

The Future for Personal Noise Dosimeters

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Excessive workplace noise exposure is one of the major sources of industrial injuries in many industrialized countries. Noise is such a pervasive hazard that many of us become “used to” high levels and we forget that they can potentially impair our hearing. This will lead to social difficulties later in life if it is not identified and controlled as soon as possible. It is generally recognized that the risk of hearing loss is a function of the absolute noise level and the duration of the exposure. Almost all countries have put into place limits on the permissible noise levels that are allowed in order to minimize the likely hearing loss claims that may be brought against an employer for people working in such conditions.

Background

In the United States, the OSHA Noise at Work legislation contained in CFR 1910-95 require the collection of noise exposure results with a view to complying with the 90 dB 8 hour Permitted Exposure Limit and with the Action Level at 85 dB for 8 hours for workers in a Hearing Conservation Program. This is in addition to other recommended limits in the U.S. from other national bodies such as ACGIH and NIOSH and similar requirements in the rest of the world. U.S. legislation calls for the average noise level to be measured with a 5 dB exchange rate while European and other countries have chosen to measure with the 3 dB exchange rate. There is also a limit to the single highest peak noise level that can be allowed.

Since noise exposure is a function of the noise level and the exposure time it might be expected that a simple investigation with a hand held sound level meter is all that is needed to make an assessment. However, it may not always be that easy. In the early 20th century where the majority of workers stood by the side of a conveyor belt and performed the same task over and over again at the same position, a hand-held sound meter would probably be an adequate solution. If the noise levels are steady in nature then simple eyeball-averaging can be performed and a rough estimate of the time spent actually performing each task will quickly give a result for the contribution of each separate task. When the noise levels are varying or random in nature, the average noise level can be measured by an integrating sound level meter that will produce a time average result in a relatively short period of time.

A measurement of 5 to 10 minutes in such circumstances is often enough to provide a high level of confidence that the true situation has been identified. This method relies on the supervisor using his or her eyes and ears to watch what is happening and to listen for significant high noise levels to make sure they are included in the average value. However, the drawback with this is that it ties the supervisor down to actually carry out the survey and it is difficult to do anything else while this is going on. To survey a large factory with many locations and sources of noise can be extremely time consuming if all the measurements have to be made by hand.

Size Matters

Over the last 30 years, the preferred way to collect the noise exposure of individual workers has been to put the noise meter onto them and let them go about their normal routine as much as possible. This frees up the supervisor to get on with other tasks that need his or her attention rather than just standing there holding the noise meter all the time. Some form of built-in time averaging must be provided so that the meter can correctly assess the changes in noise exposure. Other factors also become more important now such as the physical design of the instrument. Over the years, this form of “personal noise monitoring” has developed into a format where the main part of the meter is worn by the worker on the belt with the microphone at the end of a cable. This has proved to be an acceptable method in most situations but does run the risk of introducing some problems of its own.

From the worker’s point of view, the size of the noise meter, or personal noise dosimeter as it is more often called, becomes of primary concern. When sound level meters weighed typically a few lbs, it was not convenient to have this much weight fixed to a worker’s belt. This led to the miniaturization of the electronics needed to carry out this task and to minimize the intrusion on the person wearing the dosimeter.

Noise dosimeters in the 1970s were designed to be a little larger than the size of a packet of cigarettes, and weighed about 8 to 10 oz. In order to minimize the weight of the dosimeter they were often designed to just show the absolute minimum amount of information such as the noise dose as a percentage of an allowed limit.

One of the biggest areas of concern for the supervisor was the robustness of the microphone on the end of the cable that was worn close to the worker’s shoulder. Unless the cable was correctly positioned, there was always the possibility that it might get caught when the worker bent over a machine and pulled out. Alternatively, the cable could be cut and the microphone signal removed completely. In heavy industries many users have reported 20 to 30 percent replacement rates for the microphone assemblies because of such accidents. Not only is there a cost associated with replacing the microphone but usually the whole day’s measurements would be lost too, another frustrating aspect of this type of problem.

From the worker’s point of view, the key points for a body worn instrument are size and weight. A personal noise dosimeter needs to be as small and as inconspicuous as possible so that the worker forgets it is there and just goes about their normal work routine. One of the ways that this has become possible is by designing the microphone into the body of the dosimeter itself. This has led to a reduction in weight down to as little as a couple of oz, and a size that is only a few inches in any dimension.

DSP Technology

It could be expected that a reduction in size and weight would have to come with

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the penalty of loss of valuable data for the measurement. Careful design and use of the latest digital signal processing (DSP) technology ensures that all of the noise readings that are currently in wide use are still available in badge style dosimeters now becoming available on the industrial hygiene market.

Not only do the small badge dosimeters collect the noise with the overall run data, they also log the minute-by-minute changing noise levels that provide valuable time history information. For added convenience, a display is necessary to view the key noise exposure parameters directly on the badge dosimeter at the end of the run without having to rely on other equipment or a computer.

Record keeping forms a very important part of industrial hygiene monitoring and being able to download run results to a computer is considered to be a “must-have” in the 21st century. Comprehensive software packages provide a database approach to record keeping and allow the supervisor to show time history charts and to make simple reports for a worker’s personnel file.

Conclusion

Because of their small size and powerful capabilities, micro wearable noise dosimeters are likely to become more popular for both supervisors and workers, just like their regular bigger brothers.

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