPOONENT ENGINEERING/TECHNICAL (Specify Division)	Determine location of underground (UG) utilities, including contacting Government Affairs if excavation is off site			
	Verify operational status and operating condition of UG utilities			
	Arrange cable/pipe detection to locate utilities not shown on drawings and unmarked in the field			
PROPOONENT'S ENGINEERING / TECHNICAL SERVICES REPRESENTATIVE (Name, phone, signature & date)				
PROPOONENT OPERATIONS (Specify Division)	Survey excavation site with sponsoring organization's rep.			
	Review excavation drawing			
	De-energize known cables and isolate piping, if possible			
	Advise WP Issuer about precautions required			
PROPOONENT OPERATION'S REPRESENTATIVE (Name, phone, signature & date)				
ORGANIZATION OF WORK PERMIT RECEIVER (Specify)	Review Saudi Aramco's excavation safety requirements and implement applicable measures			
	Double-check the area for unknown UG utilities by using a cable/metal detector in the presence of the WP Issuer			
	Provide WP Issuer with this fully signed Pre-Excavation Checklist and excavation drawing			
WORK PERMIT RECEIVER ORGANIZATION'S REPRESENTATIVE (Name, phone, signature & date)				

Shoring

Shoring means supporting the sidewalls of an excavation with an engineered structure of cross braces, vertical uprights and horizontal rails. Shoring can be made from wood or metal. It may be a hydraulic or mechanical system.

Shoring is the third best choice to prevent sidewall collapse.

Sloping and benching are safer protective methods.

Good shoring inside excavations protects workers from:

- Cave-in of side walls.
- Ground collapse.
- Slippage of spoil.

Spoil to be at least **60cm (2ft)** from the edge.



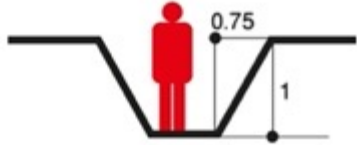
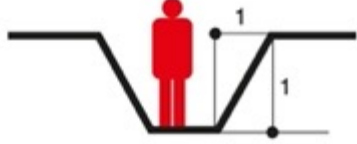
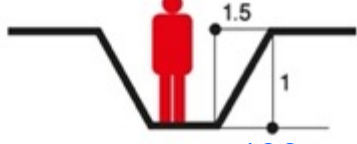
Know the soil types

A qualified person shall:

- Design the excavation method.
- Determine the appropriate soil type.

Sloping or benching more than 6m (20ft):

- Designed by a qualified engineer.

Soil Type	Cross Section
Stable Rock — Natural solid mineral matter.	
Type A Soil — A cohesive (tight) soil, such as clay or rock. Previously disturbed Type A soil becomes Type B or Type C soil.	
Type B Soil — A less cohesive soil such as a mix of sand, rocks and clay. Previously disturbed Type B soil becomes Type C soil.	
Type C Soil — The least cohesive soil, such as gravel, sand, muddy or freely seeping soils and submerged rock that is not stable.	

Buried cables

Electric, gas, sewer, water, telephone lines, cables or process piping are all found underground.

If underground equipment is damaged, an injury or death could occur.

Hazards:

- Digging up live cables with backhoe.
- Jack hammer contacting live cables.
- Hand digging around live cables.



Buried cables

When underground utility lines are known or suspected, the work permit issuer must get countersignatures from Power Distribution, Communications or Utilities.

Excavation work should be properly managed to control hazards, you must look for the warning signs like the yellow tape, red tiles and sweet sand, these are signs to indicate that a cable may be buried below.

Controls:

- Identify and mark cables and services before digging.

- Use cable drawings and plans.

- Use cable locating devices.

- Safe digging practice (by hand).

Hand digging should continue for at least **3 meters (10 feet)** away from exposed underground equipment.

Mechanical digging may resume **3 meters (10 feet)** away.



Review questions



Summary

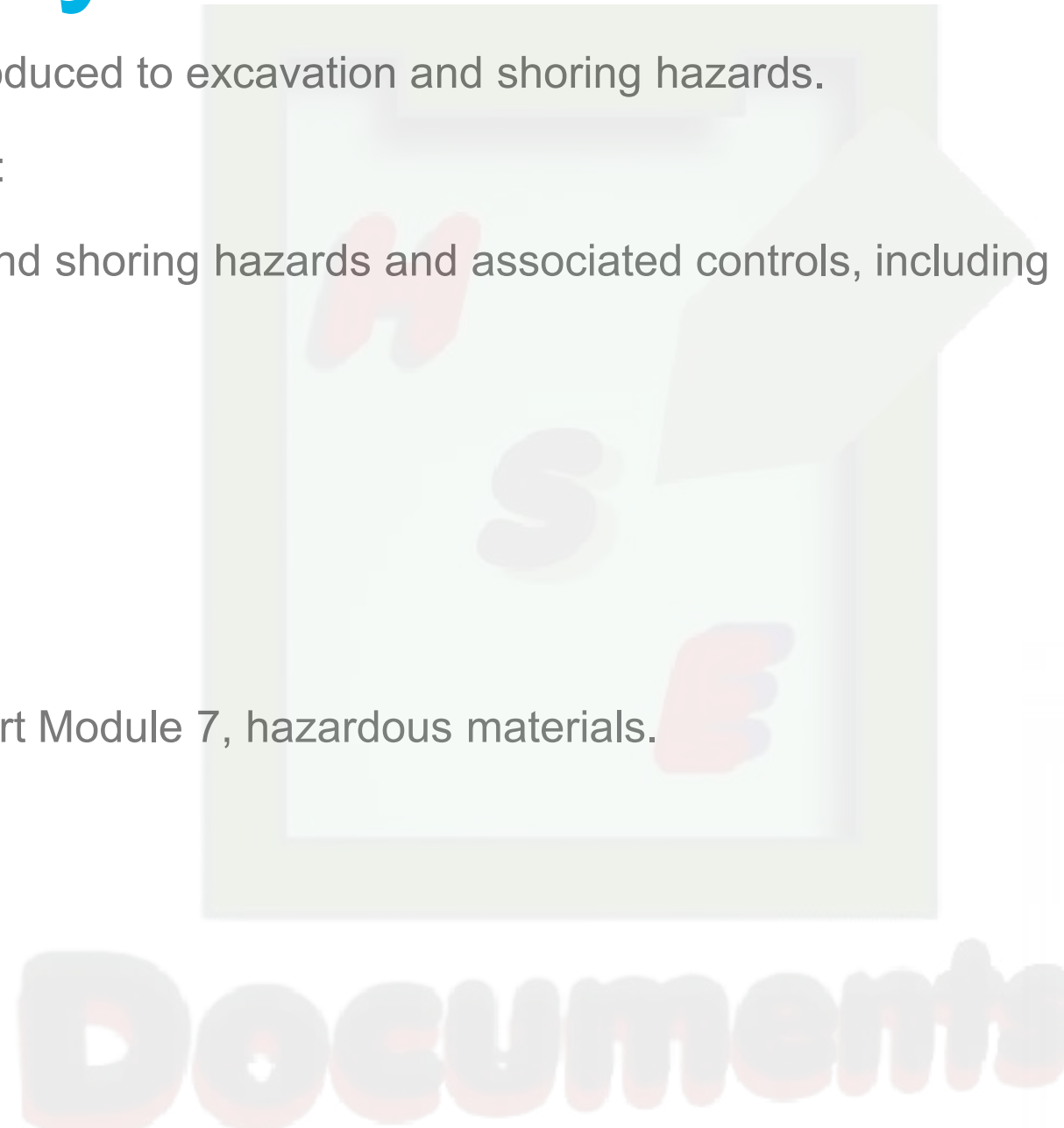
In Module 6 you were introduced to excavation and shoring hazards.

You should now be able to:

List common excavation and shoring hazards and associated controls, including

- Excavations.
- Shoring.
- Types of soil.
- Buried cables.

Your instructor will now start Module 7, hazardous materials.



Module 7

Hazardous materials

Enabling objectives

On completion of Module 7, you will be able to:

- List common hazardous material hazards and associated controls.



