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City & Guilds

IET

The City & Guilds textbook

Book 1

Electrical Installations

SECOND EDITION

REVISED & UPDATED EDITION

LEVEL 3 ELECTROTECHNICAL APPRENTICESHIP (5357)
LEVEL 3 ELECTROTECHNICAL IN DWELLINGS APPRENTICESHIP (5393)
LEVEL 2 TECHNICAL CERTIFICATE (8202)
LEVEL 2 DIPLOMA (2365)
T LEVEL OCCUPATIONAL SPECIALISMS (352/353)

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HEALTH AND SAFETY AND INDUSTRY PRACTICES

INTRODUCTION

Every year, accidents at work result in the deaths of more than one hundred people in Great Britain, with several hundred thousand more being injured in the workplace. In 2019/20, Health and Safety Executive (HSE) statistics recorded 38.8 million working days being lost due to work-related illness (32.5 million) and workplace injury (6.3 million).

Occupational health and safety affects all individuals and aspects of work in the complete range of working environments – hospitals, factories, schools, universities, commercial undertakings, manufacturing plants and offices. As well as the human cost in terms of pain, grief and suffering, accidents in the workplace also have a financial cost, such as lost income, insurance and production disturbance. The HSE put this figure at £16.2 billion for the year 2018/19. It is therefore important to identify, assess and control the activities that may cause harm in the workplace.

In addition to injuries to persons, construction site activities lead to many recorded incidents of land and air contamination impacting the environment we live in.

This chapter is designed to enable you to understand health, safety and environmental legislation and associated practices and procedures, when installing and maintaining electrotechnical systems and equipment. You will need this knowledge to underpin the application of health, safety and environmental legislation, practices and procedures.

▲ Figure 1.1 The five steps for risk assessment

INDUSTRY TIP

You can see the most up-to-date statistics relating to accidents in the workplace by visiting the HSE website.

Learning objectives

This table shows how the topics in this chapter meet the outcomes of the different qualifications.

Topic	Electrotechnical Qualification (Installation) or (Maintenance) 5357 Unit 101-001	Level 2 Diploma in Electrical Installations (Buildings and Structures) 2365 Unit 201	Electrotechnical in Dwellings Qualification 5393 Unit 101-001	Level 2 Technical Certificate in Electrical Installation 8202 Unit 201
1 The law: roles and responsibilities	1.1; 1.2		1.1; 1.2	1.2
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4 Dealing with health and safety in the work environment	2.1; 2.2; 2.3; 2.4			3.2
5 Establishing a safe working environment including: – Hazards – Risk assessment and method statements – Safety signs and packaging signs – Hazardous material – Asbestos – Personal protective equipment – First aid facilities – Fire safety – Manual handling	2.2; 3.1; 3.2; 3.3; 3.4; 3.5; 3.6; 4.1; 4.2; 4.3; 4.4; 4.7; 4.8			2.2; 3.1; 3.3; 3.4; 3.5; 3.6; 3.7; 3.8
6 Using access equipment and working in confined spaces or excavations	3.7			2.1
7 Electrical safety on site including: – Safe use of power tools – Site supplies	4.3; 4.5			2.3; 4.2
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T Level mapping grids are available on the Hodder Education website. These map the book to the occupational specialisms: 8710-353 (Electrical Engineering) and 8710-352 (Electrical and Electronic Equipment).

KEY TERMS

Civil law: decides on a dispute between parties.

Criminal law: decides if someone is guilty of a criminal act.

Liability: a debt or other legal obligation in order to compensate for harm.

1 THE LAW: ROLES AND RESPONSIBILITIES

When something goes wrong, there are two sub-divisions of the law that apply to health and safety: **civil law** and **criminal law**.

- *Civil law* – deals with disputes between individuals, between organisations, or between individuals and organisations, in which compensation can be awarded to the victim. The civil court is concerned with **liability** and the extent of that liability rather than guilt or non-guilt.
  Example: If a sub-contractor has not been paid by a main contractor, the sub-contractor may make a claim against the main contractor through a civil court. The judge will examine the terms of the contract and settle the dispute based on those terms.
- *Criminal law* – the body of rules that regulates social behaviour and prohibits threatening, harming or other actions that may endanger the health, safety and moral welfare of people. The rules are laid down by the government and

are enacted by Acts of Parliament as **statutes**. The Health and Safety at Work etc. Act 1974 (HSW Act) is an example of criminal law. It is enforced by the Health and Safety Executive (HSE) or Local Authority environmental health officers.

In terms of health and safety, criminal law is based only on statute law, but civil law may be based on either common law or statute law.

- *Common law* – the body of law based on custom and decisions made by judges in courts. In health and safety, the legal definitions of terms such as 'negligence', 'duty of care', and 'so far as is reasonably practicable' are based on legal judgments and are part of common law. Common law usually uses past cases that set a precedent to help the judge decide an outcome.
- *Statute law* – the name given to law that has been laid down by Parliament as Acts of Parliament.

KEY TERM

Statute: a major written law passed by Parliament.

INDUSTRY TIP

You can access more information about the HSW Act 1974 on the HSE website.

INDUSTRY TIP

In terms of common law, 'so far as is reasonably practicable' involves weighing a risk against the trouble, time and money needed to control it.

In summary, criminal law seeks to protect everyone in society and civil law seeks to recompense individuals, to make amends for loss or harm they have suffered (i.e. provide compensation).

The main legal requirements for health and safety at work

The HSW Act 1974 is the basis of all British health and safety law. It provides a comprehensive and integrated piece of legislation that sets out the general duties that employers have towards employees, contractors and members of the public, and that employees have towards themselves and each other. These duties are qualified in the HSW Act by the principle of 'so far as is reasonably practicable'.

