MANAGING HEALTH AND SAFETY IN THE UK

A course book for the NEBOSH National General Certificate in Occupational Health and Safety

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ELEMENT 2

HOW HEALTH AND SAFETY MANAGEMENT SYSTEMS WORK AND WHAT THEY LOOK LIKE

2.1: Key components of health and safety management systems

Introduction

A health and safety management system is a set of interrelated components/elements that allow an organisation to manage health and safety in a structured way to achieve its objectives. Formal systems are built on the elements of Plan, Do, Check, Act (PDCA), capturing the principle of continuous improvement.

The main components of the system are a *policy*, which sets out a mission statement for health and safety and mechanisms for management control and accountability, and *arrangements* for implementing, monitoring, auditing and continuously improving. A formal system develops consistency and supports a culture that can involve everyone.

Organisations need to:

- work out the issues to be addressed;
- set the direction;
- plan what needs to be done and organise who will do it;
- set them up to do so;
- carry out the plan;
- check completion and efficacy; and
- take on board any learning so that they can continually improve.

Organisations are being encouraged to adopt management systems through their supply chains. There are generic and sector-specific approaches as well as approaches for which independent third-party certification can be obtained. Organisations have freedom to choose the approach they want to follow and can decide whether they want to work towards a certifiable standard.

2.1.1 The structure of a health and safety management system: the 'Plan, Do, Check, Act' model (see ISO 45001 and HSG65)

ISO 45001[1]

ISO 45001 is the first truly international certifiable occupational health and safety management system standard. The development of the standard has drawn on experience gained with OSHSAS 18001 (replaced by ISO 45001 in 2018) and other national approaches. As a result, the new standard is enhanced and more comprehensive, reflecting the approaches of organisations that strive for and succeed at health and safety management. Figure 1 shows elements of the standard.

The management system uses the Plan, Do, Check, Act (PDCA) cycle.

- **Plan** – assess occupational safety and health (OSH) risks and opportunities, taking into account the organisation's operating environment, and set out OSH objectives and delivery plans in line with the organisation's policy.
- **Do** – implementation of the processes.
- **Check** – monitor and measure OSH processes and report results.
- **Act** – take action to continually improve OSH performance and achieve intended outcomes of the system.

APPLICATION

Think about your organisation. Can you identify examples of how the PDCA approach is used in practice?

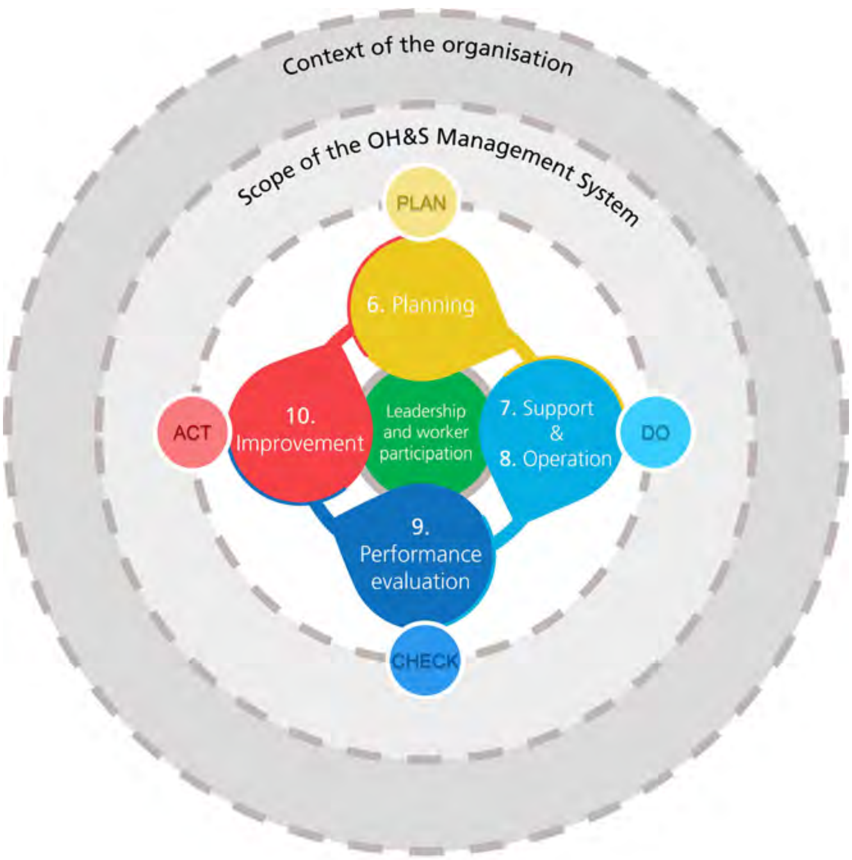

Figure 1: Elements of ISO 45001[2]

Let us look at the key clauses in the ISO 45001 standard and what they mean for organisations.

