

Introduction to Noise

The following is an article on noise. It's a decent, plain English document written fairly objectively by a credible, independent source.

Our plastic blowers emit 92 dBA measured right at the source, at 3600 rpm, compared to about 98 dBA for our stainless steel blowers. That's pretty common for all the manufacturers, inherent in the technology. Axial fans and other technologies can be quieter, but the cost goes up and other problems pop up that, in the end, make building/site design and attenuation usually less expensive. It's better not to divulge the 92 dBA number unless directly asked. That's not to cover anything up, but knowledge of the number is counter-productive in the wrong hands. It is measured right at the source, and simply stepping away from the source, for one thing, lowers the sound pressure level on the ear. Prolonged exposure to 90 dBA is known to cause hearing loss, so the 90 number immediately raises flags with some people, and it should, but who then may use their little bit of knowledge to "get on their high horse" and react emotionally, getting in the way of a suitable solution that takes care of everybody. (They then go home and cut the lawn, use the leaf blower, cut firewood, or crank up iTunes on their iPhone or stereo, exposing themselves to the same or worse situation).

Site design, building design, distance from the source, and landscaping can all be used to decrease ("attenuate") or block/direct sound. Blower layout, the direction the tunnel faces, and of course the number of blowers are also factors. Many local government ordinances dictate a maximum sound pressure level at the property line, typically 80-85 dBA for commercial properties on busy streets during the day (that's the typical level of traffic noise on a busy street) down to 50-60 dBA in quieter non-industrial, residential areas, especially at night. Some even dictate sound pressure levels by frequency.

Slowing the blower rpm with VFDs lowers the sound level much faster than the blower air flow. Using 15 HP blowers and backing down on the rpm to meet noise levels can be effective at delivering a 10 HP+ blower with lower reducing overall noise as well as reducing noise at offensive frequencies. VFDs may give you a tool to control noise by time of day as well.

If the local ordinance says the noise level must be in the 80-85 dBA range or lower, you can flatly say the blower noise will be in compliance. If the acceptable noise levels are below that, we, the architect and engineer and the municipality will have to put our heads together to come up with a quantified definition of the situation and a suitable solution to meet the code.

Noise and Hearing Loss

Noise is difficult to define!

People who study acoustics define noise as complex sound waves that are aperiodic, in other words, sound waves with irregular vibrations and no definite pitch.

In engineering, noise is defined as a signal that interferes with the detection of or quality of another signal.

The combined disciplines of psychology and acoustics (psychoacoustics) study the response of humans to sound. They define noise as unwanted sound.

Is music noise? Is the hum of tires on a highway noise? Is the surround-sound movie theater noise? Is the philharmonic concert noise? And what about the accompanying beat for aerobic exercises at the health club? Sounds that are soothing for some are irritating to others.

An expert on noise, K.D. Kryter (1996) in his text, *Handbook of Hearing and the Effects of Noise*, (New York Academic Press) defined noise as "acoustic signals which can negatively affect the physiological or psychological well-being of an individual."

Basically, noise is unwanted sound. It is a pollutant and a hazard to human health and hearing. In fact, it has been described as the most pervasive pollutant in America.

Noise in our environment affects physical health. Noise also has psychological and social implications and affects our well being and quality of life.

Unfortunately, public awareness of the hazardous effects of noise is low - especially noise considered to be non-occupational. To this end, the fourth Wednesday in April has been declared International Noise Awareness Day (INAD). As part of International Noise Awareness Day, a "Quiet Diet" is encouraged and is launched by observing 60 seconds of no noise from 2:15 to 2:16 PM. The reduction, if not stopping of everyday noises around us raises our awareness of the impact noise has on health and hearing.

According to the National Institute on Deafness and Other Communication Disorders (NIDCD) more than 30 million Americans are exposed to hazardous sound levels on a



regular basis. Of the 28 million Americans who have some degree of hearing loss, over one-third have been affected, at least in part, by noise. Visit the "[Wise Ears](#)" [Web site](#) for more information on noise-induced hearing loss.

Damage to the Inner Ear

Your ear receives sound waves and sends them through a delicately balanced system to the brain. Part of this remarkable system, the cochlea, is a chamber in the inner ear filled with fluid and lined with thousands of tiny hair cells. The hair cells signal the auditory nerve to send electrical impulses to the brain. The brain interprets these impulses as sound. When you are exposed to loud or prolonged noise, the hair cells are damaged and the transmission of sound is permanently altered.