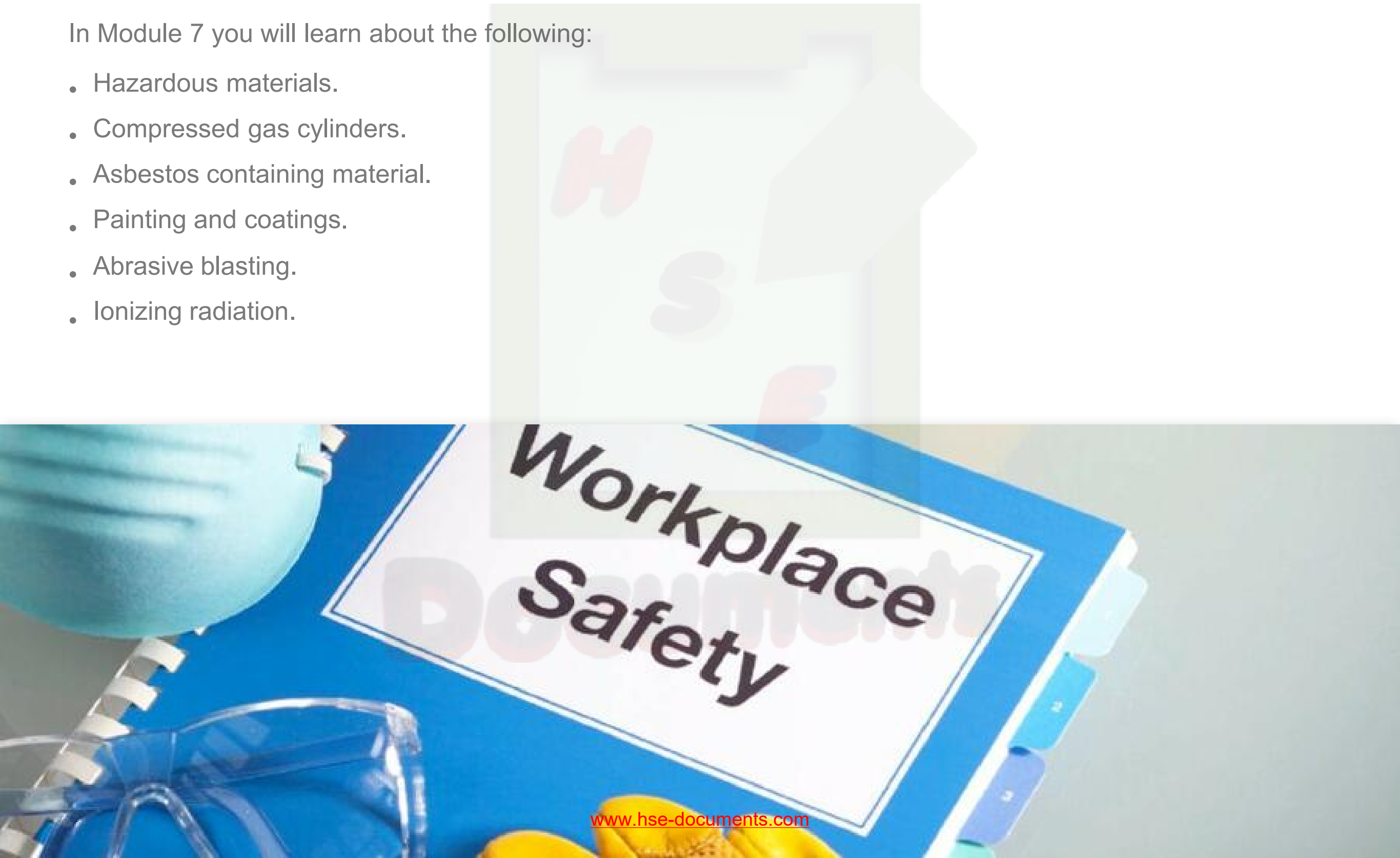
Introduction

In this module you will learn about some of the common hazardous material hazards you may see in your workplace and what controls are used to eliminate or minimize the risks.

Hazardous materials

In Module 7 you will learn about the following:

- Hazardous materials.
- Compressed gas cylinders.
- Asbestos containing material.
- Painting and coatings.
- Abrasive blasting.
- Ionizing radiation.



Hazardous materials

In Saudi Aramco, we handle, produce and store a wide range of materials, many of them are hazardous.

A product's hazardous nature is usually attributed to their health hazard, flammability and reactivity.

Health hazard is a broad term that includes potential hazards based on how the material enters your body (e.g. through the skin, by inhalation or by injection).

Hazards:

- Toxic.
- Flammable.
- Reactive.
- Chemical burns.
- Irritant.
- Corrosive.

Documents



Hazardous materials

When controlling exposure to these materials you must understand their hazardous properties. This information is in the **Chemical Hazard Bulletins (CHB)**, the **HAZCOM label** or the Safety Data Sheet (SDS).

These will help you determine how to correctly handle and store materials, their reactivity with other materials, correct PPE and RPE and the recommended first aid steps if the material is released.

Controls:

- Chemical Hazard Bulletins (CHB).
- HAZCOM labels.
- Eliminate or substitute the material.
- Correct storage.
- Correct PPE/RPE.
- Spill containment equipment.

Chemical Hazard Bulletin
CHB: 155

HYDROGEN SULFIDE GAS

INGREDIENTS	CAS NO	%	8HR OEL
hydrogen sulfide	7783-06-4	>98	14 mg/m3

UN No: 1053
Hazchem Code: 2WE
DG Class: 2.3
Subsidiary Risk: 2.1
Packing Group: Not Applicable
Poisons Schedule: S7

NFPA Rating:
 ▶ 0: Minimum
 ▶ 1: Low
 ▶ 2: Moderate
 ▶ 3: High
 ▶ 4: Extreme

PROPERTIES
 Gas.
 Mixes with water. Extremely flammable.

EMERGENCY

FIRST AID
Skin: Remove contaminated clothing. Wash with soap & water.
 For cold burns, immerse in cold water. Wash with soap & water, apply dressing. MEDICAL ATTENTION.
Fire Fighting: Keep containers cool. Water spray/ fog.
Spills and Disposal: Eliminate ignition sources. Consider evacuation. Prevent from entering drains. Contain spillage by any means.

SAFE STORAGE WITH OTHER CLASSIFIED CHEMICALS

Flammable	Explosive	Toxic	Radioactive	Oxidizing
x	x	x	x	x

x — Must not be stored together

HYDROGEN SULFIDE GAS

Danger
 UN number: 1053
 HAZCHEM: 2WE

4 HEALTH HAZARDS
 VERY TOXIC BY INHALATION.; IRRITATING TO EYES AND SKIN.

4 FLAMMABILITY
 EXTREME

0 REACTIVITY
 PRESENCE OF INCOMPATIBLE MATERIALS. PRODUCT IS CONSIDERED STABLE.

FIRST AID: Remove contaminated clothing. Wash with soap & water.; For cold burns, immerse in cold water.

PPE

CHB 155

For further information call Environmental Protection: 880-9714 (DH), or 427-0158 (JID)
 For proper disposal methods and locations for the chemical or chemical contaminated material, contact the Environmental Engineering Division, 880-9767
 NFPA Rating: 0: Minimum, 1: Low, 2: Moderate, 3: High, 4: Extreme

Compressed gas cylinders

Compressed gas cylinders are often used in our plants and facilities.

They can contain inert gases such as Nitrogen to highly flammable gases such as Acetylene.

Hazards:

May contain:

- Flammable materials.
- Toxic materials.

Poor storage:

- Full and empty stored together.
- Lack of separation for incompatible materials.
- Exposure to heat and sunlight.
- Explosion and projectile.
- Transportation.



Compressed gas cylinders

Common controls when storing and using compressed gas cylinders.

Controls:

- Identify contents (CHB).
- Store out of direct sunlight.
- Separate incompatible materials.
- Separate full and empty cylinders.

Cylinders containing Oxygen and Oxidizers:

MUST be stored **at least 6.1 m (20 ft)** from flammable gas cylinders.

or

MUST be separated by a **30 minute** fire rated barrier at least **1.5 m (5 ft)** high.



Compressed gas cylinders

Controls:

- Store in upright secure position, use cylinder rack wherever possible.
- Secure during transportation.
- Flash back arrestors for O₂ and Acetylene cylinders.
- Good housekeeping.



Asbestos Containing Material (ACM)

Asbestos becomes dangerous when disturbed. **Inhalation of asbestos fibers** results in the potential for **long term ill-health and potentially death**.

Asbestos is not easy to identify, but when it is, you should take all the steps required to ensure that it is not disturbed causing hazardous fibers to be released into the air.

Hazards:

- Difficult to identify.
- Airborne fibers, dangerous to the lungs.
- No short term health symptoms.
- Long term permanent health effects.



Asbestos Containing Material

Once identified and decisions are made to keep it or remove it, then specific controls are required. These are explained in Gl.150.001 and the Construction Safety Manual.

Controls:

- Clearly identified and warning signs posted.
- Wet Methods used for removal.
- Eating, drinking and smoking prohibited when working with ACM.



Asbestos Containing Material

Controls:

PPE and RPE to be used for ACM work.

Dry cleanup methods prohibited, such as:

- Sweeping.
- Shoveling.

GI 150.001: how to manage and control asbestos waste.



Painting and coatings

Paints and painting may seem like common/low risk type work activities but some paints and paint thinners can be very hazardous.

Some types are flammable and some have significant inhalation hazards (dangerous to the breathing), and some are irritants (dangerous to the skin).

Hazards:

- Flammable atmosphere.
- Oxygen deficiency.
- Skin and breathing hazards.
- Long term permanent ill-health effects.
- Storage.
- Poor housekeeping.



Painting and coatings

Paints and coatings require specific hazard controls:

Controls:

- Trained operator.
- Check CHB or Safety Data Sheets for precautions.
- Wear correct PPE.
- Containers closed or sealed when not in use.
- Good Housekeeping.

If you paint or coat inside a confined space, regularly measure the atmospheric conditions to ensure Oxygen or flammable limits are not exceeded.



Abrasive blasting

You must be Saudi Aramco certified to perform abrasive blasting.

Abrasive blasting equipment requires specific safety checks before work begins.

Hazards:

- Considered to be hot work.
- May create an ignition source.
- High noise levels.
- Health hazards from silica sand.
- Poor housekeeping.
- Low skilled workforce.



Abrasive blasting

Abrasive blasting hazard controls measures include:

Controls:

- Hot work permit in restricted areas.

Operators to be tested and certified by:

- Certified coatings inspector (level 2).
- Wear PPE including hearing protection.
- Good Housekeeping.
- Use of Silica sand is prohibited.

Full details of abrasive blasting controls are described in GI 6.021 and the Construction Safety Manual.



Ionizing radiation

Ionizing radiation can be extremely hazardous to your health, resulting in short and long term ill-health. Do not work with ionizing radiation without a Saudi Arabian Government issued radiation practice license.

Ionizing radiation work must always be performed under the control of an appointed Radiation Protection Officer (RPO). Due to its extremely hazardous nature, it is tightly controlled through GIs and standards.

You must never use or operate ionizing radiation equipment without being trained and competent in the safe handling of ionizing radiation sources related to your job.

