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IMPORTANT

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Enzymes

More and more in use

Enzymes may cause asthma and allergic reactions. They are used more and more in bakeries, paper mills, pharmaceutical industry and in the manufacture of washing detergents.

It is not easy to measure the level of enzymes in the workplace. One method called ELISA can be applied for measuring enzyme levels down to a billionth of a gram. This is needed, because some allergy-sufferers can experience reactions to extremely small amounts of enzymes, according to professor Olof Vesterberg at the medicine unit of the Work Environment Institute in Solna, Sweden.

A paper produced by doctor Jonas Brisman at the occupational clinic at the Sahlgrenska hospital in Gothenburg shows that health problems occur both in enzyme manufacturing plants and in work places where enzymes are used in production.

The enzymes normally enter the lungs in the form of dust or liquid particles.

People who have suffered eczema, asthma or hayfever as children are especially at risk, although others may also become sensitised, Dr Brisman says.

The occupational health problems first arose in the 1960s, when enzymes were increasingly used in washing detergents. The health trend was signified by a marked increase in respiratory allergies.

Many reports have been written on the subject, encompassing asthma and allergies among workers in bakeries, pharmaceutical industries and manufacturers of washing detergents.

Dr Brisman thinks that enzymes have special characteristics that may cause sensitisation more readily than other proteins.

The health risks vary according to how the enzymes are used. Paper mills and detergent manufacturers use enzymes in water solution. Bakeries use it in powder form. Chemical industries often use enzymes in solid form. The use of enzymes increases by 8-12 per cent annually.

Although some countries have established limit exposure levels, there is still a questionmark over health risks, since some people can become sensitised at much lower concentrations. No-one has yet discovered a No Observable Adverse Effects Level of enzymes.

Source: Brisman J.; 1994; Arbete och Hälsa; *Nordic Expert Group for Criteria Documentation of Health Risks from Chemicals; Number 111 - Industrial Enzymes; number 28.*

On an impulse

There's noise, and then there's noise

Impulse noise is more dangerous to hearing than other loud noise. It is also harder to control and provide protection against. The damage happens so fast that the brain doesn't even register.

The human car was never made for loud noise. The sound level for which the sense of hearing has evolved for noise spans from around 35 to 55 dB(A). Modern industrial noise levels average 70—90 decibel — levels which the ear has never adapted to. The threshold level for hearing damage is considered to be about 85 dB(A). Any noise above this level is capable of causing impaired hearing.

Two types of noise

Noise comes in two main categories: continuous noise, such as the hum and rumble of machinery; and impulse noise, such as a hammer blow, a gun shot or a firecracker.

Impulse noise is so called because of its very short duration; often the impulse noise lasts only 30 or 40 millionths of a second.

Because it is so brief, impulse noise doesn't give the ear a chance to use its protective reflexes. Whereas the eye has a lid that can be closed in a blink, the ear protects itself by contracting the stirrup muscle in the middle ear, which dampens the noise. The impulse noise goes straight through to the delicate auditory hairs in the inner ear.

Another effect of impulse noise is that it doesn't allow the brain to register the actual noise level; the noise sounds less loud than it actually is. An impulse noise, such as a firecracker or a rifle shot, can be way over the pain threshold, say, 140 decibel, but since it is of such short duration, we don't experience the pain.

Hard to detect

Impulse noise doesn'tjust fool the brain and the ear's pain warning system: it can also fool the notion that hearing damage has occurred. After the blow of a sledgehammer, for example, the ears may ring, but some time later the hearing may feel normal again, although the hearing loss caused might be quite significant in the high range.

The hearing damage may be noticed when difficulties in conversation are experienced, such as mishearing the difference between consonants such as “s” and “f”, and difficulties in hearing conversation in

places with loud background noise, such as a pub or cafeteria.

Hearing loss can occur in two parts of the ear: in the ear drum and the ear bones, or from nerve damage to the ear nerve itself (the cochlea). Damage to the cochlea can be particularly troublesome, since not only do you have difficulties hearing soft sounds, but you can become hyper-sensitive to natural loud noises, such as ambulance sirens.

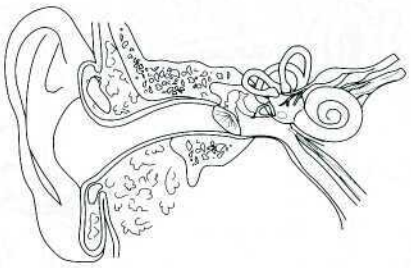
Hearing loss is also aggravated by other factors, including solvent exposure, vibration, heat and physical exertion. Workers who operate under these conditions often sustain hearing damage sooner than if the noise was the only hazard.

