



# Noise Measurement

Employers are responsible for knowing which workers are overexposed to noise. The WCB's Occupational Health and Safety Regulation sets exposure limits for noise at 85 dBA  $L_{ex}$  and a peak noise level of 135 dBA.

## What are $L_{ex}$ and $Pa^2h$ ?

The risk of hearing loss depends on the loudness of the noise, **and** how long the workers are exposed to the noise.  $L_{eq}$  is the average noise level measured by an integrating sound level meter.  $L_{ex}$  is the  $L_{eq}$  which has been corrected for shift lengths other than eight hours.  $L_{ex}$  is the noise level, averaged over eight hours, which gives the same noise exposure as would the varying noise over a typical full work shift.  $L_{ex}$ , therefore, includes both loudness and length of exposure. Another way of expressing noise exposure is by "noise dose". Noise dose is measured in units called Pascal-squared hours, abbreviated as  **$Pa^2h$** . A noise exposure of 85 dBA  $L_{ex}$  is equal to 1  $Pa^2h$ .

When workers are or may be exposed to noise above 82 dBA  $L_{ex}$  employers **must** measure the noise exposure unless an exemption applies (see page 7). How loud is 82 dBA? If you have to raise your voice in your workplace to carry on a conversation, then the noise level is likely over 82 dBA.

Measuring workplace noise:

- Identifies significant sources of noise in the workplace and helps prioritize them for noise control measures
- Determines noise exposures of workers and identifies workers who require hearing protection, hearing testing, education, and training
- Determines workplace areas that should be posted as hazardous noise areas

Area noise measurements (measurements of general noise levels in a work area) or spot measurements (measurements taken near a piece of noisy equipment or during a specific work process) may be used as a first step to determine if there is a need for further measurement.

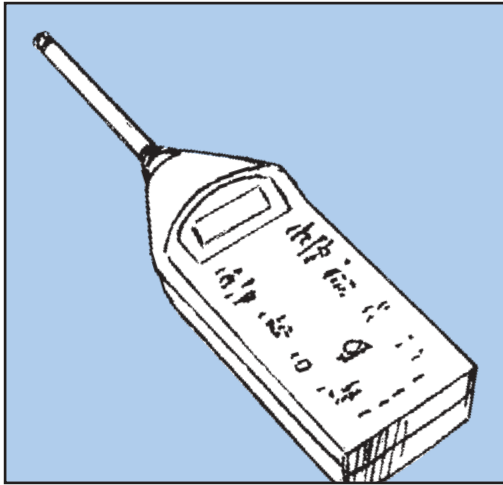
Area or spot measurements are **not** a substitute for personal exposure measurements (noise measurements taken to determine a particular worker's exposure) because area and spot readings do not incorporate information about the length of exposure. Area measurements may either overestimate or underestimate a worker's noise exposure, leading to inappropriate selection of hearing protection and inaccurate identification of workers who require annual hearing tests.

### What's the difference between dB and dBA?

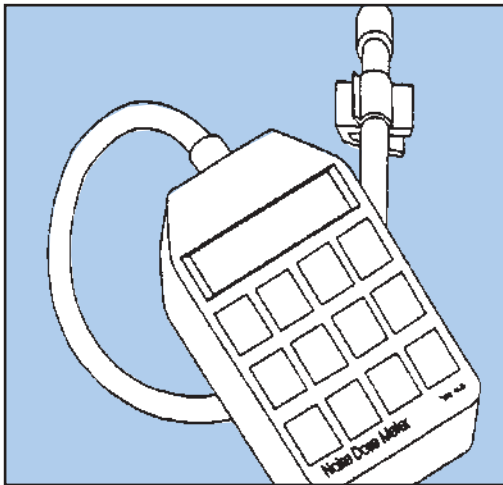
The intensity of sound is measured in units called decibels, (dB). Intensity is perceived as loudness. The notation dBA refers to decibels measured on a sound level meter using the A-weighting filter network. Sound level meters have built in filter networks. If a sound level meter is used with the A-weighting scale selected, the meter will mimic the way the human ear responds to sound. Occupational noise surveys must be done with a sound level meter using the A-weighting network.

