



# Occupational Noise

The Environmental Protection Agency (EPA) estimates that approximately two million transportation workers are exposed to high and possibly damaging levels of noise on the job.

Pitch, or frequency, is measured in hertz (Hz). The normal human ear can detect frequencies in the range of 16 Hz to 20,000 Hz. The normal speech range is 250-3000 Hz.

## What is Occupational Noise?

Noise is defined as unwanted sound. Transit workers who operate, service, or maintain vehicles, equipment, or facilities may be routinely exposed to high levels of noise. Working in maintenance shops or repairing buses involves using loud machinery such as motors, grinders, saws, presses, and pneumatic equipment. Hand held tools can also generate high noise levels.

Sound is measured using two types of instruments: sound level meters (SLMs) and personal dosimeters. A sound level meter measures the intensity of a sound at a given moment. To adequately evaluate a noise hazard, take readings in different locations within the work area at different times of the day. This is called area monitoring.

## How is Occupational Noise Measured?

Loudness is measured using a unit called the decibel (dB). The decibel system is logarithmic, rather than arithmetic. Sound intensity (loudness, or “sound pressure level”) doubles every 3 dB, increases tenfold per 10 dB, and increases 100-fold per 20 dB. This means, for example, that 88 dB is twice as loud as 85 dB, that 95 dB is ten times as loud as 85 dB, and that 105 dB is one hundred times as loud as 85 dB.

A personal dosimeter is worn by the worker for a specified time period. It records and averages the total sound exposure over the course of the work day as a time-weighted average (TWA). TWAs are used for OSHA compliance monitoring. There are also impulse or impact noise meters that can measure short blasts of noise such as that from a pile driver or punch press.

Decibels can be measured on three scales – A, B, and C. The A scale most closely mimics the response of the human ear. The A scale is recommended when taking workplace measurements.

## What are the Effects of Occupational Noise?

Evaluating the hazards of occupational noise requires determining:

- how loud the noise is
- how long a person is exposed to the noise
- the type of noise (i.e., continuous vs. impulse or intermittent)
- the pitch or frequency of the noise

### Examples of Sound Pressure Levels (in decibels)

Jet engine (distance of 75 feet)	140
Riveting on steel tank	130
Ear pain is easily felt	125
Chainsaw	110
Press machine	95
Subway	90
City traffic	85
Normal conversation	60
Living room	40
Whisper	20
Threshold of hearing	0

NTI's Hazard Factsheets provide transit workers and management with information to help recognize and resolve health and safety hazards. NTI offers a variety of other workplace health and safety training and educational resources. For more information, visit our website at [www.NTI.ONLINE.COM](http://www.NTI.ONLINE.COM) or call 732/932-1700.

**National Transit Institute**  
 Rutgers,  
 The State University  
 of New Jersey  
 120 Albany Street, Suite 705  
 New Brunswick, NJ 08901-2163





Exposure to excessive noise levels at work can result in two types of noise-induced hearing loss (NIHL):

- **Temporary (conductive) hearing loss** occurs when sound vibrations are blocked from reaching the inner ear. This may be due to wax buildup, an infection of the middle ear, or explosive sounds that damage the eardrum or middle ear. This type of hearing loss is reversible. The ear may recover on its own or it may be surgically corrected.
- **Permanent (sensineural) hearing loss** occurs when cells and nerves in the inner ear are damaged. Individuals don't realize they are experiencing hearing loss because it happens gradually. It cannot be corrected or reversed.

Exposure to excessive noise levels at work can also result in:

- **Increased stress levels** that may raise blood pressure and contribute to heart disease. High noise levels can also cause insomnia, fatigue, irritability, and decreased job performance.
- **Increased risk of accidents** because high noise levels make it more difficult to hear other workers, to hear warnings or approaching vehicles, or to be heard by other workers.

## What Can Be Done to Reduce Noise Hazards?

Noise hazards can be controlled by reducing noise at its source, along the path that it travels, or at the worker who is on the receiving end of the noise. Noise control can be accomplished through engineering controls, administrative controls, personal protective equipment (PPE), or a combination of these methods. Employers are required to implement engineering and administrative controls before issuing personal protective equipment.

### Engineering Controls

Engineering controls reduce noise at its source. Examples include:

- enclosing noisy machinery, fans, or motors, or moving them away from workers
- controlling vibration by damping or by tightening, lubricating, or isolating vibrating parts
- replacing loud machines with quiet machines
- installing sound barriers or sound-absorbing materials

### Administrative Controls

Administrative controls manage the path or duration of noise. Examples include moving workers away from sources of noise or rearranging work schedules and work tasks to decrease exposure time

### Personal Protective Equipment

Hearing protective devices (HPDs) may be used as a last resort, if engineering or administrative controls are ineffective or not feasible. Examples include earmuffs and earplugs. HPDs are required to be labeled with a noise reduction ratio (NRR). The NRR is the

Noise control can be accomplished through engineering controls, administrative controls, personal protective equipment, or a combination of these three methods. Engineering and administrative controls should be implemented before issuing personal protective equipment.

manufacturer's claim of how much noise reduction, in dB, a hearing protective device provides.