Yet other factors include high cholesterol levels, high blood pressure, genetic factors, head injuries and antibiotics.

Interestingly, light-skinned people are more susceptible to noise than dark-skinned. The reason is that dark-skinned people have more melanin (part of the skin pigment) in their cochlea. Melanin has a protective effect, since it absorbs the excess energy in the sound waves.

Electronic protection from impulse noise

Normal ear muffs have been used in industry for decades now, and have come down in attenuation. Twenty years ago, the

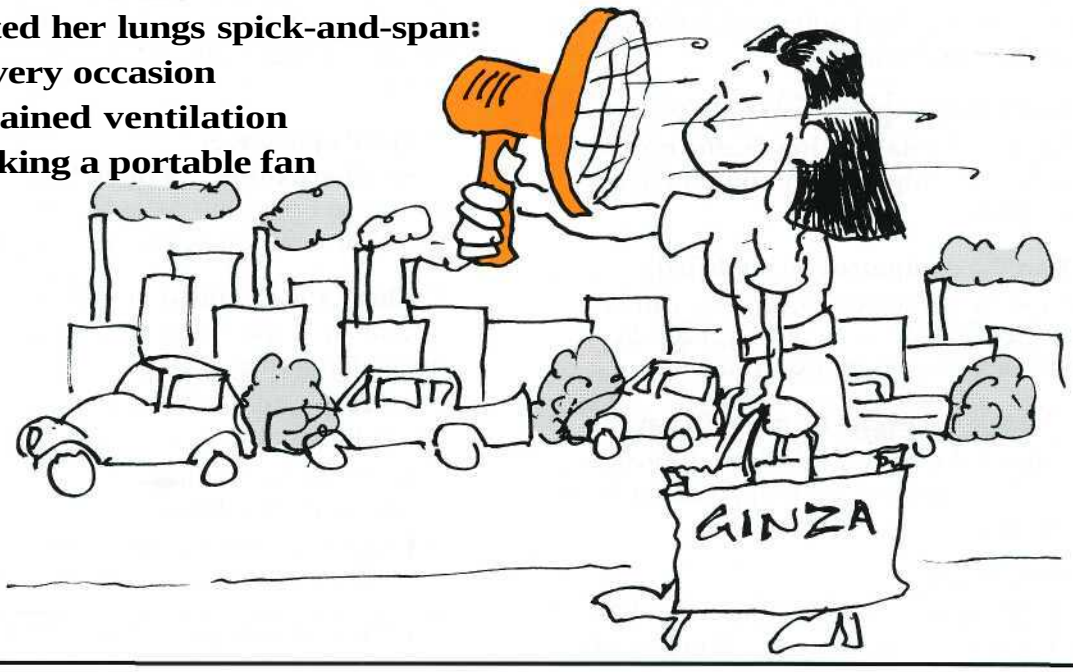


trend was to select the muffs with the highest possible attenuation. Due to the high attenuation the muffs were heavy, hot, uncomfortable and made communication with others very difficult. These days, muffs are selected according to their ability to protect the hearing from the surrounding noise without isolating the wearer or impeding communication. It is easy to fine-tune the choice of ear muffs to the noise environment... as long as you are dealing with continuous noise.

Impulse noise, on the other hand, is more difficult to handle. New sophisticated electronics have been used in impact noise hearing protectors. These ear muffs are equipped with microphones that not only cut out loud impulse noise instantly before it causes ear damage, but also amplify useful sounds, such as conversation.

Source: Tillhammar, P. 1993; Impulse sounds too fast for the ear; Forskning & Praktik om arbetsmiljö; The Swedish National Institute of Occupational Health; No 4/1993; Solna, Sweden

A woman in Tokyo, Japan
Wanted her lungs spick-and-span:
On every occasion
She gained ventilation
By taking a portable fan



Some sound ideas

Sound minimisation

Noise minimisation doesn't have to be** very **difficult or very expensive to solve at the source. Armed with the right knowledge, management can make sound decisions for an immediate improvement of the noise environment.

