



General information

Noise is probably one of the most widespread and underestimated of industrial hazards. High noise levels are experienced in many parts of industry, especially in those Caribbean factories that have machines, presses, compressors etc. Not all the sound we hear is classified as noise – after all, we all enjoy different types of music. We experience sound in different ways. What some people may find as enjoyable and stimulating, others may find as noisy and unpleasant. For example, we are all familiar with the noise coming from the music systems of the mini-buses in the region. It is often far louder than that experienced in many factories. Thus, the perception of what is noise is personal. However, it is clear that workers can have their hearing damaged, in some cases permanently, if the sound/noise levels are too high. Most people define **noise as unwanted or unpleasant sound.**

Noise can cause a variety of effects including:

- It can cause stress and interfere with concentration, thus affecting your ability to work. This can be a contributory factor in workplace accidents as workers lose concentration and co-ordination. Over the long term, this increase in stress can lead to a number of health problems including heart, stomach and nervous disorders.
- It can mask or interfere with conversation in the workplace and may contribute to accidents as shouts of warning may not be heard.
- Workers exposed to high noise levels often have difficulty in sleeping when they

get home and are constantly fatigued with that feeling of being tired all the time. Some workers take painkillers on a regular basis to get rid of headaches induced by noise. Not surprisingly, when these workers return to work, their job performance is reduced. High noise levels in the workplace are thought to be a contributory factor to increased absenteeism.

- Workers exposed to high noise levels suffer from what is known as **noise induced hearing loss (NIHL)** which can lead to a number of social problems. These workers often cannot hear or understand instructions at work; they are left out of conversations as fellow workers, family members or friends get fed up with having to repeat everything. They may have to have the volume of the TV or radio turned up much higher than others can tolerate leading to arguments at home. As a result, workers suffering from NIHL tend to be isolated and alone.

How does noise affect our hearing?

The health effects of noise on our hearing depend primarily on the level of the noise and the length of the exposure. If, after spending a short time in a noisy part of the factory, you go outside or move to a quieter section, you may notice that you cannot hear too well for a few minutes. Your hearing has been reduced and the condition is known as **temporary noise-induced hearing loss.** This kind of “deafness” is reversible and will soon wear off after a short period of rest. However, the longer you are exposed to the noise, the longer it takes for your hearing to return to normal. There comes a point, however, when your hearing does not return to

normal and the condition becomes permanent. This is known as **permanent noise-induced hearing loss**. In such cases, you have been exposed to excessive noise for too long and the sensitive components of the hearing organ have been permanently damaged – it cannot be repaired. When workers first begin to lose their hearing, there are a number of warning signals that are significant:

- Workers may notice that normal conversation is difficult to hear or have difficulty listening to someone talking in a crowd or on the telephone. This is often masked to friends or work colleagues as people suffering from NIHL begin to lip read as people talk to them. In other words, they adapt themselves to the situation.
- The ear can tolerate low tones more easily than high tones. As a result, it is the high tones which disappear first so that workers suffering from NIHL will hear people with deeper voices more easily than colleagues with high pitch voices.
- When visitors or new workers come to a noisy part of the factory, it is always interesting to note their reaction if they are not wearing any form of hearing protection. Do they cover their ears? Do they shout to hold a conversation? Do they leave in a hurry? All these indicators are significant.

A SIMPLE RULE OF THUMB

If you are unable to hold a conversation in normal tones and at your normal volume standing at arm's length from a colleague, then the noise level in the workplace could be too high! Remember however, that your colleague may be able to lip read.

How do you know if the noise level in the factory is too high?

One method of assessing noise levels is to take measurements and compare them with so-called safe levels as recommended by national regulations¹. Unfortunately, few factories or the Labour Inspectorate have sound level meters to take such noise measurements. Another method is to undertake a survey and ask workers if they find the workplace too noisy. One needs to exercise caution in doing this. Many of the workers will reply that “it was noisy at the beginning, but, “I’ve gotten used to it.” What has in fact happened is that they have started to lose their hearing since the noise level remained the same.

Sound usually consists of many tones of different volumes (loudness) and pitches (high or low frequency). We find that it is a combination of volume and pitch that affects our hearing – not solely the volume. High tones irritate much more than low tones. The volume of sound is measured in **decibels (dBA)** and the pitch is measured in **hertz (Hz)**.

