



Construction Industry Noise Exposures Construction Workers

Department of
Environmental
and Occupational
Health Sciences

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Introduction

Many construction workers complain that they can't hear as well as they used to, and statistics back them up. Construction workers are exposed to noises loud enough to cause permanent noise-induced hearing loss. In Washington state, construction workers are five times more likely to file workers' compensation claims for hearing loss than are workers in all occupations combined.

This report from the University of Washington looks at the noise exposures of construction workers and makes recommendations applicable to their specific needs. It is based on six years of research in the construction trades. Since 1997, university researchers have collected information on noise exposures of construction workers in the Puget Sound area. We now have almost 900 full-shift measurements on workers from 11 trades.



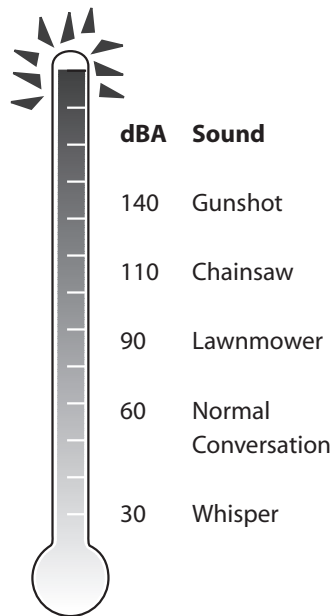
What is noise?

Noise is unwanted sound. Noise levels are measured on a decibel scale (dBA), which matches the ear's sensitivity to sound. A whisper is about 30 dBA, normal conversation is 60–70 dBA, and power tools are often between 90–110 dBA. If two people at arm's length must raise their voices to be heard, the noise level is above 85 dBA. Figure 1 shows the decibel levels of some familiar sounds.

Safe noise levels

Our noise measurements are based on the legal noise standard of the Washington Industrial Safety and Health Act (WISHA). In Washington state, the Permissible Exposure Limit (PEL) allows an 8-hour, full-shift average exposure of 85 dBA.* For every 5 dBA increase above this level, the allowable exposure time is cut in half (see figure 2 on page 3). Workers with a full-shift average exposure above 85 dBA are required to wear hearing protection devices (either earplugs or earmuffs). They also must be included in a hearing conservation program in which they receive annual hearing tests and training on noise exposure and hearing loss. Workers must *always* use hearing protection when levels exceed 115 dBA.

Figure 1.
Decibel levels (dBA)
of familiar sounds

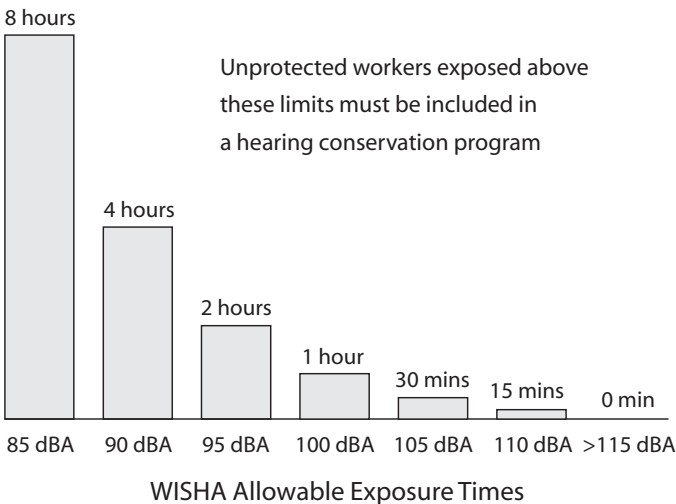


* The federal Occupational Safety and Health Administration (OSHA) PEL for construction noise is an eight-hour average of 90 dBA.

What happens if you are exposed to too much noise?

Noise exposures that are loud enough and last long enough can damage nerves in the inner ear, causing permanent and irreversible hearing loss. This damage can result from repeated exposure to levels above 85 dBA (such as years of working around construction noise without hearing protection), or from as little as one exposure above 140 dBA. Workers who have suffered hearing loss often become socially isolated because they can't communicate easily with others. They also may not be able to hear warning signals, which can lead to accidents and injuries. Our measurements show that most construction tasks and tools generate noise levels that require use of hearing protection. However, we found many situations in which workers rarely or never used hearing protection. This gap in hearing protector use puts construction workers at risk for hearing loss.

Figure 2. WISHA allowable noise exposures





What we found in our research

We have made 887 full-shift measurements on workers from the following trades: bricklayer, carpenter, cement mason, electrician, insulation worker, ironworker, laborer, operating engineer, masonry restoration worker, sheet metal worker, and tilesetter. The majority were from commercial construction sites, with the remainder from industrial, residential, road, bridge, and highway work sites. The type and size of work sites are important factors in noise levels. The largest sites generally have the highest exposure levels.

