

DEALING WITH OCCUPATIONAL NOISE EXPOSURES

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INTRODUCTION

Noise is everywhere. At work. In the home. Where we play and shop. Sometimes, it's too much to bear. So the question is, how much noise is too much, and at what point does it become a hazard to our hearing?

Over the years, the Occupational Safety and Health Administration (OSHA) has adopted standards for occupational noise levels, which are continually being updated to keep pace with the variety of harsh sounds that bombard us every day in the workplace. According to OSHA, if the standards and guidelines are followed, nearly all occupational hearing loss can be prevented.

BACKGROUND AND OSHA STANDARDS

Occupational noise is categorized as either "impulse" or "continuous."

- Impulse noise lasts less than one second in duration. Some examples are hammering, metal falling onto the floor, or a short horn blast. The number of impacts is not considered so important because the hair cells (cilia) and nerve endings in our ears generally allow us to recover after impulse peaks. Instead, the loudness of the sound is the key, with any impulse noise over 140 dBA* deemed excessive and a potential hazard.
- Continuous noise lasts at least one second in duration, and usually longer. Examples are operating electrical machinery, engine noise, and loud music. The following chart illustrates typical continuous noise levels.

* = Decibels on the "A" Scale (a unit of noise measurement).

NOISE SOURCE	dBA
Defined threshold of hearing	0
Quiet wooded area	15-20
Library	35-40
Conversational speech	60-65
Average street traffic	80-85
Compressed air with some spraying	90-105
Pneumatic chipper	100-115
Coarse grinding	110-115
Near a jet engine	140-150

The threshold of pain from sound for most people is 120 dBA. However, hearing loss can occur at much lower levels. OSHA has determined that many people will experience hearing loss if regularly exposed to an eight-hour time-weighted average of more than 90 dBA of sound per day. Since some people may be susceptible at lower levels, OSHA has established an "action" level standard of 85 dBA for eight hours.

OSHA regulates only occupational noise exposure. Nevertheless, noise can be a potential hazard anywhere. The excessive sound at a sporting event, target practice range, amusement park, rock concert, and the home workshop all represent risks of noise exposure and potential hearing loss.

Many communities have addressed the noise issue by erecting sound walls between highways and residential neighborhoods. Other examples of restrictions imposed by communities include limiting the use of leaf blowers, lawn mowers, chain saws, and other loud power tools. Consumer demand has also caused manufacturers to begin reengineering power tools to muffle the level of sound they emit.

CALCULATING OCCUPATIONAL NOISE EXPOSURE

Determining the degree of noise exposure in any environment requires the use of sophisticated measuring devices. The two most commonly used are 1) a sound level meter, which provides an instantaneous reading, and 2) a dosimeter, which measures average noise levels over a period of time.

The degree of noise exposure is based on sound pressure level (loudness), and the duration of the sound exposure. For example, an average noise level of 90 dBA over an eight-hour work shift is the OSHA threshold for overexposure. However, 95 dBA over four hours delivers an equal level of overexposure. Similarly, exposure to 100 dBA for just two hours produces the same result. Since the decibel unit is logarithmic, a drastic reduction in permissible hours as compared to a modest increase in dBA level occurs. (See Appendix A for a chart illustrating the maximum permissible exposure times at various noise levels.)

To determine the degree of exposure an employee may experience during a normal shift, combine exposure ratios for each differing noise level throughout the time period. For example:

NOISE EXPOSURE EVALUATION

Activity	Exposure Level dBA	Duration Hours	Permissible Hours	Exposure Ratio
Working Press	95	2.0	4.0	0.50
Machine Shop	85	3.0	16.0	0.19
Working Shear	97	2.0	3.0	0.67
Lunch/ Breaks	<80	1.0	Any	0
TOTAL		8.0		1.36

In this example, the employee works two hours on a press, three hours in a machine shop, and another two hours at a shear. He would be allowed to work just four hours a day at the press (within the permissible time limit) without the need for a hearing protection device. If he works two hours at this task, his exposure ratio is two (actual hours or duration), divided by the four (permissible hours), equaling 0.50. Similarly, the exposure ratio for his time in the machine shop is 0.19, and for the shearing operation is 0.67.

Hence the cumulative exposure for the day is 1.36 (0.5 + 0.19 + 0.67), which represents 136 percent of the permissible exposure. This is equivalent to working at 92.3 dBA for the entire shift (another way of expressing the combined exposure).

Note that the exposure for workers on 10 or 12-hour shifts are calculated in the same manner, as the chart below illustrates.