Context of the organisation

Clause 4 deals with establishing the organisation's context as a major building block that underpins the rest of the standard. This is about identifying and understanding the internal and external environments in which the organisation operates and the influence they exert. Influences may be positive or negative. The scope of the management system must be set out, taking account of these. Setting the scope will determine the boundaries of the system; this is particularly important if the organisation is part of a larger organisation.

External aspects could include: cultural, social, political, legal, financial, technological, economic and natural surroundings; and market conditions and key drivers and trends relevant to the industry or sector. Internal considerations could include: the organisational structure, roles and accountabilities and culture; policies, objectives and strategies; and capabilities and decision-making processes.

There are various tools that can be used to gain an understanding of these external elements. One of these is STEEPLE (see Figure 2). Other models include PEST (Political, Economic, Social, Technological) or PESTEL (Political, Economic, Social, Technological, Environment and Legal).

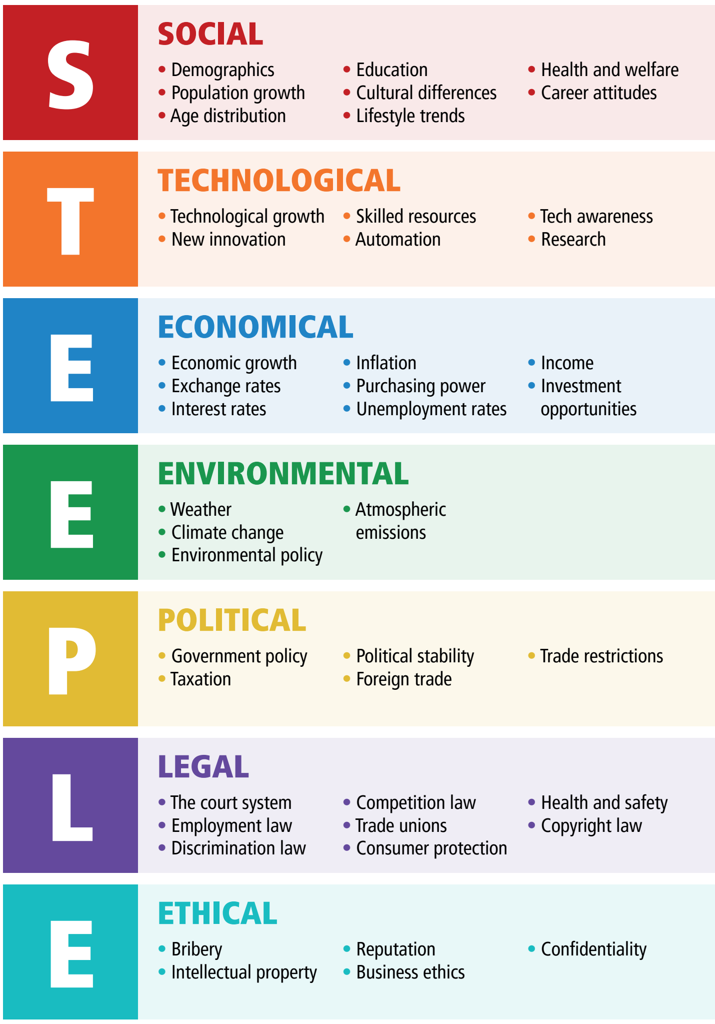

Figure 2: The STEEPLE model

There is also a requirement to consider relationships with external interested parties, such as shareholders, customers, suppliers and visitors.

ELEMENT 7

CHEMICAL AND BIOLOGICAL AGENTS

7.1: Hazardous substances

Introduction

We are now going to consider occupational health and hygiene with respect to chemical and biological agents. Firstly, it will be useful to outline what is meant by these different terms.

