

Chapter Four: Temperature, Ventilation, Noise and Lighting

4.1. Introduction

In this section we look at four types of physical hazards in more detail:

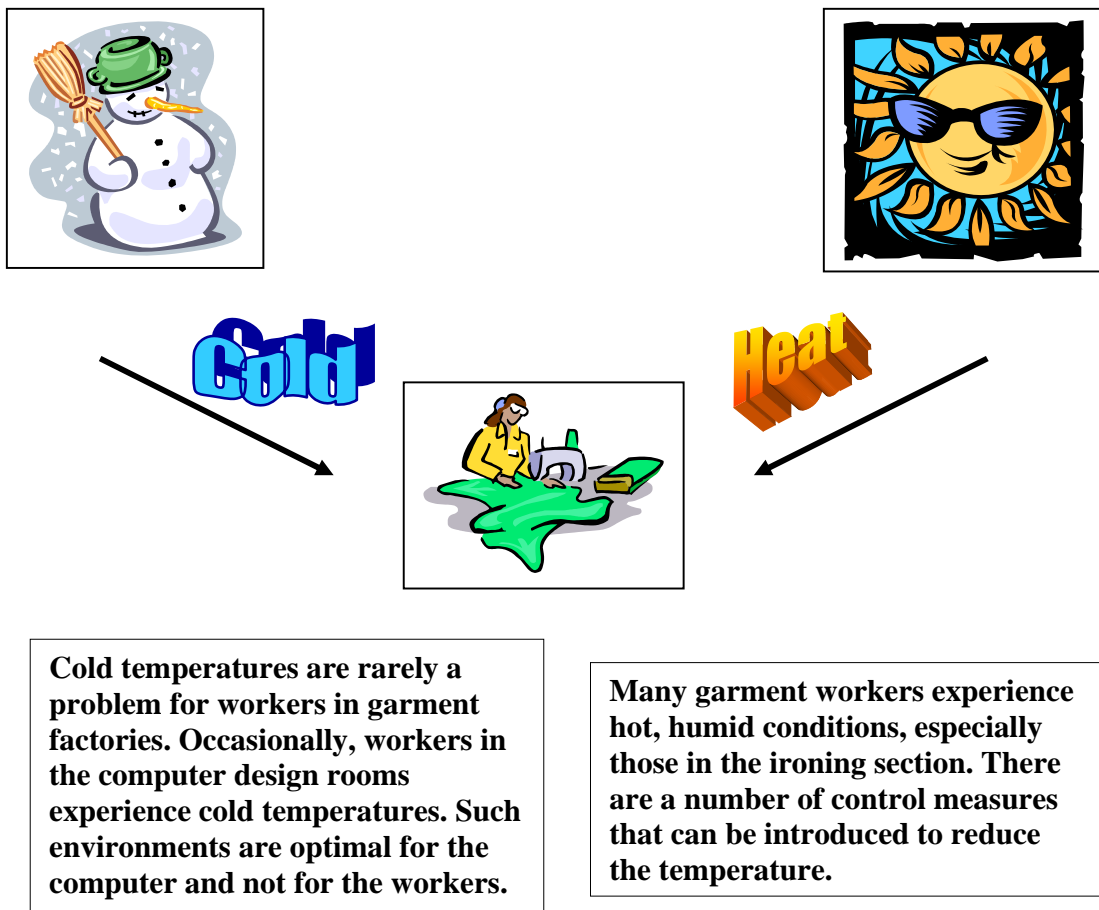
- temperature;
- ventilation;
- noise;
- lighting.

All have an impact on workers' health and safety in garment factories and require a variety of control mechanisms.

4.2. Temperature

Some workers face extremes of temperature as part of their daily work. In Cambodia, many workers face hot, humid conditions – few, however, experience cold working environments (cold store workers; some computer operators etc.) [see Figure 5).

Figure 5: Temperature in the workplace



Cold temperatures are rarely a problem for workers in garment factories. Occasionally, workers in the computer design rooms experience cold temperatures. Such environments are optimal for the computer and not for the workers.

Many garment workers experience hot, humid conditions, especially those in the ironing section. There are a number of control measures that can be introduced to reduce the temperature.