## Noise measuring equipment

Measuring noise exposure is done with noise dosimeters or integrating sound level meters. Both instruments average noise levels over time to provide  $L_{eq}$ . The integrating sound level meter is a hand-held instrument, while the noise dosimeter is a small device worn by the worker whose exposure is being measured. The dosimeter has a cable-mounted microphone that is usually placed on the worker's shoulder or collar.



An integrating sound level meter averages noise levels over time.



A noise dosimeter is a small device worn by the worker.

Non-integrating sound level meters simply measure noise levels at a given moment. They can't integrate, or average, sound levels over time. These meters may be used to take spot or area noise measurements to determine if further noise exposure measurements are necessary. Non-integrating meters may be used to estimate a worker's noise exposure where the noise is steady or non-varying. In such cases, this requires measurement of all noise sources, the length of each exposure, and calculations to derive a noise dose or  $L_{ex}$ .

Detailed requirements for noise dosimeters are outlined in *American National Standards Institute (ANSI) Standard S1.25-1991, Specifications for Personal Noise Dosimeters*.

## Noise-measuring procedures

Each time noise measurements are made, the equipment should be checked or calibrated. Calibrating the meter ensures that it is functioning properly and reading noise levels accurately. Calibrating the equipment for a survey is known as a field calibration. A complete

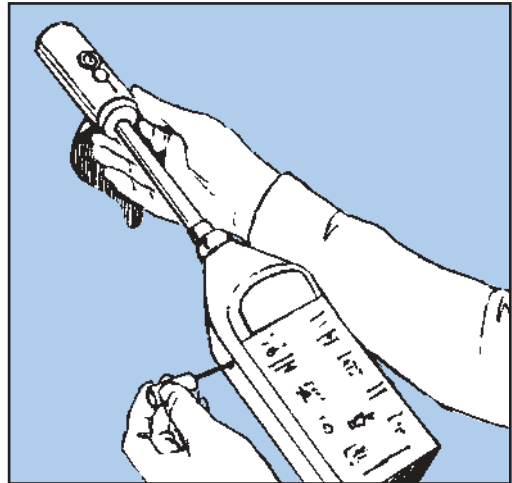
calibration of the equipment should be done in a properly equipped laboratory at least every two years. A laboratory calibration will check all of the instrument's functions to ensure correct operation.

Measurements are made with the the sound level meter, with the microphone located in the hearing zone of the worker, close enough to the worker's ear to obtain a reliable indication of the noise to which the worker is exposed. If measurements are done with a dosimeter, the microphone should be clipped to the worker's collar or shoulder. The microphone should be placed on the side of the worker subject to the most noise.

It may not be necessary to measure the noise for an entire shift. A worker's noise dose (or  $L_{ex}$ ) can be calculated from measurements over shorter periods, provided the measurements are representative of the exposure throughout the day.

To ensure that the measurements are representative, managers, supervisors, and workers should be asked by the noise surveyor about:

- Major noise sources, noisiest areas, and previous complaints.
- How the work pattern compares to a typical work day. Do the noise levels change? What are the number and



*Calibrating a sound level meter before a survey will ensure it is functioning correctly.*



When measuring noise levels, place the microphone in the “hearing zone” of the worker on the side subject to the most noise.

duration of breaks? Is there downtime, delays, product changes, or job rotation?

- If noise measurements are not taken on a typical day, what is the probable impact on the measurements, and will measurements need to be re-done.
- If noisy equipment was added, removed, or modified since the last noise measurements were taken.
- If any noise control measures were instituted.

