ASTUTIS

NEBOSH International General Certificate in Occupational Health and safety

Element 5

Health hazards – physical and psychological

Element 5: Table of Contents

5.0 Learning outcomes

The learner should be able to:

- Do a general risk assessment in their own workplace – profiling and prioritising risks, inspecting the workplace, recognising a range of common hazards, evaluating risks (taking account of current controls), recommending further control measures, planning actions.

  5-11 **Produce** a risk assessment of a workplace which considers a wide range of identified hazards (drawn from elements 5-11) and meets best practice standards (*'suitable and sufficient'*).

5.1 Noise

Noise may be considered to be any sound that is loud, unpleasant, or undesired, where sound is vibration energy that passes through air (or other media) and is received by the ear, stimulating the auditory nerves and producing the sensation of hearing.

The energy produced when something vibrates produces a series of compressions and rarefactions in the air molecules creating a longitudinal wave.

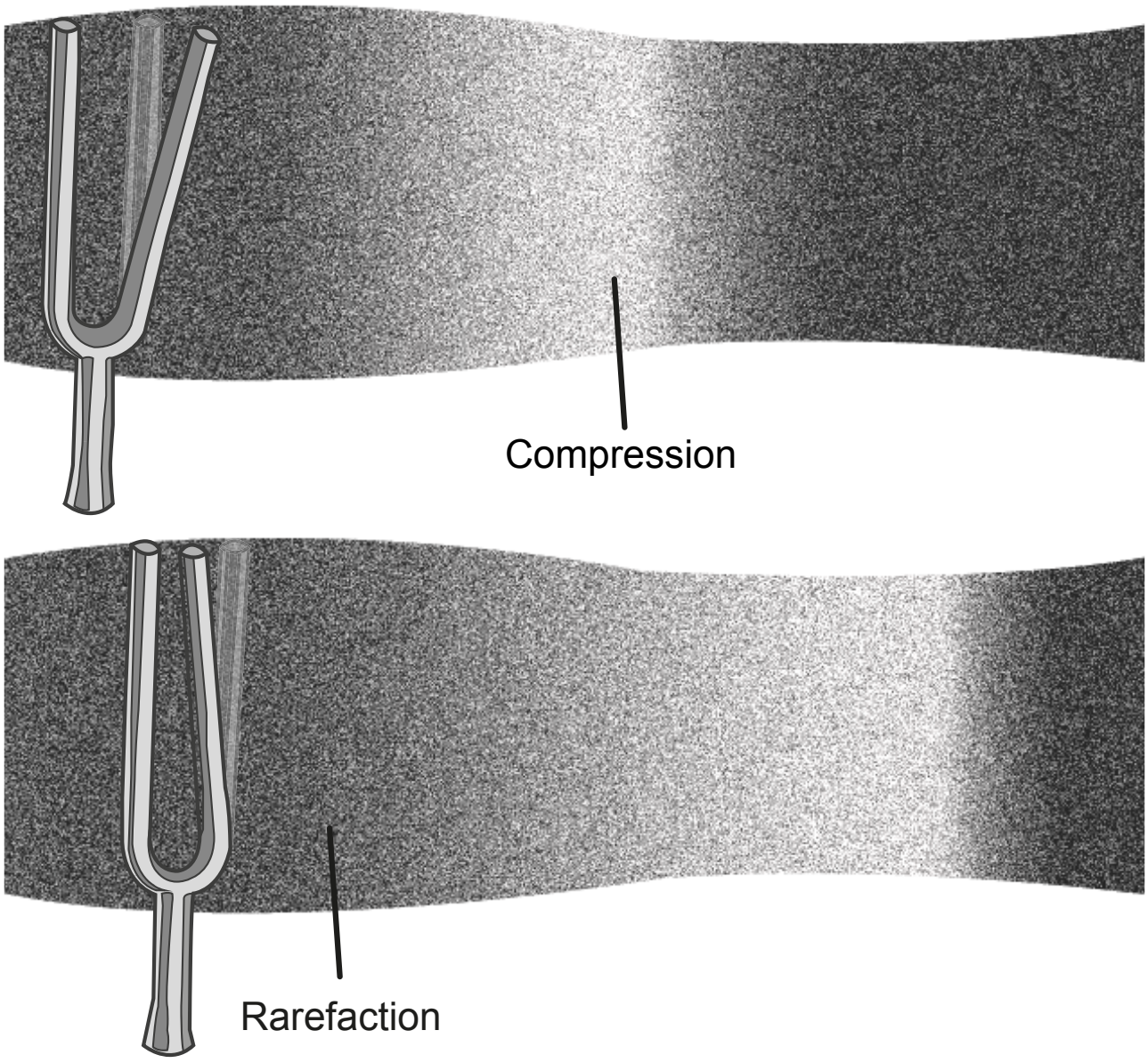


Figure 5.1: Compressions and rarefactions in air molecules

This is expressed diagrammatically as a sound wave (Figure 5.2).

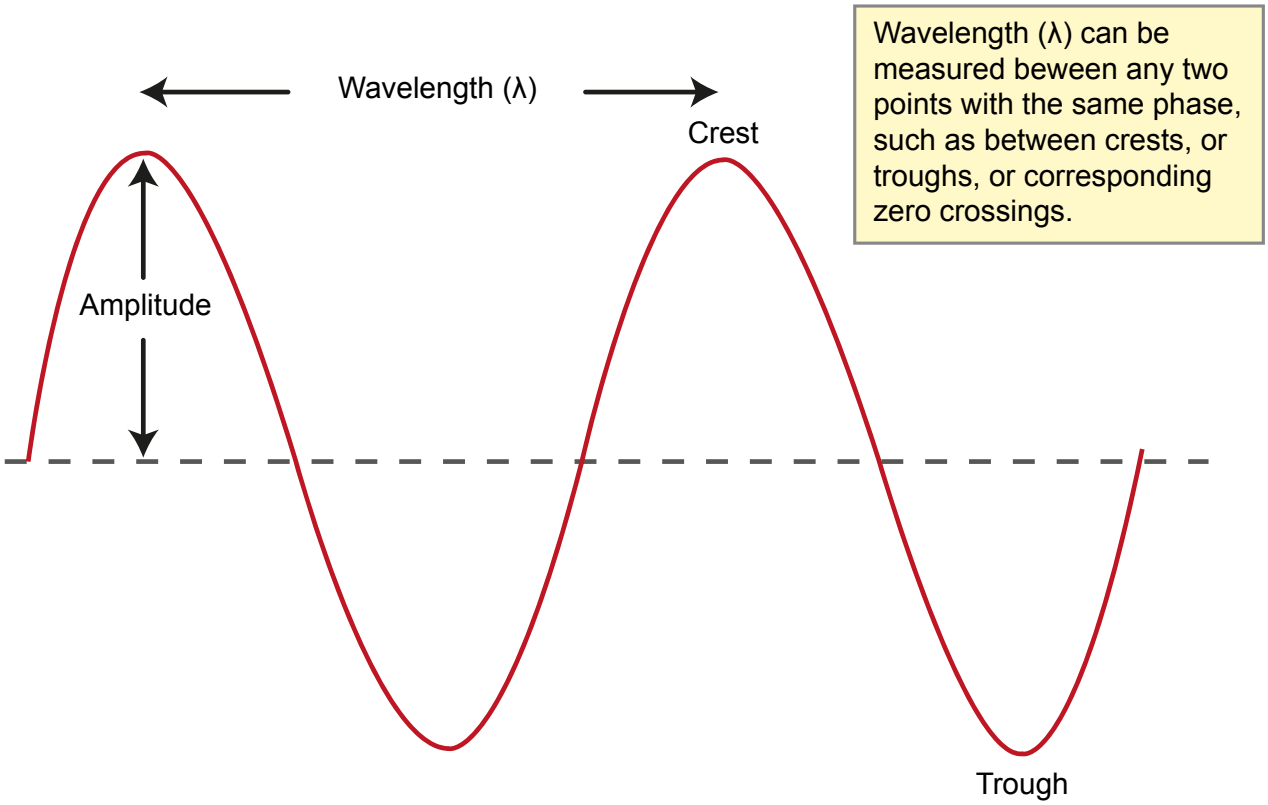


Figure 5.2: Soundwave

The *wavelength* determines the pitch of the sound. Long, slow waves are a low pitch (like a fog horn). Short, fast waves are a high pitch (like a whistle).

Frequency is measured in hertz (Hz), or waves per second. The slowest, lowest sound a human can hear is approximately 20 Hz. The highest sound a human can hear is approximately 20 000 Hz (or 20 kilohertz - kHz).

The strength or *loudness* of a sound is determined by the *amplitude* or height of the sound waves. Tall waves are loud, short waves are quiet.

'Loudness' is measured on the decibel scale (dB) which is a logarithmic scale.

The zero point on the scale is known as the *'threshold of hearing'* and is the quietest sound that the human ear can detect.

If measured as sound intensity (power/area = W/m^2) the threshold of pain, which is the level that sound becomes painful to the listener, is 10 000 000 000 000 (10^{13}) more intense than the threshold of hearing.

By converting to a logarithmic scale (*i.e.* multiplying by 10 is an increase of one on the scale, multiplying by 100 (10^2) is an increase of two etc.) you get a scale of zero to thirteen which is not a sensitive enough scale, so decibels (tenths of Bels) are used and the scale runs from zero to 130 and beyond.

NB sound pressure metres measure sound pressure rather than intensity. Sound pressure is proportional to intensity.

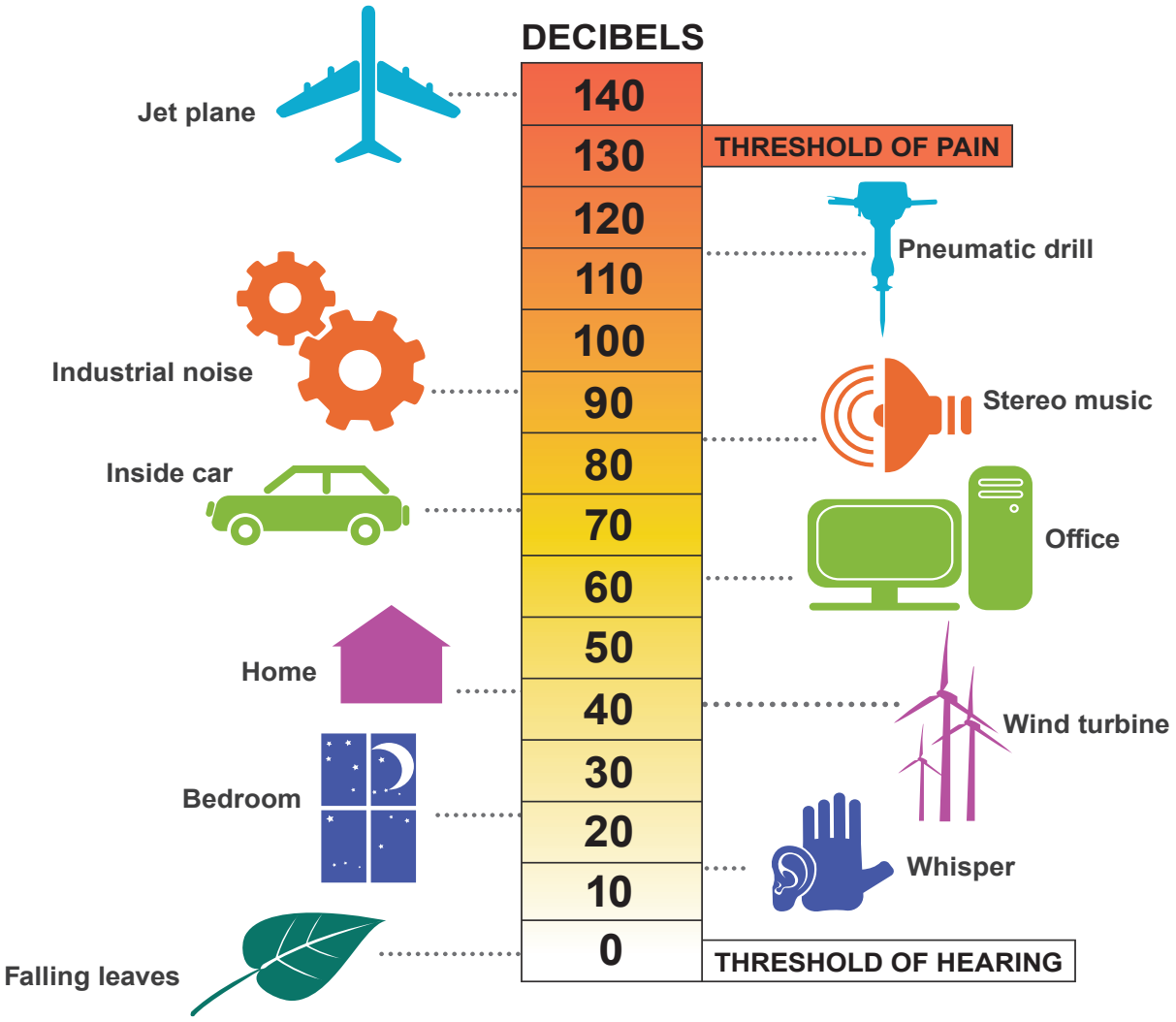


Figure 5.3: the Decibel scale

Rules of the Decibel scale

1 dB is the *'just noticeable difference'* in sound levels that the ear can detect.