General Information

A worker's ability to do his/her job is affected by working in hot environments. One of the most important conditions for productive work is maintaining a comfortable temperature inside the workplace. Of course the temperature inside the factory varies according to the season and several methods can be used to address the problem. There are two main ways in which heat (or cold) gets into the factory:

- **Directly** – through windows, doors, air bricks etc;
- **Indirectly** – by conduction through the actual fabric of the building namely the roof, walls and floor. These warm up through the day as the sun shines and the heat is transferred to the internal environment often making it hot and sticky for the workers.

There are a number of measures that management can take to try to reduce the sun's heat from entering the factory. These include:

- ensuring that the external walls are smooth in texture and painted in a light colour to help to reflect the heat;
- improving the heat reflection of the roof;
- improving heat insulation of walls and ceilings (investigate the possibility of dry lining walls or adding an insulated ceiling below the roof. Although this is an expensive option it should be considered in the plans for all new buildings and local, cheap materials should be used as far as possible);
- ensuring that the factory is shaded as far as possible by natural means (trees, bushes, hedges etc) or with shades on windows, doors etc., (note that any shades should not inhibit access/egress for safety reasons). In very expensive offices, you can see that the windows are darkened or have sun-reflecting glass. This is not an option for garment factories because of expense – a simple, cheap option is to whitewash the top part of windows¹

How does heat affect workers in the garment industry?

For workers in the garment industry, too much heat can result in the following health and safety problems²:

Safety:	Health:
- fatigue and dizziness;	- heat stress/strain (distress);
- sweating palms (become slippery);	- heat cramps;
- fogging of safety glasses;	- heat exhaustion/heat stroke;
- possible burns;	- heat rash (prickly heat);
- lower performance/alertness;	- fainting (syncope).

¹ Adapted from ILO manual, Improving Working Conditions and Productivity in the Garment Industry, J.C.Hiba, (1998).

² Partly adapted from ILO, A Training Manual for Labour Inspectors by Antero Vahapassi, (2003).

- increased irritability.

The safety problems tend to be more obvious than the health issues. For example, there is always the risk of burns for workers in the ironing section through accidental contact with hot objects. There also tends to be an increased frequency in accidents as workers lose concentration, get more fatigued, and become more irritable. Tools/equipment can also slip through sweaty palms and fingers thereby adding to the safety problem. The health problems associated with hot working environments tend to be more insidious and affect workers more slowly.

How the body handles heat:

In hot, humid conditions, workers can lose heat and cool down naturally in a number of ways:

- by **evaporation** – by sweating³;
- by **radiation** – by increasing blood flow and the temperature of the skin surface. It needs cooler objects nearby for this method to be effective;
- by **convection** – exchange of heat between the body surface and the surrounding air. It needs air movement to be effective;
- by **conduction** – direct exchange of heat between the body and cooler, solid objects.

How do you control heat in the workplace?

There are a number of basic approaches to tackling heat hazards in garment factories. All involve reducing exposure by keeping heat away from workers through:

- engineering controls;
- changing work practices;
- use of personal protective equipment (as a last resort).

Engineering controls include:

- the use of increased general ventilation throughout the factory by opening windows, by ensuring that air bricks, doors etc are not blocked;
- the use of “spot cooling” by the use of fans to reduce the temperature in certain sections of the factory (the correct placement of fans is essential – see Pictures 22 and 23);
- the use of local exhaust ventilation systems in hot spots such as the ironing section to directly remove the heat as close to the source of the heat as possible – see Picture 24;
- the use of air conditioners/coolers.

Changing work practices include:

³ The cooling effect of sweating is considerable – it is estimated that evaporating 100 ml of sweat has the same cooling effect as consuming 0.5 kg of ice or drinking 1.6 litres of a very cold drink.

- increasing the number and duration of rest periods;
- introducing job rotation so that workers are not always doing so-called “hot work”;
- doing “hot work” in the coolest part of the day;
- providing more workers to reduce the work load so that workers spend shorter times in hot environments.

Whatever method is used to reduce workplace temperature, it is important that adequate supplies of drinks are made available to workers. These drinks could be cool, diluted fruit juices or lemon tea - water alone will lead to muscle cramps etc.⁴.



