

Long Harbour: Fire Safety and Fire Extinguisher Use

1. Fire Safety and Fire Extinguisher Use

1.1 Fire Safety and Fire Extinguisher Use



Fire Safety and Fire Extinguisher Use

Long Harbour Operations

1.2 Abstract

Course Completion Instructions

Introduction

This Course is a combination of two components:

- this Module and,
- a Final Quiz.

Upon completion the module component, you will be prompted to select and complete all of the questions in the Final Quiz section.



1.3 Overview

Agenda

Introduction to Fire Safety and Fire Extinguisher Use

- ✓ Fire Classes
- ✓ Fire Prevention
- ✓ Fire Extinguishers
- ✓ Fire Response
- ✓ Summary

2. Introduction

2.1 Fire Safety and Fire Extinguisher Use



Introduction Fire Safety and Fire Extinguisher Use

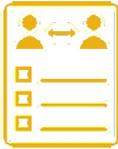
2.2 Introduction

Fire Safety and Fire Extinguisher Use

Introduction

Upon completion of this training module, you will be able to;

- Explain how fire starts and how it spreads.
- Identify and discuss the fire extinguisher types, and operating procedures.
- Identify the risks of fire, and the steps that can be taken to mitigate the risk of a fire occurring.
- Discuss safe response to a fire.



2.3 Fire Science...

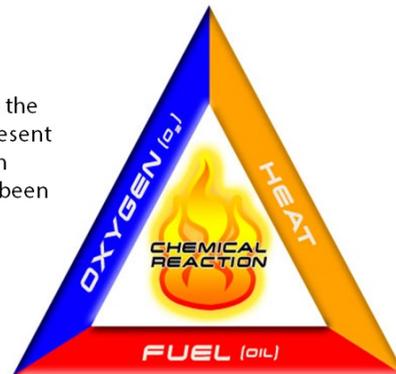
Fire Safety and Fire Extinguisher Use

Fire Science...

Before you can understand how a fire is extinguished, you first need to understand the theory of fire.

Fire science previously used the Fire Triangle Pyramid to represent the three elements, fuel, heat, and an oxidizing agent that must be present for the combustion process to occur, but now a fourth element, an uninhibited chemical chain reaction between those elements has been added to form the Fire Tetrahedron.

Fire extinguishers can remove one or more of the elements that sustain a fire... breaking the resulting chemical reaction will suppress or at best, stop the fire. If you're not sure, ask!



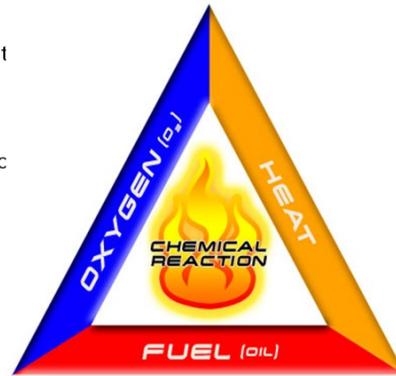
2.4 Chemistry of Fire

Fire Safety and Fire Extinguisher Use

Chemistry of Fire

Fire is a re-dox which is, a chemical process of combustion involving rapid oxidization of a fuel source at an elevated temperature accompanied by the release of energy and the production of heat and light and gaseous by-products.

As an energy release mechanism, it is the exothermic reaction involving oxidization that produces heat.



2.5 Chemistry of Fire

Fire Safety and Fire Extinguisher Use

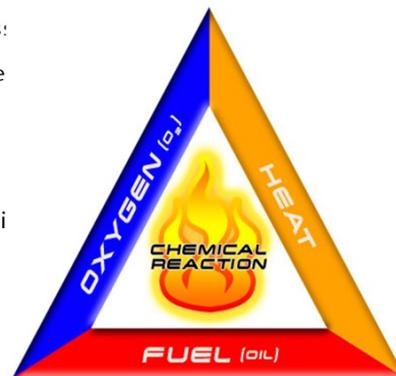
Chemistry of Fire

Oxidation and reduction always occur in tandem in a redox process:

If one substance gains oxygen (oxidation), then another substance also must be present to lose oxygen (reduction).

The first substance is the reduction agent (oxidized) and the second substance is the oxidizing agent (oxidizer).

Reducing agents *remove oxygen* from another substance, and oxidizing agents *give oxygen* to another substance.