Dramatic noise reduction can sometimes be achieved by simply moving machinery around, placing appliances on a different flooring, or covering walls with a different material. Here are some ideas that might not even have occurred to you before putting your noise problems in the "too-hard" basket:

- **Select quiet machinery from the start**

When purchasing new equipment, take noise generation into consideration. You may be able to find quieter equipment that does the same thing.

- **Some noisy equipment could be replaced**

Before you start taking drastic measures, consider trading in noisy equipment for quiet plant.

- **Can the equipment be modified?**

In some instances, machinery can be modified to run more quietly. Call the manufacturer, or get expert advice.

- **Noise sources can be moved away**

One of the easiest solutions. If possible, move the noise source away from the work area.

- Put a lid **on it!**

Building-in noisy equipment can be a fairly drastic procedure, but is well worth considering. Be careful to enclose the noise source in the correct way: an incorrect enclosure could result in greater noise levels through reverberation and amplification. Consult an expert.

- **Look down!**

Vibrating noisy equipment may cause the floor and, consequently, walls and ceilings to vibrate with it. Machinery can often be placed on steel springs or rubber feet which serve to separate the machinery from the structure of the building. However, this is specialist stuff. The wrong set-up can result in increased noise.

- **Noise absorption**

Hard, glossy surfaces act as mirrors for noise, reflecting it and spreading it around. Soft, porous surfaces absorbs the noise. A common noise absorbent material is mineral wool. The most obvious use of noise absorbents is inside booths and enclosures. But dampening materials can also be used on the ceilings, walls, pillars et cetera to cut noise.

- **Small appliances**

Small machines can often be moved to their own operating room, such as a closed room for computer printers and plotters.

- **Check your ventilation system**

The fan noise could be transported through ducting

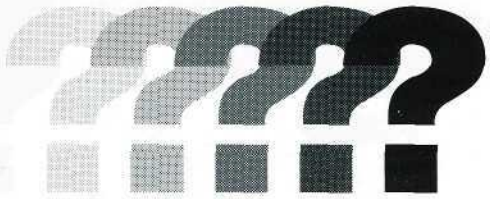
Vibration and noise from the fan could be cut by insulating walls and ceilings

Rectangular ducting causes more vibration than round ducts

Large fans could send vibrations and noise through the structure of the building

Source: Danielsson, S. 1993; Arbetsmiljö no 5 p 51; Stockholm Sweden

Six questions to ask of your Skin cream



A wide variety of skin creams is available for industrial use. How do you know which cream is best for you? Here are a few considerations to keep in mind when designing a skin protection program.

A skin cream should contain harmless ingredients that are neither irritating nor allergenic. Sometimes, a few compromises may have to be made in the final selection, since the most effective creams may also be the ones that are hardest on the skin.

Take cleaning creams, for instance. In order to rid the skin from grease and oil, the preparation must contain fat-dissolving agents. The more such ingredients it contains, the more irritating to the skin.

Solvents should never be used to clean the skin. Skin creams containing 10—20 per cent solvents are unsuitable, according to Torkel Fischer, Professor of occupational dermatology at the Swedish Work Environment Institute.

Other creams contain limonene (a type of citrus oil) and solvents, which may cause allergies in the long run. Limonene may make the cream feel and smell more attractive, but are nothing but a fad in Professor Fischer's view.

All liquid soaps contain water and preservatives that serve to eliminate the growth of bacteria and fungus during storage. Some of the preservatives, such as kathon, are allergens. Partons are also used as preservatives, and are less harmful.

The main thing, according to Prof. Fischer, is to always ask for a detailed product specification, and to stay away from skin products with undisclosed ingredients.

Ulla Jonsson is a chemist at the Örnsköldsvik health care centre in Sweden. She concurs with Professor Fischer's opinion that purchasers should always insist on a data sheet on the product. A serious manufacturer should be able to supply details on how the raw ingredients are supplied, how the manufacturing process is quality controlled, as well as chemical analysis reports and certificates. She believes that some products may contain too much perfume in order to disguise the odours of low quality ingredients. She has also found skin creams that contain unsuitable types or amounts of scrubbing agents that can actually damage the skin. Ms Jonsson presents the following questions to ask when selecting a skin cream:

- **What type of scrubbing agent is used?**
  — Avoid wood dust or plastic balls that are added to the cream in order to scrub off the dirt. These types often contain very sharp fibres that cause the skin to wear away and crack, leaving the way open for infections. If you need scrubbing agents, select creams that contain round fibres, such as ground walnut shells.