What the law expects is what good management and common sense would lead employers to do anyway; that is, to look at what the risks are and take sensible measures to tackle those risks. The person(s) who is responsible for the risk and best placed to control that risk is usually designated as the **duty holder**.

KEY TERM

Duty holder: the person in control of the danger.

The HSW Act lays down the general legal framework for health and safety in the workplace, with specific duties being contained in regulations, also called statutory instruments (SIs), which are also examples of laws approved by Parliament.

INDUSTRY TIP

The duty holder must be competent by formal training and experience and have sufficient knowledge to avoid danger. The appropriate level of competence will differ for different areas of work.

KEY TERM

Enabling Act: an Enabling Act allows the Secretary of State to make further laws (regulations) without the need to pass another Act of Parliament.

ACTIVITY

Think of any jobs you have had in the past, such as part-time work in the holidays. What do you think were your responsibilities for health and safety?

Individuals' responsibilities under health and safety legislation

The HSW Act, which is an **Enabling Act**, is based on the principle that those who create risks to employees or others in the course of carrying out work activities are responsible for controlling those risks.

The HSW Act places specific responsibilities on:

- employers
- the self-employed
- employees
- designers
- manufacturers and suppliers
- importers.

This section will deal with the responsibilities of employers, the self-employed and employees.

Responsibilities of employers and the self-employed

Under the main provisions of the HSW Act, employers and the self-employed have legal responsibilities in respect of the health and safety of their employees and other people (e.g. visitors and contractors) who may be affected by their undertaking and exposed to risks as a result. The employers' general duties are contained in Section 2 of the Act.

They are to ensure, 'so far as is reasonably practicable', the health, safety and welfare at work of all their employees, in particular:

- the provision of safe plant and systems of work
- the safe use, handling, storage and transport of articles and substances
- the provision of any required information, instruction, training or supervision
- a safe place of work including safe access and exit
- a safe working environment with adequate welfare facilities.

These duties apply to virtually everything in the workplace, including electrical systems and installations, plant and equipment. An employer does not have to take measures to avoid or reduce the risk if that is technically impossible or if the time, trouble or cost of the measures would be grossly disproportionate to the risk.

Responsibilities of employees

Employees are required to take reasonable care for the health and safety of themselves and others (including work colleagues, clients, members of the public and practically anyone who is affected). To achieve this aim, they have two main duties placed upon them:

- to take reasonable care for the health and safety of themselves and others who may be affected by their acts or omissions at work
- to co-operate with their employer and others to enable them to fulfil their legal obligations.

INDUSTRY TIP

Remember, when you are carrying out your practical tasks either in the workplace or your place of learning, everyone, including you, is responsible for safety.

In addition, there is a duty not to misuse or interfere with safety provisions. Most of the duties in the HSW Act and the general duties included in the Management of Health and Safety at Work Regulations 1999 (the Management Regulations) are expressed as goals or targets that are to be met 'so far as is reasonably practicable' or through exercising 'adequate control' or taking 'appropriate' (or 'reasonable') steps. This involves making judgements as to whether existing control measures are sufficient and, if not, deciding what else should be done to eliminate or reduce the risk. This risk assessment will be produced using Approved Codes of Practice (ACoP) and published standards, as well as HSE or industry guidance on good practice, where available.

INDUSTRY TIP

You can access Management of Health and Safety at Work Regulations 1999 (the Management Regulations) by searching the HSE website.

2 HEALTH AND SAFETY LEGISLATION

When the HSW Act came into force, there were already some 30 statutes and 500 sets of regulations in place. The aim of the Health and Safety Commission (HSC) and the Health and Safety Executive (HSE) was to progressively replace the existing regulations with a system of regulation that expresses general duties, principles and goals, with any supporting detail set out in ACoPs and guidance.

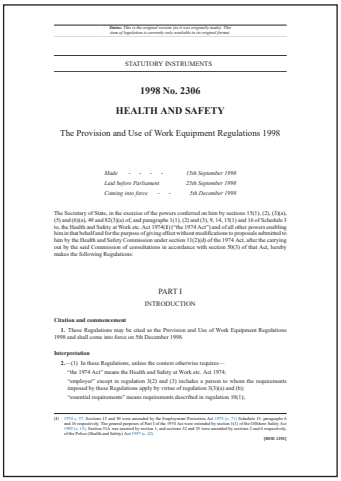
Regulations

Statutory Instruments (SIs) are laws approved by Parliament. The regulations governing health and safety are usually made under the HSW Act, following proposals from the HSC/HSE. This applies to regulations based on European Commission (EC) Directives as well as those produced in Great Britain.

The HSW Act, and general duties in the Management Regulations, set goals and leave employers the freedom to decide how to control the risks they identify. Guidance and ACoPs give advice.

Some risks are considered so great or the proper control measures so costly that it would not be appropriate to leave employers to decide what to do about them. Regulations identify these risks and set out the specific action that must be taken. Often these requirements are absolute – they require something to be done, without qualification. The employer has no choice but to undertake whatever action is required to prevent injury, regardless of cost or effort.

Some regulations apply across all workplaces. Such regulations include the Manual Handling Operations Regulations 1992, which apply wherever things are moved by hand or bodily force, and the Health and Safety (Display Screen Equipment) Regulations 1992, which apply wherever visual display units (VDUs) are used. Other regulations apply to hazards unique to specific industries, such as mining or the nuclear industry.



STATUTORY INSTRUMENTS

1998 No. 2306

HEALTH AND SAFETY

The Provision and Use of Work Equipment Regulations 1998

▲ Figure 1.2 An example of the front page of a regulatory document

INDUSTRY TIP

You can search the Government's legislation database for each of these regulations at the GOV.UK website.

The following regulations apply across the full range of workplaces.

