



Oxidisers, Organic Peroxides and O₂ enriched atmospheres

Aims & Objectives

The aim of the session is for learners to understand the main hazards and risk that oxidising materials, organic peroxides and oxygen enriched atmospheres pose.

Objectives

- Identify the classification and hazards of oxidisers & organic peroxides
- Discuss common oxidising materials
- Describe the explosive risks with oxidisers and organic peroxides
- Explore the operational considerations to these materials

What are oxidisers?

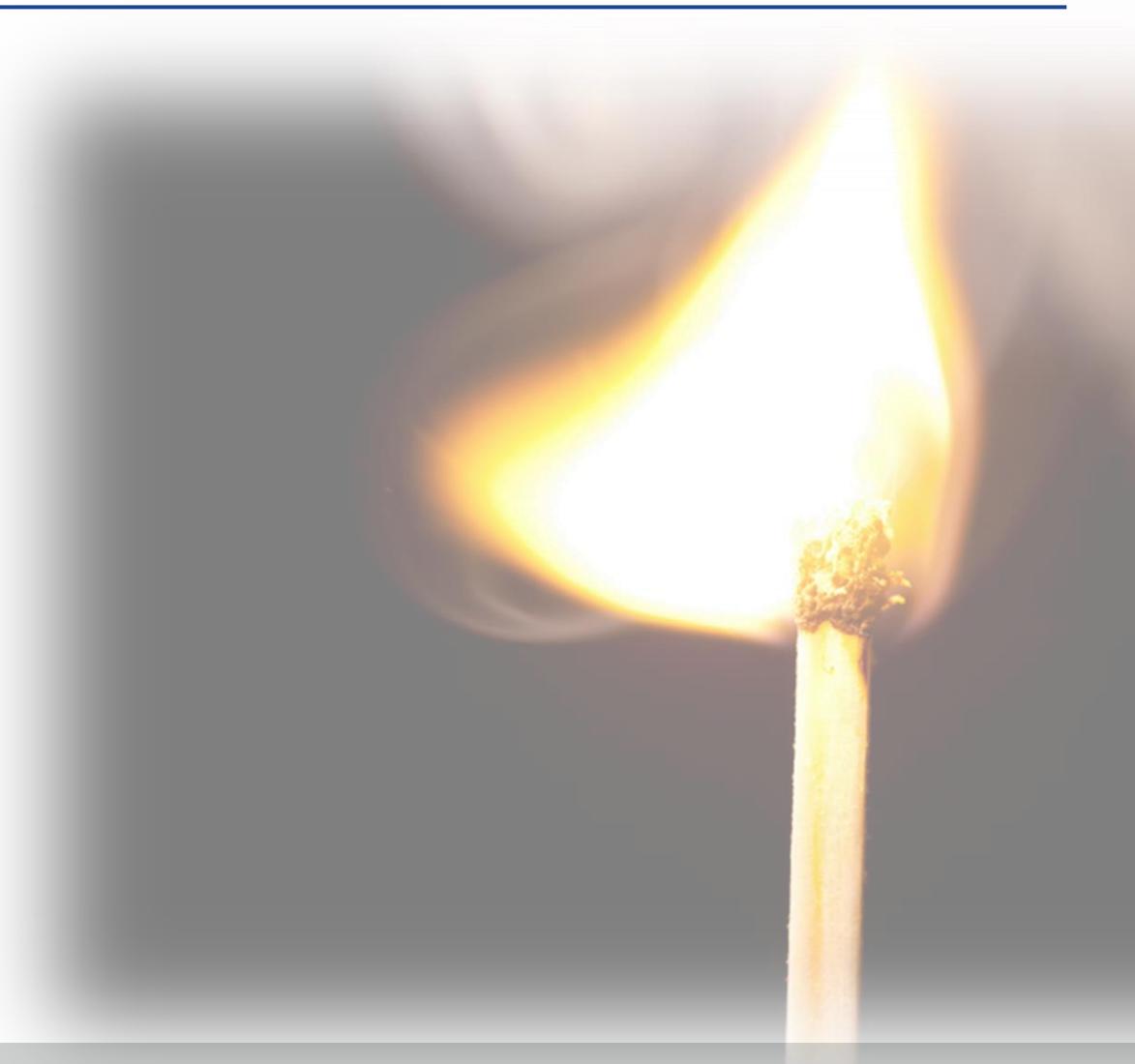
- Two-way chemical reaction on the atomic scale

Oxidation  **Reduction**

Oxidising agents (e.g. Oxygen)

Reducing Agents (e.g. Hydrogen – H₂)