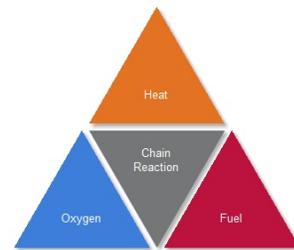
2.6 Chemistry of Fire

Fire Safety and Fire Extinguisher Use

Chemistry of Fire

The Combustion Process begins when a fuel source is heated beyond its ignition temperature, in the presence of an oxidant, this molecular energy creates a self-sustaining chemical chain reaction of **free-radicals**.

Continued burning will result as the energy it produces is greater than or equal to the energy needed to sustain the reaction.



2.7 Fuel

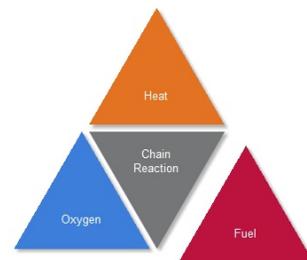
Fire Safety and Fire Extinguisher Use

Four Elements

Fuel is any substance that can undergo combustion. It exists in 3 states of matter — solid, liquid or gases.

Solids and liquids do not burn, instead, combustion occurs in a region of vapors above the surface of the fuel that is created by heating the solid or liquid above its ignition temperature in a process known as pyrolysis.

It is the escaping vapours that burn. Unlike solid or liquids, gases do not require pyrolysis before combustion can occur.



2.8 Oxygen

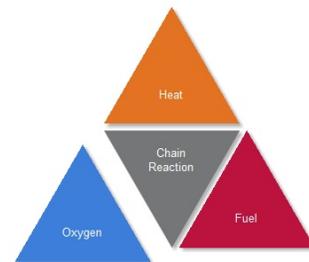
Fire Safety and Fire Extinguisher Use

Four Elements

Oxygen is the most common oxidizing agent, oxygen supports combustion but does not burn.

Normal air contains 21% oxygen; and the higher the concentration of oxygen in the air, the more intensely a fire will burn.

However, a fire can burn without presence of oxygen if another oxidizing agent is present, for example, nitrates, peroxides, iodine, chlorine, etc.



2.9 Heat

Fire Safety and Fire Extinguisher Use

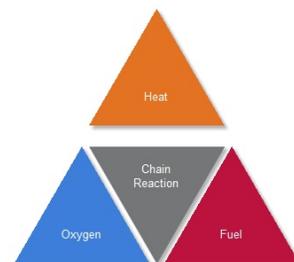
Four Elements

Heat is produced by exothermic reaction, heat transfers from an area of higher temperature by 3 principal means: conduction, convection and radiation.

Conduction is the transfer of heat between substances that are in direct contact with each other.



Flame heats the metal rod, metal rod conducts the heat to the end of the rod.



2.10 Heat

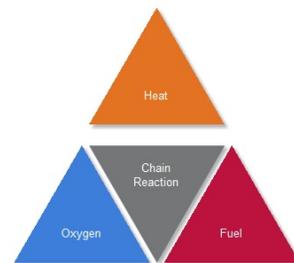
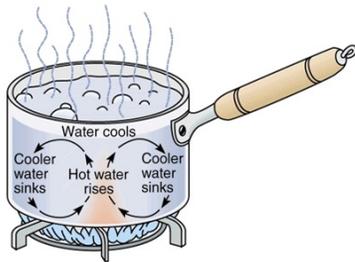
Fire Safety and Fire Extinguisher Use

Four Elements

Convection only occurs in liquids and gases. Liquid and gas expand and become less dense as they are heated.

An example of convection is a boiling pot of water, as the water starts to heat from the bottom by conduction through the pot, it transfers the heat into the liquid.

The liquid then starts to rise up as an expanding liquid and the hot liquid is replaced by the cooler liquid, with the resultant convection current occurring until a uniform temperature is attained.

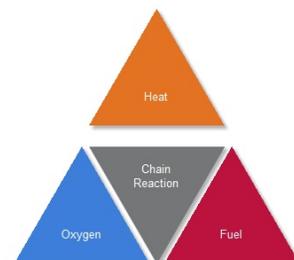
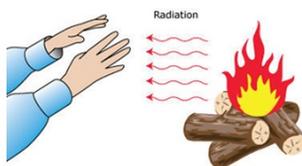


2.11 Heat

Fire Safety and Fire Extinguisher Use

Four Elements

Radiation is the transfer of the heat energy through electromagnetic radiation in the infrared part of the spectrum, between substances that are not in direct contact with each other.