- **Control of Noise at Work Regulations 2005:** require employers to take action to protect employees from hearing damage.
- **Control of Substances Hazardous to Health (COSHH) Regulations 2002 (as amended):** require employers to assess the risks from hazardous substances and take appropriate precautions.
- **Electricity at Work Regulations 1989:** require people in control of electrical systems to ensure they are safe to use and maintained in a safe condition.
- **Health and Safety (Display Screen Equipment) Regulations 1992:** give specific requirements for the use of display equipment such as computer screens. This may affect the choice of lighting to reduce glare.
- **Health and Safety (First-Aid) Regulations 1981:** require employers to provide adequate and appropriate equipment, facilities and personnel to ensure their employees receive immediate attention if they are injured or taken ill at work. These regulations apply to all workplaces, including those with fewer than five employees, and to the self-employed.
- **Health and Safety Information for Employees Regulations 1989:** require employers to display a poster telling employees what they need to know about health and safety.
- **Management of Health and Safety at Work Regulations 1999 (as amended):** require employers to carry out risk assessments, make arrangements to implement necessary measures, appoint competent people and arrange for appropriate information and training.
- **Manual Handling Operations Regulations 1992:** cover the moving of objects by hand or bodily force.
- **Personal Protective Equipment at Work Regulations 1992 (as amended):** require employers to provide appropriate protective clothing and equipment for their employees.
- **Provision and Use of Work Equipment Regulations 1998:** require that equipment provided for use at work, including machinery, is suitable and safe.
- **Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 2013:** require employers to notify the HSE of certain occupational injuries, diseases and dangerous events.
- **Workplace (Health, Safety and Welfare) Regulations 1992:** cover a wide range of basic health, safety and welfare issues such as ventilation, heating, lighting, workstations, seating and welfare facilities.

INDUSTRY TIP

As an electrician in the building services industry, you will not need to know all of the relevant legislation inside out – unless you are also training to be a lawyer! What you need to know is that they exist and generally, what they cover, and any parts which directly affect your role when at work.

The following specific regulations cover particular areas, such as asbestos and lead.

- **Chemicals (Hazard Information and Packaging for Supply) Regulations 2002:** require suppliers to classify, label and package dangerous chemicals and provide safety data sheets for them.
- **Construction (Design and Management) Regulations 2015:** cover safe systems of work on construction sites.

- **Control of Asbestos Regulations 2012:** affect anyone who owns, occupies, manages or otherwise has responsibilities for the maintenance and repair of buildings that may contain asbestos.
- **Control of Lead at Work Regulations 2002:** impose duties on employers to carry out risk assessments, prevent or control exposure to lead and monitor the exposure of employees.
- **Control of Major Accident Hazards Regulations 1999 (as amended):** require those who manufacture, store or transport dangerous chemicals or explosives in certain quantities to notify the relevant authority.
- **Dangerous Substances and Explosive Atmospheres Regulations 2002:** require employers and the self-employed to carry out a risk assessment of work activities involving dangerous substances.
- **Work at Height Regulations 2005:** apply to all work at height where there is a risk of a fall liable to cause personal injury.

Approved Codes of Practice (ACoPs)

ACoPs offer practical examples of good practice. They were made under Section 16 of the HSW Act and have a special status. They give advice on how to comply with the law by, for example, providing a guide to what is reasonably practicable. For example, if regulations use words such as '**suitable**' and '**sufficient**', an ACoP can illustrate what is required in particular circumstances. If an employer is prosecuted for a breach of health and safety law, and it is proved that they have not followed the provisions of the relevant ACoP, a court can find them at fault unless they can show that they have complied with the law in some other way.

Guidance and non-statutory regulations

The HSE publishes guidance on a range of subjects. Guidance can be specific to the health and safety problems of an industry or to a particular process used in a number of industries. The main purposes of guidance are:

- to interpret and help people to understand what the law says
- to help people comply with the law
- to give technical advice.

Following guidance is not compulsory and employers are free to take other action, but if they do follow the guidance, they will normally be doing enough to comply with the law.

One very good example of guidance and non-statutory regulation is **BS 7671** The IET Wiring Regulations, 18th Edition. If electrotechnical work is undertaken in accordance with BS 7671, it is likely to meet the requirements of the Electricity at Work Regulations 1989, which deal with work with electrical equipment and systems.

BS 7671 is the national standard in the UK for low-voltage electrical installations. The document is largely based on documents produced by the European Committee for Electrotechnical Standardization (CENELEC). The regulations deal with the design, selection, erection, inspection and testing of electrical installations operating at a voltage up to 1000 V AC.

KEY TERMS

Suitable: appropriate for a particular purpose or situation.

Sufficient: enough or adequate.

INDUSTRY TIP

Although the EWR 1989 states that all metallic parts which form part of an electrical installation must be earthed to protect persons from electrocution, the EWR 1989 does not contain any technical information on how to carry this out. Such details are, however, found in BS 7671 the Wiring Regulations, which is an example of how complying with a non-statutory document can also result in complying with statutory requirements.

INDUSTRY TIP

BS 7671 is the 18th edition of the Wiring Regulations. It was published in July 2018 and has had two subsequent amendments, most recently in 2022. It can be obtained from the IET's online bookshop, or from many electrical wholesalers/suppliers.

BS 7671 is amended approximately every three years; the 18th edition will probably be amended two or three times before it is replaced with the 19th edition.

European law

In recent years, much of Great Britain's health and safety law has originated in Europe. Proposals from the European Commission (EC) may be agreed by member states, which are then responsible for making them part of their domestic law. Modern health and safety law in this country, including much of that from Europe, is based on the principle of risk assessment as required by the Management of Health and Safety at Work Regulations 1999.

Role of the HSE in enforcing health and safety legislation

Today, the HSE's aim is to prevent death, injury and ill health in United Kingdom workplaces and it has a number of ways of achieving this. Enforcing authorities may offer the duty holder information and advice, both face to face and in writing, or they may warn a duty holder that, in their opinion, the duty holder is failing to **comply** with the law.