Average noise exposures and hearing protector use for construction workers

Table 1 shows information from our full-shift measurements on workers in 11 different trades. The average level measured was 81.4 dBA. However, one-third of all measurements were above 85 dBA, the WISHA 8-hour allowable limit. Above this level, hearing protectors are required. One in ten measurements was above 90 dBA. We found that construction workers used hearing protectors less than 40% of the time that their exposure levels were above 85 dBA. More than half of all measurements also included exposure above 115 dBA. Even though hearing protectors are always required above 115 dBA, they were used only a little more

Table 1. Work shift noise level information on 887 construction workers

Category	Result
Average full-shift noise level	81.4 dBA
Average length of measured work shifts	8 hr 26 min
% of full-shift average levels above 85 dBA	34%
% of full-shift average levels over 90 dBA	10%
% of work shifts with any noise above 115 dBA	52%
Average % time hearing protectors used above 85 dBA	39%
Average % time hearing protectors used above 115 dBA	34%

than one-third of the time. One possible reason that hearing protectors were used less at 115 dBA than at 85 dBA is that very high exposure levels are usually shorter in duration than lower levels, so workers may not have enough time or warning to put on hearing protectors.

Highest task and tool exposures for construction workers

We measured noise levels for each task that construction workers reported, along with the percent of time that they used hearing protectors when levels were above 85 dBA. The ten loudest tasks we measured are shown in Table 2. Every one of the ten loudest tasks had an average level above 85 dBA, meaning that workers should have worn hearing protection. Similarly, we measured noise levels for the tools that workers in

Table 2. Ten loudest tasks, in order of increasing average noise level

Tasks (<i>Trade</i>)	Average noise level (dBA)	Maximum noise level (dBA)	% time hearing protection worn when needed
Installing Trench Conduit (<i>Electricians</i>)	95.8	118.6	0%
Operating Work Vehicle (<i>Bricklayers</i>)	98.0	116.7	75%
Operating Manlift (<i>Operating Engineers</i>)	98.1	117.6	NA
Welding, Burning (<i>Ironworkers</i>)	98.4	119.7	6%
Operating Scraper (<i>Oper. Engineers</i>)	99.1	108.6	100%
Demolition (<i>Laborers</i>)	99.3	112.1	NA
Laying Metal Deck (<i>Ironworkers</i>)	99.6	119.9	75%
Grinding (<i>Masonry Trades</i>)	99.7	118.6	49%
Operating Bulldozer (<i>Oper. Engineers</i>)	100.2	112.5	100%
Chipping Concrete (<i>Laborers</i>)	102.9	120.3	NA

our study reported using (see Table 3). Although noise levels exceeded 85 dBA for every one of the ten loudest tools, workers didn't always report using hearing protection. In fact, workers almost *never* used hearing protection while using rattle guns or welding and cutting equipment. None of the tasks or tools had an *average* noise level above 115 dBA, which would require use of hearing protectors, no matter how short the exposure. In Table 2, "NA" indicates hearing protector use was not evaluated.

Full-shift noise exposures

The average full-shift noise exposure level for all workers in all trades was 81.4 dBA. The percentage of full-shift measurements by trade that exceeded the WISHA 8-hour allowable limit of 85 dBA is shown in


Table 3. Ten loudest tools, in order of increasing average noise level

Tools	Average noise level (dBA)	Maximum noise level (dBA)	% time hearing protection worn when needed
Welding, Cutting Equipment	94.9	122.8	4%
Other Hand Power Tool	95.4	118.3	11%
Hand Power Saw	97.2	114.0	25%
Screw Gun, Drill Motor	97.7	123.7	29%
Rotohammer	97.8	113.5	61%
Chopsaw	98.4	117.7	32%
Rattle Gun	98.4	131.1	0%
Stationary Power Tool	101.8	119.8	67%
Powder Actuated Tool	103.0	112.8	81%
Chipping Gun	103.0	119.2	33%

Table 4. The trades with the most exposures above the WISHA limit were operating engineer and cement mason (46% of full-shift measurements were over 85 dBA), while sheet metal workers had the fewest exposures above the WISHA limit (11% over 85 dBA).

The trade with the highest average work shift exposure was operating engineer (84.6 dBA), and insulation workers had the lowest average exposure (75.3 dBA). About one-third of full-shift measurements for all trades were above the WISHA limit for workers not using hearing

Table 4. Percent of work shifts above WISHA 8-hour standard (in order of increasing percentages), percent of time hearing protection was used above 85 dBA, and average full shift noise level (by trade)



Trade	% of 8-hour work shifts > 85 dBA	% of time > 85 dBA hearing protection used	Average full-shift noise level (dBA)
Sheet Metal Worker	11%	66%	79.0
Insulation Worker	18%	14%	75.3
Tilesetter	20%	12%	76.0
Electrician	20%	18%	79.9
Bricklayer	26%	49%	82.6
Masonry Restoration	37%	56%	82.7
Carpenter	40%	43%	82.2
Ironworker	40%	13%	82.9
Laborer	44%	NA	83.6
Cement Mason	46%	8%	79.3
Operating Engineer	46%	70%	84.6
▶ All Trades	34%	39%	81.4

protectors. Even “quiet” trades such as electricians and insulation workers sometimes had full-shift measurements that were above the WISHA limit. Overall, workers in all trades reported using hearing protection a little less than 40% of the time they were exposed above 85 dBA, and a little more than 30% of the time they were exposed at the much higher level of 115 dBA. For laborers, “NA” means hearing protection use was not evaluated.