3. Fire Classes

3.1 Fire Classes

✔ Fire Classes

3.2 Introduction

Fire Classes

Introduction

Most fires fit into one or a combination of the following classifications, however, not all fires are the same.

Different fuels create different fires and require different types of fire extinguishing agents.

So... Fires are classified by common fuels.

There are 3 classes of common fires.

Some types of fire extinguishing agents can be used on more than one class of fire.

Others have warnings where it would be dangerous for the operator to use a particular fire extinguishing agent.



3.3 Class A

Fire Classes

Class A

Most fires fit into one or a combination of the following classifications, however, not all fires are the same.

Class A fires involve ordinary combustibles, such as, wood, paper, cloth, rubber and many plastics.

These fires are most common and have the ability to spread to other similar materials.



3.4 Class B

Fire Classes

Class B

Most fires fit into one or a combination of the following classifications, however, not all fires are the same.

Class B fires involve flammable or combustible liquids, such as, gasoline, oil, grease, tar, paints, lacquer and flammable gases.

Burning liquids can flow rapidly and cause a fire to spread. The burning liquid will float on water and spread the fire further.

Water will not usually extinguish this type of fire.



3.5 Class C

Fire Classes

Class C

Most fires fit into one or a combination of the following classifications, however, not all fires are the same.

Class C fires involve energized electrical equipment, such as, wiring, fuse panels, circuit breakers, motors, transformers and appliances.

Always de-energize the circuit then use a non-conductive extinguishing agent.

Never attempt to extinguish a Class C fire with water, Always use a non-conductive extinguishing agent, such as Carbon dioxide.

When the circuit is de-energized, the Class C fire then becomes one of the other classes of fire.



3.6 Class D

Fire Classes

Class D

Most fires fit into one or a combination of the following classifications, however, not all fires are the same.

Class D fires involve combustible metals. Special chemicals are required to extinguish these types of fires.

Burning metals, called pyrophoric metals, such as, magnesium, sodium, aluminum, and zinc dust are the most difficult to put out.

These materials can react violently if they come in contact with ordinary extinguishing agents.

Once a metal ignites do not use water in an attempt to extinguish it. Only use a Dry Powder extinguishing agent. Dry powder agents work by smothering and heat absorption.



3.7 Class K

Fire Classes

Class K

Most fires fit into one or a combination of the following classifications, however, not all fires are the same.

Class K fires are fires in cooking oils and greases such as animal fats and vegetable fats.

These type of extinguishers will mostly be located in restaurants and areas with deep fryers.



4. Fire Prevention

4.1 Fire Prevention

 Fire Prevention

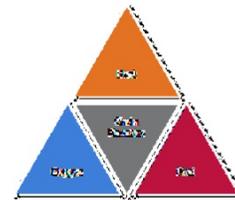
4.2 Fire Safety...

Fire Prevention

Fire Safety...

The *first step* in reducing the risk of fire-related incidents occurring in the workplace, is to be aware of the leading causes of fire...the *second step* is fire prevention.

If you remove the sources that cause fires, then you eliminate one of the elements needed to start a fire.



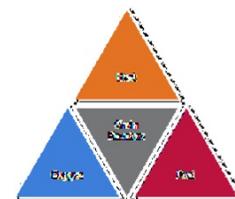
4.3 Fire Safety...

Fire Prevention

Fire Safety...

Always be aware of your surroundings...

- Clean up oil and chemical spills immediately, and keep work areas free of any extra paper, boxes or rags.
- Don't string electrical cords across floors or walkways where they can be stepped on and frayed, opening your facility up to the possibility of an electrical fire.
- De-energize machinery before any maintenance work is started and thoroughly inspect that equipment before the power is turned back on.
- Keep tools which cause friction or sparks away from areas where explosive and flammable materials are present.



4.4 Class A - Ordinary Combustibles

Fire Prevention

Class A – Ordinary Combustibles

To reduce the risk of fires caused by Class A Hazards, Always:

- Keep storage and working areas free of trash and unnecessary clutter.
- Place oily rags in covered containers. Make sure the lid is replaced securely.
- Keep combustibles and fibrous materials such as wood, paper or cloth well away from a source that could cause them to ignite.