KEY TERM

Comply: act in accordance with.

In carrying out the HSE's enforcement role, inspectors appointed under the HSW Act can:

- enter premises at any reasonable time, accompanied by a police officer if necessary
- examine, investigate and require the premises to be left undisturbed
- take samples, photographs and, if necessary, dismantle and remove equipment or substances
- review relevant documents or information such as risk assessments, accident books, or similar
- seize, destroy or make harmless any substance or article
- issue enforcement notices and start prosecutions.

INDUSTRY TIP

Following a serious accident, a HSE investigation will treat the situation as a crime scene, which is why evidence may be seized or photographed and people may be interviewed as soon as possible, before their memories fade.

An inspector may serve one of three types of notice:

- a Prohibition Notice tells the duty holder to stop an activity immediately
- an Improvement Notice sets out action needed to remedy a situation and gives the duty holder a date by which they must complete the action
- a Crown Notice is issued under the same circumstances that would justify a Prohibition or Improvement Notice, but is only served on duty holders in Crown organisations such as government departments, the Forestry Commission or the Prison Service.

3 ENVIRONMENTAL LEGISLATION AND DEALING WITH WASTE

KEY TERMS

Waste: something which has no further use to the person disposing of it.

Landfill: bury waste in large holes in the ground.

Pollution: contaminating the natural environment, causing change to that environment.

In the past, it was common for all **waste** produced on a construction site to be placed in a skip and for that waste to go to **landfill**. This practice has resulted in land **pollution** and groundwater pollution and even contributed to climate change due to the greenhouse gases that are emitted from landfill sites.

▲ Figure 1.3 A landfill site

European and UK laws have placed legal obligations on employers and operatives within all industry sectors to reduce waste, avoid pollution, reduce **carbon emissions** and **recycle** wherever possible.

What is waste?

Waste is quite difficult to define but, in general terms, it is any item that is thrown away because it is no longer useful or required by its owner. Electrical installation work generates many forms of waste, from packaging materials that come with new equipment and excess materials that cannot be saved for future use, such as part-used cable reels, to stripped-out materials and equipment, such as old light fittings and sockets and, of course, general building waste such as brick rubble and timber.

However we define waste, its disposal is governed by legislation. Previously, the majority of construction waste went to landfill sites without any thought to the potential impact of the buried materials on the **environment**.

European Union laws, that have been applied in the UK, have led to radical changes in waste handling and disposal. If you work within the construction industry, you need to have an understanding of those laws.

KEY TERMS

Carbon emission: the polluting gas given off from the burning of fossil fuels such as gas, oil or coal.

Recycle: to reuse the object or material.

Environment: the land, water and air around us.

Legislation to protect the environment

The Department for Environment, Food and Rural Affairs (DEFRA) defines the environment as the land, water and air around us. Any pollution of land, water or the air will affect the quality of life for all organisms living within that environment.

The environment is under increasing pressure, not only because of our demand for resources, but also due to our need to dispose of waste.

Both of these can lead to pollution. There are several legislative documents that determine how we deal with waste and limit our impact on the environment:

- **Control of Pollution Act 1974 (COPA):** applies to activities such as waste disposal, water pollution, noise, atmospheric pollution and public health.

INDUSTRY TIP

Visit DEFRA's website for further information at: www.defra.gov.uk

INDUSTRY TIP

You can access these legislative documents related to waste management by searching the Government's legislation database at: www.legislation.gov.uk

- **Environmental Protection Act 1990 (EPA):** makes provision for the improved control of pollution arising from certain industrial and other processes.
- **Environment Act 1995:** empowers the Environment Agency to control pollution and enhance the environment and conservation of natural resources.
- **Hazardous Waste Regulations 2005:** make provision for the controlled management of hazardous waste from the point of production to the final point of disposal or recovery.
- **Pollution Prevention and Control Act 1999:** requires a range of industrial installations to be regulated in which emissions to air, water and land, plus other environmental effects, are considered.
- **Waste Electrical and Electronic Equipment Regulations 2013 (WEEE Regulations):** require that producers (and with lesser obligations, distributors) of electrical and electronic equipment ('EEE') must be financially responsible for managing the waste.
- **Packaging (Essential Requirements) Regulations 2003:** relate to the management of packaging and packaging waste.

ACTIVITY

A four-storey block of flats built in the 1930s is to be totally refurbished. It still has the original imperial metal conduit (a metal pipe used to protect cables) but was rewired with PVC single-core cables in the late 1960s. List five different materials which will have to be disposed of in the proper manner.

Control of Pollution Act 1974 (COPA)

The aim of this Act is to deal with environmental issues including waste on land, water pollution, air pollution and noise pollution. If a person or organisation is found guilty under this Act, they can be imprisoned or fined (or both), and they may have to pay an additional fee for each day the offence continues after conviction.

Local authorities require construction companies to apply for a permit under the Act prior to starting work. The construction company must carry out an analysis of the likely impact of noise and vibration on those in the surrounding area. The Act gives local authorities the power to impose restrictions on companies or individuals carrying out construction or demolition work, including imposing limits on noise levels and working times so as to avoid causing a nuisance to neighbours.

Environmental Protection Act 1990 (EPA)

The Environmental Protection Act (EPA) applies to England, Scotland and Wales. It deals with the disposal of controlled waste on land and sets out a framework for duty of care. The EPA specifically deals with:

- waste
- contaminated land
- **statutory nuisance**.

Controlled waste is domestic, commercial and industrial waste – in fact, all waste that is disposed of on the land. Under the EPA, it is an offence for anyone to deposit waste on any land unless a waste management licence authorising that deposit is held.