Hazards:

- Radiation sources have different strengths.
- Extremely hazardous to your health.
- Short and long term ill health effects.
- NORM (**N**aturally **O**ccurring **R**adioactive **M**aterial).



Ionizing radiation

You must obtain work permit(s) for any NORM (**N**aturally **O**ccurring **R**adioactive **M**aterial) related work and personnel working with or around NORM contaminated piping, equipment, materials (e.g., filter cartridges), soil or wastes must be trained in NORM hazards.

All tasks involving NORM contaminated equipment or materials must be covered by a Job Safety Analysis (JSA), which must identify the hazards and associated controls.

Controls:

- Time, distance and shielding.
- All work under the control of a Radiation Protection Officer (RPO).
- Use personal monitoring and protection when using or handling ionizing radiation. Use warning signs.

GI's: 150.003, GI 150.005, GI 150.006 and GI 150.007



Review questions



Summary

In Module 7 you were introduced to hazardous material hazards.

You should now be able to:

List common hazardous material hazards and associated controls, including

- Hazardous materials.
- Compressed gas cylinders.
- Asbestos containing material.
- Painting and coatings.
- Abrasive blasting.
- Ionizing radiation.

Your instructor will now start Module 8, Hydrogen Sulfide.

Documents



Module 8

Hydrogen Sulfide

(H₂S)

Enabling objectives

On completion of Module 8, you will be able to:

- List common Hydrogen Sulfide (H₂S) hazards and associated controls.



Introduction

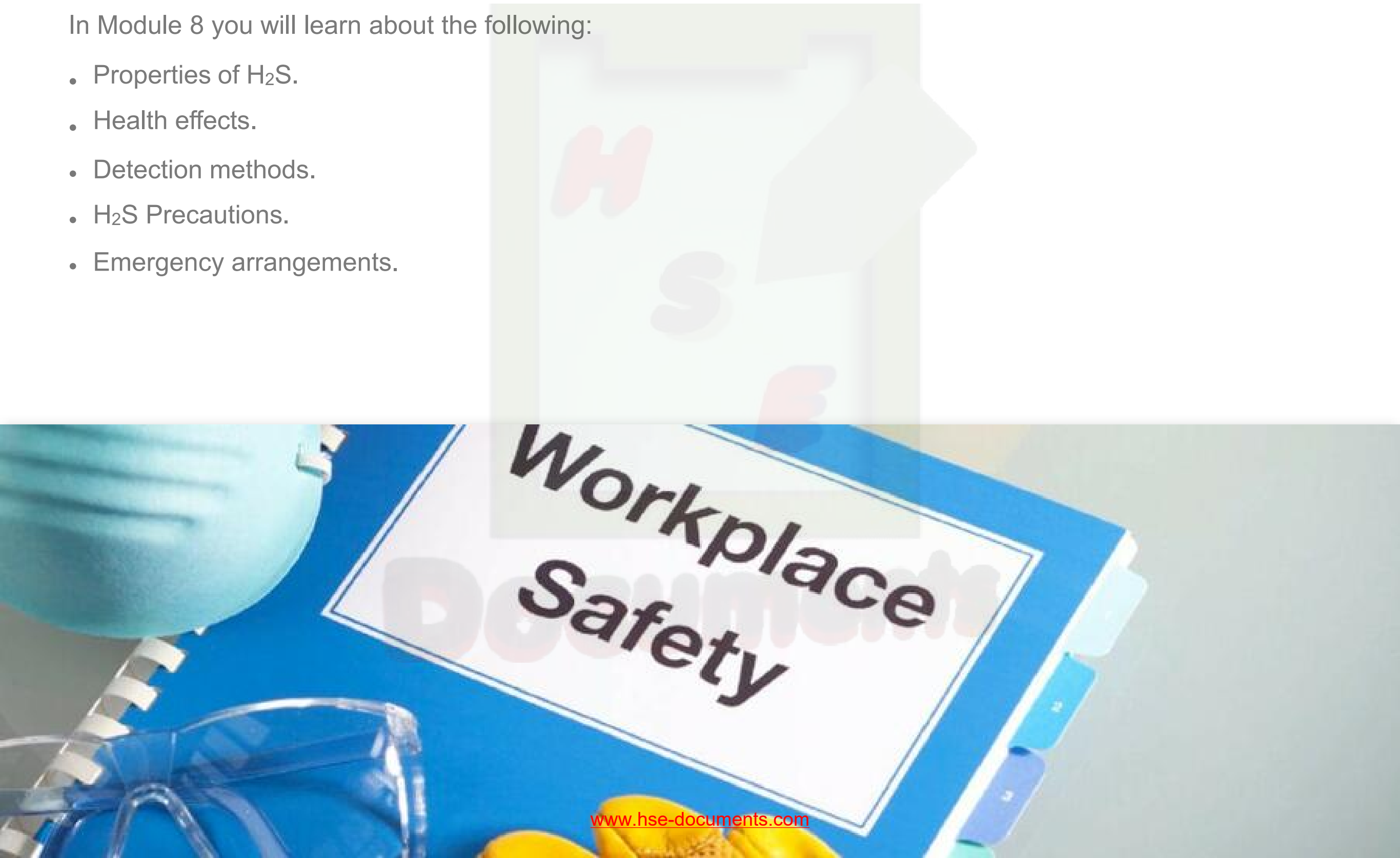
In this module you will learn about some of the common Hydrogen Sulfide (H_2S) hazards you may see in your workplace and what controls are used to eliminate or minimize the risks.



Hydrogen Sulfide (H₂S)

In Module 8 you will learn about the following:

- Properties of H₂S.
- Health effects.
- Detection methods.
- H₂S Precautions.
- Emergency arrangements.

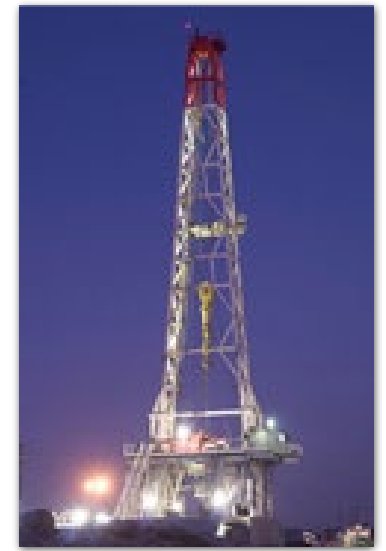


Where is H₂S found ?

H₂S is often contained in the oils and gases that are extracted by Saudi Aramco.

Many Saudi Aramco industrial processes and facilities contain potential sources of H₂S, such as:

- Producing Operations.
- Exporting operations.
- Stabilization.
- Refining.
- Storage.
- Drilling & work-over rigs, GOSP's.
- Pumps.
- Compressors.
- Pipelines.
- Sewage treatment areas.



H₂S properties

- Extremely toxic.
- Extremely flammable.
- Highly reactive with oxidizers.
- Colorless.
- Heavier than air.
- Soluble in water, forms a weak acid.
- Reacts with metals to form Sulfides.
- Asphyxiates – causing suffocation.
- Soluble in hydrocarbons.
- Rotten egg smell.
- Smell is misleading at higher concentrations as you will not be able to smell it.
- Travels with wind, and will settle in low areas.

Chemical Hazard Bulletin
CHB: 155

HYDROGEN SULFIDE GAS

INGREDIENTS	CAS NO	%	8HR OEL
hydrogen sulfide	7783-06-4	>98	14 mg/m ³

UN No: 1053
Hazchem Code: 2WE
DG Class: 2.3
Subsidiary Risk: 2.1
Packing Group: Not Applicable
Poisons Schedule: S7

NFPA Rating:
 ▶ 0: Minimum
 ▶ 1: Low
 ▶ 2: Moderate
 ▶ 3: High
 ▶ 4: Extreme

PROPERTIES
 Gas.
 Mixes with water. Extremely flammable.

EMERGENCY

FIRST AID
 Remove contaminated clothing. Wash with soap & water.
 For cold burns, immerse in cold water. Wash with soap & water, apply dressing. MEDICAL ATTENTION.

Fire Fighting:
 Keep containers cool. Water spray/ fog.

Spills and Disposal:
 Eliminate ignition sources. Consider evacuation. Prevent from entering drains. Contain spillage by any means.

SAFE STORAGE WITH OTHER CLASSIFIED CHEMICALS

Flammable	Explosive	Toxic	Radioactive	Oxidizing
x	x	x	x	x

x — Must not be stored together

HYDROGEN SULFIDE GAS

Danger
 UN number: 1053
 HAZCHEM: 2WE

4 HEALTH HAZARDS
 VERY TOXIC BY INHALATION.; IRRITATING TO EYES AND SKIN.

4 FLAMMABILITY
 EXTREME

0 REACTIVITY
 PRESENCE OF INCOMPATIBLE MATERIALS. PRODUCT IS CONSIDERED STABLE.

FIRST AID: Remove contaminated clothing. Wash with soap & water.; For cold burns, immerse in cold water.