Noise measurements **must** be carried out in accordance with acceptable standards. *Canadian Standards*

*Association (CSA) Standard Z107.56-94, Procedures for the Measurement of Occupational Noise Exposure*, provides guidance on the type of equipment to use, which workers to test, and how to test. For a detailed discussion of noise measurement techniques and sampling strategies, please see the booklet, *Occupational Noise Surveys*, available from the WCB.

Noise evaluation needs to be done by knowledgeable, trained personnel such as in-house safety or hygiene staff, or by an acoustical consulting firm (see the Yellow Pages under “Acoustical Consultants”). If consultants are hired to conduct noise measurements, ensure they are familiar with the WCB booklet, *Occupational Noise Surveys*, and can meet its requirements.

## Exemptions from noise measurement requirements

If workers are identified as being exposed to noise based on other information (see below), and an effective noise control and hearing conservation program is in place, employers do not have to measure the actual noise exposure of the worker.

Other information that demonstrates that workers are exposed to noise in excess of the limits might be:

- Labels on tools or specifications for equipment indicating there is a strong likelihood of over-exposure to noise as a result of using the equipment
- A database of worker noise exposures indicating most members of a trade are overexposed on a daily basis (one such database is kept by the WCB Hearing Conservation Section)
- The peak noise level limit of 135 dBA is exceeded daily
- Short-term noise measurements suggest  $L_{ex}$  of 85 dBA is exceeded daily (e.g., 100 dBA for 15 minutes a day)

If no previous information on sound levels exist, and it is possible workers could be overexposed to noise, noise exposure measurements **must** be completed.

## Noise survey records

A written report on the results of the noise survey can follow any format, but should contain the following information:

- A list of jobs that are overexposed according to the noise standards in the Occupational Health and Safety

Regulation, and that require hearing protection and annual hearing tests for workers in those jobs.

- A list of workers to be trained and educated about the effects of noise on hearing, and on hearing conservation techniques.
- Locations that need to be posted with signs warning about high noise levels and the requirement to wear hearing protection.
- A statement noting that the measurements were taken under typical noise conditions (or otherwise) at the survey times. The dates of the measurements and the noise measuring equipment used should be recorded.
- Explanations to account for unusual or different noise measurement levels resulting from changes in the daily work routine, if necessary.

### When should noise measurements be redone?

Measurements **must** be redone whenever workers' noise exposures could have changed due to:

- Machinery being installed or removed
- Workload or equipment operating conditions changing, causing significant changes in noise levels
- A building's structure changing, (e.g., a wall removed or added)
- The length of time employees spend in noisy areas changing

- An explanation of the calculation method used, if total daily noise exposures were calculated from partial noise exposures.