Noise Levels

Both the amount of noise and the length of time you are exposed to the noise determine its ability to damage your hearing. Noise levels are measured in decibels (dB). The higher the decibel level, the louder the noise. Sounds louder than 80 decibels are considered potentially hazardous. The noise chart below gives an idea of average decibel levels for everyday sounds around you.

Painful

150 dB = rock music peak

140 dB = firearms, air raid siren, jet engine

130 dB = jackhammer

120 dB = jet plane take-off, amplified rock music at 4-6 ft., car stereo, band practice

Extremely Loud

110 dB = rock music, model airplane

106 dB = timpani and bass drum rolls

100 dB = snowmobile, chain saw, pneumatic drill

90 dB = lawnmower, shop tools, truck traffic, subway

Very Loud

80 dB = alarm clock, busy street

70 dB = busy traffic, vacuum cleaner

60 dB = conversation, dishwasher

Moderate

50 dB = moderate rainfall

40 dB = quiet room

Faint

30 dB = whisper, quiet library

Warning Signs of Hazardous Noise

- You must raise your voice to be heard
- You can't hear someone two feet away from you
- Speech around you sounds muffled or dull after leaving a noise area
- You have pain or ringing on your ears (tinnitus) after exposure to noise.

Hazardous Noise

Sounds louder than 80 decibels are considered potentially dangerous. Both the amount of noise and the length of time of exposure determine the amount of damage. Hair cells of the inner ear and the hearing nerve can be damaged by an intense brief impulse, like an explosion, or by continuous and/or repeated exposure to noise.

Examples of noise levels considered dangerous by experts are a lawnmower, a rock concert, firearms, firecrackers, headset listening systems, motorcycles, tractors, household appliances (garbage disposals, blenders, food processors/choppers, etc.) and noisy toys. All can deliver sound over 90 decibels and some up to 140 decibels.

Read more information on [noisy toys](#).

Can't my ears "adjust" and "get used" to regular noise?

If you think you have "gotten used to" the noise you are routinely exposed to, then most likely you have already suffered damage and have acquired a permanent hearing loss. Don't be fooled by thinking your ears are "tough" or that you have the ability to "tune it out"! Noise induced hearing loss is usually gradual and painless, but, unfortunately, permanent. Once destroyed, the hearing nerve and its sensory nerve cells do not regenerate!

An audiologist certified by the American Speech-Language-Hearing Association (ASHA) can conduct a hearing evaluation to determine if you do have a hearing loss. If you are routinely exposed to noise, you should have your hearing checked by an ASHA-certified audiologist on a regular basis, at least once a year. In almost all states, a license to practice audiology is also required.

Physical Changes

The most notable physical effect of noise exposure is loss of hearing. Noise Induced Hearing Loss (NIHL) affects children, adolescents, young adults, and older adults. The National Institute on Deafness and Other Communication Disorders (NIDCD), National Institutes of Health (NIH) the National Institute on Environmental Health Sciences (NIEHS) and the National Institute for Occupational Safety and Health (NIOSH) have noted that, because of noise in our society, hearing loss is appearing much earlier in life than would have been expected just 30 years ago.

Noise not only affects hearing. It affects other parts of the body and body systems. It is now known that noise:

- Increases blood pressure
- Has negative cardiovascular effects such as changing the way the heart beats
- Increases breathing rate
- Disturbs digestion
- Can cause an upset stomach or ulcer
- Can negatively impact a developing fetus, perhaps contributing to premature birth
- Makes it difficult to sleep, even after the noise stops
- Intensifies the effects of factors like drugs, alcohol, aging and carbon monoxide

Research is on-going and continues to provide data suggesting the devastating effects of noise on health. Research is also investigating factors that may contribute to one's susceptibility to noise induced hearing loss.

Other Changes

Noise can also hamper performance of daily tasks, increase fatigue, and cause irritability.

Noise can reduce efficiency in performing daily tasks by reducing attention to tasks. This is a concern of employers when it comes to assuring workers' safety. It is also a concern to a growing number of educators interested in human learning.

Because of noise, we often find ourselves fatigued and irritable. We don't even realize the effect until the noisy hubbub stops and we feel relief.