DEFINITIONS

Occupational health *is a branch of medicine concerned with health at work and includes matters such as health screening, the study of sickness absence, health education and counselling (for example, for workers suffering from stress).*

Occupational hygiene *means the identification, evaluation and control of factors that might cause ill-health or discomfort at work.*

We will examine the forms of both chemical and biological substances and how different forms influence their levels of hazard, then move on to the meaning of acute and chronic effects and the differences between them, before classifying the different types of health hazard.

7.1.1 Forms of chemical agent

Chemical agents come in many different physical forms, which can influence where, and how easily, they can enter the body and cause damage. For example, forms such as dusts, fumes, fibres, gases, mists and vapours can enter the respiratory system, while liquids can affect the skin. The eyes are very efficient at transmitting biological agents, so if you touch a surface contaminated with a biological agent (such as a virus) then rub your eyes, it is likely your body will subsequently be affected by that virus.

DEFINITIONS

You will often come across the distinction between 'inhalable' and 'respirable' fractions of solid particles, like dusts. In simple terms:

- ***Inhalable** refers to the fraction of the airborne particles that can be breathed in through the nose and mouth.*
- ***Respirable** refers to the fraction that is breathed in and makes it all the way deep down into the lungs, where the gas exchange (getting oxygen into the blood and removing carbon dioxide) takes place. Only the finer inhalable particles will make it that far.*

Dusts

These are solid particles that are denser than air. The particles will normally settle on surfaces but can remain suspended in the air for a while before settling.

If you inhale air that contains dust, the body must use defence systems (covered in 7.2: Assessment of health risks) to reduce the risk of ill-health. Dust can be hazardous in two ways:

1 It may cause breathing difficulties simply due to its physical nature (because it is a dust). If there is no adverse chemical reaction on the organs of the body, this type of dust is often called 'nuisance dust' and the extent of any problem is related to its particle size.

2 It may cause ill-health because of its chemical nature; for example, cement dust, which we will examine in more detail later.

Fumes

These are very small metallic particles that can reach the gas exchange region of the lung. Fumes often arise from welding operations. For example, zinc oxide fumes can be created from vapourised zinc during welding; the metal oxide cools and condenses back to very finely divided airborne particles. The level of resulting harm is dependent on the metals used in the welding process.

Fibres

Fibres can be regarded as natural or synthetic threadlike substances. Whereas dust size is only considered in terms of diameter, fibre size is considered in terms of both diameter and length. Examples of natural fibres are cotton and wool; examples of synthetic fibres are nylon and rayon.

The main hazard of fibres comes from inhaling them into the lungs. The deeper they are deposited into the lungs, the greater the risk of disease. As with dusts, fibres that are respirable pose the greatest risk. Respirable fibres have a length greater than 5 microns (micrometres) and a diameter of less than 3 microns. An example of a fibre that can cause ill-health when inhaled is asbestos.

Bacteria

These are very small organisms, each being a living cell. They cannot be seen with the naked eye but require a powerful microscope. Bacteria can be classified into three groups:

1. Beneficial: the body needs these bacteria. For example, some provide the body with vitamins K and B12, both of which are essential for human health.
2. Harmful: these cause the body harm, such as *Legionella* and *Leptospira* (both of which we will discuss in 7.5: Specific agents) and *Salmonella*, which is associated with food poisoning.
3. Neither harmful nor beneficial under normal circumstances: these live in or on the body. Many of these types are found on the skin; however, if these bacteria get into the body, they can cause harm.

Under the right conditions, bacteria can reproduce by dividing into two about every 20 minutes.

Table 1 gives you an idea of just how quickly large numbers of bacteria can develop from just one bacterium.