10 dB expresses a 10x increase in sound intensity but to the subjective listener seems about twice as loud (*i.e.* it would take ten violins to sound twice as loud as one violin).

3 dB expresses a doubling in sound intensity (*i.e.* If one machine gave a sound pressure level of 75 dB two identical machines would give a reading of 78 dB).

A and C weightings dB(A) and dB(C)

A sound pressure level measurement may be A weighted or C weighted. This means that a frequency-response function filters the sounds that are picked up by the microphone in the sound level meter, emphasizing or de-emphasizing sounds of certain frequencies relative to others.

The A weighting filters out the low frequencies and slightly emphasizes the upper middle frequencies around 2-3 kHz, essentially mimicking the human ear.

The C weighting is almost unweighted, with only slight filtering at high and low frequencies. The C weighting was intended to be used when measuring high sound pressure levels such as aircraft noise.

LEPd – daily personal noise exposure

With the exception of really loud noises (130 dB+) it is the accumulated noise dose that causes hearing loss.

If an individual's noise exposure was monitored over a working day the results would present as a series of different peaks and troughs as the individual was exposed to different noise levels for different times.

To determine the average dose received over a given time an integrated sound level meter

balances out the peaks and troughs to calculate a single figure that would give the equivalent dose over that time. This equivalent level is known as an Leq (Figure 5.4). (Note: because the decibel scale is logarithmic this '*average*' dose is not the same as an arithmetic mean).

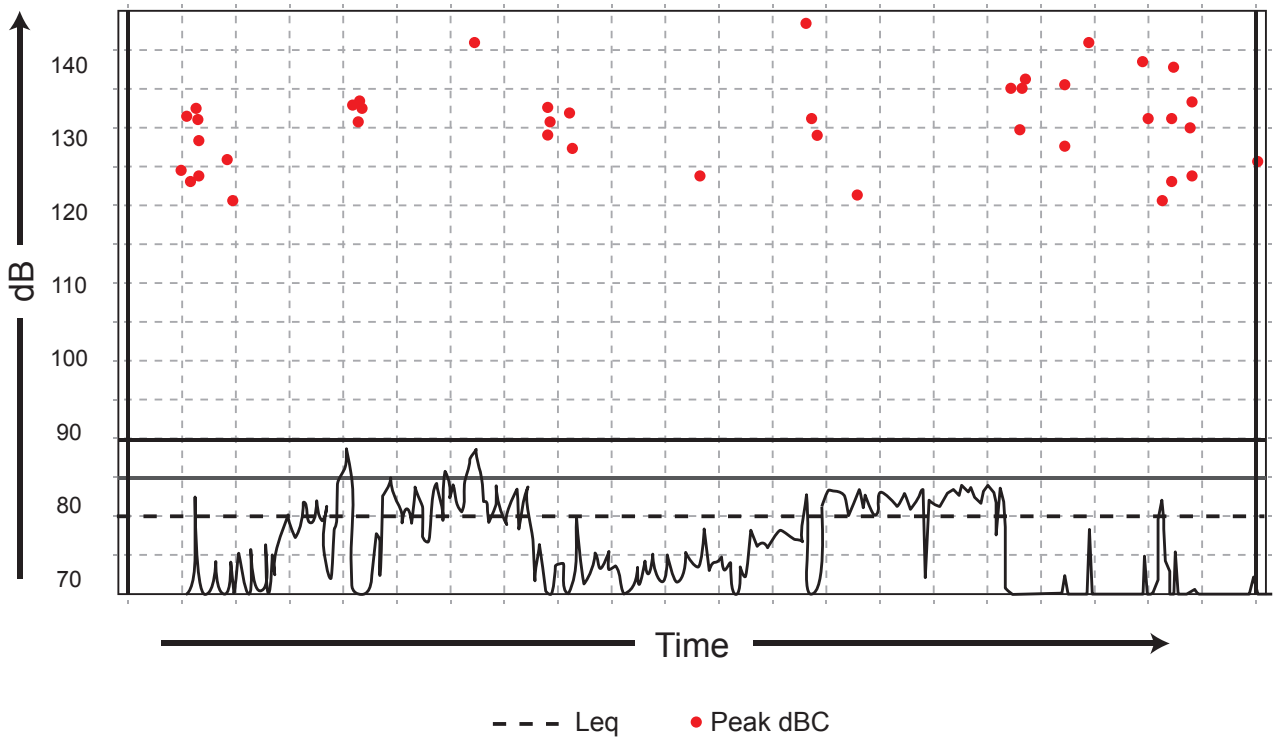


Figure 5.4: Noise exposure and Leq

If the Leq is calculated for an 8 hour working day it is known as the LEPd (Daily personal noise exposure). The LEPw is the weekly personal noise exposure which is the figure for a 40 hour working week.

Noise exposure levels equivalent to 80 dB(A) LEPd (the lower exposure action value – see Table 5.1), can be calculated using the *'rule of three'*.

80 dB (A) over 8 hours is the same noise dose as 83 dB (A) over 4 hours. Double the noise level (increase by 3 dB) over half the time gives the same dose.

dB(A) Reading	Time for equivalent dose to LEPd
80	8 hours
83	4 hours
86	2 hours
89	1 hour
92	30 minutes
95	15 minutes
98	7.5 minutes
101	3.75 minutes
104	1.88 minutes
107	56.25 seconds
110	28.13 seconds
113	14.06 seconds
116	7.03 seconds
119	3.51 seconds

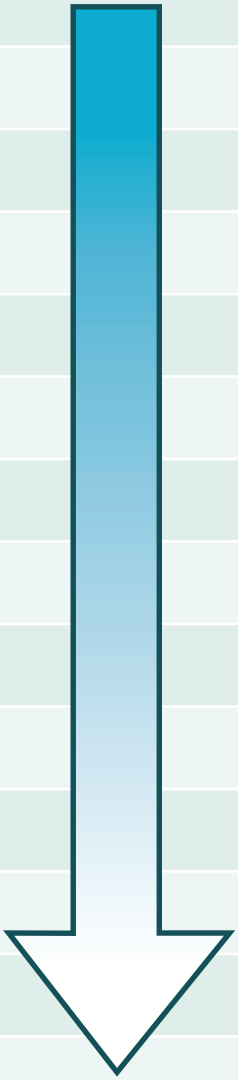


Table 5.1: Noise dose equivalent to 80 dB(A) LEPd

The hearing mechanism

The pinna, or outer part of the ear, funnels sound waves along the ear canal to the ear drum (tympanic membrane), causing the ear drum to vibrate. The ear drum vibrations are transmitted along three small bones in the middle ear (the malleus, incus and stapes or hammer, anvil and stirrup) which mechanically amplify the vibrations.

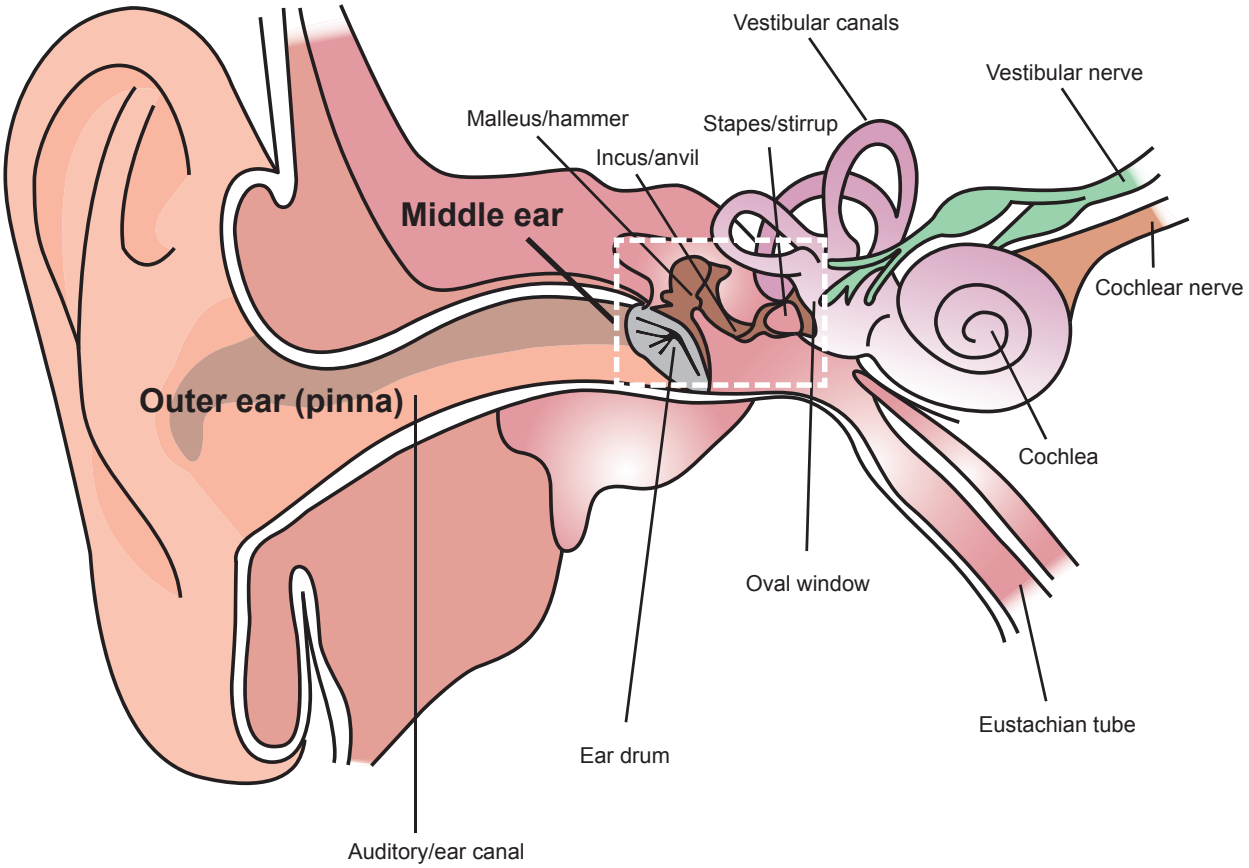


Figure 5.5: Anatomy of the human ear

The stapes presses against the oval window of the cochlea causing it to vibrate which in turns causes the fluid within the cochlea to move.

The cochlea structure consists of three adjacent tubes separated from each other by sensitive membranes. The cochlea is coiled in the shape of a snail shell (Figure 5.5) but is easier to understand if imagined stretched out as in Figure 5.6.

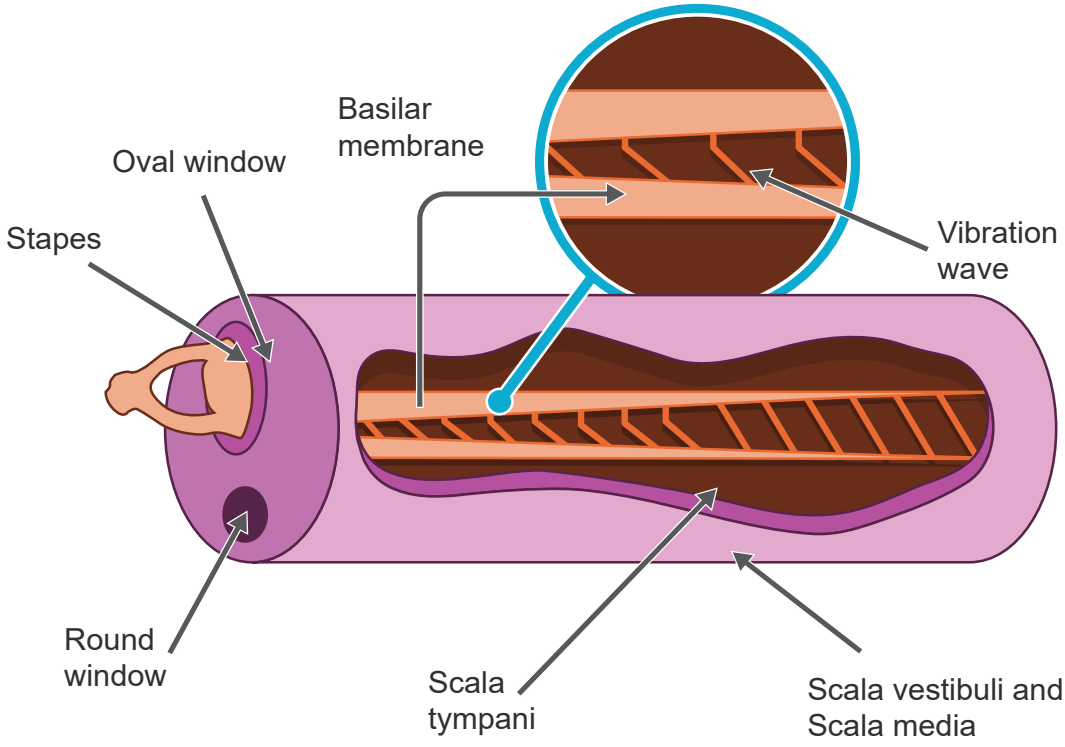


Figure 5.6: The cochlea

The middle membrane, the basilar membrane, is a rigid surface, made of 20 000 to 30 000 reed like fibres, that extends across the length of the cochlea. The movement of the oval window causes a wave to move along the surface of the membrane.