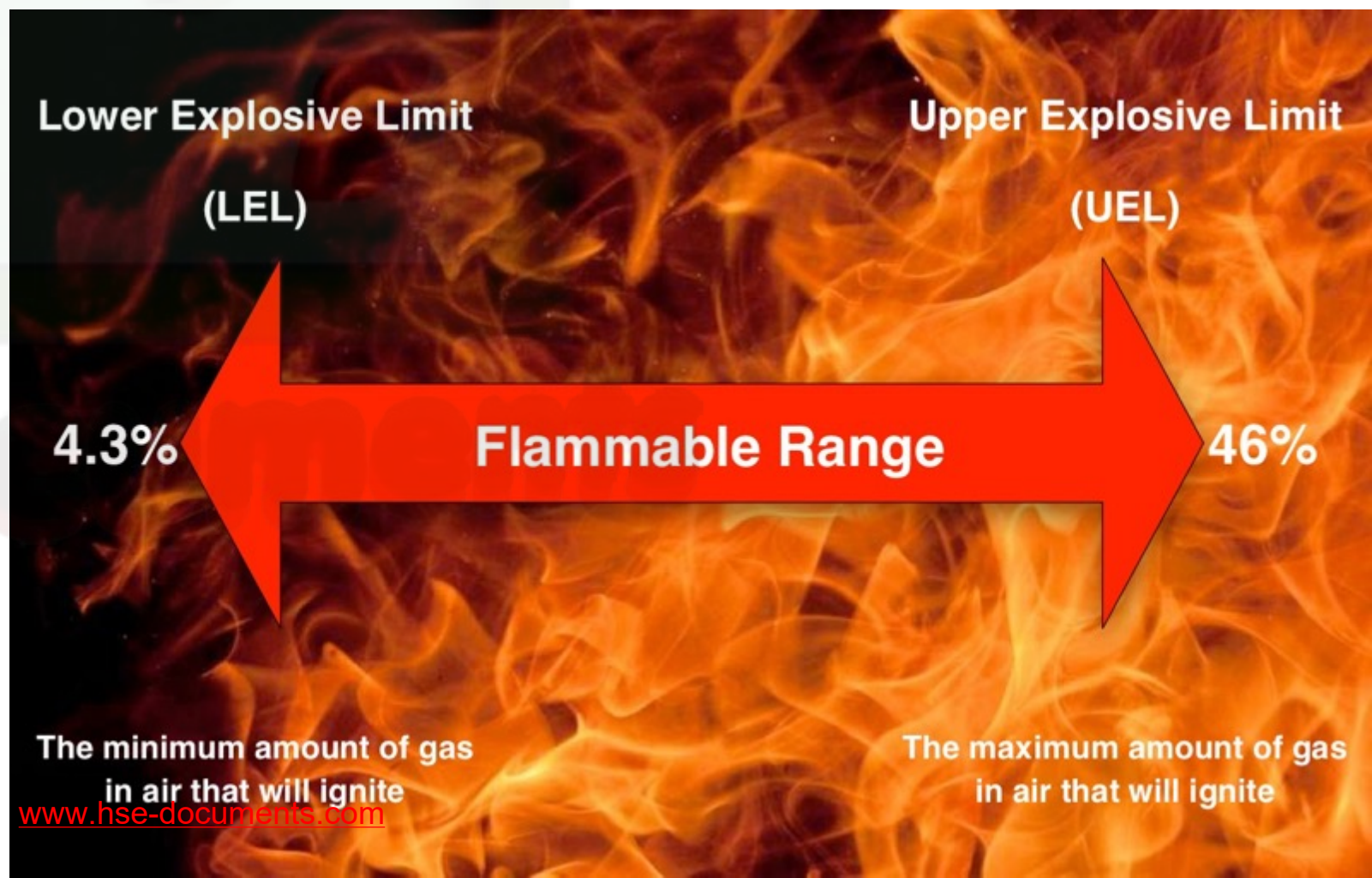
PPE (Gloves, Goggles, Full Body Protection, Boots)

CHB 155

For further information call Environmental Protection: 880-9714 (DH), or 427-0158 (JID)
 For proper disposal methods and locations for the chemical or chemical contaminated material, contact the Environmental Engineering Division, 880-9767
 NFPA Rating: 0: Minimum, 1: Low, 2: Moderate, 3: High, 4: Extreme

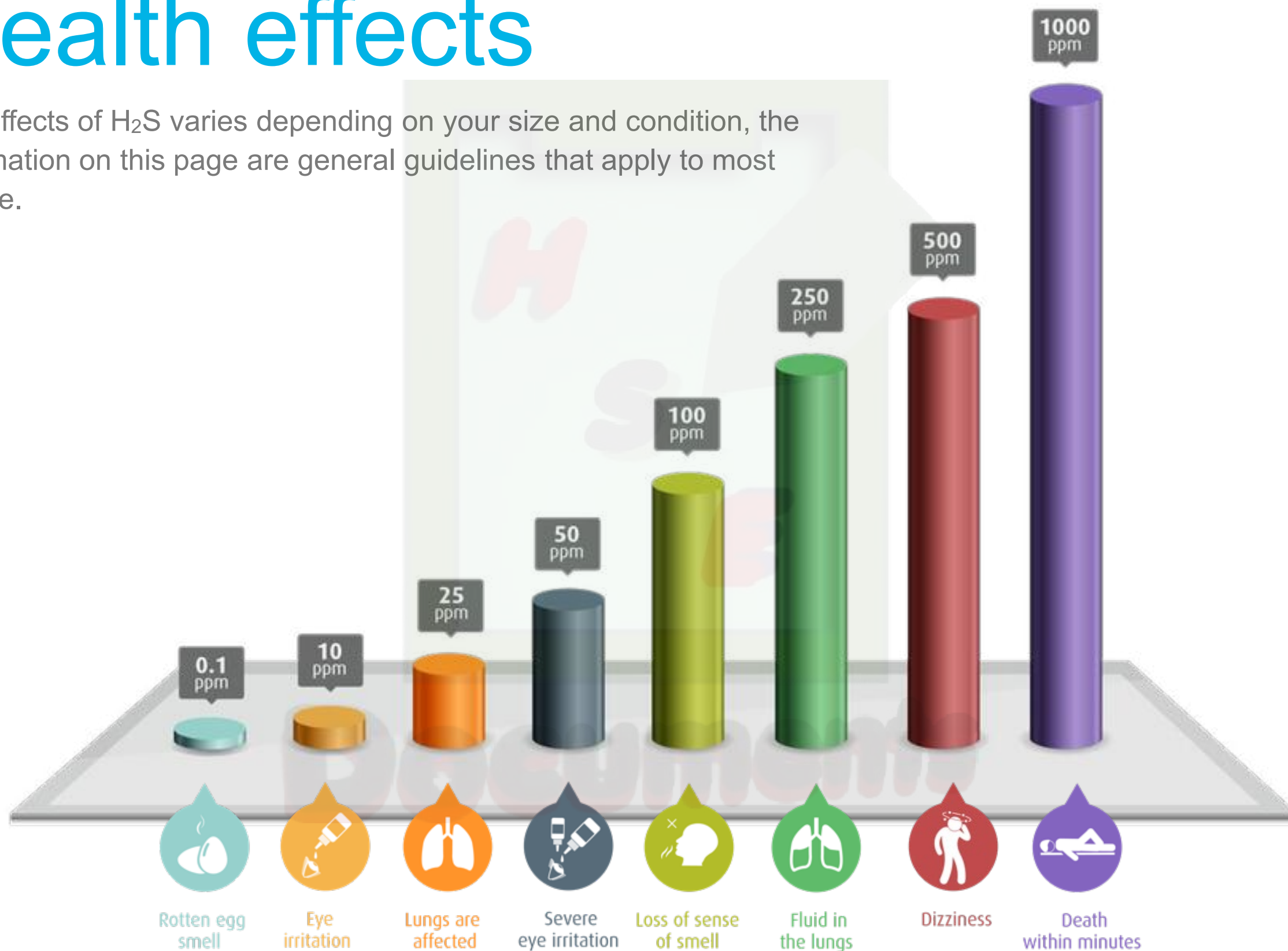
H₂S properties

- Flammable: **LEL 4.3% - UEL 46%**.
- Irritant: eyes, nose and throat.
- Reacts with strong oxidizers.
- May explode when in contact with Nitric Acid.
- Reacts with steel – produces Pyrophoric Iron Sulfide.



Health effects

The effects of H₂S varies depending on your size and condition, the information on this page are general guidelines that apply to most people.



Inhalation

Low concentration through nose and mouth:

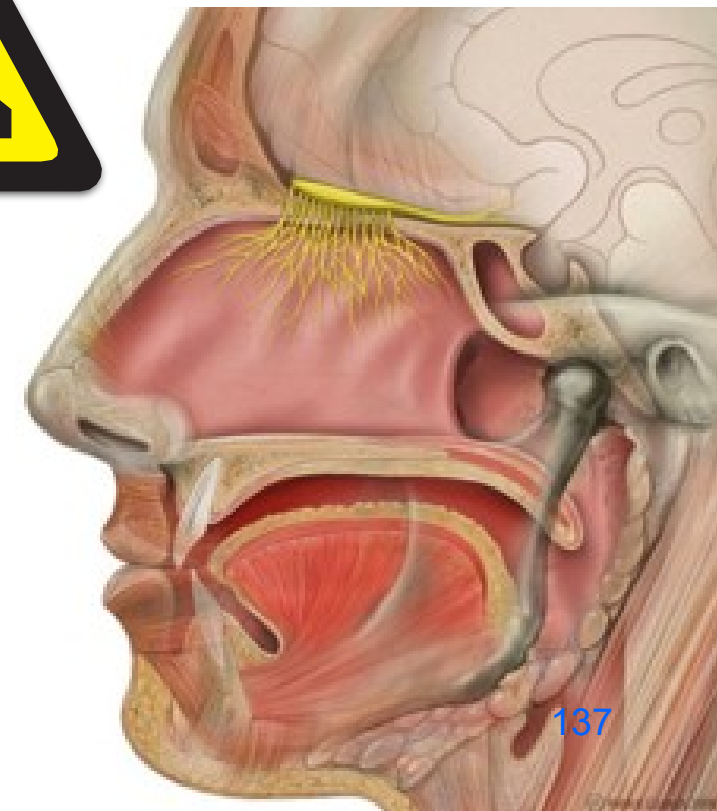
- body breaks it down over time.