Land can be contaminated with naturally occurring substances, such as arsenic, by industrial processes, such as oil refining, or by fly tipping (illegally disposing of waste in undesignated sites).

Part 2A of the EPA works on the principle of the 'polluter pays'. The 'polluter' is defined as the person who caused the pollution or who 'knowingly permitted' the contamination. 'Knowingly permitted' not only applies to allowing the contamination to take place but also to having knowledge of the contamination and failing to deal with it. Where the polluter is unknown then the occupier or owner of the land is responsible.

Part 2A of the EPA applies where significant harm to the land has taken place or where the possibility of significant harm could take place or where rivers or groundwater are or could be affected.

The EPA also covers statutory nuisance and applies to any premises that may be detrimental to health or that cause a nuisance. This section is used by local authorities when dealing with antisocial behaviour, but it also applies to work procedures and covers such things as the emission of:

- dust
- steam
- smells
- **effluvia**
- noise.

When someone complains about any of the above, the local council must investigate. If the investigation reveals that a statutory nuisance does exist, a Notice of Abatement will be issued containing a list of steps that must be followed to reduce the nuisance. In the case of construction, this action could have a serious impact on the completion of the work.

Environment Act 1995

The Environment Act 1995 set new standards for environmental management and led to the creation of a number of agencies to oversee this management. The agencies created by this Act are:

- The Environment Agency
- The Scottish Environment Protection Agency
- The National Park Authorities.

The Act required that the Government prepare strategies on air pollution, national waste and the protection of hedgerows. The stated purpose of the Environment Agency is to 'enhance or protect the environment and promote sustainable development' and 'to create a better place for people and wildlife'. The Agency looks after everything from fishing rod licences to waste disposal, from flood defences to air pollution.

INDUSTRY TIP

Access the Environmental Protection Act (EPA) by searching the GOV.UK website.

KEY TERMS

Statutory nuisance: an unlawful interference with a person's right to use or enjoy land they have lawful access to.

Effluvia: emissions of gas, or odorous fumes given off by decaying waste.

INDUSTRY TIP

There are strict rules about making changes to buildings that are within National Parks. This could even include rules about items such as outside lighting.

The Environment Agency has been given the powers to:

- stop offending taking place
- restore and/or remediate, for which it will seek to recover the costs
- bring under regulatory control
- punish and/or deter, whether that be by criminal or civil sanctions.

The Environment Agency publishes all prosecutions and associated fines on their website and these range from a couple of thousand pounds for fishing without a licence to many hundreds of thousands of pounds for operating without a waste licence.

Hazardous Waste Regulations 2005

The Hazardous Waste Regulations set out a regime of control for the tracking and movement of hazardous waste, and deal with the production and disposal of that waste. Hazardous waste includes such items as:

- fluorescent tubes
- television sets
- fridges
- PC monitors
- batteries
- aerosols and paint
- contaminated soils.

When hazardous waste is moved from one location to another, a consignment note must be completed and passed to the licensed waste carrier. Hazardous waste must be kept separate from general waste. Electrical wholesalers generally run schemes whereby fluorescent tubes can be returned to them for safe disposal. It is a requirement of the Hazardous Waste Regulations that records are kept for a period of three years.

Pollution Prevention and Control Act 1999

According to this Act, industries that emit certain substances can only operate with a permit issued by the local authority or the Environment Agency. Included in the schedule of industries requiring a permit are those involved in metal and waste processing.

KEY TERM

WEEE: waste electrical and electronic equipment.

Waste Electrical and Electronic Equipment Regulations 2013 (WEEE Regulations)

The WEEE Regulations are the implementation of a European Directive to address the environmental impact of unwanted electrical and electronic equipment, namely to reduce the amount of **WEEE** that is sent to landfill sites and to encourage recycling, reuse and recovery before disposal in an environmentally friendly manner.

INDUSTRY TIP

Access the Waste Electrical and Electronic Equipment Regulations 2013 (WEEE Regulations) by searching the GOV.UK website.

INDUSTRY TIP

Remember, when you are undertaking practical activities and assessment, in college or on site, make sure you sort your waste materials for disposal.

You must comply with the WEEE Regulations if you manufacture, import, rebrand, distribute or dispose of electrical and electronic equipment. While it may seem obvious that manufacturers and distributors must comply, WEEE Regulations apply to *anyone* who disposes of such equipment.

As electricians frequently remove **redundant** electrical equipment and have **surplus** materials for disposal, compliance with the WEEE Regulations is an obligation that must be met.

Under the WEEE Regulations, electrical and electronic items are divided into 10 categories:

1 Large household appliances, for example refrigerators, fans and panel heaters
2 Small household appliances, such as vacuum cleaners and toasters
3 IT and telecommunications equipment
4 Consumer equipment, such as radios and televisions
5 Lighting equipment, for example fluorescent tubes and discharge lamps
6 Electrical and electronic tools, such as drills
7 Toys, leisure and sports equipment
8 Medical devices
9 Monitoring and control instruments, such as smoke detectors and thermostats
10 Automatic dispensers, for example vending machines.

Electricians most commonly deal with items in categories 5 and 9 but, at times, other categories may also apply.

▲ Figure 1.4 Examples of small electrical appliances

Bear in mind that some WEEE may also be classified as hazardous waste. Examples are: smoke detectors, which contain radioactive emitters; fluorescent tubes, which contain mercury and cadmium; as well as old discharge lighting control gear containing PCBs (polychlorinated biphenyls), which are hazardous to persons and the environment. If in doubt regarding any of these items, always seek advice.

KEY TERMS

Redundant: no longer needed or useful, even though the part may still function. For example, if the cables were removed from a conduit, but the conduit remained as its removal would create decorating problems, the conduit is classed as redundant.

Surplus: more than what is needed. For example, if 75 m of cable was used from a 100 m reel, the remaining 25 m is surplus.