From another perspective, your own inability to hear and understand others clearly can cause you to feel angry and frustrated. Instead of accepting the problem is yours, you misdirect your feelings to others and blow up at them.

Noise also makes speech communication harder. More concentration and energy is needed not only to listen and hear over the noise but also to speak louder above the noise. As a result, voices can be strained and vocal cord abuses, such as laryngitis, develop. It is a physical strain to carry on even an enjoyable conversation in the presence of noise.

One demonstration of the effects of noise on behavior was done by recording how passers-by responded to a person-in-need in the presence of noise. While a noisy lawnmower was running, a woman with a broken arm dropped some books and tried to pick them up. No one stopped to help her. When the lawnmower was turned off and the scene repeated, several people stopped to help her retrieve the books.

Researchers have also looked at the effect of excessive noise in school classrooms and have drawn conclusions that are seemingly obvious, yet often minimized. In one study, test results of students from a school near railroad tracks were compared to results of students far away from the tracks. Students in the quiet school performed better on the test. Another study found that students whose classrooms face noisy streets do not do as well in school as students in classrooms facing away from noisy streets. Finally, another study demonstrated that noise distracts both teachers and students.

There is no question that noise is both a public health hazard and an environmental pollutant as well. Many of its effects are well known and many of its effects continue to unfold through research.

Protect Yourself from Noise

The key word in dealing with noise is prevention! We want to eliminate unwanted noise when we can. When noise cannot be eliminated, we want to keep it as low as possible. Here are some things to do:

Wear hearing protectors when exposed to any loud or potentially damaging noise at work, in the community (heavy traffic, rock concerts, hunting, etc.) or at home (mowing the lawn, snow blowing the driveway, etc.). Cotton in your ears won't work. Hearing protectors include ear muffs and ear plugs (not swimmer's plugs), some that are custom-made and individually molded. This protection can be purchased at drug stores, sporting goods stores or can be custom-made. Check with your audiologist to find out what best suits you.

Limit periods of exposure to noise. Don't sit next to the speakers at concerts, discos, or auditoriums. If you are at a rock concert, walk out for awhile give your ears a break ! If you are a musician, wear ear protection--it is a necessity! Take personal responsibility for your hearing.

Pump down the volume! When using stereo headsets or listening to amplified music in a confined place like a car, turn down the volume. Remember: if a friend can hear the music from your headset when standing three feet away, the volume is definitely too high. Don't be afraid to ask others to turn down the volume.

Educate yourself about the damaging effects of noise and what you can do to prevent your exposure to noise.

Educate others and take action! Educate your children through discussion and by example. Wear your ear protection and encourage your children to follow your example. Provide them with ear protection. Remind them to turn down stereo headsets. A rule of thumb is that, if sound from a head set can be heard by others 3 feet away, it is too loud.

Be a responsible consumer. Look for a noise rating when buying recreational equipment, children's toys, household appliances, and power tools. Choose quieter models, especially for equipment that you use often or close to your ears like a hair dryer. If there is no noise rating, contact the manufacturer and ask for one!

Inspect your child's toys for noise danger just as you do for small

parts that can cause choking. Remember, too, that children tend to hold toys close to their ear which can pose additional threat for hearing damage.

Have your hearing tested by an audiologist certified by the American Speech-Language-Hearing Association (ASHA), especially if you are concerned about possible hearing loss. Remember the warning signs of over exposure to noise.

Be aware of the noise in your environment and take control of it when you can. Be an advocate for reducing noise pollution. Your county may have a local noise ordinance. Find out what you can do in your community to advocate for quiet. For example, some schools have set a decibel limit for the music played at school dances in order to protect the students' hearing.

Be an advocate! Remember there are no regulations governing how loud sound can be in public places such as discos, movie theaters, dance clubs, exercise centers. Work with owners, managers, and community leaders to create a healthier less noxious listening environment.

Workplace Noise

Many people are exposed to hazardous noise levels at work, including firefighters; military personnel; disc jockeys; subway workers; construction workers; musicians; farm workers; industrial arts teachers; highway workers; computer operators; landscapers; factory workers; and cab, truck, and bus operators, to name a few. And, they number nine million according to the U.S. Environmental Protection Agency (EPA).

Continued exposure to more than 85 decibels (dBA) of noise may cause gradual but permanent damage to hearing. Hearing loss is accelerated by louder noises. Noise can also hamper job performance, increase fatigue, and cause irritability.