The reed like fibres are short and stiff near the oval window getting longer and more flexible further along the tube.

A specific wave frequency will resonate perfectly with the fibres at a certain point, causing them to vibrate rapidly.

The organ of corti is a structure containing thousands of tiny hair cells. It lies on the surface of the basilar membrane and extends across the length of the cochlea.

When a fibre resonates the organ of corti hair cells move at that point. When the hair cells are moved, they send an electrical impulse through the cochlear nerve.

The cochlear nerve sends these impulses on to the cerebral cortex, where the brain interprets them.

Health effects of noise

Noise at work can cause hearing loss that can be temporary or permanent.

Temporary deafness is often experienced after leaving a noisy place. Although hearing typically recovers within a few hours it should not be ignored. This effect is termed a *temporary threshold shift*.

Permanent hearing damage can be caused in two ways:

- Sudden, extremely loud, explosive noises, *e.g.* from cartridge-operated machines can cause immediate permanent damage. This is often referred to as *blast deafness* or *acoustic trauma*.
- Permanent hearing loss occurs gradually because of prolonged exposure to noise (*permanent threshold shift or noise induced hearing loss*). It may only be when damage caused by noise over the years combines with hearing loss due to ageing (*presbycusis*) that people realise how deaf they have become.

Tinnitus (ringing, whistling, buzzing or humming in the ears), may also be caused as a result of exposure to workplace noise and may be an acute (short term) effect or have a chronic effect (long term).

A Framework for Managing Noise Risks at Work

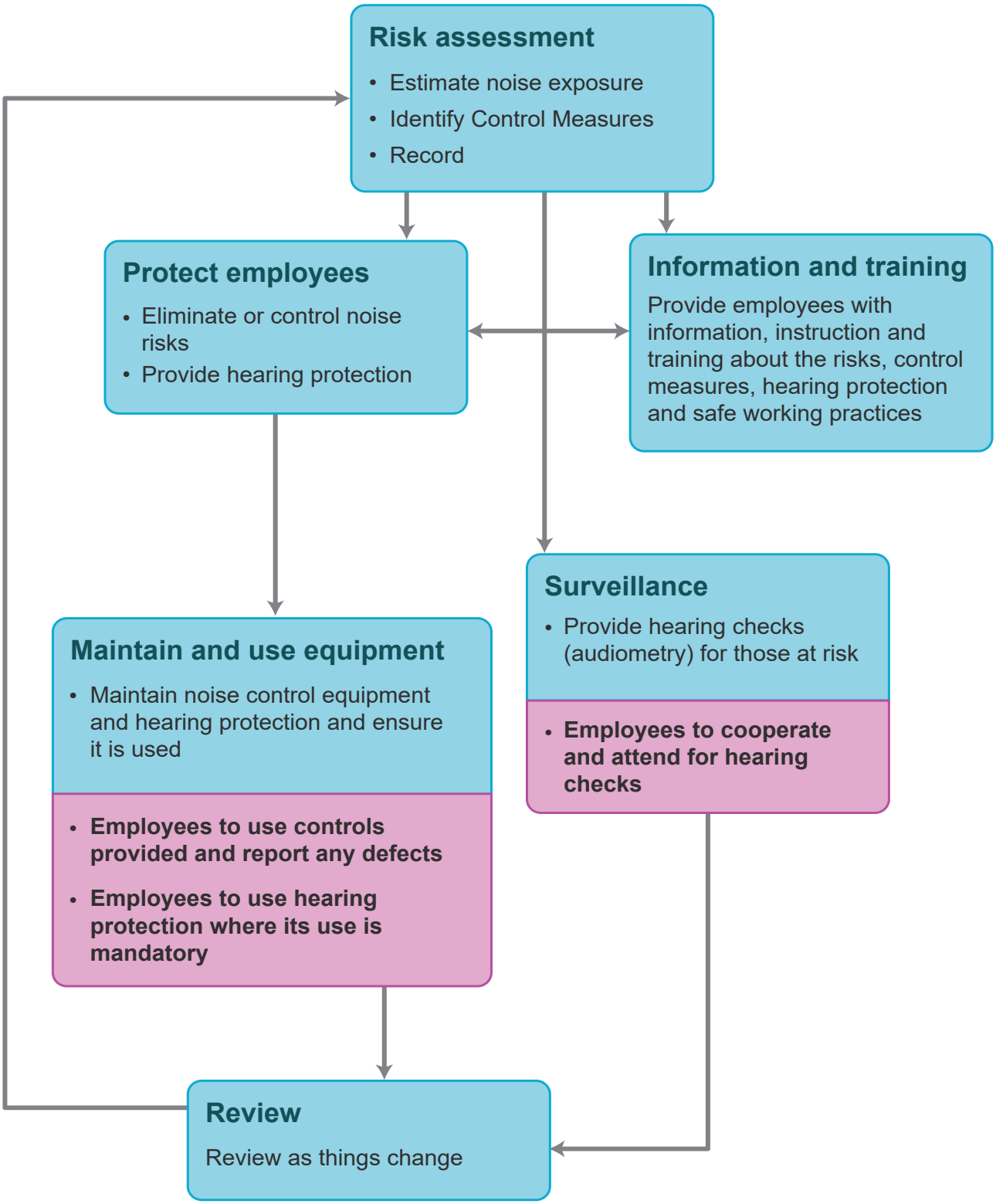


Figure 5.7: Basic requirements

Risk assessment

A noise risk assessment is required if any employee is likely to be exposed to noise levels above the lower exposure action value. Noise exposure is a product of noise levels and duration of exposure.

A rule of thumb test of whether an assessment is required is shown in Table 5.2.

Test	Probable noise level	A risk assessment will be needed if the noise is like this for more than:
The noise is intrusive but normal conversation is possible	80 dB	6 hours
You have to shout to talk to someone 2 m away	85 dB	2 hours
You have to shout to talk to someone 1 m away	90 dB	45 minutes

Table 5.2: Simple test for need of risk assessment

A *'suitable and sufficient'* assessment should:

- be drawn up by someone who is competent to carry out the task
- be based on advice and information from competent sources
- identify where there may be a risk from noise and who is likely to be affected (including employees at particular risk)
- contains reliable estimate of employees' noise exposures and a comparison of exposure with the exposure action values and limit values
- identify the measures necessary to eliminate or control risks
- identify employees in need of health surveillance.

Note:

A reliable estimate of employees' exposure need not mean a detailed noise survey. Reliable estimates can be obtained by keeping track of employees work activity and using a 'ready reckoner' as shown in Figure 5.8.

Sound pressure level, L_{Aeq} (dB)	*Duration of exposure (hours)*								*Total exposure points*	*Noise exposure $L_{EP,d}$ (dB)*
	¼	*½*	*1*	*2*	*4*	*8*	*10*	*12*		
105	320	625	1250							
104	250	500	1000							
103	200	400	800							
102	160	320	630	1250						
101	125	250	500	1000						
100	100	200	400	800					3200	100
99	80	160	320	630	1250				2500	99
98	65	125	250	500	1000				2000	98
97	50	100	200	400	800				1600	97
96	40	80	160	320	630	1250			1250	96
95	32	65	125	250	500	1000			1000	95
94	25	50	100	200	400	800			800	94
93	20	40	80	160	320	630			630	93
92	16	32	65	125	250	500	625		500	92
91	12	25	50	100	200	400	500	600	400	91
90	10	20	40	80	160	320	400	470	320	90
89	8	16	32	65	130	250	310	380	250	89
88	6	12	25	50	100	200	250	300	200	88
87	5	10	20	40	80	160	200	240	160	87
86	4	8	16	32	65	130	160	190	130	86
85		6	12	25	50	100	125	150	100	85
84		5	10	20	40	80	100	120	80	84
83		4	8	16	32	65	80	95	65	83
82			6	12	25	50	65	75	50	82
81			5	10	20	40	50	60	40	81
80			4	8	16	32	40	48	32	80
79				6	13	25	32	38	25	79
78				5	10	20	25	30	20	78
77					8	16	20	24	16	77
76					6	13	16	20		
75					5	10	13	15		

Figure 5.8: HSE ready reckoner – daily noise exposure

If noise measurements are required, the two options are:

- using personal dosimeters to obtain a detailed account of an individual's noise exposure as they move around the workplace

- using a suitably calibrated class 2 integrated sound level meter to take readings at each key noise exposure point, this information together with the time spent at each location can be used to calculate the daily personal noise exposure (LEPd).

As with OEL's for airborne substances, measurements of exposure to noise should be compared to exposure limits established by competent national authorities or international recognised standards.

Noise action levels

An international standard (ISO 1999:2013) provides the basis for occupational exposure limits (OEL) for noise but does not specify a level at which to set an OEL.

The American Conference of Governmental and Industrial Hygienists (ACGIH) recommended limit of 85 dB(A) for 8 hours has generally found acceptance in most countries.

In the European Union (EU) there are three noise action levels defined in the Physical Agents (Noise) Directive 2003/10/EC. At each level the employer is required to take certain steps to reduce the harmful effects of noise on hearing as shown in table 5.3.

Noise action levels	Daily / weekly average	Peak sound pressure	Employers duties
Lower exposure action value	80 dB(A)	135 dB(C)	• Provide information and training • Make hearing protection available
Upper exposure action value	85 dB(A)	137 dB(C)	• Take reasonably practicable measures to reduce noise exposure (engineering controls / technical measures • Provide mandatory hearing protection pending engineering controls and, where necessary, after engineering controls
Exposure limit value	87 dB(A)	140 dB(C)	• Ensure level is not exceeded, taking hearing protection into account

Table 5.3: Noise action levels

Eliminate or control noise exposure

Noise energy can be transmitted directly through the air or can be transmitted through other materials such as structural components. Noise energy also reflects off solid surfaces.

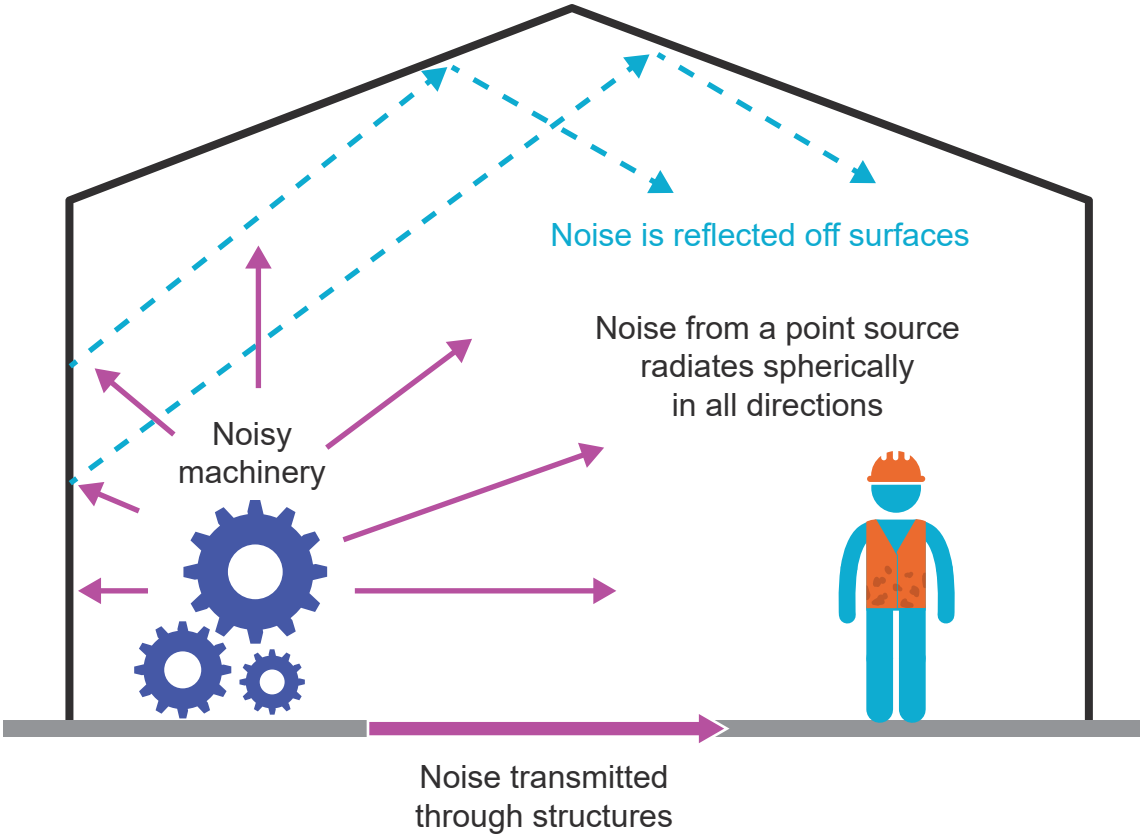


Figure 5.9: Noise transmission pathways

Noise control strategies involve controls at the source, the pathway and at the receiver.