Pictures 22 and 23: Fans are used throughout garment factories to reduce the temperature.



⁴ Prakas 54 on The Supply of Hygienic Drink specifies the requirement for employers to provide clean, hygienic drinks in the workplace.



Picture 24: In garment factories fans are located to reduce the temperature in certain locations. Here these workers have fans behind them to cool down this work area. However, fans are often placed in the wrong position so that they compete with the general flow of air in the factory as a whole. They also spread dust around the factory.

Is there a national standard for workplace temperature?

Prakas 147 on Thermal Environment at the Workplace specifies:

Employers shall create a thermal environment that meets acceptable standards. The thermal environment shall be in conformity with workers' health and shall not disturb their work. The thermal environment shall be measured by the temperature shown on the thermometer at the workplace;

In a building or a workshop with normal condition, each worker shall have a space of at least 10 cubic meters. The workplace shall be protected from the ultra heat of the sun. The production method which does not generate heat should be adopted. If the production generates extreme heat, the employer shall reduce the heat by:

- having the heat generating parts insulated;
- having the heat absorbed and diverted from the original source.

In case the heat at the workplace is high affecting the workers' health or disturbing their work, the employer shall seek every possible means to cool the workplace such as by having fans, air coolers and air conditioners installed. Unfortunately, the Labour Inspectorate and few garment factories have the correct equipment to measure workplace temperatures.

Although the regulations do not specify specific standards for maximum temperatures, there are some guidelines that outline some suggested regimens for work and rest periods in hot environments. One such set of guidelines from the American Conference of Governmental Industrial Hygienists (ACGIH) gives examples of the balance between suggested work and rest periods at various temperatures for light, moderate and heavy work:

<u>Work/rest periods</u>	<u>Light work</u>	<u>Moderate work</u>	<u>Heavy work</u>
Continuous work	30.0	26.7	25.0
75% work: 25% rest	30.6	28.0	25.9
50% work: 50% rest	31.4	29.4	27.9
25% work: 75% rest	32.2	31.1	30.0

(These ACGIH temperatures, given in degrees centigrade, are measured using the Wet Bulb-Globe Temperature Index [WBGT] which gives a more accurate measure of heat conditions than ordinary mercury or alcohol thermometers which only measure temperature and not humidity or radiant heat⁵).

REMEMBER:

It is important to know the humidity inside the factory. If the factory is very hot and humid, the process of sweating is not effective and the workers are in danger of over heating.

4.3. Ventilation

General information

It is not only essential to provide a comfortable temperature inside the factory, you must ensure;

- an adequate supply of fresh air;
- the removal of stale air; and

⁵ **Wet-bulb temperature** is measured by a thermometer in which the bulb is covered by a whetted wick, effectively shielded from radiation and exposed to a current of rapidly moving air.

Dry-bulb temperature is a measure of air temperature by an ordinary thermometer and shielded from radiant heat.

- the prevention of any build up of contaminants (dust, spot cleaning chemicals, etc).

It is important not to confuse ventilation and air circulation inside the factory. What we tend to see inside many garment factories is air circulation, namely moving the air around inside the factory without renewing it with fresh air from outside. In the case of air circulation, fans are placed near workers (see picture 24) to improve thermal comfort and, in some cases, remove dust. In essence this means that you are simply circulating stale air plus any contaminants around the factory. Ventilation refers to replacing stale air (plus any contaminants) with fresh air (or purified air in the case of air conditioners) at regular intervals. In an average workplace, the air needs to be changed between 8 and 12 times per hour and that there should be at least 10 cubic meters of air per worker⁶.

Many Cambodian garment factories rely on the principle of **general ventilation** by allowing the free flow of air through the factory from one side to the other – referred to as horizontal air-flow. This can be achieved by opening doors and windows and putting more air bricks in the walls to take advantage of any prevailing wind. However it is all too common to find doors and windows etc., locked for security reasons or blocked with excess stock or boxes of finished goods awaiting export. As a result, ventilation is limited.