High concentration through nose and mouth:

- body unable to break it down.
- paralyzes your breathing.

Low concentration **over time**:

- bronchitis
- pneumonia
- migraine headaches
- pulmonary edema
- loss of motor skills coordination.



Monitoring equipment

There are 4 main methods of detecting H₂S in the air.

Fixed detection systems, potential release locations should be equipped with continuous fixed monitoring systems where a significant leak could occur.

Continuous area monitors, transportable devices that can be used to monitor work areas, confined spaces or areas with potential leaks for an extended period of time.

Portable gas monitors, you will use portable gas monitors to check that your work area is safe.

Personal protection monitors, such as the T40 Rattler will warn you of a potential H₂S risk.



Hazardous effects

The table below lists the concentrations and company policies for H₂S.

You can see from the table below that you **must wear breathing apparatus** if the H₂S concentration reaches **10ppm**.

No work or confined space entry can be permitted if the H₂S levels reach more than **100ppm**.

Concentration	Policy
Less than 10 ppm	Permitted to enter a confined space without wearing breathing apparatus.
10 ppm but less than or equal to 100 ppm	Permitted to enter a confined space. Continuously wearing breathing apparatus. Division head approval.
More than 100 ppm	No entry permitted.

Engineering controls

Wherever possible, H₂S exposure should be minimized by introducing engineering control measures such as:

- **Ventilation.**
- **Cleaning.**



Personal Protective Equipment (PPE)

Saudi Aramco CHB 155 details the PPE that you must wear when working near H₂S.

- Breathing apparatus.
- Gloves.
- Safety glasses/goggles/full face shield.
- Coveralls.
- Safety boots or shoes.

Chemical Hazard Bulletin
CHB: 155

ارامكو السعودية
Saudi Aramco

HYDROGEN SULFIDE GAS

INGREDIENTS	CAS NO	%	8HR OEL
hydrogen sulfide	7783-06-4	>98	14 mg/m3



UN No: 1053
Hazchem Code: 2WE
DG Class: 2.3
Subsidiary Risk: 2.1
Packing Group: Not Applicable
Poisons Schedule: S7





NFPA Rating:
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PROPERTIES

Gas.
Mixes with water. Extremely flammable.

EMERGENCY

FIRST AID

Skin:	Remove contaminated clothing. Wash with soap & water. For cold burns, immerse in cold water. Wash with soap & water, apply dressing. MEDICAL ATTENTION.
Fire Fighting:	Keep containers cool. Water spray/ fog.
Spills and Disposal:	Eliminate ignition sources. Consider evacuation. Prevent from entering drains. Contain spillage by any means.

SAFE STORAGE WITH OTHER CLASSIFIED CHEMICALS

Flammable	Explosive	Toxic	Radioactive	Oxidizing
x	x	x	x	x

x — Must not be stored together

HEALTH HAZARD INFORMATION

Acute Health Effects: Very toxic by inhalation. Irritating to eyes and skin.

PRECAUTIONS FOR USE

Glasses: Consider full face-shield.

Storage and Transportation: Restrictions on Storage apply. Refer to Full Report.

Fire/Explosion Hazard: HIGHLY FLAMMABLE. Vapours/gas heavier than air. Toxic smoke/fumes in a fire. Risk of explosion if heated under confinement.

Environment: Very toxic to aquatic organisms. Avoid release to the environment. Refer to special instructions/Safety data sheets.

H₂S precautions

- Post warning signs.
- Monitor for H₂S.
- Know wind direction.
- Conduct Gas test before issuing permits.
- Work with a 'standby man'.
- Wear SCBA/SABA.
- Ventilation of work area.
- Emergency response plan & responsibilities.



Emergency arrangements

In this section of the course you will be made aware of the emergency arrangements and response required in relation to H₂S.



Emergency arrangements

The 'buddy system' is mandatory when responding to H₂S emergencies.

Use the 'buddy system' for:

- Emergency response.
- Alarm response.
- Working in Immediately Dangerous to Life or Health (IDLH) conditions.



Standby personnel

Standby personnel must constantly monitor the work area, be aware of the hazards of H₂S, and know how to summon help.

Responsibilities of standby personnel include:

- Monitoring personnel for H₂S exposure.
- Proper use of H₂S detection equipment.
- Monitoring strategy.
- Securing the work area(s).
- Monitoring wind direction.
- Notification for emergency assistance if required.



Emergency actions

There are 7 steps to take during a Hydrogen Sulfide emergency:



Evacuate Immediately:

An H₂S alarm means there may be hazardous concentrations in the building or area.

Get to a safe new area immediately by moving crosswind from the release until you know that you are in clean air by checking your personnel gas monitor.

Move to higher ground if possible.



Sound the Alarm:

Immediately notify someone that there is an H₂S release, relay any information you may have and tell them that you require assistance.

Emergency actions



Assess the Situation:

Locate the log of personnel in the area, do a head count. Consider other hazards.



Protect Rescue Personnel:

Use SCBA/SABA to protect rescue personnel. H_2S is an extremely rapidly acting, highly toxic gas.



Rescue Victims:

First ventilate the area with fans and/or open all the doors.

If safe, you may perform the rescue, but remember to wear breathing apparatus and follow the buddy system.

Enter the area and remove the victim too fresh air.

Emergency actions



Revive Victims:

Apply artificial respiration or CPR until the victim revives or until additional help arrives.

Only qualified personnel may use mechanical resuscitators or oxygen or perform CPR.



Documents

Emergency arrangements

To rescue victims, the first responder(s) should:

- Remove contaminated clothing.
- Flush eyes with water for at least 15min.
- If qualified administer oxygen.
- Wait for qualified medical help.



Review questions



Summary

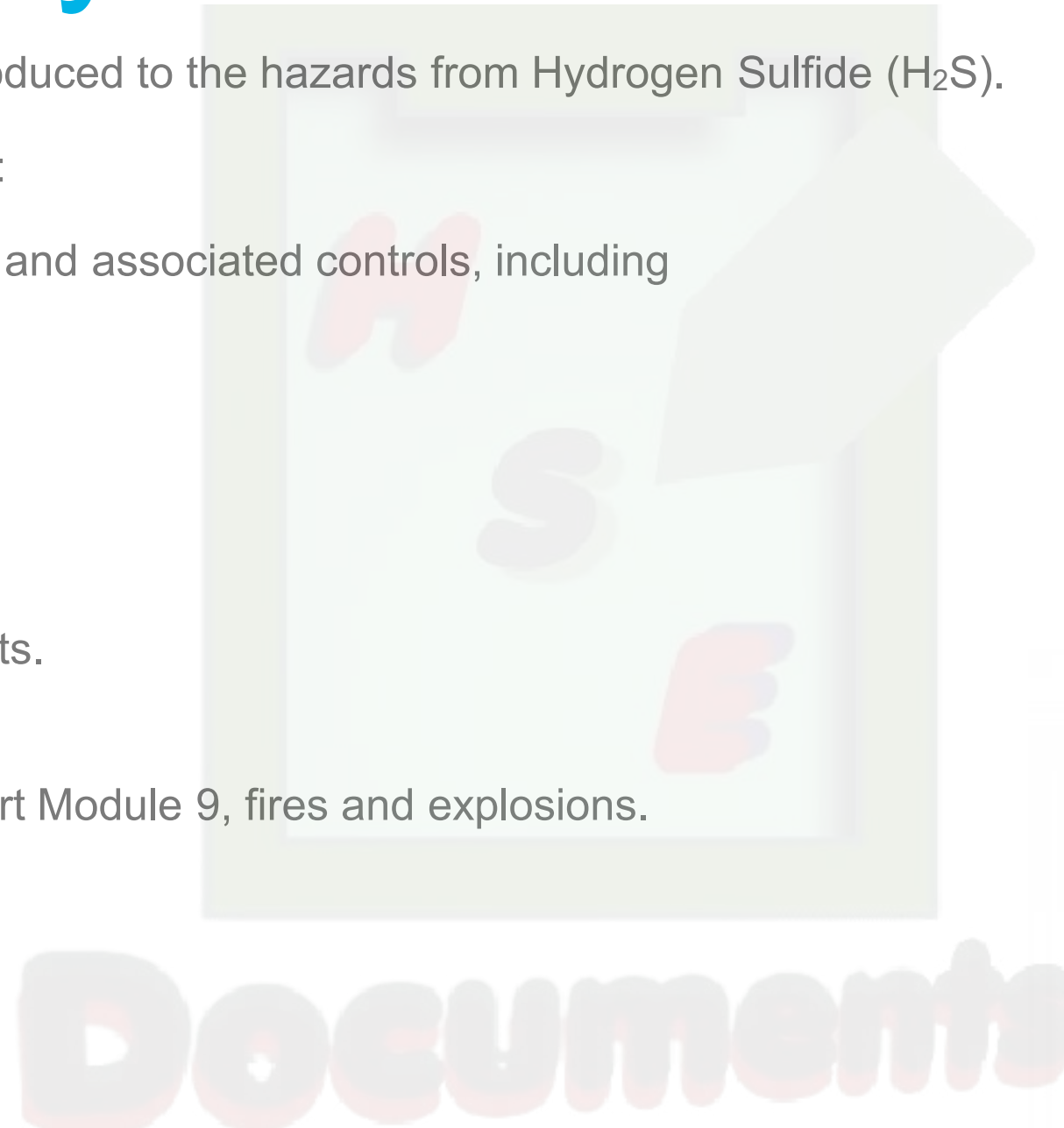
In Module 8 you were introduced to the hazards from Hydrogen Sulfide (H₂S).