NOISE EXPOSURE EVALUATION FOR A 12-HOUR SHIFT

Activity	Exposure Level dBA	Duration Hours	Permissible Hours	Exposure Ratio
Working Press	95	3.0	4.0	0.75
Machine Shop	85	5.0	16.0	0.32
Working Shear	97	3.0	3.0	1.00
Lunch/Breaks	<80	1.0	Any	0
TOTAL		12.0		2.07

In this case, the combined exposure ratio is 2.07 or 207 percent, which is equivalent to eight hours of continuous exposure at a 95.2 dBA level.

Any noise exposure ratio over 1.0 or 100 percent is considered an overexposure. An exposure ratio of between 0.5 (50%) and 1.0 reaches the action level. At this point specific steps must be taken by the employer to establish a Hearing Conservation Program. The requirements for such a program vary somewhat depending on whether the exposures fall entirely within the action level or extend beyond to the more serious overexposure level.

For exposures limited to the action level the program must:

1. Provide for initial and annual hearing testing for all workers exposed to noise levels above 85 dBA, but below 90 dBA, for the eight-hour average exposure.
2. Provide approved hearing protection with an appropriate Noise Reduction Ratio (NRR) for all workers exposed to average noise levels between 85 and 90 dBA. These workers must be required to wear a hearing protection device if their annual hearing test shows a significant threshold shift. Otherwise, the hearing protection device can be offered as a voluntary safety measure.

When employees are at the overexposure level (at or above 90 dBA for the eight-hour average) for an eight-hour average period, a Hearing Conservation Program is also required. The requirements are similar except that the use of hearing protection is mandatory rather than voluntary. In both cases, training in the hazards of noise, as well as proper use and maintenance of hearing protection, is required.

NOISE CONTROL OPTIONS

Noise exposure should be reduced to levels below 90 dBA average whenever feasible. Utilizing engineering controls in the workplace is the most efficient and desirable way to reduce harmful noise levels, and is considered the most efficient long-term solution.

Conversely, hearing protection devices are the least desirable and should be used only as a last resort. This control method usually requires annual audiograms, on-going training, supervision, and motivation to maintain the desired result.

Steps to develop effective engineering controls:

1. Modify or repair the offending source so it operates at acceptable noise levels. Repair noisy bearings, loose covers, slipping belts, leaking compressed air, dull cutters, and excessive end-play in reciprocating equipment.
2. Remove noisy equipment from the operation.
3. Replace equipment with those that produce noise levels under 85 dBA. New equipment is generally more efficient and quieter.
4. Consider alternative processes that may eliminate or reduce the use of noisy equipment.
5. Isolate the noise source with a barrier and/or isolation mounting.
6. Isolate the worker's location from the noise source (i.e., place the employee in a noise attenuating enclosure).

Steps for effective administrative controls:

1. Schedule noisy tasks or use of loud equipment during off-hours or evening shifts.
2. Rotate workers who are normally exposed to excessive noise so their 8-hour exposure average is below 85 dBA.
3. Restrict noisy areas to designated employees.
4. Eliminate or control the use of personal noise sources (such as radios or boom boxes).

CONCLUSION

Occupational hearing loss is usually preventable. The steps to minimize the possibility of hearing loss include:

1. Conduct and document a Noise Level Survey.
2. Establish a Hearing Conservation Program for applicable employees.
3. Determine if engineering controls are feasible to minimize exposure.
4. Ascertain if administrative controls are feasible to minimize exposure.
5. Provide suitable hearing protective equipment until the exposure has been reduced to acceptable levels.

APPENDIX A

OSHA TABLE G-16: 'A' weighted sound level/permmissible duration in hours

dBA	Hours	dBA	Hours	dBA	Hours	dBA	Hours
Less than 80	Any	92	6.1	105	1.00	118	0.160
80	32.0	93	5.3	106	0.87	119	0.140
81	27.9	94	4.6	107	0.76	120	0.125
82	24.3	95	4.0	108	0.66	121	0.110
83	21.1	96	3.5	109	0.57	122	0.095
84	18.4	97	3.0	110	0.50	123	0.082
85	16.0	98	2.6	111	0.44	124	0.072
86	14.0	99	2.3	112	0.38	125	0.063
87	12.2	100	2.0	113	0.33	126	0.054
88	10.6	101	1.7	114	0.29	127	0.047
89	9.2	102	1.5	115	0.25	128	0.041
90	8.0	103	1.3	116	0.22	129	0.036
91	7.0	104	1.1	117	0.19	130	0.031

Adapted from OSHA 29 CFR 1910.95 Table G-16a

ADDITIONAL RESOURCES

US Department of Labor – Occupational Safety and Health Administration

<https://www.osha.gov/SLTC/noisehearingconservation/>

<https://www.osha.gov/Publications/OSHA3074/osh3074.html>

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