- **How much preservative does it contain?**
  — If the cream contains more than one per cent preservative, there is cause to suspect that the manufacturer's microbiological control might be lacking.

- **Is the preservative classed as an allergen?**
  — The preservatives kathon, BHT and Dowicil should be avoided.

- **Is the product perfumed?**
  — Make sure it doesn't contain excessive amounts of perfume. Some people arc sensitive to perfume smells. The perfume could be there because the raw ingredients are of poor quality.

- **Is the packaging hygienic?**
  — Avoid large tins or buckets that everyone dips into. Select a good dispenser, such as a wall dispenser that portions out the correct amount for a wash.

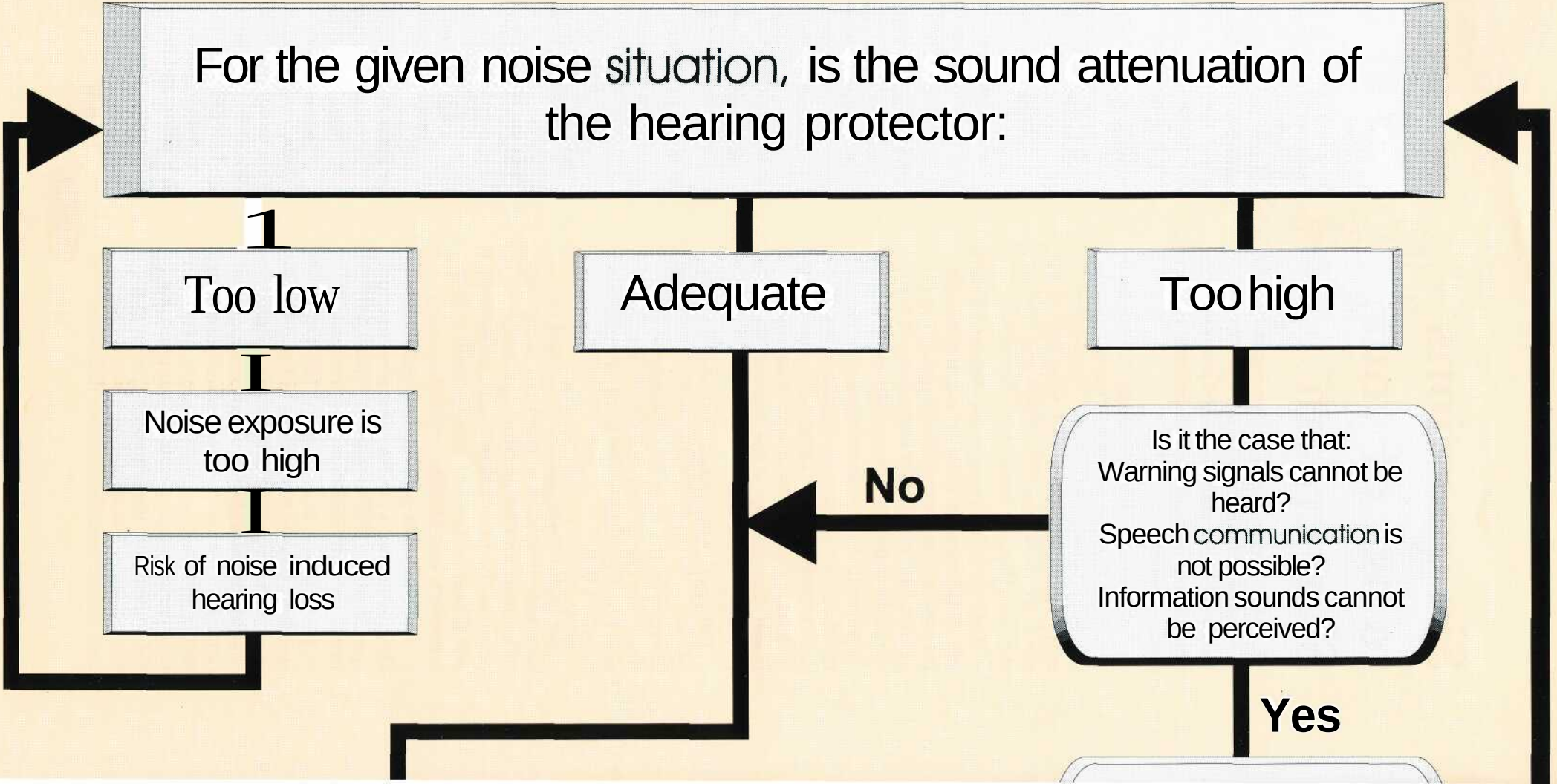
- **How does it feel to use it?**
  — A subjective yet important consideration. The skin should feel clean and refreshed when you use the cream.