4.5 Class B - Flammable Liquids or Gases

Fire Prevention

Class B – Flammable Liquids or Gases

To reduce the risk of fires caused by Class B Hazards, Always:

- Use flammable liquids only in well-ventilated areas.
- Keep flammables away from any spark-producing source.
- Store flammables in tightly-sealed, self-closing, spill-proof containers. Pour only what you need from storage containers.
- Never refuel gasoline-powered equipment while it is still hot.



4.6 Class C - Energized Electrical Equipment

Fire Prevention

Class C – Energized Electrical Equipment

To reduce the risk of fires caused by Class C Hazards, Always:

- Check wiring and electrical fittings for wear or damage. Report any hazardous conditions to your supervisor.
- Investigate any unusual odors coming from an electrical device.
- Prevent electrical equipment from overheating by keeping it clean and in good working condition.
- Keep areas around electrical outlets or other spark-producing devices free of combustible materials such as paper, cloth or dust.



4.7 Class C - Energized Electrical Equipment

Fire Prevention

Class C – Energized Electrical Equipment

To reduce the risk of fires caused by Class C Hazards, Always:

- Make sure utility lights have a guard over the bulbs to prevent them from coming into direct contact with combustible materials.

Never:

- Install a higher-rated fuse than is specified for a circuit.
- Overload electrical outlets.



4.8 Class D - Combustible Metals

Fire Prevention

Class D – Combustible Metals

To reduce the risk of fires caused by Class D Hazards, Always:

- Handle all combustible metals, such as magnesium, potassium, titanium and sodium, in accordance with recommended safety procedures and the specific guidelines provided in the manufacturer's SDS.

Be aware that; No work on combustible metals is permitted onsite without an authorized permit, and Class D fires require a Class D extinguisher.



4.9 Class K - Commercial Cooking Oils and Fats

Fire Prevention

Class K – Commercial Cooking Oils and Fats

To reduce the risk of fires caused by Class K Hazards, Always:

- Ensure there is adequate ventilation.
- Ensure appropriate material that will prevent grease saturation is in place.

Frequency of cleaning will depend upon the frequency and type of cooking is being conducted; however a minimum of once a week is recommended.



5. Fire Extinguishers

5.1 Fire Extinguishers

✔ Fire Extinguishers

5.2 Introduction

Fire Extinguishers

Introduction

Different types of fire extinguishers are designed to fight different classes of fires.

The three most common types of fire extinguishers are:



5.3 Pressurized Water

Fire Extinguishers

Pressurized Water

This type of fire extinguisher is not used at Vale sites, however you have all seen them particularly in assembly areas such as schools.

Water extinguishers, extinguish fires by cooling burning material below the ignition point and are designed for use on Class A hazards only, such as wood, cloth, trash, and other materials that leave an ash.

They are often found in office environments and industrial locations, as well as warehouse and oxidizing chemical storage areas.

Never use water on a fire unless you know what is burning. Water conducts electricity which could spread the problem, and cause more shorting in the equipment.

Water will also carry burning oil, gas, and other petroleum products into new areas to ignite.

Pressurized water extinguishers have pressure gauges to allow visual capacity check, the maximum effective range is 30 to 40 feet and can be started and stopped as necessary.



5.4 Carbon Dioxide (CO₂)

Fire Extinguishers

Carbon Dioxide (CO₂)

Carbon dioxide extinguishers provide the power to respond quickly and effectively and are designed to protect against Class B, (flammable liquids and gases) and, Class C (energized electrical equipment) fires.

These extinguishers release a cloud of carbon dioxide to displace air and cut off the fire's oxygen supply, they have a short discharge range of 3 to 8 feet and are best used in brief spurts.

The effectiveness of this type will decrease as the temperature of the fire increases.

CO₂ disperses quickly; for example, a 10 pound extinguisher will empty in 5 to 10 seconds, it is important to continue applying until the fire is completely out.

Be aware that upon release, the contents are extremely cold and may cause freeze burns. Hold properly and keep hands away from the nozzle.