ACTIVITY

Look around your home and identify five items that come under the WEEE Regulations.

INDUSTRY TIP

The WEEE Regulations will apply to you when disposing of any electrical equipment.

Packaging (Essential Requirements) Regulations 2003

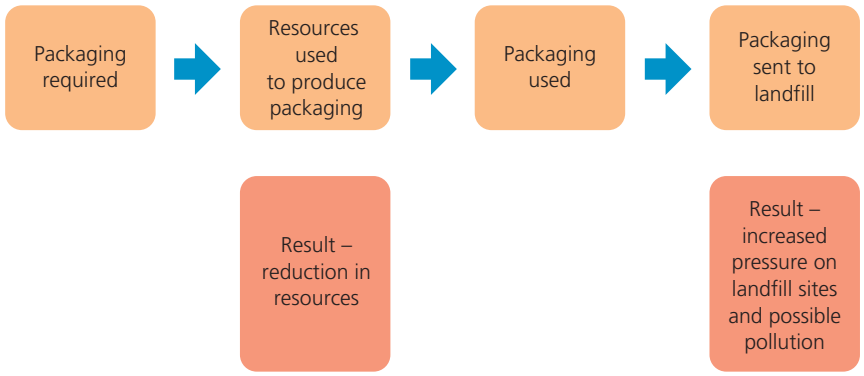
INDUSTRY TIP

Access the Packaging (Essential Requirements) Regulations 2003 by searching the GOV.UK website.

These regulations require anyone, but generally manufacturers of products, who place packaging into the marketplace, to take certain steps to:

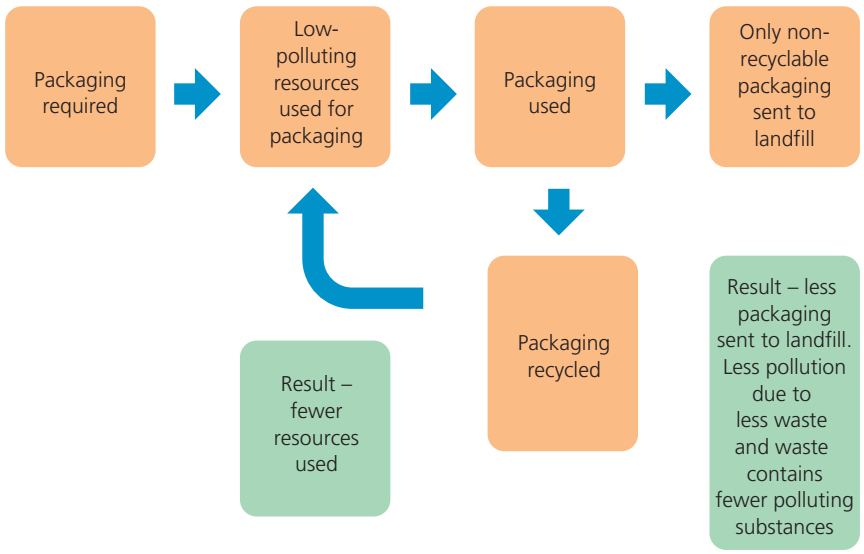
- minimise the amount of packaging used
- make sure packaging can be recovered (recycled)
- ensure that packaging has the minimum possible impact on the environment
- ensure that packaging does not contain high levels of hazardous materials or heavy metals.

Packaging has a very short life cycle. It is useful only from the time it leaves the manufacturer to when it arrives at the end user. While the Packaging (Essential Requirements) Regulations are not directly aimed at end users, they do reinforce the requirements for dealing with any waste product.



▲ Figure 1.5 A poor waste model

It is obvious that the poor waste model for packaging in Figure 1.5 is unsustainable. The sustainable waste model shown in Figure 1.6 is far better.



▲ Figure 1.6 A sustainable waste model

In the sustainable waste model, the packaging is made of materials that will cause minimum pollution in landfill sites. However, the materials are actually recyclable, thus cutting down waste and also reducing the demands on dwindling resources.

The key person in this cycle is the person who ensures that the waste product is recycled.

4 DEALING WITH HEALTH AND SAFETY IN THE WORK ENVIRONMENT

The role of safety culture

An organisation's **safety culture** can have as big an influence on safety outcomes as the safety management system itself, with safety culture being a subset of the overall organisational or company culture. Poor safety culture has contributed to many major incidents (e.g. the Piper Alpha oil platform disaster; the fire at King's Cross underground station; the sinking of the Herald of Free Enterprise passenger ferry; the passenger train crash at Clapham Junction; the Chernobyl disaster) and personal injuries. Success in this area normally comes from good leadership, good worker involvement and good communications.

By paying attention to human factors, forward-looking companies can identify and deal with potential hazards before they manifest themselves as accidents. This, coupled with legislation in the form of regulations and ACoPs that are easily understood and complied with, can have a positive effect on health and safety standards and help prevent or reduce accidents and incidents.

Procedures for handling injuries sustained on site

The type of accident that can occur in the workplace is dependent on the work activity being undertaken but can range from a cut finger to a **fatality**, or from a vehicle collision to the collapse of a structure. The person in control of the premises, such as a site supervisor, needs to be prepared to deal with all types of accidents to ensure that the injured person can be treated quickly and effectively and that all the legal obligations are met.

Having a well-established procedure that everyone on site is aware of and understands will enable the person in control of the premises to cope calmly and effectively when dealing with an accident. Good management following an accident will ensure that the injured person is attended to promptly, appropriate records are made, the accident is reported correctly and any lessons to be learned from the accident are understood and communicated to the workforce.

The procedures to be followed in the event of any accident or incident should be clear and specific to the project or site and should detail the following as a minimum:

KEY TERMS

Safety culture: 'the product of individual and group values, attitudes, perceptions, competencies, and patterns of behaviour that determine the commitment to, and the style and proficiency of, an organisation's health and safety management.' (Source: Health and Safety Executive)

Fatality: death.