Control the noise at source

- replace the machine with one with lower noise emissions
- move the machine to an area with fewer employees
- ensure the machine is being properly maintained
- modify parts of the machine, *e.g.* by replacing components with ones designed to operate more quietly:
  - isolate panels or add damping materials to them
  - isolate the machine from the building with isolation mounts or isolated foundations (isolation made of rubber or springs can be used to reduce the spread of structure borne sound through a machine frame)

- add damping material to receiving trays to reduce impact noise from falling materials (damping involves adding material to reduce vibrations and the tendency of machine parts to "*ring*")
- line solid guards with sound-absorbing material (taking care not to impede ventilation)
- fit appropriate silencers to air inlets and exhausts (the increased volume of the silencer decreases the speed of the air flow at the exhaust, thus reducing the noise)
- fit silencers to compressed air systems or feed the exhaust away from the working area.

Control the path of the noise

- fit a suitably designed enclosure around a machine if it does not require *'hands on'* operation
- provide a noise haven for employees supervising the operation of large machines where enclosing the whole machine would be difficult
- erect barriers or screens between different elements in the production process, separating quiet operations from noisy ones
- add absorptive materials to the building to reduce reverberant noise or echoes (absorption is the ability some materials have of reducing the amount of noise as the noise passes through it)
- use active noise control to address low frequency tones.

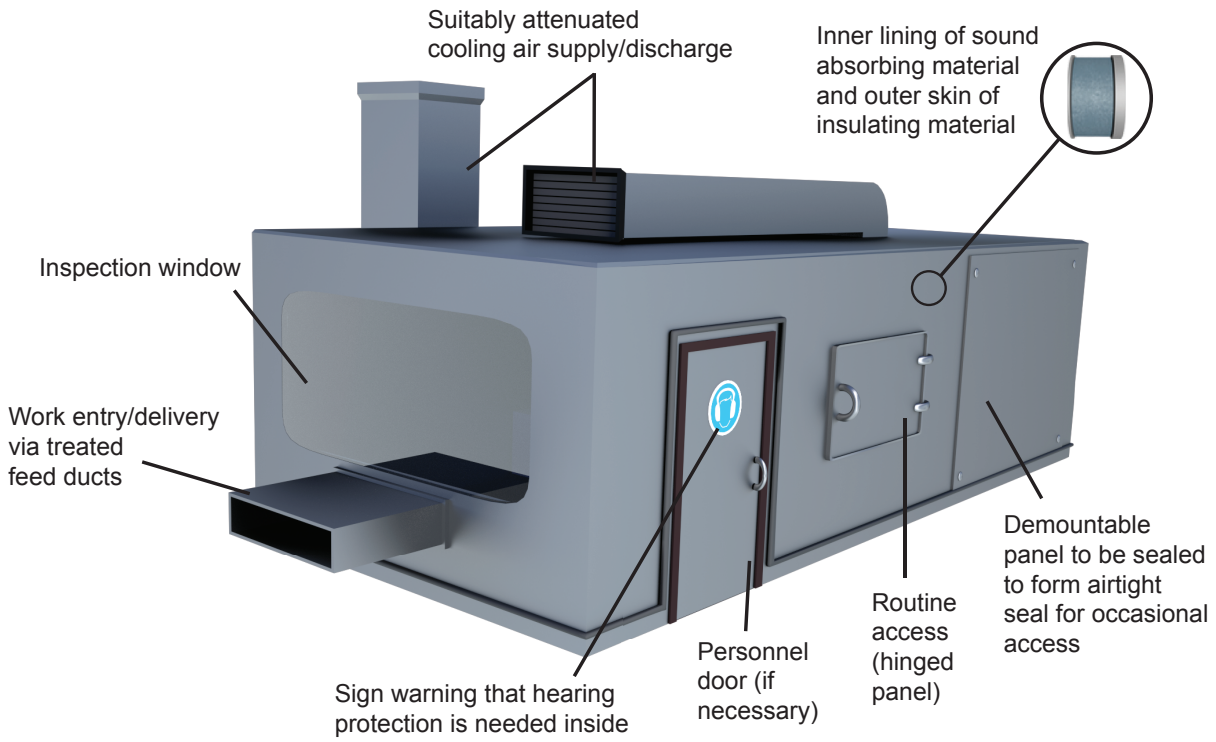


Figure 5.10: Acoustic enclosure

Control noise at the receiver

The receiver can be protected from the effects of noise by: positioning (distance), reduction of the time exposed or provision of PPE.

Positioning

Position the worker further away from the source of noise (Doubling the distance can reduce the effect of the noise by 3 to 6 dB). Noise energy diminishes in accordance with the inverse square rule.

Time

With the exception of very loud noises (130 dB+) it is the accumulated dose that causes hearing loss. Halving the time exposed will reduce the dose received by half (3 dB).

Personal hearing protection

Personal hearing protection (PHP) should be provided quickly on discovering a risk to health due to noise. It is not an alternative to technical and organisational noise controls but a means of managing the immediate risk pending the development of other control measures.

Longer term, it should be used where there is for additional protection beyond what has been achieved through noise control.

Hearing protectors are available in many forms all of which are capable of providing a reduction in noise exposure. Manufacturers' information should be used to help ensure the selection of suitable hearing protectors for the work situation.

The following factors should be considered in selecting appropriate hearing protection:

- types of protector, and suitability for the work being carried out
- noise reduction (attenuation) offered by the protector
- compatibility with other safety equipment
- pattern of the noise exposure
- the need to communicate and hear warning sounds

Figure 5.11: Types of hearing protection

- environmental factors such as heat, humidity, dust and dirt
- cost of maintenance or replacement

- comfort and user preference
- medical condition of the wearer.

Hearing protectors should be CE marked or to a recognised standard, in good condition, the correct size and worn properly.

Type	Description	Advantages	Disadvantages
Ear Muffs	Hard plastic cups which fit over and surround the ears. Sealed to the head by cushion seals under tension from a headband. Inner surfaces of the cups are covered with a sound-absorbing material. Available in a range of sizes.	Easy to fit and use. Clearly visible so easy to monitor use.	May not be compatible with other PPE. May be uncomfortable in warm conditions. Long hair, beards and jewellery may interfere with seals.
Ear plugs	Earplugs fit into the ear or cover the ear canal to form a seal. Available in different forms (pre-shaped, user formable or semi-insert). Reusable or disposable. May be attached to a cord or a neckband.	Suited for use with safety glasses and other forms of PPE.	Can be hard to fit. Only effective when fitted properly. Difficult to monitor by observation. Work loose over time reducing efficiency. Unsuitable for dirty dusty environments or work requiring regular removal.

Type	Description	Advantages	Disadvantages
Helmet mounted earmuffs	Individual cups attached to safety head-gear such as a visor or a hard hat, usually by adjustable arms.	Avoids issue of compatibility with safety helmets.	May not be compatible with other PPE. May be uncomfortable in warm conditions. Long hair, beards and jewellery may interfere with seals.
Custom moulded plugs	Earplugs made from a material such as silicone rubber, individually moulded to fit a person's ears.	Easier to fit than other types of earplug therefore more likely to get good protection. Comfortable.	Poor performance if manufacturing and initial fitting are not done properly.

Table 5.4: Personal hearing protection

Surveillance

Any employee identified as at risk should be paced under suitable health surveillance.

Hearing loss is measured by audiometry. This involves the subject sitting in a soundproof booth and listening through earphones to a series of pure tone sounds, pressing a button to indicate that he has perceived that sound.

At the end of the test, an audiogram is produced for each year showing the subjects hearing response.

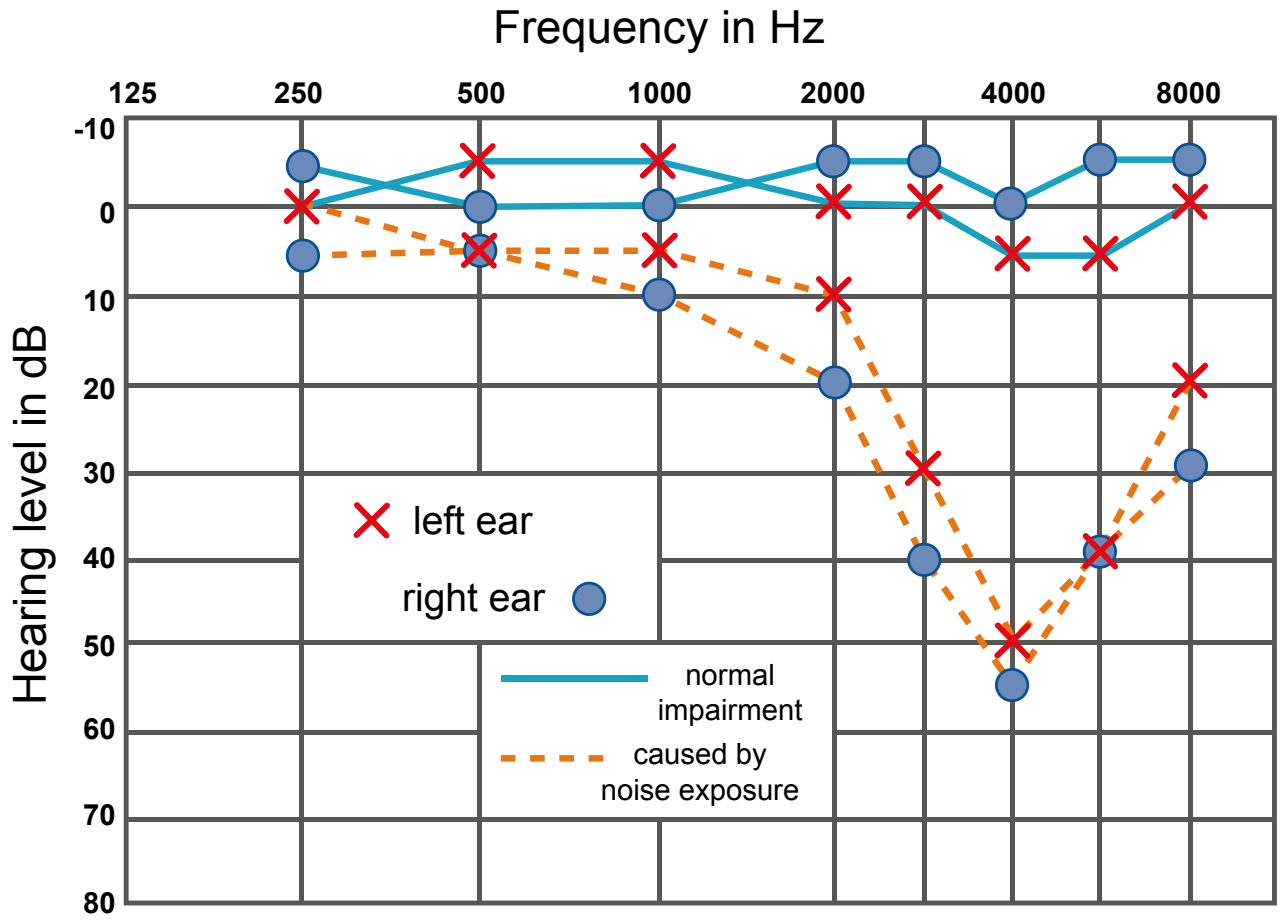


Figure 5.12: Audiogram comparing noise induced hearing loss to normal hearing

If the audiometry indicates that an employee has suffered noise induced hearing loss, the occupational health professional making the diagnosis should:

- inform the employee of the results and advise on the risk of continuing exposure
- inform the employer of the findings (excluding confidential information).

5.2 Vibration

Vibration refers to the mechanical movement of a body rhythmically back and forth through a fixed point.

The effect of mechanical vibration on the human body is termed human vibration. There are two main types of human vibration, classified according to the body systems that affect:

- whole-body vibration (WBV)
- hand-arm vibration (HAV).

Whole-body vibration is shaking or jolting of the human body through a supporting surface (usually a seat or the floor), *e.g.* when driving or riding on a vehicle along an unmade road, operating earthmoving machines or standing on a structure attached to a large, powerful, fixed machine which is impacting or vibrating.

Hand arm vibration is vibration transmitted from work processes into workers' hands and arms. It can be caused by operating handheld power tools, such as road breakers, and hand guided equipment, such as powered lawnmowers, or by holding work pieces being machined.

The whole-body system and the hand-arm system are *'mechanically different'* and they are therefore dealt with separately (see Tables 5.5 and 5.6).

Measuring vibration magnitude

When a body vibrates it moves in three planes: up and down, left to right, and forward and backward. There are three parameters that could be measured: the distance travelled (displacement), the speed of travel, or the acceleration.

The international standard for human vibration measurement specifies the measurement of the average acceleration across all three planes as the appropriate measurement of magnitude. Acceleration is measured in metres per second per second (m/s^2).