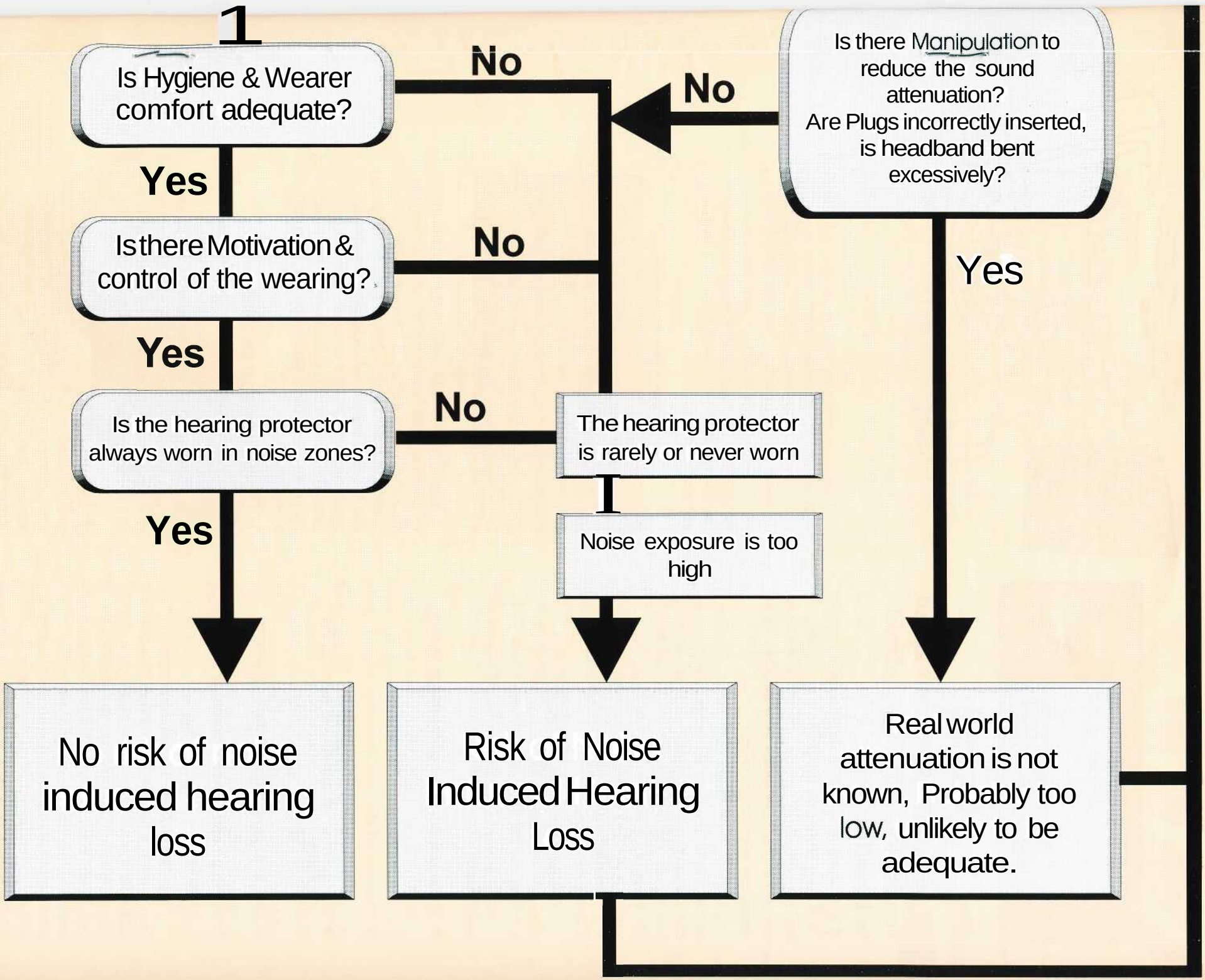
Ms Jonsson advocates a three-step skin care program: Firstly, a protective cream; Secondly, a cleaning cream; and thirdly, a re-fattening cream. Pre-work protective creams are particularly important if the handling and use of solvents.