Time after first division (minutes)	Resulting number of bacteria
0	1
20	2
40	4
60	8
120	64
180	512
240	4096
300	32,768

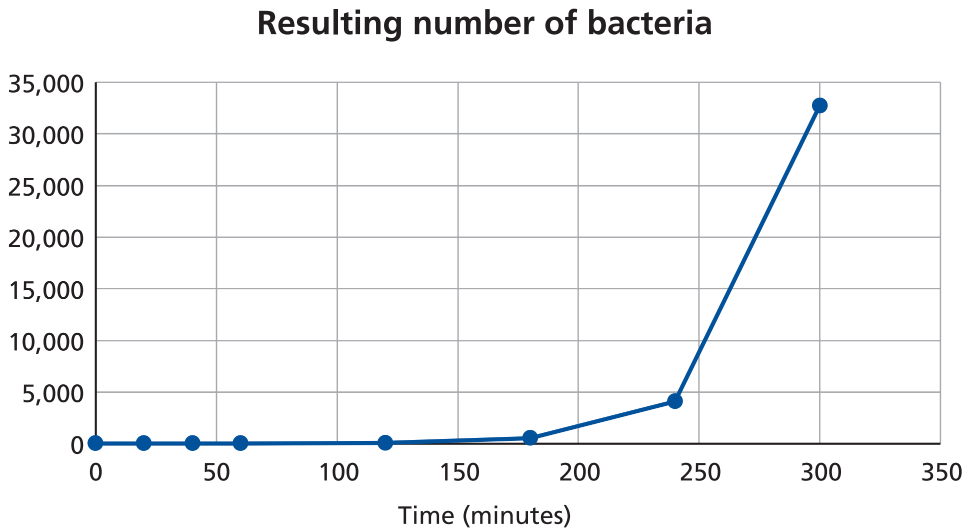

Table 1: Pace of bacteria growth

ELEMENT 10

FIRE

10.1: Fire principles

Introduction

Fire is a major risk to any organisation. It doesn't matter whether this is a low-risk office-based organisation or a high-risk chemical manufacturer. The consequences of a fire are devastating; some organisations never recover from the effects of fire and cease trading. When organisations can recover, it can take years to get back to the same state that the organisation was in prior to the fire.

To illustrate this, many people will remember the fire that destroyed part of Notre-Dame Cathedral in Paris in April 2019. It took less than 90 minutes from the alarm being raised for the spire to collapse. Around 400 fire-fighters were engaged in trying to control the fire. Fortunately, no one was killed but three emergency workers were injured. It is estimated that it will take between 10 and 20 years to return the building to its former glory.

It is therefore vital that organisations understand the risk of fire and what they need to do to control these risks. However, to understand how to control fire risks it is first necessary to understand the principles of fire. In this section we will be looking at fire classifications, how fires can start and, once they have started, how heat can be transmitted to spread the fire. Finally, we will look at some of the common causes of fire and the consequences of fire.

DEFINITION

***Fire** is a chemical reaction giving off heat, light and (most of the time) smoke and is the visible effect of the process of combustion.*

10.1.1 The fire triangle

There are three essential elements required for a fire to start and to continue to burn. These are heat, fuel and oxygen; these are known collectively as the 'fire triangle'.

Remove any one of these components and a fire will not start, or it will be extinguished if it is already burning. We will look at this concept later when looking at the principles of fire prevention (stopping the fire from starting) and protection (mitigating the effects of fire).

Figure 1: The fire triangle

Sources of ignition (heat)

Heat is not the only thing that might cause a fire to start. It is probably better to describe this side of the fire triangle as 'sources of ignition' rather than just heat. A source of ignition is anything that has the capability of igniting materials and starting the combustion process.

Other forms of energy, such as a spark, can also contribute to a fire starting. Some common workplace ignition sources include:

- friction, for example, from worn parts of machinery;
- hot surfaces;
- faulty electric supplies;
- faulty electrical equipment;
- static electricity;
- tools that can cause sparks by friction, such as grinding wheels;
- open flames, for example, from a blowtorch or welding activities;
- smoking materials (matches and unextinguished cigarettes);
- lightning strikes;
- radiant heat from the sun; and
- faulty heating systems, including hot air blowers or electric bar heaters.

TIP

Combustion

For a material to burn, there must be an energy (heat) source. There first must be sufficient energy applied to the material to raise it to a temperature that will generate vapour that must then be ignited. The heat component in the fire triangle therefore relates to the heat required to vaporise the fuel **plus** the heat to provide the means of ignition.

Close inspection of any burning liquid or solid, for example, ethanol or a piece of wood, reveals that the flame is not actually in contact with the liquid or the solid but is a small distance above it; fire is therefore a gaseous reaction – it is the vapour that is burning.