You should now be able to:

List common H₂S hazards and associated controls, including

- Properties of H₂S.
- Health effects.
- Detection methods.
- H₂S Precautions.
- Emergency arrangements.

Your instructor will now start Module 9, fires and explosions.



Module 9

Fires & explosions

Enabling objectives

On completion of Module 9, you will be able to:

- List common fire and explosion hazards and associated controls.



Introduction

In this module you will learn about some of the common fire and explosion hazards you may see in your workplace and what controls are used to eliminate or minimize the risks.

Fires and explosions

In Module 9 you will learn about the following:

- Fire and explosions.
- Cutting, welding and brazing.
- Hot work permit controls.
- Fire watch.
- Electrical fires.

Fires and explosions

• Fire and explosions commonly occur due to the uncontrolled release of flammable materials (liquids and/or gasses).

Once materials are released they look for a source of ignition.

This could be nearby hot work activity (e.g. welding or cutting), a vehicle engine running or a smoker.

Hazards:

- Fire and explosion.
- Hot work.
- Liquid hydrocarbon or gas leaks.
- Sources of ignition.
- Accumulated trash.
- Smoking in non designated areas.



Fires and explosions

To prevent fires and explosions it is important to establish hot work controls.

For example, restricting vehicle access to high risk areas, establishing safe areas for smoking, keeping workplaces and storage areas tidy, and sheeting in areas (with fire resistant materials) where welding/burning/grinding activities are undertaken.

Controls:

- Hot work permit.
- Monitoring of work.
- Gas testing.
- Areas wetted.



Fires and explosions

In addition to the controls listed on the previous page, also consider the firefighting ability.

Most large fires start as small fires. Having a fire watch and extinguisher available are controls aimed at preventing fires from growing.

Controls:

- Fire barriers or shields in place.
- Good housekeeping.
- Combustible materials removed.
- Fire extinguisher(s) and equipment.



Cutting, welding and brazing

Flammable atmospheres and combustible material can be easily ignited by welding, cutting and brazing tasks.

Performing these in confined spaces also increases the risk of Carbon Monoxide (CO) exposure and/or low Oxygen levels.

Hazards:

- Fires and explosion.

Build up of:

- Flammable gas.
- Toxic vapors.
- Oxygen depleting gases or vapors.
- Extreme light, electric welding flash.
- Defective equipment.
- Unskilled operators.



Cutting, welding and brazing

Control measures for cutting, welding and brazing include:

Controls:

- Equipment inspections before use.
- Hot work permit.
- Ventilate area.
- Gas testing in confined spaces.
- Welding screens for electric welding.
- Flashback arrestors on oxy/acetylene cylinders.
- Equipment turned off or isolated at shift end.



Hot work permit controls

Hot work controls include ensuring the area is well prepared before activities begin.

In hydrocarbon facilities:

- Cover or water seal sewers within 23 m (75 ft) of all ignition sources.
- Hot work is not permitted above 0% LEL.
- Fire protection equipment shall be readily available.
- Cutting, welding or open flame, fire watch shall remain for no less than 30 minutes after work is finished.
- Combustible material shall be protected against sparks, welding slag or heat.
- Open fires and/or open burning require an authorization from Saudi Aramco Fire Protection Department.

HOT WORK PERMIT
Saudi Aramco 9873-2 (12/15) Form No. 8
Complete this form in English and write clearly. Use ink pen, not pencil.

أرامكو السعودية
saudi aramco

SECTION 1 – WORK DESCRIPTION
Month _____ Day _____ Year _____ Duration _____
A. Identify plant/facility area: _____
B. Exact work location: _____
C. Work to be done: _____
D. Equipment to be used at the site: _____

SECTION 2 – HAZARD IDENTIFICATION & CONTROL
A. Identify and attach any supplementary forms required to perform/control the work:
Job Safety Analysis ☐ Gas test records ☐ Isolation plan ☐ Blind list ☐ Critical Lift Plan ☐
Excavation Checklist ☐ Hydrotest procedure(s) ☐ Other _____ Other _____
B. Energy Types:
Hydrocarbon/gas/steam/chemicals ☐ Mechanical ☐ Electrical ☐ Hydraulic/pneumatic ☐
Potential energy (spring loaded, gravity) ☐ Automated extinguishing systems ☐ Other _____
C. Isolation Method(s):
Locked switch/breaker ☐ Mechanical block ☐ Block valve ☐ Single block & bleed ☐
Double block & bleed ☐ Blinding ☐ Disconnect ☐
D. Potential Exposures:
High noise level ☐ Hydrogen Sulfide (H₂S) ☐ Flammable liquid/gases ☐ Hazardous/toxic materials ☐
Radioactive materials ☐ Temperature ☐ High pressure ☐ Other _____
E. Protective Equipment:
Personal H₂S monitor ☐ FR ☐ ARC rated PPE ☐ Goggles/face shield ☐ Chemical suit/coveralls ☐
Fall protection ☐ Barricades/warning signs ☐ Respiratory protection ☐
(Explain further in Additional Safety Precautions below)
F. Fire Protection Methods:
Fire extinguisher ☐ Fire monitor/hose ☐ Area wetted ☐ Fire barriers/shields ☐
G. Cover/water seal all sewers within 23 m (75 ft) of the Hot Work area ☐
H. Standby Man needed ☐ Badge No. _____ Fire Watch needed ☐ Badge No. _____
I. List any Additional Safety Precautions: _____

HAZARD ANALYSIS CHECKLIST
Any "N" (NO) answers below shall initiate a "STOP" point where the Issuer and Receiver are to analyze the hazard(s) and develop methods to adequately control the hazard(s) and list the additional precautions on the permit.

	Y	N	N/A
Is the correct type of permit(s) issued for the work?	☐	☐	☐
Have the Job Safety Analysis (JSA) and other applicable supplementary forms been communicated to the work crew?	☐	☐	☐
Are weather conditions (e.g., wind speed, rain, fog, heat, lightning) acceptable to perform the work?	☐	☐	☐
Are slip and trip hazards controlled?	☐	☐	☐
Does the work crew have the correct tools/equipment for the job? Are they in good condition?	☐	☐	☐
Do personnel have the proper certifications to perform the activity and/or operate the equipment?	☐	☐	☐
Is the equipment's inspection sticker valid?	☐	☐	☐
Have all requirements for working at heights (i.e., fall protection) been applied?	☐	☐	☐
Is the scaffold tag completed correctly, signed, and with a valid inspection date?	☐	☐	☐
Has the potential for contact with sharp objects, rotating equipment, hot/sold surfaces, or live electricity been eliminated?	☐	☐	☐
Is the system/equipment properly isolated and locked out? Did all workers apply their personal locks?	☐	☐	☐
Has the system/equipment been depressurized, drained, and/or purged before opening it?	☐	☐	☐
Has the potential for releasing flammable liquids and gases been controlled?	☐	☐	☐
Are all ignition sources eliminated or controlled?	☐	☐	☐
Does the fire watch have firefighting equipment readily available and know how to use the equipment?	☐	☐	☐
Has the potential for exposure to high noise levels, H ₂ S, hydrocarbons, asbestos, hazardous chemicals, or radioactive materials been controlled?	☐	☐	☐
Is the correct personal protective equipment (PPE) available for use by personnel?	☐	☐	☐
If the work may impact others nearby, or vice versa, have the work crews discussed their activities with each other (i.e., simultaneous operations [SAOPS])?	☐	☐	☐
Is there an emergency contingency plan in place to respond to the work being performed?	☐	☐	☐
Does the work crew know what to do in the event of an emergency, such as evacuation routes, location of emergency equipment, and where assembly areas are located?	☐	☐	☐

SECTION 3 – GAS TESTING/MONITORING
Gas testing frequency: _____
Periodic monitoring required: Yes ☐ No ☐ If yes, attach a supplemental form.

ONLY CERTIFIED GAS TESTERS PERFORM GAS TESTS

	U/I (%)	H ₂ (ppm)	O ₂ (%)	CO (ppm)	Others	Badge No.	Signature

SECTION 4 – PERMIT AUTHORIZATION & CLOSURE
Additional approvals and countersignatures per GI 2.100 or local instructions:
Signature _____ Position _____ Org _____ Badge No. _____
Signature _____ Position _____ Org _____ Badge No. _____
Receiver Org: _____ Issuer Org: _____
PCMBT Badge No. _____ Cert. No. _____ Signature _____ Badge No. _____ Cert. No. _____ Signature _____
Open _____
This permit is renewed Date: _____ Time: _____ Countersignature notified of permit renewal ☐
Renewed _____
This permit is closed Date: _____ Time: _____
I HAVE INSPECTED THE WORK SITE AND CONFIRM THAT IT HAS BEEN RETURNED TO A SAFE CONDITION.
Closed _____

Signatures:
Issuer or Designated Representative _____
Receiver _____

Fire watch

A fire watch can be an Saudi Aramco employee, SMP or a Contractor employee.

He must be designated on the hot work permit form by the Work Permit issuer.

The fire watch must understand the following:

- Hazards from hot work.
- Precautions to prevent fires.
- Procedures for raising the alarm.
- Monitors hot work activities.
- Ensures fire equipment readily available.
- Trained in using fire equipment.



Electrical arc flash fires

Many arc flash incidents across the company have resulted in serious consequences, including injuries (and in some cases death) resulting from electric shock, exposure to arc flash and arc blast, and excessive light and sound energies.

Hazards:

- Fires.
- Electric shock.