As with OELs for airborne substances and LEPd for noise, measurements of exposure to vibration should be compared to exposure limits established by competent national authorities or international recognised standards.

As there is a clear dose response relationship for HAV (not so for WBV) the accumulated dose over the working day is the measure of interest. This is known as the A8 and is comparable to the LEPd for noise.

A Framework for Control of Vibration at Work

The basic requirements of the EU Physical Agents (Vibration) Directive:

- assess the vibration risk to employees
- if exposure is likely to be above the daily exposure action value (EAV) introduce a programme of controls to eliminate or reduce daily exposure so far as is reasonably practicable
- if exposure is likely to be above the daily exposure limit value (ELV) take immediate action to reduce exposure below the ELV
- provide health surveillance for any employees whose health is at risk or is likely to be exposed to levels above the exposure action value
- provide information and training on health risks and controls to employees at risk.

Risk assessment

A *'suitable and sufficient assessment'* vibration risk assessment as required in the UK will identify and record:

- where there may be a risk from HAV or WBV
- in the U.K. a sound estimate of employees' exposures and a comparison with the EAV and ELV (The UK's Health and Safety Executive (HSE) has produced vibration calculators and ready reckoners for HAV and WBV which can be used to estimate employees exposure)
- any individuals who may be at greater risk
- the available risk controls
- actions to be taken to control and monitor the risks.

Health surveillance

Health surveillance is a programme of systematic health checks to identify early signs and symptoms of work related ill-health (HAVS or WBVS)

The main aims are to:

- safeguard the health of employees (including identifying and protecting people at increased risk)
- check the long-term effectiveness of control measures.

A tiered approach to health surveillance is sensible. The first level is to use questionnaires to identify workers who may be at risk or may be experiencing early symptoms.

The second level would involve an assessment by an occupational health nurse. If ill-health was indicated the third level would involve a referral to an occupational health physician for a formal diagnosis.

Medical assessments are more appropriate for HAVS as the early signs of Vibration White Finger (VWF) can be tested for.

Hand Arm Vibration (HAV)	
What is it?	Hand arm vibration is vibration transmitted into the hands and arms when using handheld powered work equipment.
Who might be affected?	Regular users of handheld or hand guided power tools and machines such as, concrete breakers, sanders, grinders, disc cutters, hammer drills, chainsaws, powered mowers, scabblers or needle guns. Workers holding work-pieces which vibrate while being processed by powered machinery such as pedestal grinders.
What are the symptoms?	Hand Arm Vibration Syndrome (HAVS) affects the nerves, blood vessels, muscles and joints of the hand, wrist and arm. It includes vibration white finger (VWF), which can cause severe pain in the affected fingers. HAV can also cause carpal tunnel syndrome – a nerve disorder which may involve pain, tingling, numbness and weakness in parts of the hand.

Hand Arm Vibration (HAV)	

What are the risk factors?	• frequency of the vibration:
	  • 2 to 1 500 Hz is potentially damaging
	  • 5 to 20 Hz is most dangerous
	• magnitude of the energy measured in m/s^2
	• strength of the grip and other forces necessary to hold or guide the tool or work-piece
	• duration of exposure
	• frequency of exposure
	• low temperature
	• individual factors, *e.g.* smoking, susceptibility to vibration energy, age, health and general well-being.

How is it controlled?	• eliminate the need for a worker to hold vibrating equipment, *e.g.* automate a process • minimise the required force or grip on the tool or work piece • provide suitable low vibration tools • ensure the right tool is used for each job • ensure tools have been properly maintained to avoid increased vibration caused by faults or general wear, and keep cutting tools sharp so that they remain efficient • reduce the amount of time vibrating tools are used (work scheduling / job rotation / rest breaks) • use of dose monitors / limiters • keep workers warm and dry (provide gloves, a hat, waterproofs and heating pads if required) • provide workers with information and training on the risks and precautions.

Table 5.5: HAV summary

Whole Body Vibration (WBV)	
What is it?	Whole-body vibration is the shaking or jolting of the human body through a supporting surface (usually a seat or the floor), *e.g.* when driving or riding a vehicle along an unmade road.
Who might be affected?	Regular operators and drivers of off-road machinery *e.g.*: • construction, mining and quarrying machines and vehicles, and • Tractors and other agricultural and forestry machinery.
What are the symptoms?	Short Term: Back pain, abdominal pain or general feeling of discomfort, including headaches, chest pain, nausea and loss of balance Long Term: Disc displacement, degenerative spinal changes, lumbar scoliosis, degenerative disorders of the spine and disorders of the gastrointestinal system. The HSE view is that WBV is unlikely on its own to cause back pain but can aggravate a back problem caused by another activity, *e.g.* a muscle strain caused by an accident
What are the risk factors?	• unusually high vibration or jolting or the vibration is uncomfortable for a long time on most working days • unsuitable vehicle for terrain and roadway • lack of vehicle maintenance • driving vehicle off designated roadway or driving too fast.
How is it controlled?	• select vehicles and machines with the appropriate size, power and capacity for the work and the ground conditions • maintain vehicle suspension systems correctly (*e.g.* cab, tyre pressures, seat suspension) • make sure that paved surfaces or site roadways are well maintained, *e.g.* potholes filled in, ridges levelled, rubble removed • train and instruct operators and drivers to be able to adjust seat positioning and driver weight setting on suspension seats, keep to roadways and observe speed limits.

Table 5.6: WBV Summary

5.3 Radiation

Radiation is energy that is radiated or transmitted in the form of rays or waves or particles.

Based on the effect that radiation has on matter it is classed as ionising or non-ionising radiation.

Ionising radiation

When ionising radiation passes through matter, including human tissue, it leaves energy behind. This causes an electrical imbalance at the atomic level creating ions. An ion is an atom that has gained or lost electrons. If an atom gains electrons it is negatively charged (anion), if it has lost electrons it is positively charged (cation). The ionisation of human tissue can result in harmful biochemical effects.

Ionising radiation may occur naturally from the deterioration of radioactive substances such as uranium or may be man-made.

A radioactive substance has electrically imbalanced atoms and gives off electrons (beta particles) or larger alpha particles (a combination of two neutrons and two protons) as it tries to achieve balance. Gamma rays are also emitted during this process.

X rays are man - made wave form ionising radiation.

The four main types of ionising radiation are:

- alpha particles (α)
- beta particles (β)
- gamma rays (ɣ)
- X rays.

The ability of radiation to form ions is a function of mass and penetrating ability. Alpha particles have the greatest effect, gamma rays the least.

Alpha particles (α)

Alpha particles are emitted from the nuclei of the radioactive atoms and consist of two protons and two neutrons. They are heavy, slow moving and carry a double positive charge.

They are potentially the most damaging type of ionising radiation but are fairly easy to stop with barriers. They will not penetrate human skin and can only travel a few centimetres in air.

Alpha particle emitters are used in smoke detectors and as static eliminators.

Beta particles (β)

Beta particles are high energy negatively charged particles. Each particle is actually an electron emitted from the nucleus.

Beta particle electrons do not come from the electron shells around the nucleus but are formed when a neutron splits into a proton and an electron. The electron then shoots out of the nucleus at high speed.

Beta particles can travel further than alpha particles and can penetrate human skin but are not as harmful as alpha particles.

Beta emitters are used in industrial thickness gauges and as medical radioactive tracers.

Gamma rays (ɣ)

Gamma rays are very short wavelength (high frequency) electromagnetic radiation. Gamma radiation is similar in many ways to other types of electromagnetic radiation such as visible light and X-rays, which can travel long distances.

Gamma emitters such as Cobalt 60 have a range of medical and industrial uses including steel thickness testing, medical sterilisation, food pasteurisation and cancer treatment.

X rays

X rays are similar to gamma rays but are generally man made and lower in energy.

X ray machines are used universally in medicine and industry for examinations, inspections and process controls.

The effects of ionising radiation

The energy that radiation deposits in body tissue may have no effect or can cause cell damage or cell death.

The extent of the damage depends upon:

- the total amount of energy absorbed
- the time period
- the dose rate of the exposure
- the particular organs exposed.

Absorbed dose and dose equivalent

There are maximum dose levels that must not be exceeded as this can lead to acute and chronic health effects.

Acute and chronic effects

Acute effects

Acute exposure is exposure to a large, single dose of radiation, or a series of moderate doses received during a short period of time. Acute exposure to radiation may cause both immediate and delayed effects.

A large dose of radiation can cause rapid development of radiation sickness, evidenced by gastrointestinal disorders, bacterial infections, haemorrhaging, anaemia, loss of body fluids, and electrolyte imbalance.

An extremely high dose of acute radiation exposure can result in death within a few hours, days, or weeks.

Delayed biological effects include: cataracts, temporary or permanent sterility, cancer, mutagenic (inheritable genetic effects) or teratogenic (interferes with embryonic development) effects.

Chronic effects

Chronic exposure is continuous or intermittent exposure to low doses of radiation over a long period of time.

With chronic exposure, there is a delay between the exposure and the observed health effect.

The effects of chronic exposure include: cancer, benign tumours, cataracts, and mutagenic or teratogenic effects.

Controlling exposure

The three main factors that can be controlled to reduce radiation exposure are:

- shielding
- time
- distance.

Shielding

The type and amount of shielding needed to achieve a safe working level varies with the type and quantity of radioactive material used. Gamma rays and X rays are more penetrating that alpha or beta particles and will require a few inches of lead or several feet of concrete to stop them (see Figure 5.13).

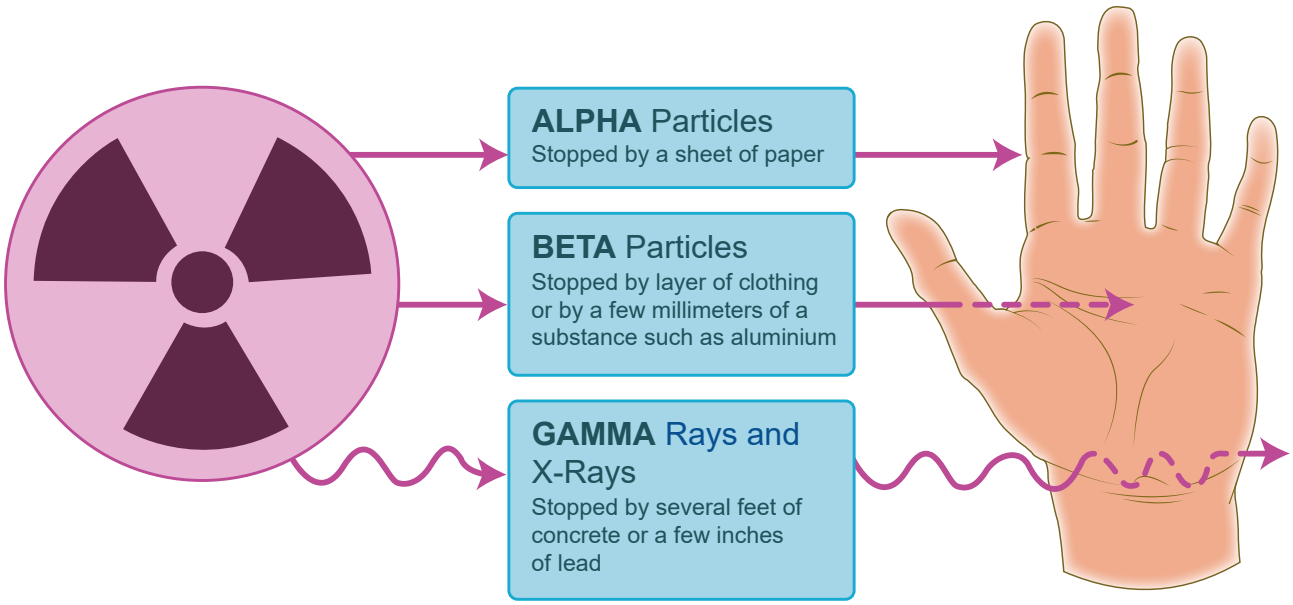


Figure 5.13: Shielding

Time

As the accumulated dose increases with time exposed control of exposure times is a useful control measure.

Distance

Distance is the most effective strategy. Alpha and beta particles do not travel far (alpha

particles – several centimetres/beta particles – several metres) so small distances can make a big difference.

Wave form energy dissipates in accordance with the inverse square law. The amount of energy received two metres from a source would be 1/4 of that received at one metre, at three metres it would be 1/9 etc.

Other controls

These can include the selection and use of appropriate personal protective equipment, correct disposal of any contaminated waste and measuring personal dose using appropriate dose meters.

Radiation Protection

The International Commission on Radiological Protection (ICRP) recommends a system of protection against the risks from exposure to ionising radiation which is based upon three main principles of 'justification, optimisation and dose limitation.'

The recommendations laid down in the **ILO Code of Practice on Radiation Protection of Workers (Ionising Radiations)** are based upon these principles as are regulatory frameworks around the world.

In the 2013/59/Euratom lays down basic safety standards for the protection of the health of workers and the general public against the dangers arising from ionising radiation.

Prior risk assessment

A suitable and sufficient risk assessment is required before commencing a new activity involving work with ionising radiation.