Sources of fuel

For a fire to start, there must be the material to burn (the fuel). Fuel is any material that will combust given the right set of conditions. Most things will burn; it is simply a matter of applying sufficient energy to them. Fires are categorised by the fuel involved (this will be discussed later).

Typical sources of fuel include:

- wood;
- paper and cardboard;
- fabrics;
- flammable liquids, including oils and solvents;
- flammable gases;
- flammable metals;
- foam; and
- rubber and plastics.

Radiation

All objects transmit radiant heat all the time. In the case of, for example, a brick wall at 25°C, the amount of radiant heat being given out is very low. However, in the case of a burning curtain, the amount of radiant heat emitted can be strong enough to initiate fires some distance away. Escape routes can become compromised or effectively 'blocked' by radiated heat. Heat radiated from a thick layer of smoke at ceiling level can set fire to the contents of the room above.

TIP

There is a basic physical principle known as the inverse square law. This says that at double the distance from a source of light or radiant heat, the intensity will reduce fourfold.

This is true for what is known as a 'point source' of light or radiant heat: one that is radiating equally in all directions. However, when the source is a massive wall of fire, moving, say, 10 to 20 metres away will not make much difference. This is due to the colossal amount of radiant heat being given off, largely in one direction.

An example of this occurred in the UK in 1985 when a wooden stand at the Bradford City Football Stadium caught fire. Tragically, 56 people lost their lives and hundreds more were injured during that incident.

Direct burning

This is the easiest way for fire to spread. It is the direct application of a flame to a material that it moves along or through. For example, if the corner of a piece of paper catches fire, the flame will spread across the paper. Burning material dropping onto something else is also another instance of direct burning. An example of this could be bits of a burning curtain dropping onto a carpet, setting the carpet on fire.

Fire spread

There are many things that could cause a fire to spread in a building. Figure 3 shows the different types of heat transmission and how these contribute to fire spread.

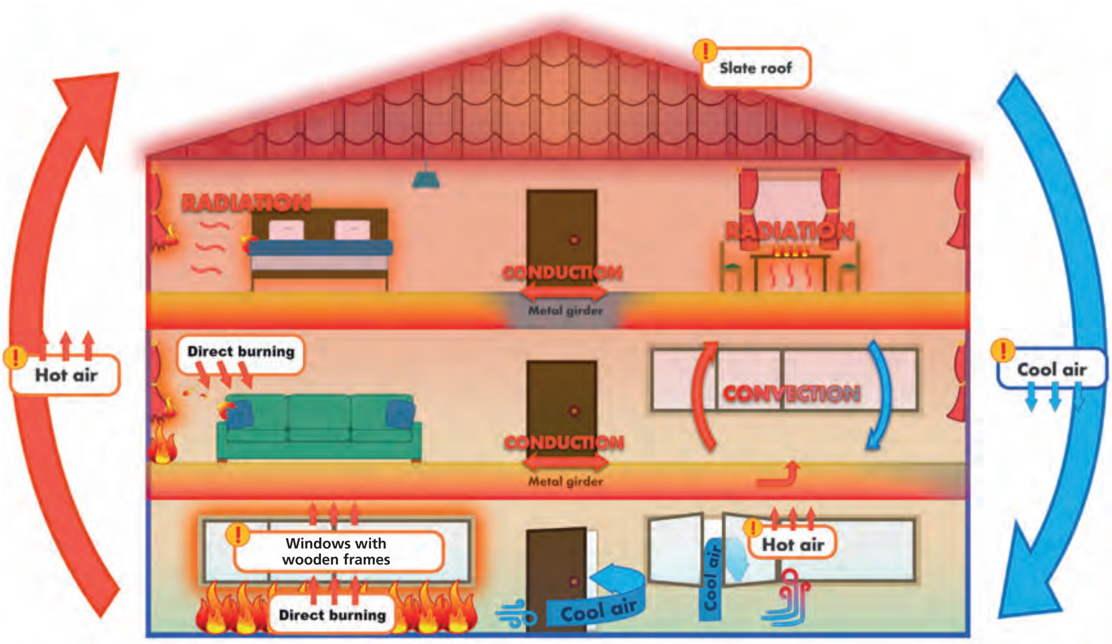

Figure 3: How types of heat transfer contribute to fire spread