MONITORING FOR HEALTH HAZARDS IN THE WORKPLACE

When you see deaths in the news caused by workplace incidents it is normally down to safety related issues such as falls from height. But deaths from health related issues arising out of the workplace far exceed those from safety failings, with UK estimates that 13,000 people die every year from work related ill health.[1]

Figure 1 - An air sampling pump

The cost of ill health to businesses is becoming increasingly understood. In the UK construction industry work related ill health costs £848 million per year.[2] This is the cost to the employer alone and excludes the cost to society and the individual.

Monitoring for issues that can effect ill health in the workplace is therefore increasing. There are many monitoring technologies available for measuring hazards that can cause long latency health effects and monitoring forms part of the risk assessment. There are many ways in exposure can be estimated from existing data, such as Hand Arm Vibration (HAV) from tool manufacturers data, but often this is not enough to consider real world factors, such as tool wear which might increase exposure levels with time.

Understanding monitoring technology is key so you know the data you are getting is valid and accurate. We can now look at types of exposure and look at the pros and cons of different instrumentation to make measurements.

Dust and aerosols

Dusts can cause significant health effects, both acute and chronic. There are two types of ways to measure exposure, the most common being an air sampling pump (Figure 1). Pumps are generally bodily worn devices which sample the dust onto a filter, via a sampling head worn in the breathing zone. The filter can be sent off to a laboratory for analysis. It seems almost archaic in the modern world that we need to do this, that there isn't an instant result. Well of course, there is with a real time dust monitor. A pump and filter method is the most accurate way of assessing exposure, but you have to wait for the lab results, so a real time instrument is appealing. Real time monitors (Figure 2) generally use light scatter to measure dust level, and can provide a level of dust straight away. But as light interacts with different types of dust in different ways it cannot give a true level of dust, but gives an indicative level. So air sampling pumps can give as near a true level of exposure and real-time instruments can then tell you when the exposure occurred. Real time instruments can tell you if something has changed, if control measures such as LEV are effective, and provide a training tool to educate employees of how there actions may be effective exposure, such as using a brush to sweep dust rather than the recommended vacuum cleaner. Remember it is the dust you cant see that you breath in because it is too small, that is harmful, so being able to show this with a real time monitor is very helpful.

Gases and Vapours

There are similar parallels here to dust exposure, there is generally a pump method and often a real- time alternative. Pumps for sampling gases and vapours are generally smaller than those for dust as they don't need to draw air at such a high flow rate, and the air is typically sampled onto a adsorbent tube filled with for example, charcoal. The pump is again the most accurate way of assessing exposure, but you must know what you're sampling for and select the right tube, flow rate and ensure the lab selected can analyse what you want to measure. There are also real time equivalents such as a Photo-ionisation detector for vapours, and the gas detectors. Gas detectors are of course a monitoring technology that most health and safety professionals are familiar with, being used for safety to stop people being hurt in the here and now, but they can also be used to monitor exposure. The pump sampling through a tube with allow calculation fo the 8 hour exposure to compare to Workplace Exposure (WEL) limits, but gas detectors can tell you when exposure is occurring, which can then point to the place exposure is occurring and therefore look at where control measures need to be put in place.

Figure 2 - A real time dust monitor

Gas detectors and PIDs have different sensitivities to different gases or vapours so care must be taken to know exactly what is present in the air to make the correct assessment, and sensor cells can suffer from cross sensitivity to other gases. Know what you are measuring, and ensure any real time instrument is calibrated. For an accurate analysis of exposure, use the methods described in legislation such as the UKs Methods for Determination of Hazardous Substances (MDHS) available from the HSE.

Noise

Many health hazards are invisible in the workplace but at least noise can be heard! Nothing highlights the effects of the latency of some long-term health effects more than noise, where Noise Induced Hearing Loss (NIHL) becoming degenerative later in life, or not so later depending on the severity! Noise measurement is often perceived of straight forward, surely everyone knows what a decibel is? The reality is there are a plethora of parameters and options when monitoring.

Figure 3 - A sound level meter for workplace noise

Modern instruments for workplace noise tend to have setups that are defined and named to local workplace legislation, this means that you can pick a setup and it will automatically measure all the required parameters with the correct settings, removing the possibility of measuring incorrect parameters.

A sound level meter (Figure 3) is a hand-held device, enabling measurements to be taken at the ear (within 10-15cm) with the instrument pointing at the noise source. This process must be repeated for both ears, for all duties employees perform, making it possible to calculate an accurate record of daily exposure. Settings on these meters can be adjusted according to the type of noise being assessed. Monitors should be compatible to the international IEC 61672 Class 2 standard ensuring correct measurements are made.