If you are trying to improve the general ventilation in your factory, here are a few simple suggestions that can help:

- if you have ventilation systems or free standing fans in the factory, make sure that they increase the natural flow of air through the factory and not try to blow air against any prevailing wind (see picture 25);
- ensure that hot, stale air that rises to the factory roof can easily be removed and replaced with fresh air (see picture 26);
- make sure that all fans are well maintained and regularly cleaned so that they work efficiently;
- ensure that the air-flow to and from fans is not blocked (see picture 27);
- try to ensure that any “hot” processes such as the ironing section is sited next to the “down wind” wall so that the heat is extracted directly outside rather than being spread around the factory (see figure 6).

⁶ These figures are given in the ILO manual *Improving Working Conditions and Productivity in the Garment Industry*. The UK, Health and Safety Executive recommends that the quantity of fresh air should never fall below 0.28 metres per person per minute.



Picture 25: Ensure that all fans add to the prevailing flow of air in the factory.

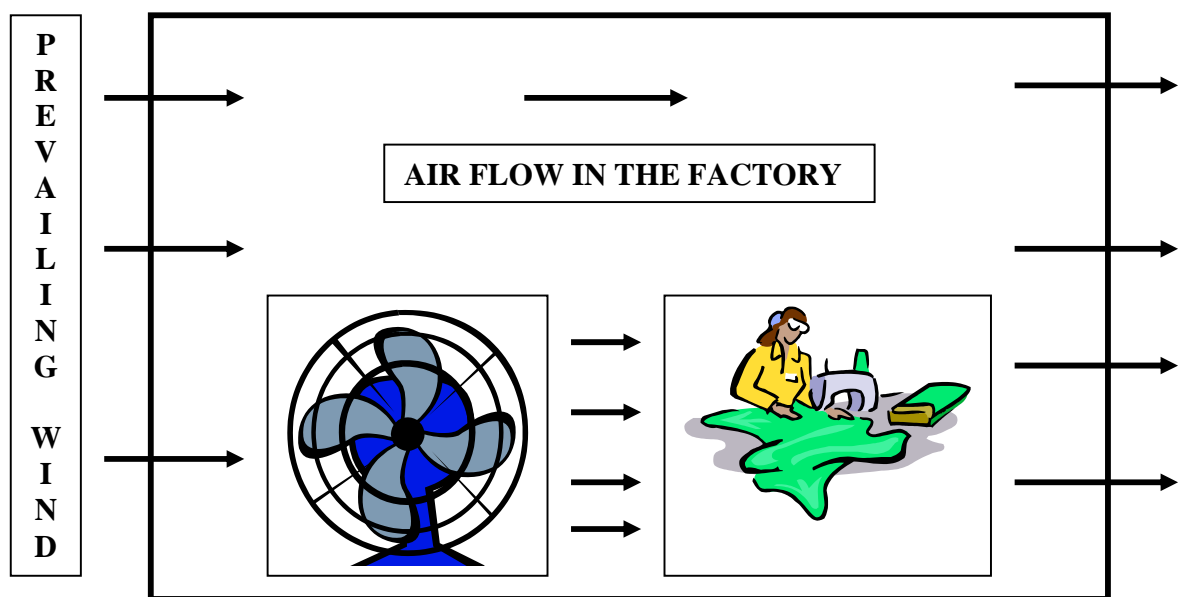


Picture 26: Utilise the tendency of hot air to rise inside the factory. These cowls help to remove hot air and will facilitate ventilation inside the factory. Note the asbestos roof.



Picture 27: This fan is blowing directly into rolls of material which inhibits the most efficient flow of air. Also look at the electric wiring.

Figure 6: Use free standing fans to add to the flow of air in the factory. Place hot or dusty operations next to outside walls and extract the stale, contaminated air.



In cases where there is a build up of contaminants or heat in specific areas of the factory, **local exhaust ventilation** has to be used to remove the hazard. This type of ventilation uses suction and hoods, ducts, tubes etc to remove the hazard as close to the source as possible and extract it to the outside environment. It works on a principle similar to that of a vacuum cleaner but on a much larger scale (see picture 28).



Picture 28: Local exhaust ventilation tubes sucking the dust away from the sewing machine into a waste reservoir which is emptied daily. Note that the suction tubes are placed as close as possible to the source of the hazard.