Oxygen + Hydrogen  **Water (heat & light)**
Combustion



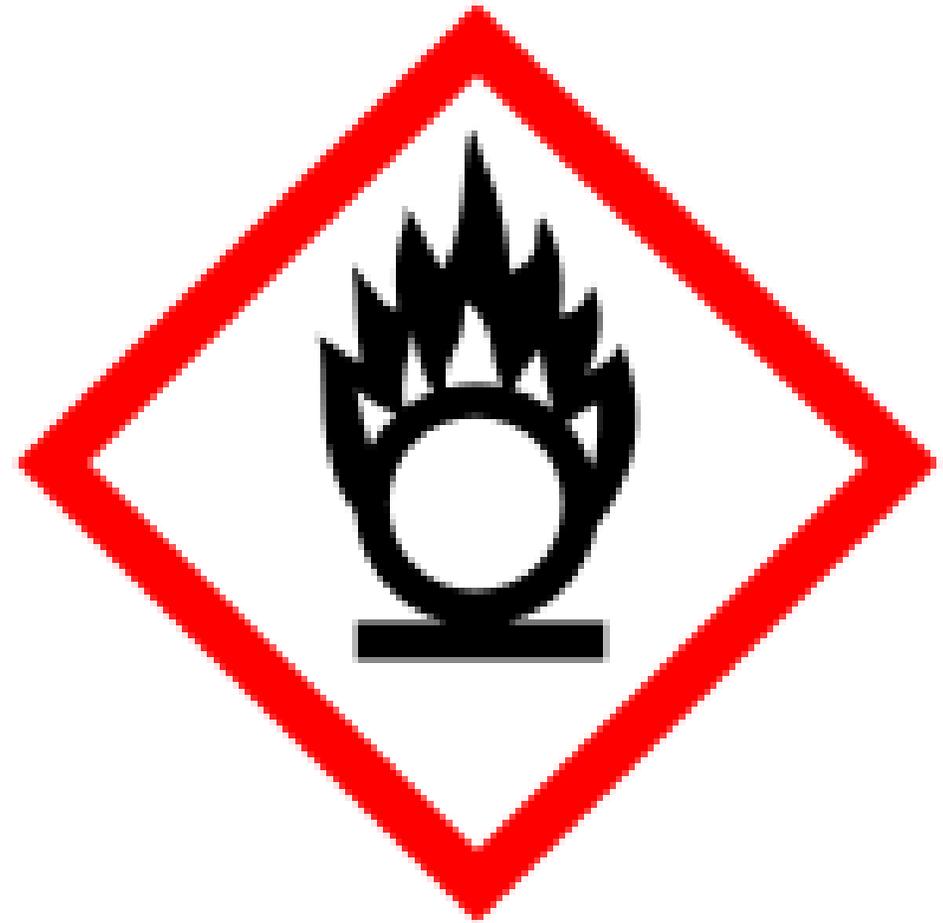
AGENDA

Oxidisers

Organic Peroxides

Oxygen Enriched atmospheres

Identification – UN Class 5.1



General Behaviour / Hazards

Supporters of combustion

- Intensify heat flux
- Shorten burn time (may be explosive)
- Ignition can be easier

Secondary hazards

- Toxic
- Corrosive

Most are Inflammable

- Support combustion – are not inherently flammable



Chemical & Physical Properties

IT DEPENDS!

Solids

- Ammonium nitrate

Liquids

- Hydrogen Peroxide

Gases

- Nitrous Oxide

Almost all however, dissolve in water – where / when might this be an advantage?



Uses

- **Industrial**
 - Rocket propellant (oxygen, hydrazine)
 - Water treatment (permanganates)
 - Chemical oxygen generation (hydrogen peroxide)
- **Propellants**
 - Artillery
 - Gunpowder
- **Domestic**
 - Cleaning
 - Bleaching

Incidents Involving Oxidising Agents

Prevent contact with fuels

Cool/ventilate if appropriate & practical

Be mindful of visual indicators

Other hazards:

- Toxic
- Dangerous to the environment
- Can be solid, liquid or vapour/gas – difficulties with each
- Contain corrosive runoff water.

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Fuel and Oxidiser
bound together

General Behaviour

Very sensitive!

- Friction
- Shock
- Heat

Often insoluble in water

Decompose quickly

- When they go... they go!

Improvised explosives

- TATP & HMTD

Temperature control

Type of receptacle	SADT (self accelerating decomposition temperature)	Emergency temperature	Control temperature
Single packages and IBCs	20°C or less	10°C below SADT	20°C below SADT
	20°C to 35°C	10°C below	15°C below
	>35°C	5°C below	10°C below
Tanks	No greater than 50°C	5°C below	10°C below

Improvised Explosives

- MEKP (detonation velocity 5200 m/s)
- HMTD (detonation velocity 4511 m/s)
- TATP (detonation velocity 5300 m/s)

Ingredients

- MEK (methyl, ethyl ketone), Hexblock camping fuel or Acetone
- Hydrogen Peroxide (>20%)
- Strong acid (catalyse reaction)
- LOTS OF ICE!

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Hazards

Oxygen is different to the 'air'

- The 'air' contains approximately 20.9% oxygen

An increase up to 24% is dangerous

- Fuel catches fire more readily – burning more fiercely and hotter
- Can be very difficult to extinguish
- Fuels like rubber, textiles and other less flammable fuels can burn violently
- Pure Oxygen can cause spontaneous ignition

How do we get oxygen enriched atmospheres?

Leaking equipment – cylinders, connections, pipes, hoses etc

Incorrect or careless use of equipment

Using an excess of oxygen – welding, cutting etc.

Not closing cylinders properly

Application of medical oxygen

As oxygen levels increase:

- Ignition energy reduces
- Autoignition temperatures reduce
- Flammable limits widen
- Burning speeds up
- More heat is released

Operational considerations

Identify products

Avoid contamination

Monitor and manage temperature

Manage ignition sources

Be mindful of environmental consequences

Consult scientific advice – risk of explosions

Ventilate areas where possible

Monitor contaminated PPE post incident



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Any Questions?