This should include:

- all hazards with the potential to cause a radiation accident have been identified
- the nature and magnitude of the risks to employees and other persons arising from those hazards have been evaluated.

Restriction of exposure

All reasonable steps must be taken to restrict the extent to which workers are exposed to ionising radiation.

This requires the application of the following hierarchy of control measures throughout the design, construction, installation and use of sources of ionising radiation:

- engineering controls, including shielding and interlocked access
- warning devices
- systems of work, training, local rules and instructions
- personal protective equipment.

Radiation protection adviser (RPA)

The role of the RPA is to advise on:

- risk assessments
- designation of controlled and supervised areas
- incident investigations
- contingency planning
- dose assessment and recording.

Controlled and supervised areas

Where a worker is likely to receive a significant annual dose in a particular work area or will need to follow special procedures to limit exposure the work area should be designated a controlled area.

Where it is necessary to keep an area under review to establish whether it should be a controlled area it is designated a supervised area in the interim.

Local rules (key working instructions) for restricting exposure are established for controlled areas and Radiation Protection Supervisors (RPS) are appointed to enforce them.

Information, instruction and training

Employers must ensure that employees working with radiation are given suitable and sufficient training, information and instruction so that they understand:

- the key risks to health caused by exposure to ionising radiation
- the required precautions and control measures
- the medical, technical and administrative requirements

- what to do if things go wrong.

Classification and monitoring of persons

Any employee who is likely to receive a significant annual dose should be designated as a classified person and informed accordingly. (Note: workers cannot be a classified person unless they are 18 years or older).

A classified person must be subject to an assessment of all significant doses of ionising radiation and a written record must be kept for a minimum of fifty years or until the classified person reaches 75 years of age.

Radon

Radon 222 is a radioactive (α particles) gas which comes from uranium and occurs naturally in many rocks and soils. As an example Radon can seep out of the ground and build up in houses and indoor workplaces. Figure 5.14 shows radon affected areas across the globe.

Radiation Protection

The International Commission on Radiological Protection (ICRP) recommends a system of protection against the risks from exposure to ionising radiation which is based upon three main principles of 'justification, optimisation and dose limitation.'

The recommendations laid down in the **ILO Code of Practice on Radiation Protection of Workers (Ionising Radiations)** are based upon these principles as are regulatory frameworks around the world.

In the **EU Directive 96/29/Euratom – Ionising Radiation** lays down basic safety standards for the protection of the health of workers and the general public against the dangers arising from ionising radiation.

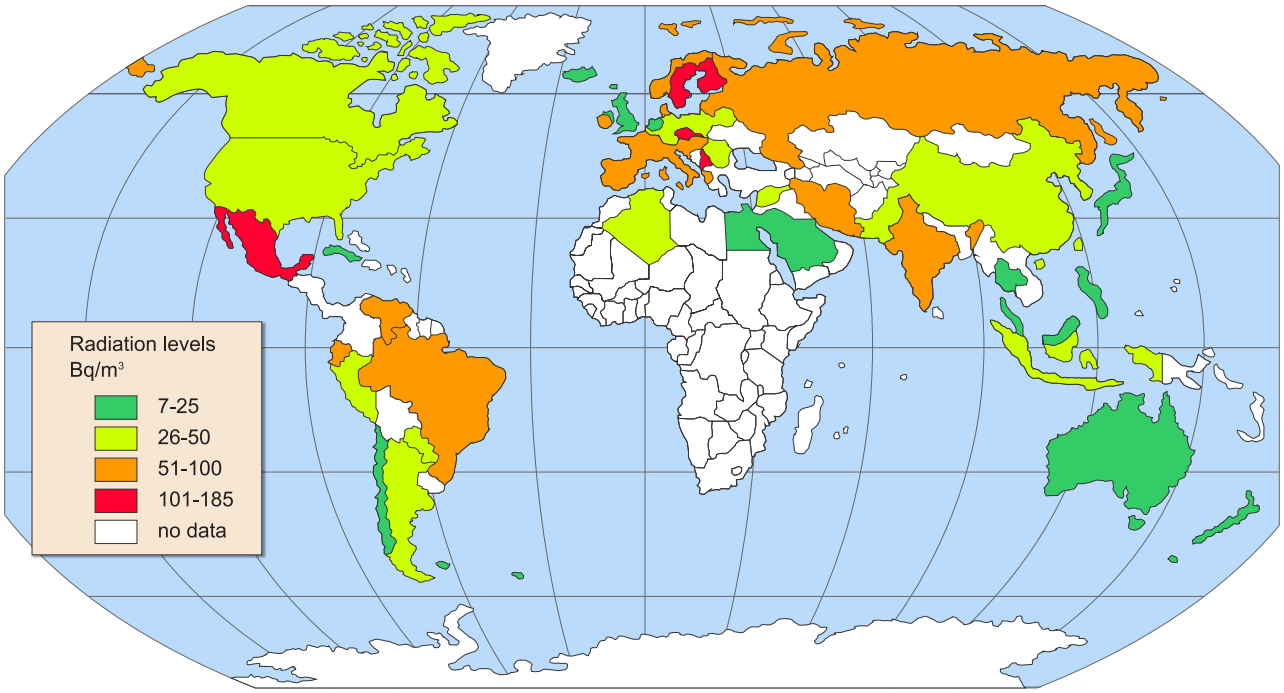


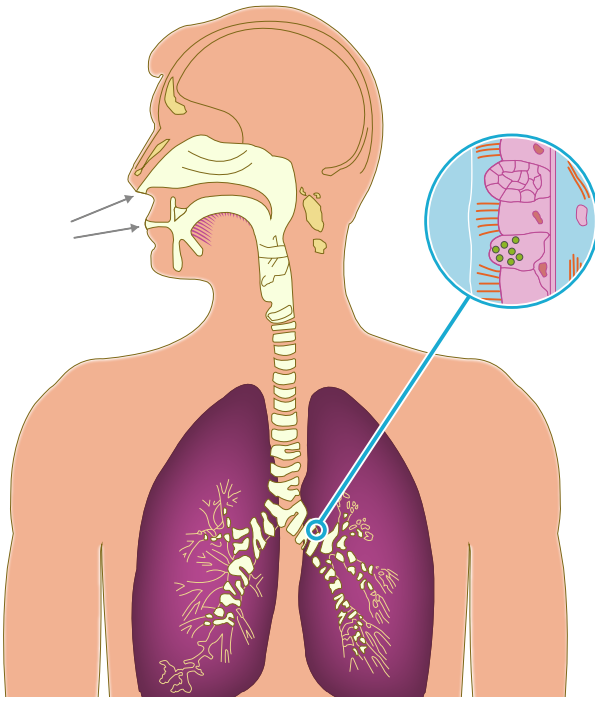
Figure 5.14: Radon affected areas in England and Wales

The highest levels are usually found in underground spaces such as basements, caves and mines, though high concentrations are also found in ground floor buildings (as they are at

slightly lower pressure than the surrounding atmosphere radon from the sub-soil underneath buildings seeps in through cracks and gaps in the floor).

The health effects of radon

Recent studies on indoor radon and lung cancer in Europe, North America and Asia provide strong evidence that radon causes a substantial number of lung cancers in the general population. Current estimates of the proportion of lung cancers attributable to radon range from 3 to 14%, depending on the average radon concentration in the country concerned and the calculation methods.



Most radon gas breathed in is immediately exhaled and presents little radiological hazard. However, the decay products of radon (radon daughters) behave more like solid materials than a gas and are themselves radioactive.

These solid decay products attach to atmospheric dust and water droplets which can then be breathed in and become lodged in the lungs and airways. Some decay products emit alpha particles which cause significant damage to the sensitive cells in the lung.

Radon contributes by far the largest component of background radiation dose received by the UK population (50%) and although the largest radon doses occur in domestic dwellings significant exposures are possible in workplaces.

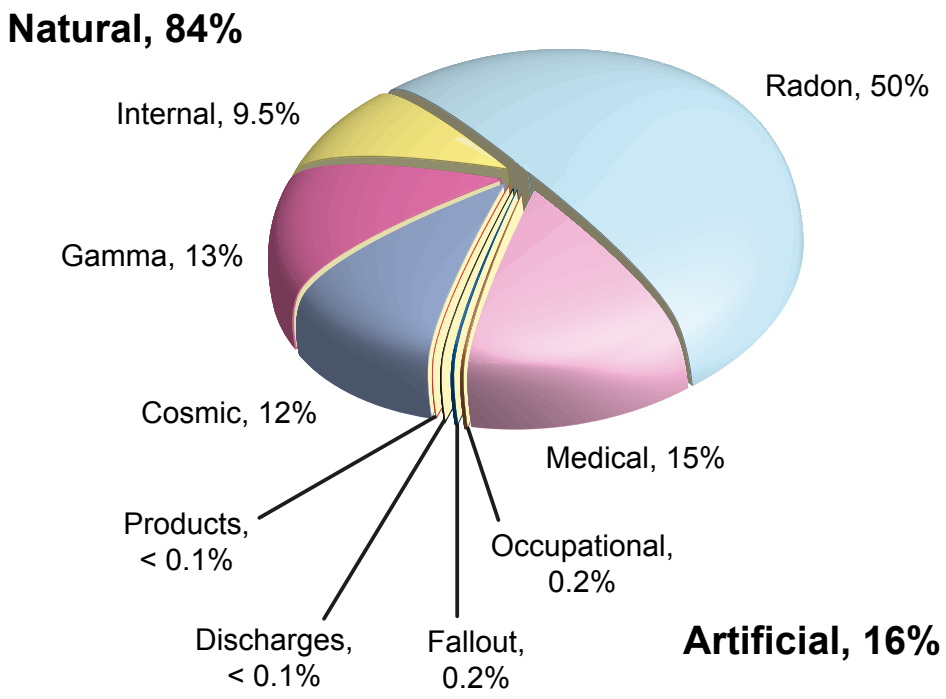


Figure 5.15: Components of background radiation dose

Radon levels

Radon is present in all buildings: the average level in the UK is 20 becquerels per cubic metre of air. Some workplaces have been found to have measured radon levels significantly in excess of the 300 Bq/m^3 annual average activity concentration at which the provisions where UK legislation applies. Worst cases have shown levels over 17 000 Bq/m^3.

The becquerel (Bq)

The unit in which radioactivity is measured.

One becquerel = one atomic disintegration per second.

If there are 20 Bq per cubic metre of air, the amount of radon is such that 20 atoms disintegrate every second in that volume.

Testing for radon

Radon levels in buildings vary widely throughout any given day and from season to season. For these reasons measurements are usually made over a period of three months and the worst-case winter levels estimated using seasonal correction factors.

In the U.K. Public Health England runs a routine radon monitoring service for employers. This includes provision of monitors, processing and providing a written report of the results and brief advice.

The radon monitors contain a piece of sensitive plastic that registers damage tracks when exposed to alpha particles. The tracks are counted with an automated microscope to determine the average radon levels during the three month measurement period.

Figure 5.16: Radon monitor

The number of monitors required for each building depends on the workplace type and use, see below, and should be placed in the lowest routinely occupied floor and any basement areas.

Workplace type	Examples	Number of monitors
Office, individual or small	Banks, shops, professional practice	One per 100 m^2, generally corresponds to between a half and third of all ground floor rooms
Open plan office, and retail or workshop up to about 1000 m^2, also public access areas	Administrative and call centres, light industry, hotels, schools	One per 250 m^2
As above, up to 5 000 m^2	Large retail etc	One per 500 m^2
Very large areas of several thousand m^2	Manufacturing or process plant, warehouses	One for each distinct area with obviously different environmental conditions, not less than 1 per 1 000 m^2

Workplace type	Examples	Number of monitors
Basements	Retail, bank and professional storage areas	One in each separate room, section or area irrespective of size. Even if rarely used, changes in procedures might increase exposure.
Wholly underground	Water industry, mines and caves	As a guide at least one in each main working area, and other normally occupied areas, but seek specialist advice

Table 5.7: Recommended numbers of radon monitors

Remedial action

For occupied areas with levels above 300 Bq/m^3, the employer may need to immediately take steps to manage occupational exposures pending any decision they may take to reduce the radon levels by engineered means.

A Radiation Protection Adviser (RPA) with radon experience should normally be consulted about how best to manage radon exposures but, if the employer plans to immediately remove the radon, it is better to consult a specialist radon remediation contractor in the first instance.

Practical control of radon levels in buildings

Protection measures for reducing levels inside workplaces vary depending upon the severity of the problem and the type of building construction.

New buildings can be protected during construction by installing a *'radon proof barrier/ membrane'* within the floor structure.

In existing buildings the best approach is to prevent radon entering the building by altering the balance of pressure between the room and the ground. Pressure inside the building can be increased by blowing air from the roof space with a small fan and pressure under the floor is reduced by connecting a low power fan to a small sump and extracting the air.

