DAY DESIGN PTY LTD

Consulting Acoustical Engineers

INDUSTRIAL NOISE CONTROL

NOISE IS CONTROLLABLE

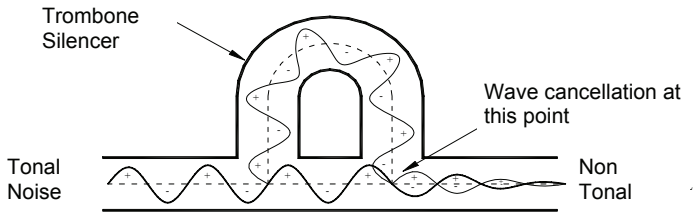
Industrial noise has been accepted in the past as one of the unfortunate costs of progress. However, the good news is that ***"noise is not inevitable, it is controllable".***

Day Design acoustical engineers, have 30 years experience in measuring noise, analysing noise and providing advice on cost- effective industrial noise control .

The adverse effects of noise have been known and largely understood for many years, but it was not until the 1970's that governments and the community in Australia became sufficiently concerned about the effects of noise to take steps to control it.

Now, all Australian States have legislation proscribing noise exposure in the work place at $L_{eq\ (8\ hour)}$ levels in excess of 85 dBA. Even so, many people continue to be subject to levels of noise that may cause hearing disability.

An acoustical engineer at Day Design, measuring steam pressure reducing valve noise at a Sydney chemical plant.



ENVIRONMENTAL NOISE CONTROL

Neighbours are often affected by the noise from a factory or industrial complex. The Environment Protection Authority or Local Council have the power to require factory noise emission to be reduced.

We normally place a logger near the site to measure the background noise over a number of days. The acceptable noise level in NSW is usually the background noise level + 5 dBA.

We will then model the factory and the surrounding environment on computer and calculate the level of noise at nearby residential premises, taking due account of sound barrier walls, natural topography, distance, ground absorption, prevailing winds, temperature inversions, etc. Noise controls are then designed to meet council or EPA limits.

The sawdust hopper pictured below emitted a strong tonal noise that was most annoying to nearby residents. Our noise survey revealed that the tone had a frequency of 507 Hz. A trombone type side-branch silencer, designed by Day Design, was fitted into the ductwork. As the length of the trombone was adjusted the noise disappeared.

A side-branch silencer works by destructive interference of the tonal sound-wave formation in the duct. Sound passing through the side-branch comes back into the main duct 180° out of phase, the positive and negative waves cancelling each other out, as illustrated below.

Occupational Noise

The first step in resolving an occupational noise problem is to conduct a noise survey and sound analysis to establish its magnitude and character.

An occupational noise survey firstly establishes what the major sources of noise are, then quantifies both the level of noise and the time that employees are exposed to it. This information is then converted to a *"Daily Noise Exposure Level"* which can then be related to the effect on hearing loss. The measurements will then be used to determine the type of noise control required.

The use of hearing protection by workers reduces the amount of noise reaching the ear. Hearing loss caused by the work environment can be virtually eliminated. Whilst hearing protectors are a common solution to the problem of occupational noise, they may be uncomfortable to wear. Enforcing their use can be a significant management problem.

Reduction of the noise to acceptable levels by engineering methods is by far the best solution. This requires analysis of the noise and design of an effective and practical noise reduction system. Noise may be reduced by changing or improving the operation of equipment.

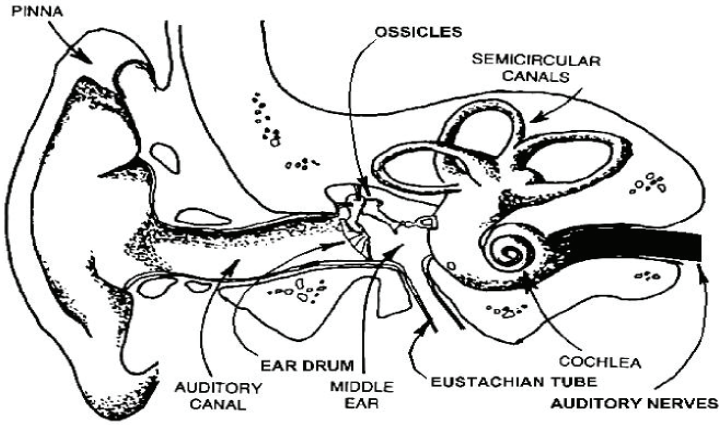
Hearing Loss

"Ringing in the ears" after a day at work is nature's warning that the hearing mechanism has been overloaded. Repeated overloading will cause permanent hearing loss.

Occupational noise exposure firstly results in a loss of sensitivity to sound at the mid to high frequencies of 1,000 to 10,000 Hz. The hearing impaired person can still hear the lower frequency vowel sounds, but cannot understand the conversation.

The NSW "Occupational Health & Safety (Noise) Regulation 1996" places the responsibility for hearing loss compensation with the claimants last noisy employer.

Day Design specialise in occupational noise exposure surveys to determine the likelihood of hearing loss being caused at different places of employment. Engineers who conduct such noise surveys are qualified to present expert evidence in the NSW Compensation Courts.



The ear is a most sensitive listening and direction-sensing device. It is comprised of three main parts, as illustrated above. These are the external ear (Pinna), middle ear (Ossicles) and the inner ear (Cochlea). Sound waves collected by the Pinna travel down the ear canal to the eardrum; which vibrates in response.

The vibrations are amplified and transmitted across the middle ear by the Ossicles (three small bones, called the hammer, anvil and stirrup). The base of the stirrup touches the oval window of the Cochlea (the inner ear). The vibrations are then passed into the fluid contained within the spiral cavity of the Cochlea.

The Cochlea is divided along almost the entire length by a skin (the Basilar Membrane) in which some 30,000 hair cells are imbedded like strings in a piano. Nerve endings in the hair cells are cabled together to form the auditory nerve that leads to the brain. The ear sends messages to the brain in digital code (like a computer) where it is interpreted as words, music, sound and/or noise. Surprisingly, the brain also sends sound impulses to the ear, allowing us to cancel out sounds that we are not interested in and listen to those sounds that are of greater interest to us.

The ear is an incredible instrument with a frequency range of 20 to 20,000 Hz and a dynamic range of 0 to 140 dBA. Because the inner ear is extremely sensitive, it has a "blink" mechanism that automatically protects it from short-duration loud noise events. However, permanent hearing loss can result when repeated loud noises override the safety mechanism and damage the hair cells in the Cochlea.

Day Design Pty Ltd
Suite 17, 808 Forest Road
Peakhurst Sydney 2210

Phone: (02) 9584 2639
Fax: (02) 9584 2619
acoustics@daydesign.com.au
www.daydesign.com.au

"Good Acoustics By Design"

Association of Australian Acoustical Consultants