HEALTH AND SAFETY

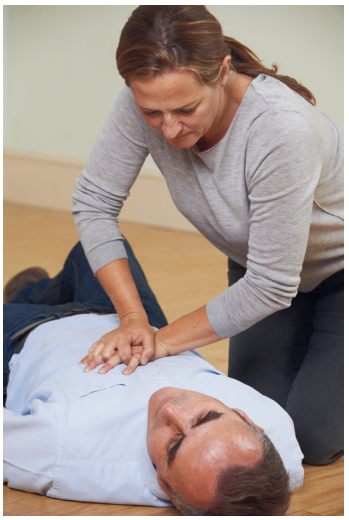
The examples of poor safety culture that are given here all led to the loss of many lives. In each case, poor safety procedures were used and/or shortcuts were taken to save time or energy. It is easy for these shortcuts to turn into habits which then become seen as acceptable procedure. Everyone should do their part to ensure this does not happen. Safety procedures are in place for very good reasons and should not be ignored, but instead be constantly reviewed.

ACTIVITY

How would you deal with a deeply cut hand sustained while cutting metal trunking?

- name of the appointed person(s) who will take control when someone is injured or falls ill
- name of the person(s) who will administer first aid
- location of the first aid boxes and name of the person(s) responsible for ensuring they are fully stocked
- course of action that must be followed by the appointed person who takes control in the event of an accident
- guidance on action to take after the accident.

How to deal with electric shocks



▲ Figure 1.7 CPR being performed

If all of the correct requirements are met, precautions taken and training of staff undertaken, it is unlikely that an electrical accident will occur. However, procedures should be in place to deal with electric shock injury in the event of an accident. The recommended procedure for dealing with a person who has received a low-voltage shock is as follows:

- Raise the alarm (colleagues and a trained first-aider).
- Make sure the area is safe by switching off the electricity supply.
- Request colleagues to call an ambulance (999 or 112).
- If it is not possible to switch off the power supply, move the person away from the source of electricity by using a non-conductive item.
- Check if the person is responsive, whether their airway is clear and whether they are breathing.
- If the person is unconscious and breathing, move them into the recovery position.
- If they are unconscious and not breathing, start to give cardiopulmonary resuscitation (CPR):
  - CPR is undertaken by interlocking the hands and giving 30 chest compressions in the centre of the chest, between the two pectoral muscles, at a rate of about 100 pulses per minute.
  - Tilt the casualty's head back gently, by placing one hand on the forehead and the other under the chin, to open the airway and give two mouth-to-mouth breaths.
  - Repeat the cycle of 30 compressions to two breaths until either help arrives or the patient recovers.
- Any minor burns should be treated by placing a sterile dressing over the burn and securing with a bandage.

KEY TERMS

Accident: an unplanned event that results in injury or ill health, damage, or loss of business.

Business opportunity: in this context, the opportunity to make profit from the work or contract.

Procedures for recording accidents and near misses at work

An **accident** is defined by the HSE as 'any unplanned event that results in injury or ill health of people, or damage or loss to property, plant, materials or the environment, or a loss of a **business opportunity**'.

A **near miss** is an unplanned event that does not result in injury, illness or damage, but had the potential to do so. Normally, only a fortunate break in the chain of events prevents an injury, fatality or damage taking place. So, a near miss could be defined as any incident that could have resulted in an accident. The keeping of information on near misses is very important in helping to prevent accidents occurring. Research has shown that damage and near miss accidents occur much more frequently than injury accidents and therefore give an indication of hazards.

The Social Security Act 1975 specifically requires employers to keep information on accidents. This should be the Statutory Accident Book for all Employee Accidents or an equivalent. Each entry should be made on a separate page and the completed page securely stored to protect personal data (under the General Data Protection Regulation 2021). An entry may be made by the employee or by anyone acting on their behalf. This information should be kept for a period of not less than three years.

INDUSTRY TIP

You can access the Social Security Act 1975 by searching the HSE website.

Reporting the incident

The reporting of certain types of **injury** and **incidents** to the enforcing authority (the HSE or the local authority) is a legal requirement under the Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 2013 (RIDDOR). Failure to comply with these regulations is a criminal offence.

RIDDOR states that deaths, specified injuries (listed in the regulations) and injuries resulting in absence from work for over seven days, and dangerous occurrences (again, listed in the regulations) and occupational diseases must be reported. This seven-day period does not include the day of the accident, but does include weekends and rest days. The report must be made within 15 days of the accident.

It is the responsibility of employers or the person in control of premises to report these types of incidents. Reportable specified injuries include fractures, amputations, permanent loss of sight, crush injuries and serious burns. A dangerous occurrence is a 'near-miss' event (incident with the potential to cause harm). There are also special requirements for gas incidents. Accidents must be recorded, but not reported, where they result in a worker being incapacitated for more than three consecutive days.

The police and HSE have the right to investigate fatal accidents at work. Therefore, all fatal accidents must also be notified to the police. The police will often notify the HSE, but it is always a sensible precaution to ensure that the HSE has been notified.

KEY TERM

Near miss: any incident that could, but does not, result in an accident.

▲ Figure 1.8 An accident book

ACTIVITY

Ask to see the accident book at your place of work and see what the most common cause of accidents is.

Investigating accidents

There is nearly always something to be learned following an accident and ideally the causes of all accidents should be established regardless of whether injury or damage resulted. The level and nature of an investigation should reflect the significance of the event being investigated. The results of the accident investigation may lead to a review, possible amendment to the risk assessment and appropriate action to prevent similar accidents from occurring.

INDUSTRY TIP

Try to keep notes of what happened during any incident. People are very bad at remembering what they actually saw, so take notes straight away or use your phone and record a voice memo.