Source: Ekelöf, E. 1994; Arbetsmiljö no16 p 45, Stockholm, Sweden; Patmalnieks, A. 1995; Arbetsmiljo no 5 p 42; Stockholm Sweden

How to select hearing protection

A la European Standard

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Is Hygiene & Wearer comfort adequate?
No
Yes
Is there Motivation & control of the wearing?
No
Yes
Is the hearing protector always worn in noise zones?
No
Yes
The hearing protector is rarely or never worn
Noise exposure is too high
Is there Manipulation to reduce the sound attenuation? Are Plugs incorrectly inserted, is headband bent excessively?
No
Yes
No risk of noise induced hearing loss
Risk of Noise Induced Hearing Loss
Real world attenuation is not known, Probably too low, unlikely to be adequate.

Up in the air

Part I

All you wanted to know about ventilation... but were afraid to breathe

We have always said that personal respiratory protection should be a last resort, and that breathing hazards should be removed through engineering methods, if possible. Ventilation can often do the trick.

There are two main uses for ventilation in a workplace where the atmosphere contains hazardous materials, such as solvents. Firstly, the ventilation system should keep the breathing away from your face. Secondly, it should dilute the concentration of the hazardous material in the work area to a harmless level.

Another effect that can be achieved through ventilation include warming or cooling the air to a comfortable level.

What determines the required extent of ventilation?

- **The number of people working in the area**
- **The size of the area**
- **The number of machines, motors, engines in the area**
- **The heat generated by the equipment**
- **The type and concentration of airborne hazards**

There are different ways of measuring ventilation. Traditionally, it was common to talk about how many air exchanges occurred in the room during the course of one hour. Nowadays, ventilation is often measured as air flow in relation to floor area and time, that is, m^3 per m^2 floor per hour. Depending on ceiling height, 5—10 air exchanges per hour equals 20—40 $m^3/m^2/h$ approximately.

A human being at rest in an uncontaminated atmosphere (say, in an office or a home) needs an average of 12—15 m3 of air per hour. Therefore, an industrial site where hard work is carried out, and where the air may be of poor quality or contain breathing hazards, would require a much greater air flow.

Here are a few examples:

Work placeAir flow ($m^3/m^2/h$)
Mechanical workshop: 15—40
Paint manufacture: 15—40
Work booth (e.g. mixing room): 600—800
Offset printing room: 40—60
Furniture varnishing: 15—40

Usually, industrial sites require a mixture of general ventilation, which adds clean air to the atmosphere, and local exhaust (point exhaust), which removes air from the room. Since local exhaust removes a great deal of air, this must be taken into consideration when calculating how much clean air must be supplied by the general ventilation.

Effects on the person

Ventilation will affect the general climate of the workplace in various ways. There are several factors that can make us feel more comfortable if the ventilation is done correctly, or equally uncomfortable if the set-up is not working properly.

- **Temperature**

Heat and cold can both have very significant effects on the human body. Recent research (see PPM vol 8 no 29, Dec 1993) shows that only a few degrees to either side of the ideal temperature can affect not only

the general comfort, but can also lead to poor work performance, fatigue, less ability to concentrate, longer reaction times, poor judgment, and more mistakes. Thus, ventilation can contribute to better work efficiency and lower risks of accidents.

- **Humidity**

The relative humidity in the air is a measure of how much more water the air can absorb before reaching saturation level. That is, at 80% relative humidity (R.H.), the air can absorb another 20%. At 100 per cent R.H., the air is fully saturated, and cannot absorb any more humidity.

The human body can withstand a wide range of humidity levels without any discomfort. However, if the air is very dry, below 20% R.H., it feels uncomfortably dry. As everyone knows, if the R.H. climbs above 80 per cent, the air becomes muggy and sticky.

- **Airspeed**

You start to notice the air moving at about 0.2 metres per second. At slightly greater air speeds, the environment feels cooler, even though the temperature remains the same.

It is easy to work out how much cooler it feels by multiplying the air speed (expressed in m/s) by eight. For example, if the air speed is 0.5 m/s, the room feels 0.5 x 8 = 4ºC cooler than it actually is.

Therefore, ventilation can be used to increase the comfort of people who perform hard work in hot surroundings. Sometimes, much higher air speeds are needed to decrease the heat stress on the body.

- **Heat exchange**

Since normal body temperature is around 37ºC (anywhere from 30—37 on the skin surface), the human body usually radiates heat to the cooler surroundings. This happens in three ways:

Through **convection;** that is, the body gives heat to the surrounding air;

Through **radiation;** that is, the skin gives heat to cooler objects;

Through **condensation;** that is, perspiration.