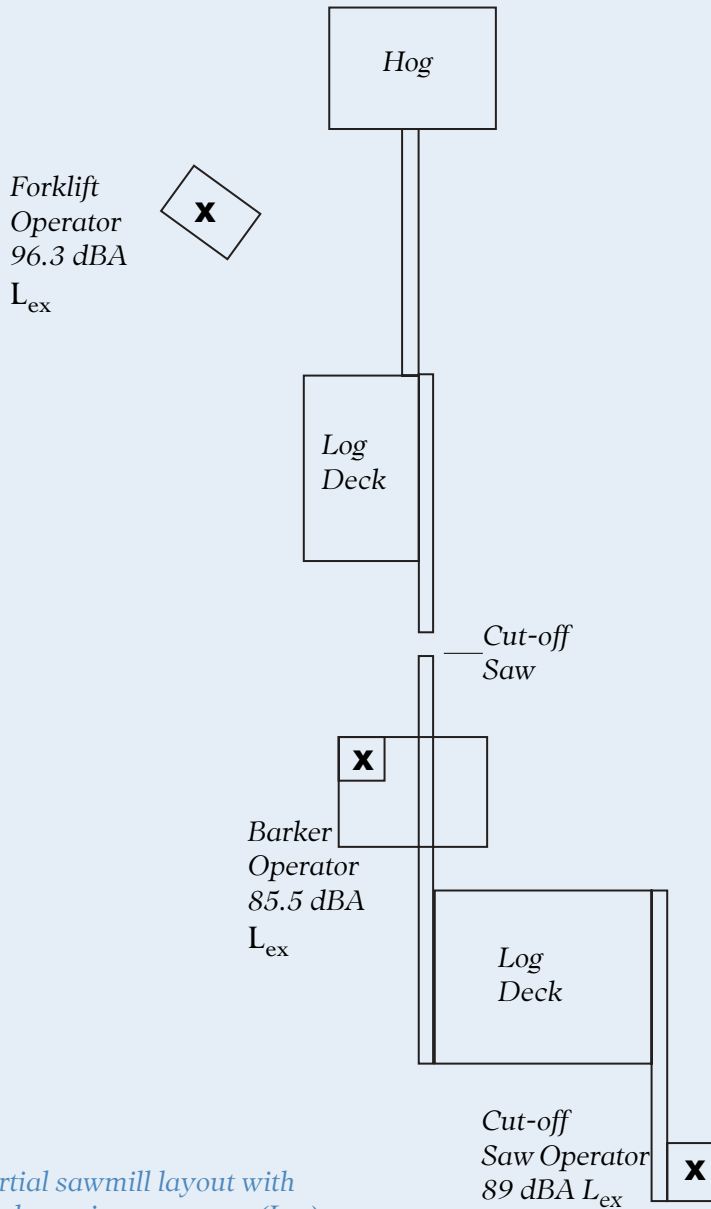
In addition to a written report, it may be useful to summarize the noise survey information in a table or write the noise levels on a general layout of the plant.

Employers **must** ensure that the current noise measurement results are readily available for reference by a WCB officer, the company occupational health and safety committee, or a company health and safety representative.

## Example of Summarized Survey Information

Company Name	Division/Department	Address					
<i>Peacham Pill Co. Ltd.</i>	<i>Manufacturing</i>	<i>221A Holmes Street, Burnaby BC, Canada, V1E 2T4</i>					
Worker's name or job	Number of workers	Shift duration, hours	L <sub>eq</sub> dBA	L <sub>ex</sub> dBA (L <sub>ex</sub> = L <sub>eq</sub> + correction)	Comments	OK with Regs? Y/N	Recommendations
<i>Bottling</i>							
Feeder	1	83.5	10	84.5	(correction to 8h = +1 dB)	Y	make ear plugs available etc
Filler	1	85.5	10	86.5	steady noise for long periods	N	do Noise Control (NC)
Capper	1	81	10	82	no significant impact noise	Y	make ear plugs available etc
Labeller	1	80	10	81	(job rotation to reduce	Y	no action required
Packer	1	78.5	10	79.5	average L <sub>ex</sub> to 83.5 dBA)	Y	no action required
<i>Tablet Pressing</i>							
Acme Press #1	1	89	7	88.5	(correction to 8h = -.6 dB)	N	Hearing Conservation Program/NC
Acme Press #2	1	93.5	7	93	Signif Impact Peaks = 133	N	Hearing Conservation Program
Acme Press #3	1	93.5	8	93.5	Signif Impact Peaks = 138	N	Hearing Conservation Program
<i>Shipping</i>							
Forklift	1	82.2	12	84	(correction to 8 h = +1.8 dB) variable level. No significant	Y	make ear plugs available etc. fit new muffler to F/L
Truck Driver	1	79	12	81	impact noise in Shipping	Y	no action required
<b>Noise Surveyor:</b> A.N. Other		<b>Signature:</b>		<b>Survey Date:</b> 1994-08-28			
<b>SLM/Dosimeter:</b> Valiant		<b>Model:</b> N1	<b>S/N:</b> XYZ1234				
<b>Calibrator:</b> Valiant		<b>Model:</b> N2	<b>S/N:</b> ABC987				

## Example of a General Layout Diagram



*Partial sawmill layout with worker noise exposures ( $L_{ex}$ )*