Inside a typical factory, noise may come from a number of different sources such as sewing machines, presses, compressors, radios, background noise, etc. The noise, in the form of sound waves, is transmitted directly through the air and reflects off walls and ceilings as well as passing through the factory floor. Obviously, the further away you are from the source of the noise, the quieter and less harmful it is as the sound waves lose their intensity and die out. One method of control therefore, is to be as far away as possible from the source of the noise. Unfortunately, many workers cannot do this as they have to operate the noisy machine. If you want to identify the noise problem in a factory you should measure the noise from each source and then calculate the overall level using the decibel scale. This in itself is unusual as the scale is a logarithmic one in which a change of 3 dBA means that the sound has either doubled or halved. For example, if two machines each create noise levels of 80 dBA by themselves, the total noise level they make together is 83 dBA (not 160 dBA). Similarly, if the noise level has been cut from 90 dBA to 80 dBA, it means the reduction is the same as if we removed 9 out of 10 noisy machines from the factory (*see Figure 1*).

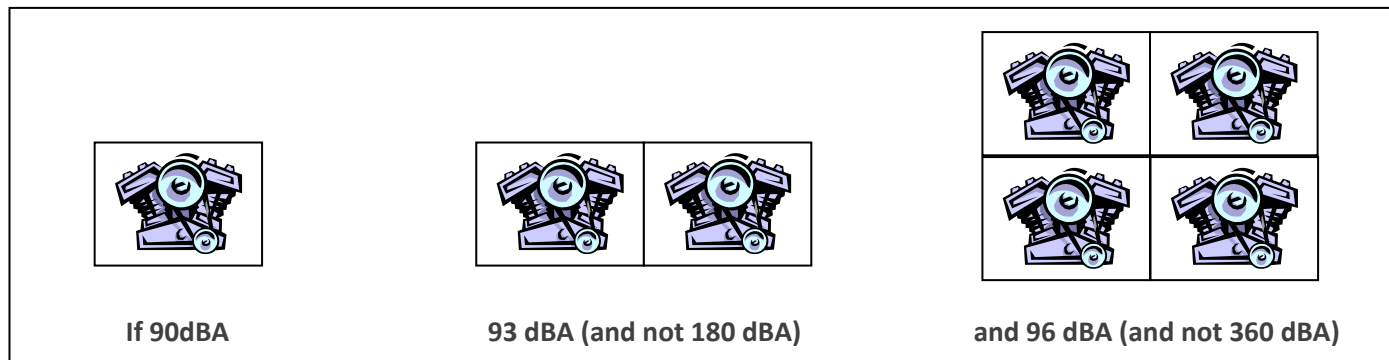
It is worth mentioning that in 1996, a relevant standard was adopted by the International Organization for Standardization (ISO) known as ISO 11690: 1996 on

¹ Usually this requires that the level of daily sound or the average sound that a worker encounters during their work shall not exceed 85 dBA.

Acoustics - Recommended practice for the design of low-noise workplaces containing machinery. In this standard, Part 1 deals with noise control strategies; Part 2 covers noise control measures; and Part 3 relates to sound propagation and noise prediction in workrooms.

continuous, constant noise or from intermittent noise. In calculating any exposure it is important therefore to add up all the component noise exposures to ensure that they do not exceed 85 dBA.

Figure 1: The Complexities of the Decibel Scale








Is there a safe level of noise?

A so-called safe level of noise depends on the volume and how long you are exposed to it. In most countries, the standards usually refer to 85 dBA but often do not give an exact indication of the duration apart from referring to a “daily level”. Most international standards refer to 85 dBA over an eight-hour work day. If workers are exposed to higher noise levels without any form of hearing protection, the exposure time must be reduced, either by rotating workers or providing longer rest periods.

| Recommended limits of noise levels for the number of hours exposed | |
|--|-----------------|
| Number of hours exposed | Sound level dBA |
| 8 | 85 - 90 |
| 6 | 92 |
| 4 | 95 |
| 3 | 97 |
| 2 | 100 |
| 1.5 | 102 |
| 1 | 105 |
| 0.5 | 110 |

How does 85 dBA compare with everyday sounds²?

| Effects on human beings | Sound level in dB(A) | Sound source | |
|-------------------------|----------------------|---|--------------|
| Highly Injurious | 140 |  | Jet engine |
| | 130 | | Rivet hammer |
| Injurious | 120 |  | Chain saw |
| | 90 |  | Heavy truck |
| Risk | 80 |  | Car |
| Little risk | 70 |  | Conversation |
| | 30 | | Whispering |

The eight-hour per day exposure limit refers to the **total** amount of noise that a worker may be exposed to over an eight-hour day. This exposure may be from

² This table has been adapted from *Safety-health and working conditions – training manual*, Joint Industrial Safety Council and ILO, 1987.