The human body generates a surprising amount of heat. Even at light work, the heat energy is about 110 Watts, the same as a very bright lightbulb.

General ventilation

In work places where the atmosphere contains solvents, general ventilation is often not enough: additional local exhaust must be used at the source of the breathing hazard and along the path the air travels.

However, the general ventilation can serve to remove humidity, to remove odours, and to supply fresh, clean air. Sometimes the general ventilation can also be relied upon to remove those minor amounts of breathing hazards that may escape the effects of local exhausts.

General ventilation usually comprises both inlets, where the fresh air is pumped in, and outlets, where the "spent" air is sucked out.

Inlets

The inlets can be adjusted to warm or cool the air supply, and to blow it at various speeds.

There are two types of inlets: high impulse and low impulse.

High impulse air supply blows the air at a relatively high speed, 6—10 metres per second, using fairly small vents, grilles and meshes. The large amounts of air pulls a lot of surrounding air along with it as it moves through the room. In many instances, the supplied air can pull very large volumes of still air with it, up to a hundred times more than the air volume from the inlet.

The effect has both pros and cons. On the one hand, the contaminated air is rapidly diluted. On the other hand, the pollutants are fairly evenly distributed throughout the room.

Low impulse air supply usually operates at around 0.5 m/s, and hasn't got the "pull force" of the high impulse method. The air is added from inlets with much larger surface area, such as perforation holes all over the ceiling. If the air is slightly cooler than the temperature in the room, the effects is that the air sinks slowly to the floor.

It is interesting to note that the low impulse method is more effective when it comes to lower the concentration of pollution in the air. Another benefit is that there is no uncomfortable draught.

The placement of the inlets, regardless of method, is crucial. The general idea is that the clean air should be blown in to areas that are already fairly uncontaminated, and should then move to high-pollution areas, where it is removed by the outlets or by local exhaust.

Outlets

Mistakes are common in the placement of the air outlets. Because solvent vapours are usually heavier than air, it is easy to think that the outlets should be placed as low as possible, e.g. at floor level. This is not necessarily so.

The reason for this is that solvent fumes rarely occur on their own; they mix with the air in low concentrations, blurring the weight difference between the solvent and the air. In some instances, for instance if the solvent vapour is warmer than the air, the mixture can rise, even though the solvent is heavier than air.

It is therefore better to view solvent vapour as though it were normal air.

In certain situations it is still correct to place the outlets at floor level:

- —Where spillages of paint or solvents are common
- —Where there is a risk of leakage in taps and pipelines
- —Where the solvent vapour is colder than the air

Two common mistakes

Forced ventilation

As we said earlier, the supplied air should be colder than the air in the room. Cooling large volumes of air can be both difficult and costly, and it may sound more attractive to increase the air flow (for instance, by raising the air speed or adding more fans) instead to achieve the same result.

However, you must remember that a higher air speed results in a marked increase in the evaporation rate of solvents. Doubling the air speed from 0.2 m/s to 0.4 m/s means that the evaporation rate of a solvent increases two and a half times. Moreover, higher air speed may also mean that dust and aerosol particles stay in the air longer, increasing the total amount of pollution in the environment.

Air intake placement

Naturally, the fresh air must be taken from outside the polluted area, for example from an intake on the roof of the building. Everything must be done to ensure that the intake is far removed from any exhaust of contaminated air in order to avoid "recycling" of polluted air. Ensure that the exhaust air doesn't reach the intake, even in adverse wind conditions.

Local exhaust

Local (point) exhausts are placed at the very source of contamination. A good local exhaust set-up should remove at least 80—90% of the generated pollutants. Unless the exhaust and the contamination source are completely enclosed, it is impossible to achieve 100% exhaust levels, since some pollutant will always escape, spills and leakages may occur, surrounding air movements may pull some contaminant away from the exhaust, and other causes.

The area of the source should be as enclosed as possible without making work impractical or impossible. The more enclosed the area is, the higher the efficiency of the exhaust, and the lower the required exhaust air flow.

Apart from enclosing the source, several other factors influence the efficiency of a local exhaust:

- **Distance from the source**

The exhaust should be as close as possible to the contamination source. The air flow requirement increases steeply, in fact by the distance squared. In short, if you double the distance between source and exhaust, you need four times the air flow for the same result.