5.5 Multi-Purpose Dry Chemical

Fire Extinguishers

Multi-Purpose Dry Chemical

This fire extinguisher is the most common type found at Vale sites, multi-purpose dry chemical extinguishers are designed for protection of light and ordinary hazards.

These compact and portable extinguishers are best suited for use on common combustibles, solvents and electrical equipment.

This type extinguishes by smothering burning materials by releasing a stream of mono-ammonium phosphate.

A 2.5 to 20 lb. extinguisher has an 8 to 25 second discharge time, with a 5 to 20 foot maximum effectiveness range.



5.6 Special Types

Fire Extinguishers

Special Types

In response to the ban on Halon, the fire suppression industry has responded with the development of alternative clean agents that pose less of a threat to the ozone layer.

Two classes of agents have emerged as suitable replacements: halocarbon-based agents and inert gas agents. The halocarbon-based agents are carbon-based compounds and extinguish fire primarily via the absorption of heat.

Inert gas agents are based on the inert gases (i.e., nitrogen, argon, carbon dioxide) and extinguish fire via oxygen depletion.

Rated for Class A, B, and C fires, the extinguisher agent leaves no residue, requires no cleanup after discharge, and will not cause collateral damage to materials, equipment, and facilities.



5.7 Special Types

Fire Extinguishers

Special Types

This type of fire extinguisher is not used at Vale sites, however the Type K extinguisher is designed specifically to fight some of the toughest fires — hot grease, cooking oil and fat fires in kitchen areas.

Type K extinguishers can be used on Class A fires.



5.8 Wheeled Fire Extinguisher

Fire Extinguishers

Wheeled Fire Extinguisher

Wheeled extinguishers are designed for high-risk fire hazards, large diameter steel wheels allow the unit to be quickly and more easily moved to fight fires at their source and in the toughest environments.

The Ansul Red Line Model (CR-I-AR-33-D Foam Fire Extinguisher) is a foam and water solution that works on both hydrocarbon and polar solvent type fuel fires.

The RED LINE wheeled foam extinguishers are designed for high-risk fire hazards. These industrial wheeled fire extinguishers have greater agent capacities than hand portable fire extinguishers, yet are highly mobile and can be fully operated by one person.



5.9 Fire Extinguisher Pressure

Fire Extinguishers

Fire Extinguisher Pressure

There are two main types of fire extinguishers: stored pressure and cartridge-operated.

In stored pressure units, the expellant is stored in the same chamber as the firefighting agent itself.

Depending on the agent used, different propellants are used. With dry chemical extinguishers, nitrogen is typically used; water and foam extinguishers typically use air. *Stored pressure fire extinguishers* are the most common type.



5.10 Fire Extinguisher Pressure

Fire Extinguishers

Fire Extinguisher Pressure

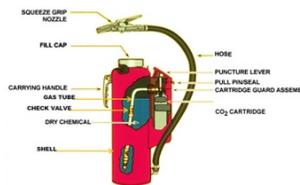
Cartridge-operated extinguishers contain the expellant gas in a separate cartridge that is punctured prior to discharge, exposing the propellant to the extinguishing agent.

This type is not as common, used primarily in areas such as industrial facilities, where they receive higher-than-average use.

They have the advantage of simple and prompt recharge, allowing an operator to discharge the extinguisher, recharge it, and return to the fire in a reasonable amount of time.

Unlike stored pressure types, these extinguishers use compressed carbon dioxide instead of nitrogen, although nitrogen cartridges are used on low temperature (-60 rated) models.

Cartridge operated extinguishers are available in dry chemical and dry powder types in the U.S. and in water, wetting agent, foam, dry chemical (classes ABC and B.C.), and dry powder (class D) types in the rest of the world.



5.11 Fire Extinguisher Sizing

Fire Extinguishers

Fire Extinguisher Sizing

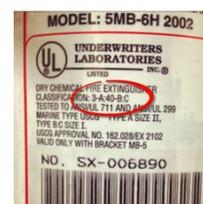
Extinguishers are labeled with numbers which identifies the extinguisher's fire-fighting effectiveness. The larger the number, the larger the fire the extinguisher can be expected to extinguish.

Class A Extinguishers are labeled with a number from 1 to 40, while, Class B Extinguishers are labeled with a number from 1 to 640.