Is there a national standard for ventilation?

Prakas 125 on Air Circulation and the Cleaning of the Workplace requires:

- **An employer shall make an arrangement to have a good/clean atmosphere at the workplace in order to maintain the health and safety of the employees;**
- **Air circulation in a workplace without a dirty atmosphere may be possible by blowing in air naturally or artificially;**
- **If dangerous substances in the workplace cannot be eliminated, the employer must remove the hazard as close to the source as possible to the outside environment in accordance with the Environmental Protection Law;**

This regulation also specifies the need for employers to provide the appropriate personal protective equipment if these hazards cannot be controlled by general or local exhaust ventilation systems.

4.4. Checklist for Temperature and Ventilation

	Yes	No	Action Required
Are temperatures in the factory maintained at comfortable working levels?			
Are there any hot or cold areas in the factory?			
Have any workers complained about these areas?			
Is there good natural ventilation (through open doors, windows, air bricks etc) in the factory?			
Are draughts avoided for those workers seated near windows, doors etc?			
Is this natural ventilation blocked when there are excess boxes of incoming/outgoing stock?			
Are fans provided where the natural ventilation is inadequate?			
Do the fans circulate any fumes, dusts or other harmful chemicals around the factory?			
In processes where fumes, dusts etc may be released, have any local exhaust ventilation systems been installed?			
Do these systems exhaust contaminated air safely outside the factory?			
Are the filters in these systems checked/changed regularly?			
Are the air flows in these systems checked regularly?			

4.5. Noise

General information

Noise is probably one of the most widespread and underestimated of industrial hazards. High noise levels are experienced in many parts of the garment industry, especially in those factories that have weaving machines. Not all the sound we hear is classed as noise – after all, we all enjoy different types of music. We experience sound in different ways. What some people find enjoyable and stimulating, others may find noisy and unpleasant. Thus, the perception of what is sound or 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:

- Noise 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;
- Noise can mask or interfere with conversation in the workplace and may contribute to accidents as warning shouts 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 pain-killers on a regular basis to get rid of headaches induced by the noise. Not surprisingly, when these workers return to work, their job performance will be 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 have to have the volume of the TV or radio 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 effect 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 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 is 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?

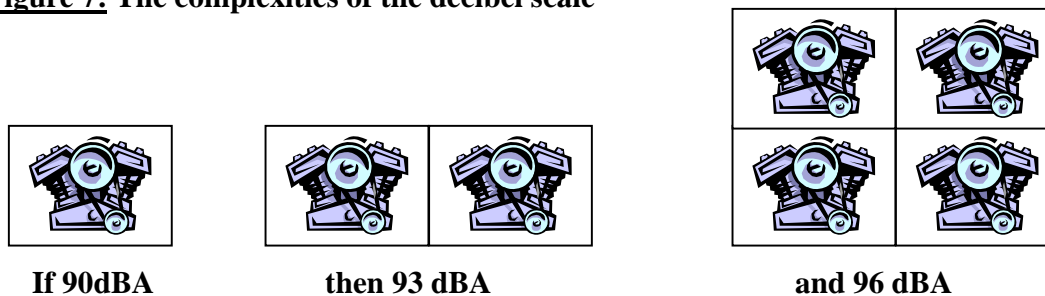
One of the problems is trying to find out if the noise in certain parts of the factory is too high. One method is to take measurements and compare them with so-called safe levels as recommended by national regulations⁷. Unfortunately, few factories or the Labour Inspectorate have sound level meters to take such noise measurements. Another method is to undertake a survey and ask workers if they find the workplace too noisy – **BE CAREFUL**. Many of the workers will reply that “it was noisy at the beginning, but, I’ve got used to it”. Remember the term “I’ve got used to it” – No they haven’t – the noise level is still the same. All that has happened is that they have started to lose their hearing.

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 effects 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)**.

⁷ Prakas 138 on Sound in the Workplace requires that the level of daily sound or the average sound that a worker is encounters during their work shall not exceed 85dBA.

Inside a typical garment factory, noise may come from a number of different sources such as the sewing machines, weaving looms, 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. So one method of control 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 80dBA 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 80dBA it means the reduction is the same as if we removed 9 out of 10 noisy machines from the factory (see figure 7).