- **Flanges around the exhaust**

A flange around the mouth of the exhaust increases the efficiency by 20—25 per cent. The reason is that less air from behind the exhaust opening is sucked out. This means that adding a flange lets you decrease the air flow by almost a quarter. This holds true for small exhaust openings only.

- **Grilles**

Slats in the mouth of the exhaust mean better distribution than an open mouth.

- **Placement**

Place the exhaust so that the air moves away from the worker, and the air does not move past the worker's face. For instance, if the process involves bending over a bench top, do not place the exhaust above the worker's head, but in front of the person.

- **Air movement**

If air blows across the exhaust area, it can take hazardous air away from the exhaust.

- **Exhaust air speed**

Do not set the exhaust at a higher air flow than required. For instance, increased air flow leads to higher evaporation of solvent. Also, the amount of harmful chemicals added to the air outside the building increases.

Golden rule
Remember that the main purpose of local exhaust is not to suck out as many contaminants as possible, but to prevent them from moving away from the machine, hood or work area.

Ducting

A large part of a ventilation system consists of the ducting, and the way the ducting is designed can greatly affect both the efficiency of the system and the amount of noise and vibration. After all, you want to remove hazards and discomfort - not add to them!

- **Materials**

Naturally, the ducting must be made from a material that withstands the effects of the contaminant. You may need a non-corrosive, acid-proof, solvent resistant material, depending on the situation.

- **Course of air movement**

Think of air ducts as though they were roads and highways for traffic. Sharp bends create resistance - straighten them, and use shortcuts where possible. Avoid bottlenecks in pipes that are too narrow. Minimise the length of pipes, ducts and hoses. Remove kinks. Try to keep the system as horizontal as possible, and remember that heavy particles, dust, oil and moisture can collect in lower parts of the system.

- **Use round ducts**

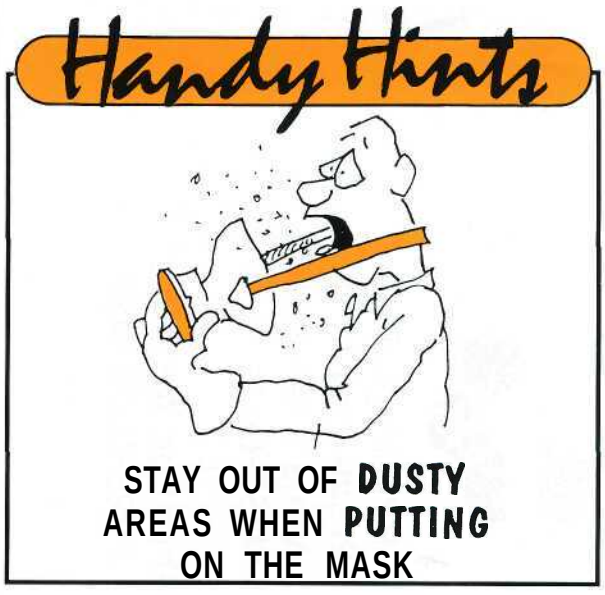
Rectangular ducting creates much more vibration and noise than round.

- **Avoid rattling**

Keep ducts away from fixed objects, machinery, walls etc. to avoid rattling and vibration.

Part two of this topic will appear in the next issue of PPM: "Practicalities — how to set up a ventilation system".

Source: The Swedish Work Environment Fund; Riskerna med Lösningsmedel, Medicinska erfarenheter - tekniska åtgärder, Stockholm, Sweden (publication year not stated)



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SUMMARY

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  The use of enzymes is spreading rapidly in a wide array of industries, ranging from bakeries to paper mills. But not only the enzymes are spreading — so are the allergies.

- **Impulse noise (page 2)**

  It happens so quickly, the brain doesn't have time to react: impulse noise can cause hearing damage without giving you any notice.

- **Noise minimisation (page 4)**

  Some simple measures that can be taken in your workplace to minimise noise — BEFORE bringing out the hearing protectors.

- **Skin care: what to look for (page 5)**

  The selection of a skin protection program requires careful consideration. Some experts give their opinions on the best choice of skin protections on offer.

- **Wall chart: Hearing Protection and the European Standard (pages 6—7)**

  A practical flowchart showing how the Europeans select their hearing protection equipment

- **Special 2-part feature: Ventilation**

  Ventilation is a vast topic. This first instalment looks at the various types of ventilation, the effects of the surrounding atmosphere on the human body, common mistakes and simple solutions.

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