When using a sound level meter, measurements must be started at the beginning of a task, representing workers' actual exposure. If workers are likely to be exposed to high levels of impulsive noise, emitted from heavy pressing operations or sheet metal working, peak noises must be measured for accurate results and compared to peak action levels.

When conducting noise surveys, sound level meters are the preferred supporting device, as the operator is present, ensuring that the noises measured are of good quality. A representative measurement is made for each job function, with the exposure time for each, ensuring an 8 hour exposure can be calculated as a result.

Dosimeters (Figure 4) are small devices worn by workers, measuring personal exposure. These are small, shoulder worn devices.

Figure 4 - A noise dosimeter worn on the shoulder

Dosimeters can be started at the beginning of a shift and should be used until the end of the day, when data can be uploaded onto a computer, detailing the history of the noise exposure, highlighting where high exposures occur throughout the day. If the dosimeter is placed on an employee who then makes a diary of times and jobs performed throughout the day, the employer will be able to instantly see the operations that require more effective noise controls.

It is best to use dosimeters for individuals with a complex work pattern and varying noise level exposure, or when certain tasks make it difficult to monitor with a sound level meter, such as fork lift truck driving. It is important to remember that noise dosimeter measurements are open to spurious results from employees, especially when first used. So, high exposures should be checked to see if they are a legitimate part of the workers exposure. Modern noise dosimeters can record the actual audio. This would allow the sound to be played back to determine what the exposure was from, such as a particular machine, or indeed that it was spurious.

A noise dosimeter.

Ensuring regulations are met, employers must purchase dosimeters that are compliant with the IEC 61252 standard.

Vibration

It is estimated nearly two million people in the UK are at risk of developing Hand Arm Vibration, commonly referred to as HAV syndrome. Exposure to vibration in the workplace can lead to serious consequences, causing long-term injury or impairment. HAV is transmitted into workers' hands and arms from the use of hand-held power tools and hand guided equipment. Whole body vibration (WBV) from, for example, plant vehicles moving over rough ground, causes other issues such as damage to vertebrae.

Different jobs emit different levels of vibration; cutting brick will create different levels to cutting wood. Irrespective of the task, employers must adhere to the government standards of safety that stipulates the daily exposure limit for vibration (ELV) is 5 m/s^2. This value is the maximum level of vibration an employee can be exposed to on any single day and above which employees should not continue until steps have been taken to reduce exposure.

Employers must also focus on the daily exposure value (EAV), which should not exceed 2.5 m/s^2. Employers should take the necessary control measures, ensuring exposure is reduced below this value as far as is reasonably practicable. High powered tools are now designed with estimated vibration levels and employers should use this as a guide, indicating how long workers can operate these for. Measuring the vibration levels with a HAV monitor (Figure 5) extends this, actually measuring exposure. This is essential, measuring the vibration levels of tools not just when the tools are new, but as their vibration levels deteriorate with time.

Monitoring gives employers the knowledge that tools and machinery continue to be safe for use after purchase, helping to ensure worker productivity and safety. When manufactured, all monitoring devices should adhere to the standard ISO8041. The data monitoring provides could shape further education campaigns, highlighting areas where further training is required, ensuring employees are completely aware of the issues.

Monitoring for other health hazards

There are many other monitoring types of monitoring technology to measure exposure in the workplace, which includes:

- Heat and cold stress: Monitors, which can measure temperature indices and when compared to work rate and other factors determine how long it is safe to work in a specific environment.
- Radiation: this can fall into two forms, ionising and non-ionising. Sources of ionising radiation, such as from radioactive decay will be controlled if the occur in a workplace and this is of course a specialist field where measurement of radiation dose is critical. Non-ionising radiation sources such as Ultraviolet from sources such as welding or outdoor work, are much more prevalent. Various instruments to measure these Electro Magnetic Fields (EMF) monitoring instruments are available but vary considerably depending on wavelength of radiation they are being used for. Legislation has been published to control exposure to electromagnetic fields with the European Directive (2013/35/EU).

There are other ways of course other forms of monitoring from routes of exposure such as dermal (through the skin), via indigestion or from bio aerosols (e.g. bacteria) for which it is possible to monitor, and of course it may well be necessary to in order to control exposure.

Figure 5 - A hand arm vibration meter

Conclusion

A 2004 study conducted by the HSE found employers considered health and safety to be a generic phrase where individuals were unable to distinguish between the different types of risk concerned. We are much further forward then this now, and the remits of a health and safety professional are wider than ever before. But as the costs of occupational ill Health are increasingly understood, then monitoring for these health hazards at work as a means to reduce risk and control exposure. Understanding the options available for monitoring and the best use of the technology to ensure data is relevant and accurate are key to quantifying risk with the end goal of employees remaining healthy through their working life and beyond.

References

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