Exposure to:

- Arc-flash.
- Arc-blast.
- Extreme light and sound energy.



Electrical arc flash fires

Where ever practicable, do not work on electrical systems while still live. Where live electrical work is required, GI 2.721 details specific requirements, such as approach boundaries and specific PPE.

GI 2.721 Electrical Arc Flash Hazards Mitigation gives clear instructions on the controls required to prevent this type of incident.

Controls:

- Hot work permit.
- LOTO.
- Ground fault circuit interrupter.
- Approach boundaries for live work.
- Qualified individuals wearing PPE to work on electrical equipment.
- Certified electrical equipment.



Electrical fire hazards

Common electrical fire hazards, including electrical system short circuits, can generate enough heat or sparks to ignite nearby combustible materials.

Below is a list common electrical fire hazards.

Hazards:

- Damaged power cords.
- Overloaded extension cords.
- Unsafe space heaters.
- Accumulated trash.
- Poor storage and housekeeping.



Electrical fire hazards

Controls:

- Regular inspections.
- UL listed equipment.
- Good housekeeping.
- Use of GFCI.
- Fire extinguisher(s).
- Qualified personnel for maintenance.



Review questions



Summary

In Module 9 you were introduced to fires and explosion hazards.

You should now be able to:

List common workplace fire and explosion hazards and associated controls, including

- Fire and explosions.
- Cutting, welding and brazing.
- Hot work permit controls.
- Fire watch.
- Electrical fires.

Your instructor will now start Module 10, emergency preparation.



Module 10

Emergency preparations

Enabling objectives

On completion of Module 10, you will be able to:

- List common emergency preparation hazards and associated controls.



Introduction

In this module you will learn about some of the common emergency preparation hazards you may see in your workplace and what controls are used to eliminate or minimize the risks.



Emergency preparedness

In Module 10 you will learn about the following:

- Orientations.
- Response plans.
- Reporting and responding to an emergency.



Orientations

Orientations inform you of the site specific hazards, controls, response plans, local area operations and the actions you will be expected to take during an emergency.

Hazards:

Employees unaware of:

- High risk work areas.
- Local alarm sounds.
- Correct actions on hearing alarms.
- Muster point locations.

Your work may be affected by the work of others.

- Equipment Opening and Line Break permits.
- Hot work.



Orientations

The orientation may also include the coordination of work activities.

For example, where to get your work permits, notification and authorization requirements for work and accessing restricted areas, and the coordination of different work activities (simultaneous operations).

Controls:

- Orientations for the site and work areas.
- Awareness of local alarm sounds.
- Awareness of response actions required.
- Your attendance in the area is identified and logged (e.g. visitor log).
- Surrounding jobs that may effect your work have been communicated to you (SIMOPS).



Response plans

An incorrect or delayed response to a real emergency can result in incident escalation and/or increased damages or casualties.

You should know what is expected of you, whether you are a responder or simply a visitor. The plan should state what you are expected to do in an emergency.

Hazards:

- Lack of planning.

Generic plans that are not specific to:

- The work or job performed.
- The exact work site.

Workers do not:

- Understand their role and responsibilities.

Workers not:

- Trained in response plan actions.



Response plans

If you have a specific role within an Emergency Response Plan (ERP), you must know that role and complete it safely.

Controls:

Written emergency response and rescue plans for:

- All high risk work and jobs.
- Confined space work, such as inert entry.

Workers are aware of:

- Roles and responsibilities.
- Rescuers trained to carry out the plan.

Contractor plans must fit with existing site rescue plans.



- What is an emergency.
- How to report an emergency.
- Actions to take.
- Evacuation or muster location.
- No ability to report emergencies.

Documents



Reporting and responding to an emergency

Controls:

Know how to report an emergency.

- Dial **911**.
- Radio call.

Training on:

- What to do in an emergency.
- Response actions required.
- Alternative muster points.



911

مركز الطوارئ
Emergency Center

Document



Reporting an emergency

The table below lists the seven steps on how to report an emergency.

How to report an emergency
1. say “this is an emergency”.
2. describe the incident location.
3. describe the incident
4. report injuries, if any.
5. give your name and badge number.
6. repeat the above information.
7. stay on the line until further instructed.

Summary

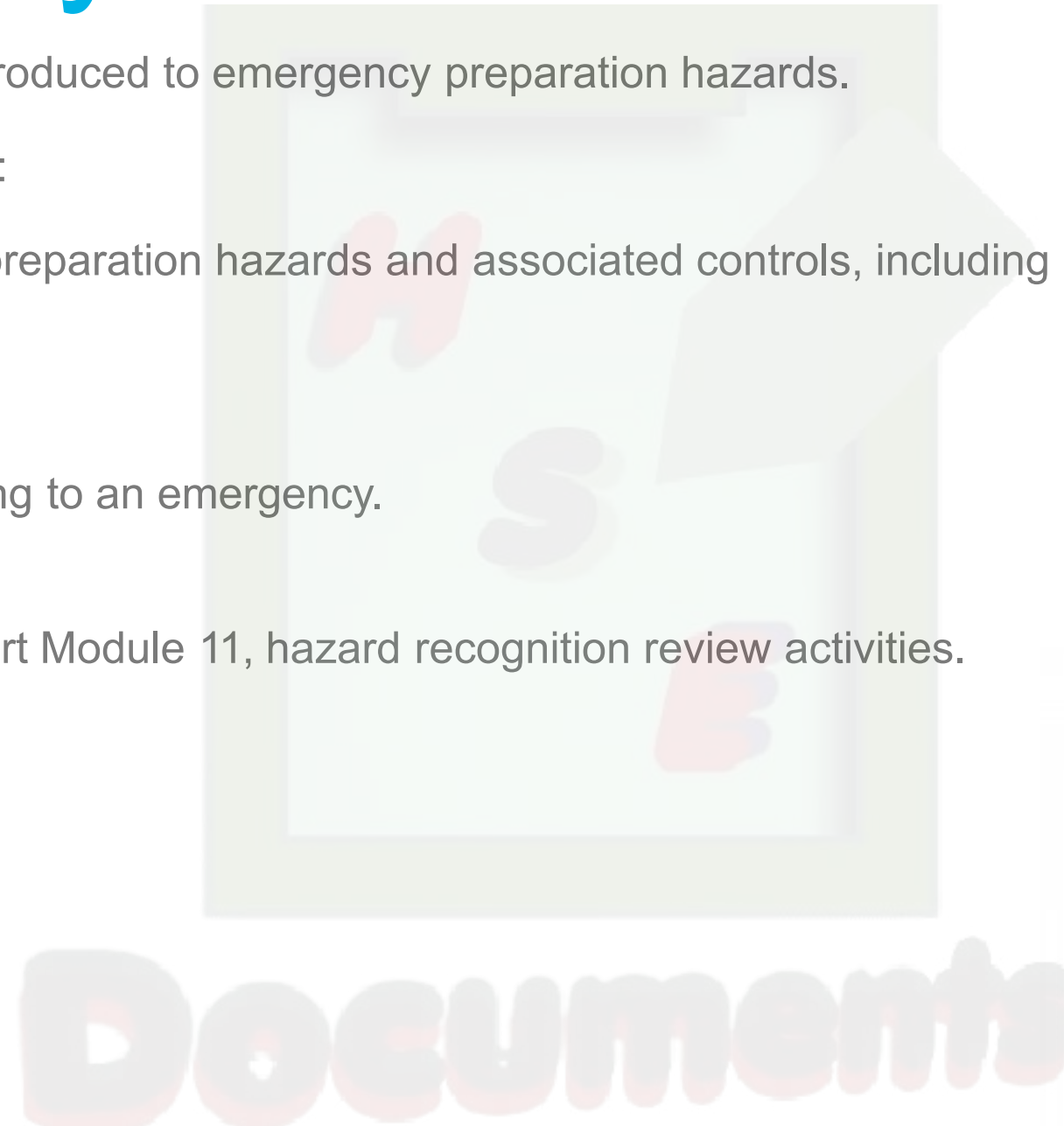
In Module 10 you were introduced to emergency preparation hazards.

You should now be able to:

List common emergency preparation hazards and associated controls, including

- Orientations.
- Response plans.
- Reporting and responding to an emergency.

Your instructor will now start Module 11, hazard recognition review activities.



Module 11

Review activities

Enabling objectives

On completion of Module 11, you will be able to:

- Identify common workplace hazards and controls by completing the hazard recognition activities.