Figure 7: The complexities of the decibel scale




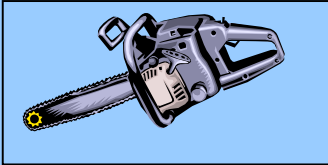
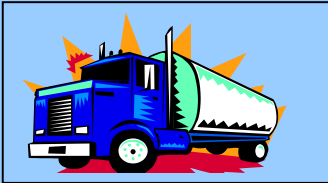
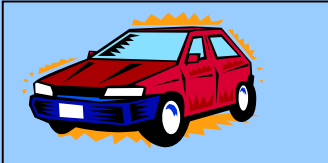

Is there a safe level of noise?

A so-called safe level of noise depends on the volume and how long you are exposed to it. In Cambodia, the standard states 85 dBA but doesn't give an exact indication of the duration apart from referring to a "daily level". Most international standards refer to 85 dBA over an 8 hour working 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. The following chart gives some recommended limits of noise level 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

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

How does 85 dBA compare with everyday sounds⁸?

Effect 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

⁸ This table has been adapted from Safety-Health and Working Conditions – Training Manual published by the Joint Industrial Safety Council and ILO (1987).

Is there a national standard for noise in the workplace?

Prakas 138 states:

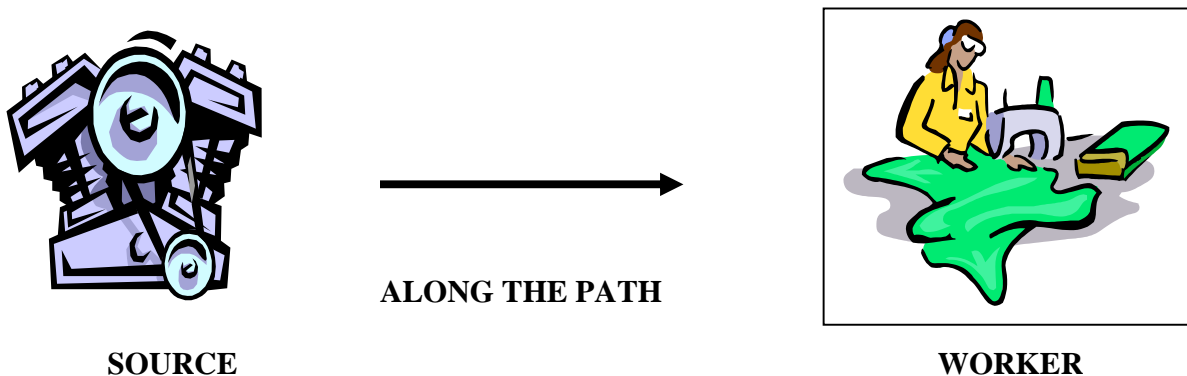
- **Employers shall endeavour to reduce noise in the workplace to as low as practicable, ensuring that the sound is within such a limit that does not damage the health of workers and, in particular, their hearing.**
- **Employers shall give priority to production methods which generate low noise levels; which reduce noise levels at source of equipment; isolate equipment that generates high noise levels; reduce the number of workers in the vicinity; avoid the spread of noise from one part of the workplace to another; organise work so that there is the maximum possible distance between workers and the source; organise a workplace in such a way as to reduce echo.**
- **The level of daily noise or the average noise that a worker encounters during their work shall not exceed 85 dBA.**
- **In case of necessity, and at all times, employers shall provide workers with personal protective equipment and ensure that it is used when the sound cannot be technically be reduced to below 85 dBA.**

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 (see below).