The National Institute for Occupational Safety and Health (NIOSH) has found that as actually used HPDs provide much less protection than their labels claim. OSHA has devised a formula for determining a more realistic measurement of effectiveness. The OSHA formula calls for subtracting seven from the NRR and dividing the result by two. OSHA says the result is a more accurate evaluation of the level of noise reduction, in dB, provided by a particular HPD.

For example, a brand of expandable earplugs has a NRR of 35. This implies that wearing the plugs in a 100 dBA environment will reduce exposure down to 65 dBA ( $100 - 35 = 65$ ). Using the OSHA formula, a different, more modest level of protection is indicated:  $(NRR - 7)/2 = (35 - 7)/2 = 28/2 = 14$  dBA of protection. In a work environment with 100 dBA of noise, this HPD will reduce exposure by only approximately 14 dBA, for an equivalent exposure of 86 dBA, ( $100 - 14 = 86$ ).

### **What Are the Legal Requirements and Professional Guidelines for Limiting Noise Hazards?**

The Federal OSHA Occupational Noise Standard (29 CFR 1910.95) applies to transit workers employed by private companies. Standards set by state OSHA plans apply to many transit workers employed by government-owned transit systems or by public authorities.

Federal and state occupational noise standards require:

### **Adherence to Permissible Exposure Limits (PELs) on Noise Exposure**

OSHA's PEL for noise exposure is 90 dB averaged over an 8-hour work shift. For every 5 dB increase above 90, the number of permissible hours of exposure is cut in half.

NIOSH recommends less exposure than the PELs allow. The American Conference of Governmental Industrial Hygienists (ACGIH), a private professional organization, has TLVs for noise similar to the NIOSH recommendations below. TLVs are recommended limits for maximum exposures to hazards over an 8-hour work shift.

Time Hrs.	OSHA PELs in dBs (legal limits)	NIOSH PELs in dBs (recommended limits)
8	90	85
4	95	88
2	100	91
1	105	94

### **Reliance on Engineering and Administrative Controls to Reduce Noise**

Use of hearing protective devices (earplugs, earmuffs) is permitted only if engineering and administrative controls fail to reduce sound levels within the prescribed levels.

### **Monitoring of Noise Levels**

Noise levels need to be monitored when noise levels are known or suspected to be at or above 85 dB or hearing protective devices are not sufficient to lower exposure to 90 dB. Workers have the right to observe monitoring procedures and to be notified of monitoring results.

### Audiometric Testing and Evaluations

Hearing tests are required to be conducted by a licensed or certified practitioner within six months of an employee being exposed at or above 85 dB and annually thereafter. Individuals tested must be notified in writing of any abnormal results and referred for further audiological evaluation as necessary.

### Hearing Protective Devices (HPDs)

If engineering and administrative controls cannot reduce noise exposure below 85 dB the employer may be required to supply hearing protective devices. Employers must provide employees exposed to noise levels between 85 dB and 90 dB with earplugs or earmuffs if an employee requests such protection or if an employee suffers loss of hearing in either ear of 10 dB or more at predetermined frequencies. Hearing protective devices are required for all employees exposed to 90 dB or more averaged over eight hours.

### Records

Records of noise exposure must be retained for two years. Audiometric test records must be retained for the duration of the worker's employment. Records must be made available to the employee upon request.

### Annual Training

Employees exposed at or above 85 dB averaged over eight hours must be trained on noise hazards. Training must cover the hazards of exposure to excessive noise levels, reasons for, and proper selection, fitting, and maintenance of hearing protective devices, and an explanation of audiometric testing.

---

This factsheet was made possible through a grant from the Federal Transit Administration. It was developed in cooperation with the New York Committee for Occupational Safety and Health (NYCOSH). The information presented is based on a review of regulatory standards and current thinking in the field of workplace health and safety. The contents do not necessarily reflect the official views or policies of the U.S. Department of Transportation or Rutgers University. It is intended for informational purposes only. Published December 2000.

If engineering and administrative controls cannot reduce noise exposure below 85 dB the employer may be required to supply hearing protective devices.



Rutgers,  
The State University  
of New Jersey  
120 Albany Street, Suite 705  
New Brunswick, NJ 08901-2163

phone: 732/932-1700  
fax: 732/932-1707  
www.NTI.ONLINE.com