There is no numeric designation for an extinguisher's effectiveness in fighting Class C, D, or K fires. The letters C, D, or K tell you only that the unit has been rated to combat energized electrical equipment, combustible metals, or cooking oil fires.

Class K Extinguishers work on the principle of saponification. Saponification takes place when alkaline mixtures such as potassium acetate, potassium citrate, or potassium carbonate are applied to burning cooking oil of fat.

The alkaline mixture combined with the fatty acid create a soapy foam layer on the surface which holds in the vapours and steam and extinguishes the fire.



5.12 Fire Extinguisher Colour

Fire Extinguishers

Fire Extinguisher Colour

There are 5 fire extinguisher colours: Red, Cream, Blue, Black, and Yellow. Each colour represents a different type of extinguisher, used on different types of fires.

Although not used in North America, you may see these types in equipment manufactured overseas or on international ships.

KNOW YOUR FIRE EXTINGUISHER COLOUR CODE

Water	Dry powder	Foam	CO ₂ Carbon dioxide	Vapourising liquids	Wet chemical
					
For use on Wood, Paper, Textiles etc.	For use on Wood, Paper, Textiles etc.	For use on Wood, Paper, Textiles etc.	For use on Flammable liquids	For use on Flammable liquids	For use on Wood, Paper, Textiles etc.
					
Do not use on Flammable liquids	Gasous fires	Do not use on Live electrical equipment	Do not use in a confined space	For use on Flammable liquids	For use on Wood, Paper, Textiles etc.
					

6. Fire Response

6.1 Fire Response

 Fire Response

6.2 Introduction

Fire Response

Introduction

Each year, fire kills or severely injures thousands of people and destroys assets worth millions of dollars.

Many fires start out small and may be extinguished or controlled until help arrives.

You can reduce the risk of personal injury and damage to property by having the proper fire extinguisher available and knowing how to use it.



6.3 Upon Discovery of a Fire

Fire Response

Upon Discovery of a Fire

If you discover smoke or fire:

- *Stay Calm*
- *Do Not Panic*
- *Assess the Situation*

Then immediately, **ACTIVATE** the building alarm system or notify the ERT by radio Emergency Channel 1 or calling 752-3111.

ASSIST any persons in immediate danger, or those incapable of exiting the building on their own, without any risk of injury to yourself.

Only after these two are completed should you...

ATTEMPT to extinguish the fire.



6.4 Rules for Fighting Fires

Fire Response

Rules for Fighting Fires

Only fight a fire if:

- The fire is controllable,
- You are safe from toxic smoke,
- You have a means of escape... always stay between the fire and an exit route... ensure you have a way out!

Do not compromise your safety or the safety of others and call for assistance as required.



6.5 Rules for Fighting Fires

Fire Response

Rules for Fighting Fires

Never attempt to extinguish a fire if:

- The fire is spreading beyond the area where it started or, the fire has grown larger than you can physically handle,
- The fire could block your safe path of escape,
- You placed yourself in immediate danger,
- You do not know what material is burning,
- You do not have the correct extinguisher available or,
- *Your instincts tell you not to.*



6.6 Rules for Fighting Fires

Fire Response

Rules for Fighting Fires

Always ensure that;

- You know the emergency procedures, and evacuation routes for the area you are working in.
- You know the types of extinguishers in the area, and know where they are located.

Remember...

Always sound the alarm regardless of the size of the fire, and always ensure you have a safe means of escape.

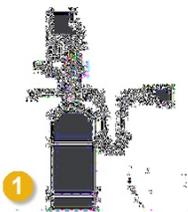


6.7 Rules for Fighting Fires

Fire Response

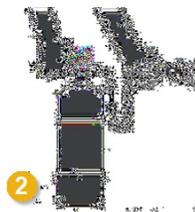
How to use a Fire Extinguisher

To use a fire extinguisher correctly, follow the **PASS** method, which are 4 simple rules on how to extinguish a fire effectively.



Pull

Pull the pin. This will also break the tamper seal.



Aim

Aim low, pointing the extinguisher nozzle (or its horn or hose) at the base of the fire.

Note: Do not touch the plastic discharge horn on CO₂ extinguishers; it could get very cold and may damage skin.



Squeeze

Squeeze the handle. This will release the extinguishing agent.



Sweep

Sweep from side to side at the base of the fire, pushing the fire from front to back until it appears to be out.