Keeping records

There are numerous records to keep following even a minor accident. Easily accessible records should be maintained for all accidents that have occurred. In addition to the legal requirements, accident information can help an organisation identify key risk areas within the business. The accident book must be kept for three years following the last entry. The HSE has an online reporting tool which you can find by searching for RIDDOR on the HSE website.

The **F2508** for reportable incidents should be kept for a period of not less than three years from the date the accident occurred.

What to do in an accident or emergency

When an emergency situation occurs and the emergency services need to be called, be sure you know the following information:

- the address and location of the incident
- the nature of the incident, such as fire, injury etc.
- any difficulties the emergency services may encounter while trying to get to the incident, such as a high-rise building or in a field in a remote location
- any immediate dangers such as explosive materials, persons trapped etc.

INDUSTRY TIP

You must only ever tackle a fire if you can do so without endangering yourself or others.

In an emergency, think quickly but do not act hastily.

Should an emergency occur that requires evacuation, it is essential you know what or where the designated escape route is. On construction sites, due to their ever-changing nature, designated escape routes may frequently move so always be sure you are familiar with them. What may have been a safe escape route one day could be a dangerous route the next.

In nearly all fire situations, the emergency services should be called, but some very small fires may be extinguished before they become too serious. Be sure you know how to tackle different fires and know where appropriate fire-fighting devices are located.

Emergencies

Emergency procedures are there to limit the damage to people and property caused by an incident. Although the most likely emergency to be dealt with is fire, there are many more emergency situations that need to be considered, including the following.

Electrical fire or explosion

Fires involving electricity are often caused by lack of care in the maintenance and use of electrical equipment and installations. The use of electrical equipment should be avoided in potentially flammable atmospheres as far as is possible. However, if the use of electrical equipment in these areas cannot be avoided, then equipment purchased in accordance with the Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres Regulations 1996 must be used.

Escape of toxic fumes or gases

Some gases are poisonous and can be dangerous to life at very low concentrations. Some toxic gases have strong smells such as the distinctive 'rotten eggs' smell of hydrogen sulphide (H_2S). The measurements most often used for the concentration of toxic gases are parts per million (ppm) and parts per billion (ppb). More people die from toxic gas exposure than from explosions caused by the ignition of flammable gas. With toxic substances, the main concern is the effect on workers of exposure to even very low concentrations. These could be inhaled, ingested (swallowed) or absorbed through the skin. Since adverse effects can often result from cumulative, long-term exposure, it is important to measure not only the concentration of gas, but also the total time of exposure.

Gas explosion

A gas explosion is an explosion resulting from a gas leak in the presence of an ignition source. The main explosive gases are natural gas, methane, propane and butane because they are widely used for heating purposes in temporary and permanent situations. However, many other gases, such as hydrogen, are **combustible** and have caused explosions in the past.

The source of ignition can be anything from a naked flame to the electrical energy in a piece of equipment. Industrial gas explosions can be prevented with the use of intrinsic safety barriers to prevent ignition. The principle behind intrinsic safety is to ensure that the electrical and thermal energy from any electrical equipment in a hazardous area is kept low enough to prevent the ignition of flammable gas. Items such as electric motors would not be permitted in a hazardous area.

INDUSTRY TIP

Access the Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres Regulations 1996 by searching the GOV.UK website.

Employer and employee responsibilities

Employers have a duty of care to each of their employees. This duty rests solely with the employer and cannot be assigned to other persons – for example, consultants who offer advice on health and safety matters, or sub-contractors who are employed to undertake tasks within the company. All organisations should have a clear policy for the management of health and safety. The policy sets the direction for health and safety within the organisation, and its contents need to be clearly communicated to everyone within the organisation to ensure everyone understands what their responsibilities are in day-to-day operations.

Everyone has responsibility for safety, but employers have the following duties under the HSW Act:

- the health, safety and welfare at work of employees, and other workers whether they are contractors, casual, temporary, part time or trainees
- the health and safety of anyone who is allowed to use the organisation's equipment
- the health and safety of anyone who may be affected by the organisation's activities, i.e. the general public or adjacent organisations or neighbours.

Examples of matters under the control of an employer include:

- establishing policy to ensure that electrical equipment is purchased to an appropriate specification
- establishing policy to ensure that electrical equipment is properly maintained (including user inspection)
- implementing policy through the introduction of appropriate management systems
- on-going monitoring to confirm that the policy is properly implemented and remains fully relevant.

Employees have specific responsibilities under the HSW Act and these can be summarised as:

- to take reasonable care for the health and safety of themselves and others who may be affected by their acts or omissions at work
- to co-operate with their employer and others to enable them to fulfil their legal obligations
- not to interfere with or deliberately misuse anything provided in the interests of health and safety.

Examples of matters under the control of an employee include:

- adherence to company procedures and systems of work
- use of equipment in accordance with information and training provided
- not to use equipment that is faulty or damaged but to report it in accordance with company arrangements for dealing with defective equipment.

In summary, under the HSW Act employers have duties to ensure that appropriate management systems are established so that electrical work can be undertaken in a safe manner, while employees have a responsibility to comply fully with such management systems.

ACTIVITY

Consider some situations where you could be at risk because the desire to get the work done is greater than the need to spend some time creating a safe situation. One example is disconnecting bonding before isolating the entire installation!

What to do if you have concerns about health and safety issues

Employees are responsible for ensuring that the work they are required to undertake is carried out in a manner which is safe for themselves and other persons who may be affected by the work activity. They must undertake this work activity in accordance with the instruction or procedure provided by the employer.

If an employee has concerns about health and safety at work, or feels that there is a situation which they believe exceeds their level of responsibility, then these concerns should be raised with their supervisor or line manager. If the organisation

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