Federal Occupational Safety and Health Administration (OSHA) regulations require that, when engineering controls and/or administrative controls cannot reduce noise levels in industry to an eight-hour time-weighted average (TWA) level of less than 85 dBA, a hearing protection (or conservation) program must be established. A successful hearing loss prevention program benefits both the employee and the employer. Employees are spared disabling hearing loss and may experience less fatigue and better health in general. Employers benefit from reduced medical expenses and worker compensation costs. Overall, there is

improved morale and work efficiency in the workplace.

OSHA requires a five phase hearing conservation program for industry:

1. Noise Monitoring

Sound levels must be measured. Results are used to decide: (a) which employees need to be in the hearing conservation program, (b) whether hearing protection devices must be used or be available on an optional basis, (c) which hearing protection devices are appropriate for different noise levels of the facility.

2. Audiometric (Hearing) Testing

All employees in a hearing conservation program must have baseline and annual hearing tests.

Baseline audiometric testing helps the employer to determine the presence or absence of a pre-existing hearing loss and may assist the employer in determining job placement for the employee.

Annual audiometric testing assesses the effectiveness of the hearing conservation program. Each annual audiometric test is compared with the employee's baseline test to determine if there has been any deterioration in the employee's hearing. There are no better alternatives than quality audiometric testing to determine if workers are protected from the damaging effects of noise.

3. Employee Training

Employees involved in a hearing conservation program must receive annual education and training on (a) the effects of noise on hearing, (b) hearing protection devices (their availability to employees, their advantages and disadvantages, techniques for proper selection, fit, use, and care) and, (c) the purpose and procedures of audiometric testing. By being involved in education, employees learn how to protect their hearing when exposed to loud noise, both on and off the job.

4. Hearing Protectors

Hearing protection devices should be made available to all employees. Mandatory versus optional use is determined by noise exposure monitoring. Hearing protection devices must be worn by employees whose eight hour TWA is 90 dBA or greater and by employees whose TWAs are between 85-90 dBA if they display standard threshold shifts in hearing levels. A standard threshold shift is defined by OSHA as "a

change in hearing threshold relative to the baseline audiogram of 10dB or more for the frequencies 2000, 3000, and 4000 Hz in either ear." Hearing protection devices must meet sound reduction levels required by OSHA.

5. **Recordkeeping**

Sound measurement results, equipment calibration results, and audiometric test records of employees must be maintained for specific periods of time.

The skills of a knowledgeable professional are essential to assure an effective and successful hearing conservation and protection program. For the audiometric testing phase, OSHA specifically requires supervision by an audiologist, otolaryngologist, or physician. As a professional with specialized training and expertise in all areas of hearing, the audiologist is able to assist and guide industry for better hearing health of employees.

Home, Community, and Recreational Noise

Exposure to damaging noise does not come only from the workplace. If you use stereo headsets, operate power tools for yard work, have a long daily commute in heavy traffic, or use a number of household appliances, you still may be exposed to potentially damaging noise.

Recreational activities such as hunting, target shooting, motorboating, waterskiing, jetskiing, snowmobiling, motorcycle riding, woodworking, rock music, or stereo headsets are sources of hazardous noise. So are some movie theaters, home entertainment centers, car stereo systems, health clubs, dance clubs, bars, and amusement centers.

Just in our day-to-day living activities we can also be exposed to damaging noise when we use lawnmowers, hairdryers, blenders, power saws, weed-wackers, leaf blowers, food choppers/processors, and other convenience appliances.

Children's toys can also be hazardous, e.g., toys with horns and sirens, toy vacuum cleaners and vehicles, musical instruments, talking dolls, squeeze toys, and battery-operated toys that emit sounds.

Dealing with noise and its effects is a personal responsibility, a work-place responsibility, and a community responsibility. The first and obvious rule is avoid loud noise whenever possible. A good rule of thumb is to remember that if you must shout to be heard, then you should be avoiding the situation or using ear protection.

Visit our news room for more information about the dangers of environmental noise and hearing health.

Links

- League for the Hard of Hearing
- National institute on Deafness and Other Communication Disorders
- Hearing Education and Awareness for Rockers
- Noise Pollution Clearinghouse
- National Institute for Occupational Safety and Health
- <http://www.safe-at-work.com>

©1997-2009 American Speech-Language-Hearing Association -