How construction workers can prevent hearing loss

Construction workers in *all* of the trades we examined have the potential for high exposure to noise. Although construction workers make up only 7% of the Washington State workforce, they file more than 21% of all accepted workers' compensation hearing-loss claims. The preferred way to prevent hearing damage is to reduce noise at its source. However, earplugs and earmuffs will always be necessary for some construction activities.

One-third of all full-shift average measurements on construction workers were above the WISHA standard for an 8-hour noise exposure. Unfortunately, workers used hearing protection less than one-half of the time they were exposed above 85 dBA, and only about one-third of the time they were exposed above 115 dBA. Construction workers often get more noise exposure from activities going on around them than they did from their own work, and need to consider nearby activities as well as their own when choosing hearing protection.

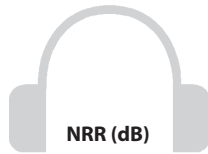
Recommendations

Educational programs can help make construction workers aware that many activities on the job site—including breaks, lunch, and cleanup—have potentially hazardous noise levels. All construction workers in the 11 trades measured should be enrolled in a hearing conservation program, and efforts should be made to reduce the noise levels of construction activities and to increase the use of hearing protection.

All hearing protectors are labeled with a Noise Reduction Rating (NRR), which is a laboratory estimate of how much noise the hearing protector will block. For each of the 11 trades that we measured, we calculated the amount of noise a hearing protector must block to protect 95% of workers in each trade from exposure above the 8-hour allowable limit. Our suggested NRR levels for each trade are shown in Table 5 (on page 11), and take into account the fact that the NRR is twice as high as

the protection that most workers actually get. For most activities, NRR levels higher than these (33 dB is the highest available) will provide too much protection, interfering with normal communication and work. On the other hand, workers exposed to *very* high levels of noise should use a hearing protector with a higher NRR than listed in Table 5. Workers exposed to intermittent noises should consider using earmuffs or banded earplugs, which can be removed and inserted quickly. A single type of hearing protector *will not* work for all workers and all exposure levels, so it is important to have several types and styles of hearing protectors available.

Table 5. Hearing protection NRR which should prevent almost all workers from being exposed above the 8-hour allowable limit (by increasing NRR)



Trade	NRR (dB)
Sheet Metal Worker	12
Insulation Worker	12
Electrician	12
Tiler	12
Carpenter	14
Cement Mason	14
Ironworker	18
Bricklayer	22
Laborer	24
Operating Engineer	24
Masonry Restoration Worker	26

Summary

Many of the measured construction tasks exposed workers to noises above 85 dBA, loud enough to warrant use of hearing protection. Almost all of the ten noisiest tasks involved occasional exposures above 115 dBA, a level at which hearing protection is *always* required. We found that actual use of hearing protection ranged from never to 100% of the time, depending on task.

Likewise, all of the ten noisiest construction tools we measured exposed workers to noise levels above 85 dBA, and almost all of them sometimes exceeded 115 dBA. The workers we studied almost always used hearing protection with powder actuated tools, but used it less much with other tools.

Workers exposed to loud noises without use of hearing protection risk losing their hearing. Properly worn hearing protection can prevent this loss. Training on the proper use of hearing protection is an important part of a hearing conservation program, and should take into account the need for construction workers to hear warning shouts and signals. In addition to providing hearing protectors and training, construction companies should look into reducing noise exposure levels by purchasing quieter equipment or shielding workers from the noisiest equipment.

For additional information

About the UW study and its results

University of Washington *Occupational Noise* Web site:

<http://depts.washington.edu/occnoise>

or contact the Field Research and Consultation Group

at 206-543-9711 or cnstsafe@u.washington.edu

For more information about noise and its effects on hearing

NIOSH web page: <http://www.cdc.gov/niosh/topics/noise/>

or WISHA hearing conservation web site:

<http://www.lni.wa.gov/Safety/Topics/AtoZ/NoiseHearing/default.asp>

For assistance in developing a hearing conservation program

Contact the WISHA consulting service for the nearest consultant

<http://www.lni.wa.gov/Safety/KeepSafe/Assistance/Consultation/default.asp>

or call 800-547-8367

Or contact Build It Smart, a local labor/management organization

for the construction industry, at www.builditsmart.org

or 360-596-9200

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