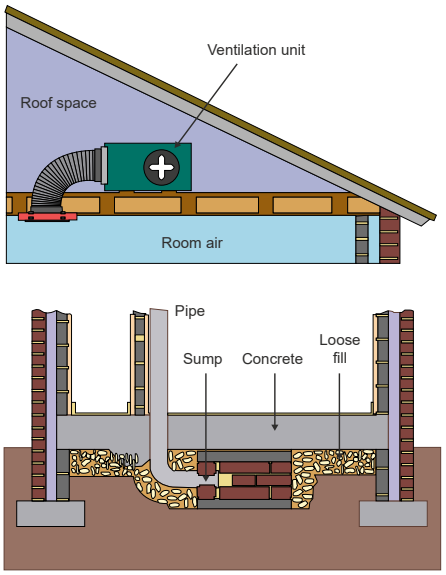


Figure 5.17: Ventilation Unit and Sump

Reviewing radon risk assessment

As with all health and safety risk assessments radon risk assessments should be kept under review.

Where significant changes are made to the fabric of a building or to the work processes carried out within it, then the need to re-measure the radon levels should be considered.

In the U.K. it is good practice to set a timescale after which re-measurement of the radon levels will occur. The HSE suggests the following guidelines:

- where initial levels were significantly less than 300 Bq/m^3 re-measurement should occur once every 10 years
- where initial levels were just below 300 Bq/m^3 re-measurement should occur before 10 years
- where initial levels were above 300 Bq/m^3 and measures have been taken to reduce radon exposures (such as engineered systems or occupancy restrictions), the re-measurement periods may need to be significantly more frequent in order to verify their continuing effectiveness.

Non-ionising radiation

Non-ionising radiation (NIR) is the term used to describe the part of the electromagnetic spectrum covering two main regions, namely optical radiation (ultraviolet (UV), visible and infrared) and electromagnetic fields (EMFs) (power frequencies, microwaves and radio frequencies).

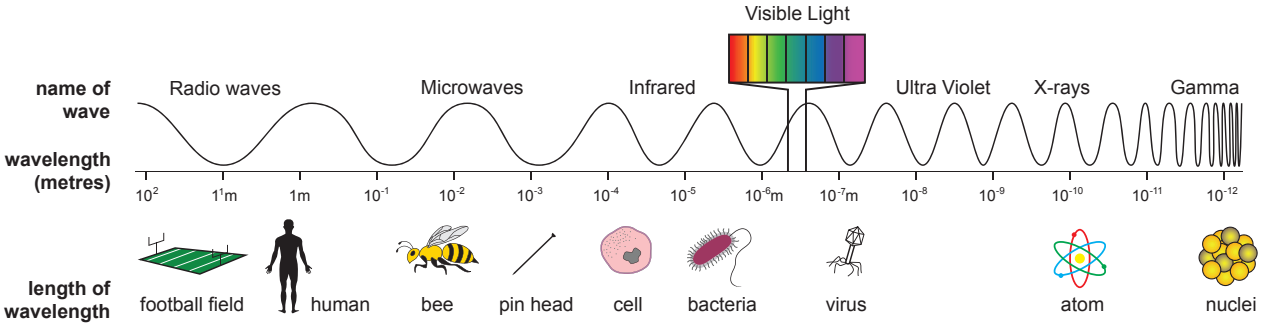


Figure 5.18: Electromagnetic spectrum

The greatest risks to health from optical radiations are probably:

- UV radiation from the sun
- the misuse of powerful lasers.

Exposure to high levels of EMFs can give rise to acute effects. The central nervous system (CNS) can be affected at low frequencies whilst at high frequencies local heating effects can occur. In reality, these effects are extremely rare and will not occur in most day-to-day work situations.

Typical workplace exposures, potential harms and typical control measures are presented for each type of non-ionising radiation in Table 5.8.

Type of radiation	Typical occupational exposure	Health effects	Controls
Radio frequencies	Communications transmitters, high frequency welding apparatus, microwave drying equipment, food preparation, glue curing	Tissue damage through heating effect. Radio frequencies will pass through the body	Guarding/encasement with interlocked access. Distance – safe positioning of transmitters
Microwaves		Tissue damage through heating effect. Microwaves absorbed near skin surface.	
Infra-red	Work which generates heat: Furnaces, cutting, brazing, welding, heat lamps, LASERS.	Heat sensation and pain Burns to skin and eyes.	Skin protection Eye protection Time controls – regular breaks and rehydration
LASERS	Material processing – cutting, drilling, etching surgery entertainment measurement communications.	Emit optical radiations – IR, visible light and UV. Depends on type and class of LASER – Damage to eyes and skin	Specify low class LASER Enclosed in case with interlocked access Eye protection
Ultra-violet	Outdoor work – sunlight UV emitted during arc welding UV lamps used in: • paint and ink curing • tanning industry • sterilisation.	UVB radiation most destructive: • sunburn • cataracts • photokeratitis (arc eye) • skin cancers.	Shielding – shade, clothing, sun protection lotion Time – limit duration Distance from source PPE (*e.g.* welding mask)

Table 5.8: Non-ionising radiations

Mental ill-health in the workplace

Mental health problems are common with one person in four in the UK experiencing a mental health problem at some point in their life. Most mental health problems are mild with anxiety and depression being the most common.

Anxiety is an unpleasant feeling when worried, uneasy or distressed about something that may or may not be about to happen.

Depression is having feelings of extreme sadness, despair or inadequacy that last for a long time.

Post-Traumatic Stress Disorder (PTSD) occurs following a psychologically distressing event that is beyond the range of usual human experience such as a simple bereavement, chronic illness, business loss or marital conflict. The event is usually experienced with intense fear, terror, and helplessness.

The characteristic symptoms of PTSD include: re-experiencing the traumatic event; avoidance of stimuli associated with the event; numbing of general responsiveness; and increased arousal e.g. difficulty falling asleep, staying awake, irritability or outbursts of anger.

The symptoms can be acute, chronic or delayed.

Often anxiety and/or depression are experienced as a reaction to a difficult life event such as moving house, bereavement, or problems at work.

Work related stress and Common Mental Health Problems (CMHP) such as anxiety and depression often go together. Work related stress may trigger an existing mental health problem or cause it to worsen.

Stress and CMHP can also exist independently. Many people experience the physiological changes such as high blood pressure that are associated with work related stress without ever experiencing anxiety and depression. Others may be anxious or depressed without ever experiencing work related (or other) stress.

In practice, it can be hard to distinguish when ‘stress’ turns into a ‘mental health problem’ and when existing mental health problems become exaggerated by stress at work.

Generally diagnosis and treatment through medication and/or talking therapies will be through a General Practitioner (GP). Occasionally sufferers may need to be referred for specialist help

The majority of people with mental health problems are capable of continuing to work productively. Evidence shows that employment can be of great benefit, both to the employer and to the employee.

Stress

The HSE (2007) has defined stress as:

'the adverse reaction people have to excessive pressures or other types of demand placed on them.'

There is a clear distinction between pressure, which can create a *'buzz'* and be a motivating factor, and stress, which can occur when this pressure becomes excessive.

A degree of stimulation or pressure in the workplace is beneficial. However, when that pressure is excessive and results in ill-health stress occurs.

Research provides strong links between stress and:

- *physical effects* such as heart disease, back pain, headaches, gastrointestinal disturbances or various minor illnesses
- *psychological effects* such as anxiety and depression, loss of concentration and poor decision making
- *behavioural effects* such as reliance on drugs and alcohol, lack of confidence, relationship difficulties, lack of concentration, mood swings and aggression.

In 2017/18 in the U.K. 595 000 British workers self-reported stress, anxiety or depression arising from pressure at work, 239 000 of these were new cases. The average length of sick leave due to a stress related illness was 25.8 days. More than 15.4 million working days were lost each year as a result of stress, anxiety and depression - representing 57% of all working days lost due to ill health.

Public service industries such as education, health and social care, and public administration and defence have higher than average rates of stress, depression or anxiety.

Management standards

The HSE have developed management standards to help reduce levels of occupational stress.

The Management Standards define the characteristics of an organisation where the risks from work-related stress are being effectively managed. The standards cover six primary sources of stress at work:

- *demands* – issues related to workload, work patterns and the work environment
- *control* – how much say the person has in the way they do their work
- *support* – levels of encouragement, sponsorship and resources provided by the organisation, line management and colleagues
- *relationships* – promoting positive working to avoid conflict and dealing with unacceptable behaviour
- *role* – whether people understand their role within the organisation and whether the organisation ensures they do not have conflicting roles
- *change* – how organisational change is managed and communicated in the organisation.

The Management Standards approach is intended to simplify risk assessment for work-related stress by:

- identifying the main risk factors
- helping employers focus on the underlying causes and their prevention
- providing a step-by-step approach to carrying out a risk assessment.

For each of the six sources of stress there are clearly defined standards and descriptions of desirable work conditions.

	Management standard	Desirable conditions
Demands	• employees indicate that they are able to cope with job demands • systems are in place locally to respond to any individual concerns.	• realistic and achievable demands for the agreed hours of work • skills and abilities are matched to the job demands • jobs are designed to be within the capabilities of employees • rmployees' concerns about their work environment are addressed.
Control	• employees indicate that they are able to have a say about the way they do their work • systems are in place locally to respond to any individual concerns.	• employees have control over their pace of work • employees are encouraged to use their skills and initiative • the organisation encourages employees are encouraged to develop new skills and undertake new challenges • employees have a say over when breaks can be taken • employees are consulted over their work patterns.
Support	• employees indicate that they receive adequate information and support from their colleagues and superiors • systems are in place locally to respond to any individual concerns.	• policies and procedures are in place to adequately support employees • systems enable and encourage managers to support their staff • systems enable and encourage employees to support their colleagues • employees know what support is available and how to access it • employees know how to access resources to do their job • employees receive regular and constructive feedback.

	Management standard	Desirable conditions
Relationships	• employees indicate that they are not subjected to unacceptable behaviours, *e.g.* bullying at work • systems are in place locally to respond to any individual concerns.	• the organisation promotes positive behaviours at work to avoid conflict and ensure fairness • employees share information relevant to their work • policies and procedures are in place to prevent or resolve unacceptable behaviour • systems enable and encourage managers to deal with unacceptable behaviour • systems enable and encourage employees to report unacceptable behaviour.
Role	• employees indicate that they understand their role and responsibilities • systems are in place locally to respond to any individual concerns.	• the organisation ensures that the different requirements it places upon employees are compatible • employees are clearly informed of their role and responsibilities • the organisation ensures that, as far as possible, the requirements it places upon employees are clear • employees are able to raise concerns about any uncertainties or conflicts they regarding role or responsibilities.
Change	• employees indicate that the organisation engages them frequently when undergoing an organisational change • systems are in place locally to respond to any individual concerns.	• timely information is provided to enable employees to understand the reasons for proposed changes • employees are adequately consulted on changes and given opportunities to influence proposals • employees are aware of the probable impact of any changes to their jobs and given necessary support and training to adapt • employees are aware of timetables for changes • employees have access to relevant support during changes.

Table 5.9: Management standards and desirable conditions

Home-work Interface

Some of lifes biggest stressors are not work related but occur in family or social life. However colleagues coming into work under significant pressure already will have lower thresholds for coping with pressures of work.

Pressure points might include: caring for family members e.g. children or elderly parents; or the impact of a lengthy commute following a house or work move.

Maintaining a healthy work-life balance is increasingly seen as important.

The main focus of the Management Standards approach is on issues that are likely to be potential sources of stress for groups of employees. There is still a need to address the needs of individual workers whose experiences may be different to that of the group. This may involve:

- creating an environment of open communication where employees are encouraged to talk, both formally and informally, to managers
- reminding employees that issues can also be raised via health and safety representatives, or human resources personnel
- encouraging employees to seek medical advice if concerned about their health
- mentoring and other forms of co-worker support
- provision of counselling services.

Mental ill-health and work

One in four people in the UK will have a mental health problem at some point. Most common mental health problems, such as depression and anxiety are mild, tend to be short-term and are normally successfully treated, with medication, by a GP.

Colleagues with such mental health problems can usually continue to work effectively.

If work is causing the health issue or aggravating a pre-existing condition the employers has a legal responsibility to help their employees. If a colleagues mental ill health amounts to a disability, the employer must consider making 'reasonable adjustments' to help them carry out their job without being at a disadvantage.

Work-related mental health issues must also be assessed to measure the levels of risk to staff. Where a risk is identified, steps must be taken to remove it or reduce it so far as is reasonably practicable.

Where a colleague seems to be struggling the line manager should have an early, private, sensitive conversation to try to understand the nature of the challenge.

Colleagues who have previously experienced mental ill health or have ongoing difficulties should be encouraged to develop their own Wellness Action Plan. This can be used to identify:

- triggers, symptoms and early warning signs
- how mental ill health may impact performance
- what support they may need from their manager.

5.5 Violence at work

The HSE has defined work-related violence as:

'Any incident in which a person is abused, threatened or assaulted in circumstances relating to their work.'

Workers who deal directly with clients or customers may face aggressive or violent behaviour including verbal abuse, threats of violence and physical attacks. Fortunately, physical attacks are comparatively rare.

Workers engaged in the following areas of work are most at risk of occupational violence:

- giving a service
- caring
- education
- cash transactions
- delivery/collection
- controlling
- representing authority.