Introduction

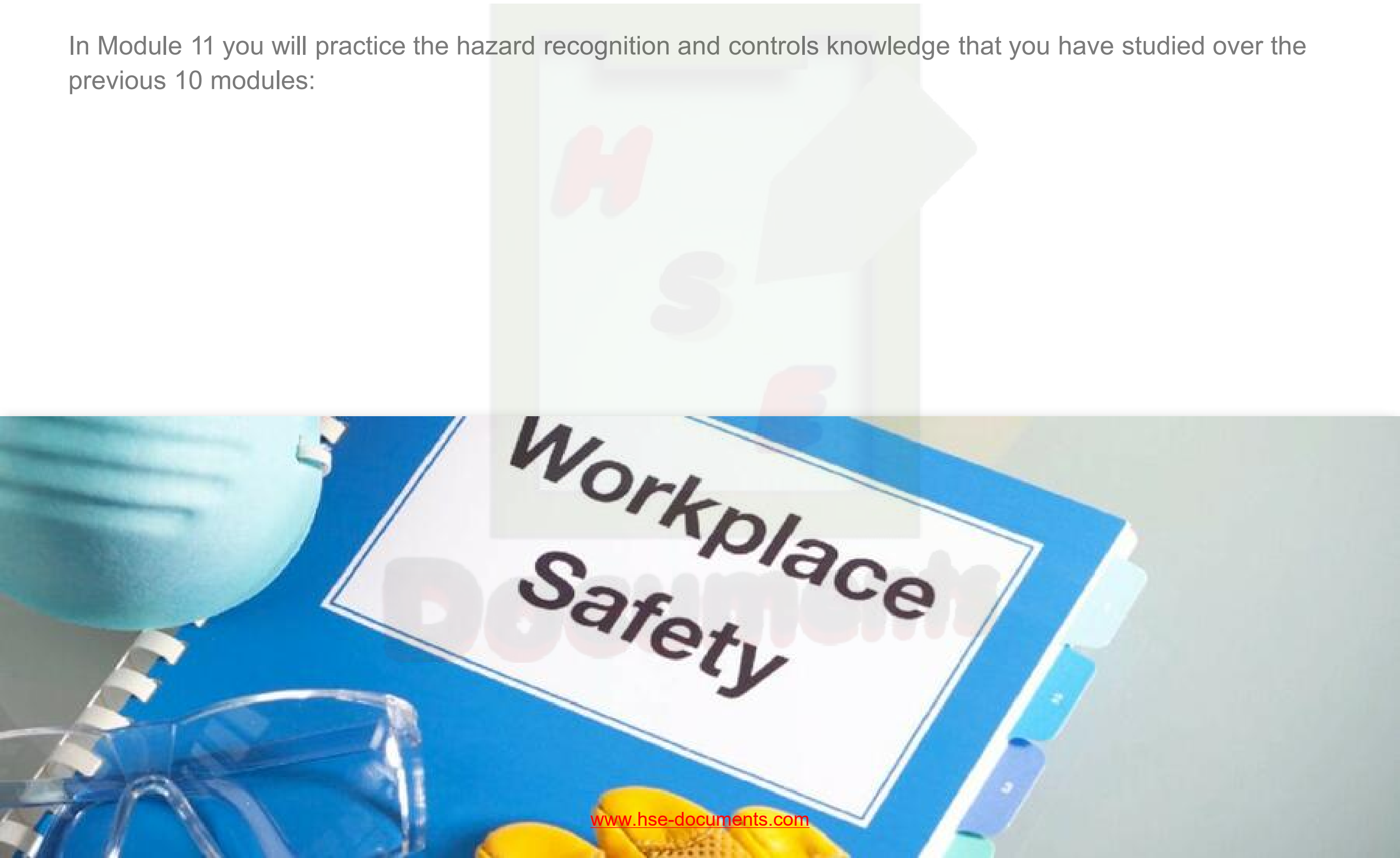
In this module you will complete the hazard recognition activities.

Using the information that you have learned during this course you will identify the hazards and control measures required to eliminate or minimize the risks.



Hazard recognition activities

In Module 11 you will practice the hazard recognition and controls knowledge that you have studied over the previous 10 modules:



Hazard recognition activities

Look at the following images, identify any common hazards that you can see and think about suitable control measures that may be required to minimize or eliminate the risks.

But first a reminder of safety hazards and health hazards.

Safety hazards	Examples	Health hazards	Examples
Electrical	power lines, transformers, static charge, lightning, energized equipment, wiring and batteries.	Biological	animals, bacteria, viruses, insects, blood borne pathogens, improperly handled food, contaminated water.
Gravity	crane lifting operations, excavations, falling objects, collapsing roof, a body tripping or falling.	Chemical	dust, fumes, gases, mists, vapors, liquids, hydrocarbons, solvents, lead.
Mechanical	rotating shafts, belts, pulleys, saw blades.	Radiation	lighting issues, welding arcs, solar rays, microwaves, lasers, x-rays, NORM scale
Motion	vehicles, marine vessels, equipment movement, flowing water, wind, body positioning when lifting, straining or bending.	Noise and vibration	equipment noise, impact noise, vibration, high pressure release, impact of noise on communication.
Pressure	pressure piping, compressed cylinders, control lines, vessels, tanks, hoses, pneumatic and hydraulic equipment.	Temperature	open flame, sparks, hot or cold surfaces, liquids, gases, steam, friction, general environmental and weather conditions.

Image 1



Image 1

Motion: repetitive movement of arms while using the cutting torch and grinder. Strain from using heavy tools.

Mechanical: mechanical energy from spinning disc on grinder.

Pressure: pressure contained within the two gas cylinders and hoses.

Electrical: electrical energy hazards from the electric grinder and the control box for the winch supporting the pipe.

Gravity: gravity acting on the pipe, if the supports fail the pipe will fall.

Gravity hazard to the worker falling off the edge of the raised working platform.



Image 2



Image 2

Biological: biological hazard from bacteria in the open water.

Temperature: worker in an open location, heat or cold hazards depending on specific location.

Radiation: from the welding arc (UV light), potential for UV burns to skin and eyes.

Chemical: toxic fumes from the welding.

Noise/sound: high levels of noise (above 85db) from the pile driver/hammer.



Image 3



Image 3

Pressure: hazards from the high pressure hydraulic system and operating rams on the back-ho arm/bucket

Motion: movement of the back-ho arm and bucket close to workers.

worker walking/standing on the top of an unsecured pipe.

Gravity: risk of excavation collapse from gravity pulling on the unsupported sand/soil sidewalls.



Image 4



Image 4

Motion: movement and operation of the truck lifting arm.

Electrical: high voltage overhead power lines.



Summary

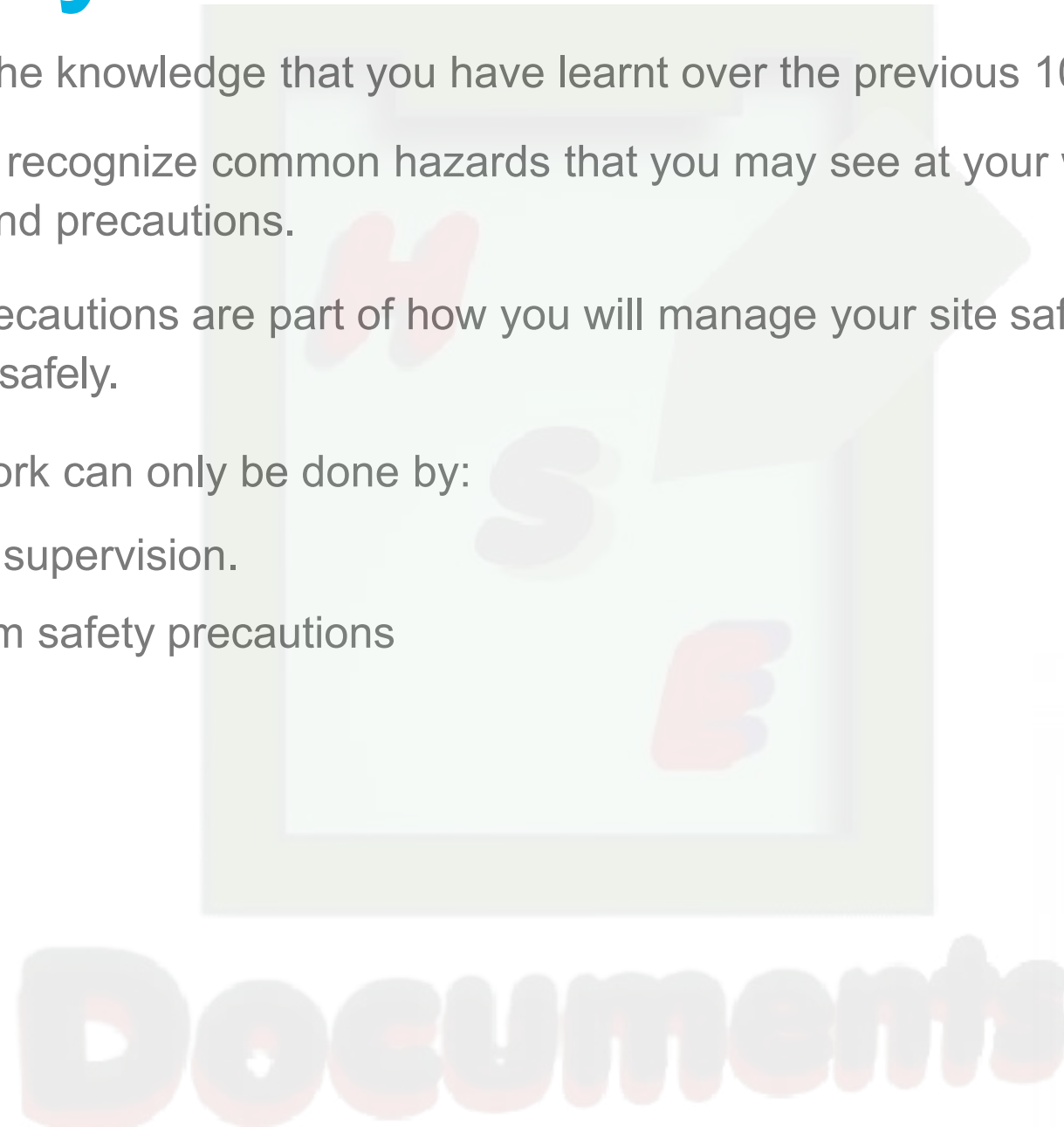
In Module 11 you applied the knowledge that you have learnt over the previous 10 modules.

You should now be able to recognize common hazards that you may see at your workplace and describe their associated controls and precautions.

Identifying hazards and precautions are part of how you will manage your site safety risks so that you and your co-workers can work safely.

Safe completion of your work can only be done by:

- Proper preparation and supervision.
- Agreeing to the minimum safety precautions





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