Figure 7:



In common with all control strategies for health and safety problems, the most effective method is to control the hazard at source. However, this often requires considerable expense and, with profitability being cut to a minimum in the global market, owners and managers are often loathe 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:

i) Controlling the noise at source:

Ideally, any 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 when 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 etc are included. Tragically for many workers in the region, this obsolete equipment is often sold on to developing countries together with all the faults. Against this background, there are a number of mechanisms that can be used to control/reduce noise levels at source including:

- Purchase “quieter” machines;
- Enclose 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 through to the outside. The number of holes in the enclosure (access points, holes for wires, piping etc.) should be minimised and fitted with rubber gaskets where possible;
- Regularly service and maintain machines;
- Replace worn or defective machine parts;
- Reduce the vibration in component parts and casings. Ensure that the machines are mounted correctly on rubber mats or other damping material and that mounting bolts are secured tightly;
- Replace metal parts with others made of sound absorbing materials e.g. plastic or heavy duty rubber;
- Fit mufflers on exhaust outlets and direct them away from the working area.

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

- Reduce the dropping height of goods/waste being collected in bins and containers. Make sure these boxes and containers are rigid and made of sound absorbing material such as heavy plastic or rubber;
- Ensure that chutes, conveyor belts etc., are made of similar sound absorbing materials;
- Reduce the speed of any conveyor systems;

- Use belt conveyors rather than the roller type.

ii) Controlling noise along the path between the source and the workers:

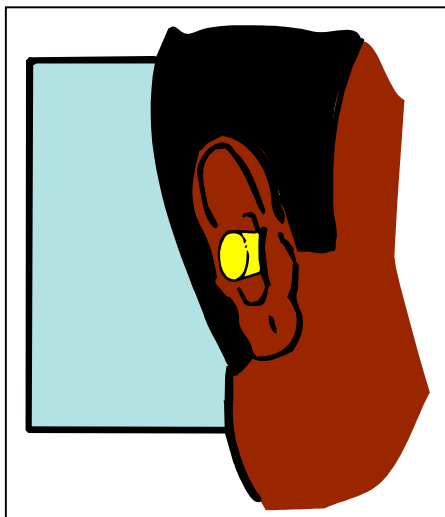
If it is not possible to control the noise at source, then methods can be used to minimise the spread of the sound waves around the factory. Sound waves travel through the air rather like the ripples on water if you throw a pebble into a pond – the waves spread out from the source. Accordingly, any method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

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

iii) Controlling the noise at the worker:

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 8)

Figure 8: Types of ear protectors



Ear plugs



Ear Muffs

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 (see picture 29). Ear plugs are the least desirable type of hearing protection from an efficiency and hygiene perspective. On no account should workers be encouraged to stuff cotton wool in their ears to act as some form of 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 health and safety perspective, ear muffs are more efficient than ear plugs providing 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.



Picture 29: Look closely at this picture. The worker on the right is wearing a set of earplugs but not the one on the left. Conversely, the one on the left is wearing a dust mask but not the worker on the right. Is there a noise problem or a dust problem or both?

Whatever 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 Cambodian 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 emergency;
- Ear plugs and muffs must be thoroughly tested before use and regularly cleaned, repaired or replaced;
- Workers must be given training in the correct use of the PPE.

iv) Vibration combined with noise:

Many machines in garment 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*. The solution rests primarily with reducing the vibration from the machine.

4.6. Checklist for Noise

	Yes	No	Action required
Does the factory conform to national regulations on noise?			
Are 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?			
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 etc regularly cleaned, maintained or replaced as necessary?			
Have workers been given training in the correct use of ear muffs or ear plugs?			

4.7. Lighting

General information

From the workers' perspective, poor lighting at work can lead to eye strain, fatigue, headaches, stress and accidents. On the other hand, too much light can also cause health and safety problems such as "glare" headaches and stress. Both can lead to mistakes at work, poor quality and low productivity. Various studies suggest that good lighting at the workplace pays dividends in terms of improved productivity, and a reduction in errors⁹. Improvements in lighting do not necessarily mean that you need more lights and therefore use more electricity – it is often a case of making better use of existing lights; making sure that all lights are clean and in good condition; and that lights are positioned correctly for each task. It is also a case of making the best use of natural light.



Pictures 30 and 31: Show typical lighting in garment factories.



Most garment factories have a combination of natural and artificial lighting. However, little attention appears to be paid on the nature of the work – it is as though all work in the factory requires the same degree of lighting. As we will see, this is not the case.

Let us look at some common lighting problems in the factory:

Lack of natural and artificial light in the factory:

⁹ In ILO Manual, *Improving Working Conditions and Productivity in the Garment Industry*, page 45, Hiba suggests that these studies have confirmed that improved lighting resulted in a 10% growth in productivity and a 30% reduction in errors.