Effects of workplace violence

Workplace violence can have negative effects for the victim but also for the employing organisation.

For employees	For employers

• Pain, distress and even disability or death
• Psychological effects following violence may include:
  • insomnia
  • stress
  • anxiety
  • irritability
  • loss of confidence
  • agoraphobia.
	• poor morale
	• poor corporate image
	• difficulty with staff recruitment and retention
	• extra costs from absenteeism, higher insurance premiums and compensation payments.

Table 5.10: Effects of workplace violence

Managing workplace violence

The first stage of a programme for managing workplace violence is to determine whether or not there is a problem, and if there is to assess the level of risk.

This can be accomplished through discussions with staff and the introduction of systems for the reporting and recording of violent incidents.

If there is a problem, it may be appropriate to devise and communicate a specific policy addressing workplace violence. A clear zero tolerance policy that is strongly communicated has been seen to have a positive impact in workplaces such as airport security check areas, hospital Accident and Emergency (A&E) waiting rooms, and bars and clubs.

An example of such a statement would be:

'Management supports this policy and will not tolerate any instances of work-related violence, including verbal abuse, to our staff.

No member of staff will be blamed for an instance of work-related violence caused by a customer or member of the public.

All employees have the right to be treated with consideration, dignity and respect.'

The policy should also include:

- detailed responsibilities of managers and staff
- procedures for dealing with an incident
- procedures for recording and reporting the details of an incident
- control measures in place
- arrangements for post-incident support.

Appropriate control measures should be devised, introduced and monitored to assure effectiveness.

Control measures will usually involve a combination of measures to:

- improve the working environment
- designing the job to reduce risk
- providing staff with appropriate information and training.

Controls will vary depending on the areas of work. Some examples of effective control measures are given below.

The environment

In hospital A&E waiting rooms comfortable seating, better lighting, pleasant décor, means of passing the time and regular updates on waiting times has been seen to be effective.

In banks and bookmakers, the design of service counters can have an impact with wider counters and raised floors on the staff side of the counter offering staff improved protection.

Physical security measures such as video cameras, alarm systems and coded security locks on doors may also be useful.

Job design

Reducing the levels of cash handled and stored will reduce the risk of robbery.

Avoiding lone working situations and improving systems for tracking field-based staff.

Information and training

Information systems can be used to forewarn staff of potentially violent clients.

Training can be given to enable staff to understand the triggers for violent behaviour, to avoid confrontation, to defuse situations, and if necessary to physically defend themselves or restrain an aggressor.

Post-incident support

Following a violent incident involving an employee it is important to respond quickly to avoid any long-term distress to the directly affected employee or others.

When planning post incident support the following should be considered:

Debriefing: Victims may need to talk through their experience as soon as possible after the event. Specialist counselling may be required.

Time off work: Will depend on the degree of physical or psychological harm and the individuals' recovery process. The return to work may well need to be managed.

Legal help: In serious cases there may be criminal and civil legal action. Legal help may well be appropriate.

Other employees: May need guidance and/or training to help them respond appropriately.

Bullying and harassment

The issues of bullying and harassment in the workplace are also covered by the HSE definition of workplace violence.

These terms are often used interchangeably, and many definitions include bullying as a form of harassment.

ACAS (Advisory, Conciliation and Arbitration Service) has defined *harassment*, as applied to sexual orientation, religion or belief and race and ethnic and national origin as:

'Unwanted conduct that violates people's dignity or creates an intimidating, hostile, degrading, humiliating or offensive environment'

and *bullying* as:

'Offensive, intimidating, malicious or insulting behaviour, an abuse or misuse of power through means intended to undermine, humiliate, denigrate or injure the recipient.'

The TUC (Trades Union Congress) has identified a number of bullying behaviours, including: shouting at staff, deliberately excluding someone from work activities, blocking promotion, setting up someone to fail through unrealistic targets or deadlines, and regularly making someone the butt of jokes.

5.6 Substance misuse

Drug, alcohol and other substance misuse can damage individual health and cause difficulties for employers because of increased absenteeism and reduced productivity.

Drug misuse

HSE defines drug misuse as:

'The use of illegal drugs and the misuse, whether deliberate or unintentional, of prescribed drugs and substances such as solvents.'

Misused drugs include, recreational drugs (including *'legal highs'*), prescription medicines and other chemicals such as solvents. Drug misuse can harm the misuser both physically and mentally and, through the misuser's actions, cause serious harm in the workplace. Some of the major misused drugs are shown in Table 5.11.

Name and legal status	How taken	Desired effect	Harmful effects
Heroin Class A	Injected, snorted or smoked	Drowsiness, sense of warmth and well-being	Physical dependence, tolerance, overdose can lead to coma and even death. Sharing injecting equipment brings risk of HIV or hepatitis infection
Cocaine Class A	Snorted in powder form, injected	Sense of well-being, alertness and confidence	Dependence, restlessness, paranoia, damage to nasal membranes
Ecstasy Class A	Swallowed, usually in tablet form	Alert and energetic but with a calmness and a sense of well-being towards others. Heightened sense of sound and colour	Possible nausea and panic, overheating and dehydration if dancing, which can be fatal. Use has been linked to liver and kidney problems. Long-term effects may include mental illness and depression

Table 5.11: Commonly misused substances (1 of 2)

Name and legal status	How taken	Desired effect	Harmful effects
LSD Class A	Swallowed on tiny square of paper	Hallucinations, including distorted or mixed-up sense of vision, hearing and time	There is no way of stopping a bad trip which may be a very frightening experience. Increased risk of accidents can trigger off long-term mental problems
Cannabis Class B	Rolled with tobacco and smoked, smoked in a pipe or eaten	Relaxed, talkative state, heightened sense of sound and colour	Impaired co-ordination and increased risk of accidents, poor concentration, anxiety, depression, increased risk of respiratory diseases including lung cancer
Amphetamines Class B	In powder form, dissolved in drinks, injected, sniffed/snorted	Stimulates the nervous system, wakefulness, feeling of energy and confidence	Calm and relaxed state, larger doses produce a drunken effect
Barbiturates Class B	Swallowed as tablets or capsules, injected – ampules	Calm and relaxed state, larger doses produce a drunken effect	Dependency and tolerance, overdose can lead to coma or even death. Severe withdrawal symptoms
Tranquillisers (*e.g.* valium, mogadon, temazepam) Class C	Swallowed as tablets or capsules, injected	Prescribed for the relief of anxiety and to treat insomnia, high doses cause drowsiness	Dependency and tolerance, increased risk of accidents, overdose can be fatal, severe withdrawal symptoms
Solvents Illegal to sell to Under 18	Sniffed or breathed into the lungs	Short-lived effects similar to being drunk, thick-headed, dizziness, possible hallucinations	Nausea, blackouts, increased risk of accidents. Fatal heart problems can cause instant death

Table 5.11: Commonly misused substances (2 of 2)

Signs of drug misuse

Signs of drug misuse include:

- sudden mood changes
- unusual irritability or aggression
- a tendency to become confused
- abnormal fluctuations in concentration and energy
- impaired job performance
- poor time-keeping
- increased short-term sickness absence
- a deterioration in relationships with colleagues, customers or management
- dishonesty and theft (arising from the need to maintain an expensive habit).

Note: all of these indicators may be caused by other factors such as stress and should be regarded only as an indication that a person MAY be using drugs.

Alcohol related problems

Alcohol related problems fall into two main categories:

Absenteeism and sickness absence

In the U.K. alcohol is estimated to cause:

- 3-5% of all absences from work
- 8 to 14 million lost working days.

Safety and productivity

Alcohol is known to affect judgement and physical coordination. Drinking before, or while carrying out, *'safety sensitive'* work is likely to increase the risk of an accident.

Alcohol consumption may also result in reduced work performance, damaged customer relations, and resentment among employees who have to *'carry'* colleagues whose work declines because of their drinking.

Acute effects

Alcohol reduces physical coordination and reaction speeds. It also affects thinking, judgement and mood.

A few drinks may be relaxing and uninhibited, getting drunk can lead to arguments, mood swings, and even violence.

Large amounts of alcohol in one session can strain the liver and adversely affect muscle function and stamina. The after effects include nausea, vomiting and headaches (hangovers).

Chronic effects

Increased risk of:

- coronary heart disease and some kinds of stroke, as a result of high blood pressure
- liver damage
- cirrhosis of the liver
- cancers of the mouth and throat
- psychological and emotional problems, including depression.

Sensible drinking limits

Health advice

Current advice is not to regularly consume more than 14 units of alcohol per week, spread over 3 days or more, both for men and women. This is considered as a low health risk. It is also recommended to have several drink-free days each week.

A unit of alcohol is a half pint of ordinary strength beer, a small wine or a single shot of spirits (Figure 5.19).

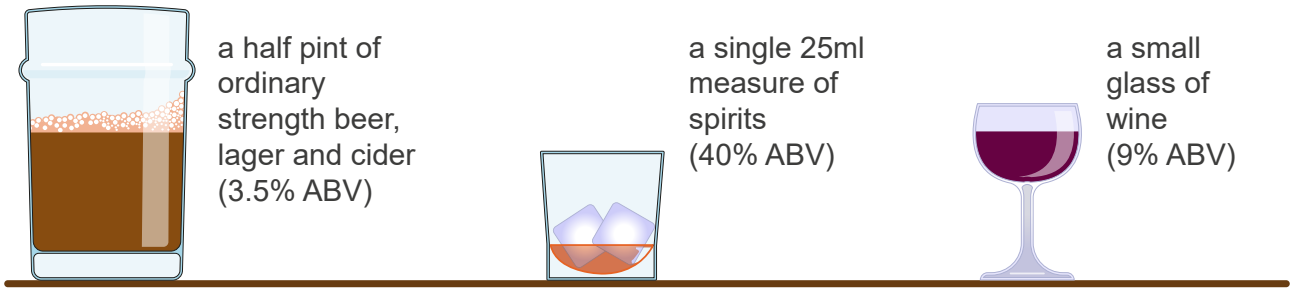


Figure 5.19: Unit of alcohol

Drink driving

It is an offence in England and Wales to drive with more than 80 mg of alcohol in every 100 ml of blood (50 mg of alcohol in every 100 ml of blood in Scotland).

Tackling substance misuse

The approach to tackling workplace problems with drugs and/or alcohol involves four major stages:

- consultation
- policy
- screening
- support and/or discipline.

Consultation

Before implementing a drugs and alcohol policy there should be an extensive consultation process culminating with all employee contracts being changed.

Contracts should be amended to clearly state that the employee agrees to the company policy on drugs and alcohol including the approach to screening.

Policy

A drugs and alcohol policy applying to all staff should form part of the overall health and safety policy. As a minimum the policy should:

- clearly state the standards of acceptable behaviour expected of all employees
- apply equally to all management levels
- address issues in the workplace that may contribute to increased levels of drug/alcohol use
- be primarily non-punitive
- clearly state the behaviours likely to lead to disciplinary action
- provide for rehabilitation and treatment of affected employees.

The policy should also be communicated effectively to all employees and be periodically reviewed and amended if necessary.

Screening

Screening can be a very sensitive issue. No one can be tested against their will, however once testing has been introduced, a refusal can lead to disciplinary action.

Careful consideration needs to be given to arrange of issues including:

- the availability of suitable, reliable screening techniques
- the expense of the system
- the need for medical support and resources
- what happens in the case of a positive result.

The time that drugs and alcohol can be detected in urine is shown in Table 5.12.

Drugs	Approx detection time
Alcohol	6–10 hours
Acid (LSD)	8 hours
Amphetamine (Speed)	1 – 2 days
Cannabis	1 day – 5 weeks
Cocaine	1 – 4 days
Ecstasy	1 – 2 days
Heroin (morphine)	1 – 2 days

Table 5.12: Detection times of drugs in urine

Drug and alcohol testing may be undertaken on the following basis:

Pre-employment	Conducted prior to an applicant commencing employment. May be done during a pre-employment medical examination.
Probation	Carried out during the probationary period following commencement of employment. Not practicable with a peripatetic workforce.

Periodic	Routine testing after specific work tasks (crane and plant operating/vehicle driving) or to agreed time scales.
Post-incident	Carried out after an accident where there are grounds to believe that the effects of drugs or alcohol could be a contributory factor.
For-cause	When an employee's behaviour (unsteady gait, slurring of words or unusual actions) leads a manager to suspect that drugs or alcohol are involved.
Random	Purely random testing of the entire workforce or a sub-set of workers.
Rehabilitation	Precautionary testing after an employee has submitted to a period of rehabilitation.

Table 5.13: Approaches to drug and alcohol screening

Support

Support services include:

- tackling workplace stress issues that might be leading to substance misuse
- counselling and rehabilitation
- referrals for specialist medical support.

An employee with a drugs or alcohol problem should have the same rights to confidentiality and support as they would if they had any other medical condition.

Discipline

The drugs and alcohol policy will need to coordinate with the organisations disciplinary policy.

The circumstances in which a breach of the drugs and alcohol policy would be deemed misconduct or gross misconduct, and the potential disciplinary consequences should be clear.

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