Methods of noise control

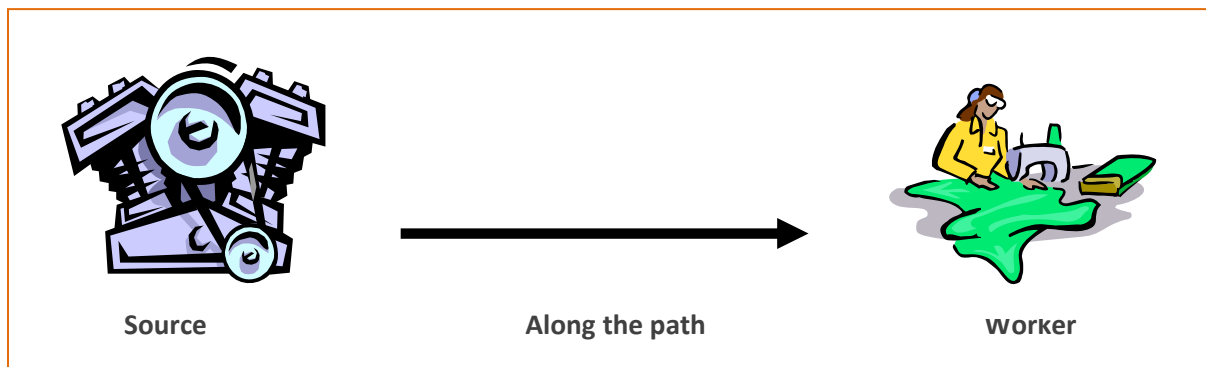
Workplace noise can be controlled in three ways:

- at the source of the noise;
- along the path between the source and the worker; and lastly
- at the worker's location (*See below*).

through to the outside. The number of holes in the enclosure (access points, holes for wires, piping etc.) should be minimized and fitted with rubber gaskets where possible;

- regularly servicing and maintaining machines;
- replacing worn or defective machine parts;

Figure 2



In common with all control strategies for safety and health problems, the most effective method is to control the hazard at the source. However, this often requires considerable expense and, with profitability being cut to a minimum in the global market, owners and managers are often hesitant to spend money in this area. The least effective, but most common and cheapest method of control, is to put the emphasis on workers wearing some form of personal protective equipment (PPE). Let us look at some of these methods of control in more detail.

1. Controlling the noise at source

Ideally, machines in the factory should conform to national and international standards and not produce noise levels above 85 dBA in the first place. Unfortunately, many of the machines are old, require regular servicing, and should be replaced whenever possible. In Europe and North America, machines that no longer meet national standards have to be replaced with new machines that certify that the noise levels emitted are well below 85 dBA and that all possible safety devices are included. There are a number of mechanisms that can be used to control/reduce noise levels at source including:

- purchasing “quieter” machines;
- enclosing entire machines or particularly noisy parts of machines with soundproof casing. Remember that no part of the enclosure should be in contact with the machine otherwise the sound waves will be transferred

- reducing the vibration in component parts and casings, ensuring that the machines are mounted correctly on rubber mats or other damping material and that mounting bolts are secured tightly;
- replacing metal parts with others made of sound-absorbing materials e.g. plastic or heavy duty rubber;
- fitting mufflers on exhaust outlets and directing them away from the working area;
- placing noisier machines together away from quieter ones; and
- minimizing human intervention in noisy areas.

The noise generated in the handling of materials can also be reduced in many ways, such as by:

- reducing the dropping height of goods/waste being collected in bins and containers, making sure that these boxes and containers are rigid and made of sound-absorbing material such as heavy plastic or rubber;
- ensuring that chutes, conveyor belts etc., are made of similar sound-absorbing materials;
- reducing the speed of any conveyor systems; and
- using belt conveyors rather than the roller type.

2. Controlling noise along the path between the source and the workers

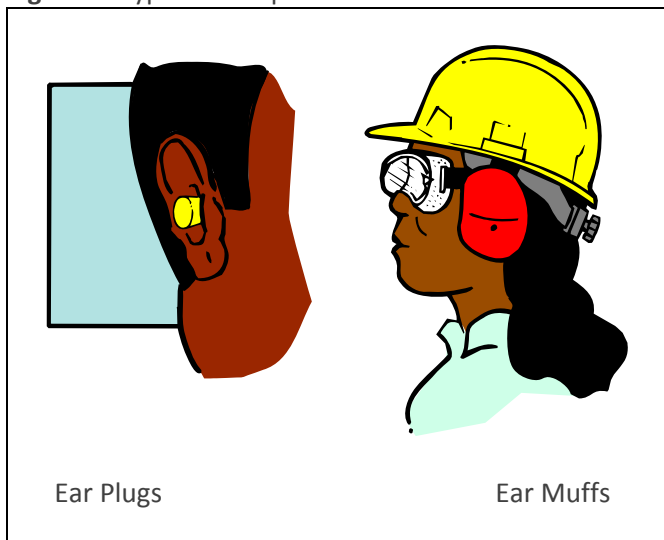
If it is not possible to control the noise at the source, then methods can be used to minimize the spread of the sound waves around the factory. Sound waves travel through the air rather like the ripples on water when you throw a pebble into a pond – the waves spread out from the source. Accordingly, any method that can be used to stop the spread or absorb the sound waves can effectively reduce the noise problem. Such methods include:

- use of sound-absorbing materials where possible, on the walls, floors and ceilings;
- placing sound-absorbing screens between the source of the noise and workers;
- hanging sound-absorbing panels from the ceilings to “capture” some of the sound waves and reduce the overall noise level;
- building sound-proof control areas and rest rooms; and
- if possible, increase the distance between a worker and the source of the noise.

3. Controlling the noise at the worker's location

The most common form of noise “control” is the use of personal protective equipment in the form of hearing protectors. They work on the principle of preventing damaging sound waves from reaching the sensitive parts of the inner ear. There are basically two types of protectors – ear plugs and ear muffs (see Figure 3).

Figure 3: Types of ear protectors



Ear plugs are worn in the internal part of the ear and they are made of a variety of materials including rubber, mouldable foam, coated plastic or any other material that will fit tightly in the ear. Ear plugs are the least desirable type of hearing protection from an efficiency and hygienic perspective. On no account should workers be encouraged to stuff cotton wool in their ears to act as some form of an ear plug – all that happens is that some

of the cotton wool gets left behind when the plug is removed and causes an ear infection.

From a safety and health perspective, ear muffs are more efficient than ear plugs provided that they are worn correctly. They must fit over the whole ear (not press the ear flap against the side of the head) and seal the ear from the sound waves. Workers who have beards or wear glasses have difficulty in getting a tight seal around the ear.

POINTS TO REMEMBER WHEN WEARING EAR PROTECTION

Whatever the type of ear protection is used, there are a number of points to remember:

- the noise problem is still present – it has not been reduced;
- in the hot, humid conditions that exist in many Caribbean factories, most workers find the wearing of any type of PPE uncomfortable;
- workers cannot communicate easily if they are wearing hearing protection which can be a problem in the case of an emergency;
- ear plugs and ear muffs must be thoroughly tested before use and regularly cleaned, repaired or replaced; and
- workers must be given training in the correct use of the PPE.

Vibration combined with noise

Many machines in factories are mounted incorrectly or are in need of servicing and, as a result, vibrate and cause a noise problem. As the machines vibrate, they transmit their vibrations to the workers. The part of the body affected depends upon which part of the body is in contact with the machine. These vibrations can injure muscles, joints and, in particular, the blood vessels. For example, workers whose hands and fingers are in contact with machines which vibrate can suffer from a condition known as *Vibration White Finger (Raynand's Phenomenon)*. The solution rests primarily with reducing the vibration from the machine.

Workers who drive heavy machinery and other work vehicles over rough or uneven ground may be subject to whole-body vibration (WBV). Such vehicles include tractors, quarrying and earth-moving machinery as well as fork lift trucks. This is particularly true if the machines are old and the seating is in poor condition. WBV is transmitted through the seat or the feet and can lead to

severe pressure on the joints and lower back. Control methods include reducing the amount of exposure/time that workers spend in the machines and improving ergonomic seating/choice of tyre.

Checklist for noise

| | Yes | No | Action required |
|---|-----|----|-----------------|
| Does the factory conform to national regulations on noise? | | | |
| Are the noisy parts of machines enclosed? | | | |
| Are machines serviced and maintained regularly? | | | |
| Is there a policy to replace older, noisy machines with quieter ones? | | | |
| Are machines correctly mounted to avoid vibration and reduce noise levels? | | | |
| Has the condition of heavy machinery and other work vehicles been checked in order to prevent or reduce whole-body vibration? | | | |
| Are sound-absorbing materials used on ceilings, walls and floors? | | | |
| Are adequate barriers used to prevent noise spreading around the workplace? | | | |
| Are people working in quieter sections of the factory protected from noise sources? | | | |
| Are workers in noisy areas rotated so that their noise exposure is reduced in duration? | | | |
| Are workers provided with the best form of hearing protection? | | | |
| Are the ear muffs/plugs regularly cleaned, maintained or replaced as necessary? | | | |
| Have workers been given training in the correct use of ear muffs or ear plugs? | | | |