Watch the area. If the fire re-ignites, repeat steps 2 through 4.

7. Emergency Action Plan

7.1 Emergency Action Plan

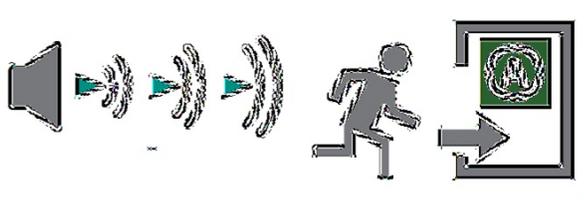
✔ Emergency Action Plan

7.2 Introduction

Fire Response

Introduction

Fire in the workplace can be one of the most devastating hazards, it is important that you and your co-workers understand the fire procedures in the area in which you are working.



You must ensure that you know;

- The location of the fire extinguishers in the workplace and be aware of where the nearest extinguisher is at all times.
- Where your nearest primary and secondary emergency exits are located.
- The difference between alarm signals to quickly recognize the situation.

Always treat each drill as if it were an actual emergency.

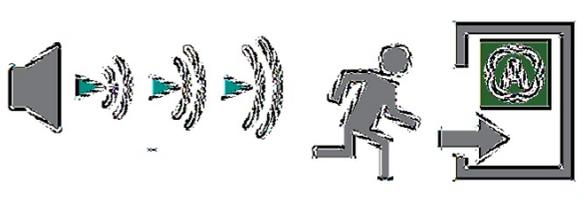
7.3 Upon hearing a fire alarm:

Fire Response

Introduction

Upon hearing a fire alarm:

- Proceed calmly but quickly to the nearest emergency exit.
- If you are in an office, if possible shut the lights off, close but do not lock the door behind you if you are the last to leave your area.
- If you are in a building, evacuate the area ensuring the exit door is closed behind you.
- Use stairs to exit to the ground floor of multi-level buildings. Never use elevators in a fire drill or during an emergency.



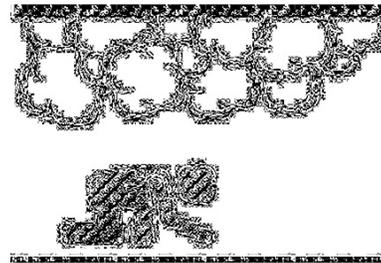
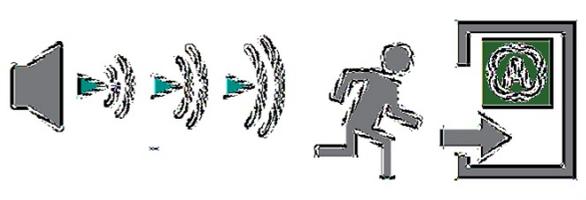
7.4 Upon hearing a fire alarm:

Fire Response

Introduction

Upon hearing a fire alarm:

- Stay close to the floor to avoid inhaling smoke or toxic gases that may be present.
- If possible, cover your nose and mouth with a damp cloth to aid breathing.
- Once you are safely outside, ensure the fire is reported and then proceed to the assigned Emergency Assembly Area.



7.5 If You Catch-on Fire:

Fire Response

Introduction

If You Catch-on Fire:

- Stop, Drop, and Roll.
- Drop to the ground or floor. Cover your face.
- Roll around on the ground to extinguish the flames.

If a co-worker catches on fire... Smother the fire by wrapping a blanket or coat around them. Do not beat the flames.



STOP



DROP



ROLL

7.6 If You Catch-on Fire:

Fire Response

Introduction

If you become Trapped Inside a Burning Building;

- Do not panic.
- By phone or radio, call for help and give your exact location, (e.g. located in "Building 221, column 2C").
- Feel closed doors with the back of your hand before opening. If it feels hot, do not open.
- Stay close to the floor to avoid smoke and toxic gases. Make your way to an outside wall if possible.



7.9 Summary

Fire Safety and Fire Extinguisher Use

Summary



This concludes the material for the Fire Safety and Fire Extinguisher Use module.

Before you go on to the module quiz, you may want to review the following:

- How fire starts and how it spreads,
- Fire extinguisher types and operating procedures,
- The risks of fire and the steps that can be taken to mitigate the risk of a fire occurring.
- Safe response to a fire.