Although we have already spoken about the need for shading windows to reduce heat inside the factory, there is also a need to make sure that all windows, skylights, etc., are clean and in the best position to allow the maximum amount of natural light into the workplace. Companies can always use appropriate shading methods for reducing the temperature – they should not rely on the windows being dirty. Skylights and windows high up the factory walls let in much more light (and air) than low windows, which often get blocked with stock, raw materials etc.

Similarly, all lights (and reflectors) in the factory should be well maintained and cleaned on a regular basis (especially when you consider how much dust is released into the atmosphere during each shift) (see Pictures 32 and 33).



Pictures 32 and 33:

Look at the dirt and cobwebs on the fluorescent light. The reflector has a layer of dust all over it. Clearly the light hasn't been cleaned for a long time. In some factories, workers use long handled brooms to clean the ventilation ducts and the lights. As we will see, this method of cleaning can create other health problems.

It has been known for companies, when the order books are low, to introduce “energy saving” programmes to save costs. In the case of lighting, “non essential” light bulbs may be removed or reduced in number, flickering fluorescent tubes which need changing are left in place – this proves to be a false economy as quality and productivity fall.

One simple way to improve the lighting levels in the factory is to paint the walls and ceilings with light, pale, matt colours – the use of matt paint avoids reflection of light which can lead to problems of glare. The colour of equipment such as sewing machines, workbenches, etc., should normally be matched with that of the walls and again avoid black, shiny paints. By brightening up the workplace, this helps to produce a more pleasant place to work which impacts on workers' well-being and, ultimately, productivity.

Find the best place for the light source:

It may sound like common sense, but it is essential for the light to focus on the work in hand and not directly, or indirectly in to the workers' eyes. The more detailed the task, the more light that is needed for the workers to carry out the job efficiently (see pictures 34 and 35):



Pictures 34 and 35:

In both these pictures, good lighting is essential for the tasks to be carried out. Note the local lighting for the sewing machine operator shines directly upon the task and not into the workers' eyes.

It is also essential to avoid your own shadow masking the work task.

It is also essential that lights are positioned in the correct place so that workers do not have to adopt poor working postures to see the task in hand. It is also important to have adequate lighting near any potential hazards such as steps, ramps, etc. and outside the factory for security at night.

Avoid glare:

Although lighting levels may be adequate in the factory as a whole, glare from a direct light source or reflected off equipment or shiny surfaces can cause discomfort, eye strain and fatigue – all of which contribute to an increase in errors, and a reduction in quality and productivity. Glare has been described as “light in the wrong place” and comes in three different kinds:

- **Disability glare** – can dazzle and impede vision, and so may be a cause of accidents. It is the result of too much light entering the eye directly;
- **Discomfort glare** – is more common in work situations – it can cause discomfort, strain and fatigue, especially over long periods. It is caused by direct vision of a bright light source and background; and
- **Reflected glare** – is bright light reflected by shiny surfaces into the field of vision.

There are several methods that you can use to avoid or reduce glare in the workplace:

To reduce glare from windows:

- Use blinds, curtains, louvers, or shades;
- Replace clear glass with opaque/translucent materials – paint glass with whitewash;
- Change the layout of workstations.

To reduce glare from lamps:

- Ensure that no naked lights are in direct view of workers;
- Raise the light fittings (if suspended) providing this does not reduce the overall level of lighting;
- Use shades or shields but ensure that the work area is well lighted.

To reduce reflected glare:

- Change position of the light source and reduce its brightness;
- Cover reflecting surfaces with opaque, non-glossy materials;
- Change the layout of the workstations.

How is light measured?

The level of light is measured in **LUX** using a light meter. Unfortunately, few factories or the Labour Inspectorate have any of these meters. The table below gives an indication of some typical light levels:

2. Choose appropriate visual backgrounds for walls, ceilings etc;
3. Find the best place for the light source to avoid glare etc;
4. Use the most appropriate lighting devices and fixtures;
5. Avoid shadows;
6. Ensure regular cleaning and maintenance.