40—Noise and Hearing Conservation

Hearing loss is an affliction which has existed throughout the history of mankind It occurs in all walks of life and is due to many causes Until the development of the audiometer in recent years, there was no means of measuring the degree of hearing loss with appreciable accuracy Now partial losses are easily measurable by use of commercially available instruments

The growing interest of industrial management in hearing loss due to noise has been stimulated by (*a*) the trend toward coverage of partial loss of hearing under state workmen's compensation laws, and (*b*) the passage of noise regulations by the Occupational Safety and Health Administration in the U S Department of Labor These developments have had considerable impact upon the operations and profitability of many companies

That workers in noisy occupations develop a greater than average degree of hearing loss has been known for more than 100 years Prior to 1948, hearing loss was not regarded as a significant factor in workmen's compensation Some claims occurred, but these were primarily due to traumatic injuries from such causes as blasts, concussions, blows to the head, and foreign objects or infections in the ears Since 1948, a number of states have passed hearing loss legislation or revised existing laws to include noise-induced hearing loss as a basis for workmen's compensation benefits Now it is reported that there are at least 16 states with workmen's compensation laws providing compensation in varying degrees for partial hearing loss due to industrial noise exposure

What is noise? Technically defined, *noise is unwanted sound* It is a form of vibration which may be conducted through solids, liquids, or gases It is a form of energy in air, consisting of invisible vibrations that enter the ear and create a sensation Almost every conceivable kind of sound can, at one time, be welcome—at another time abhorred It follows that before attacking a noise problem it must be asked Who doesn't want it? When? And why? When these questions are answered, steps can be taken to solve the problem

In the operation of industrial machines, unbalanced forces are applied to parts of the machine and cause displacement or movement of these parts, or the whole machine These displacements or motions are vibrations which set up air-borne sound waves When people come into direct contact with noise, undesired effects may result

Properties of Noise

Some of the properties of noise are intensity (or pressure), frequency, and duration All of these are important factors in evaluating the effects of noise on man's hearing The louder the noise, the higher its intensity, high-frequency (high-pitch) noises are more damaging to hearing than low-frequency noises, and the longer the noise exposure, the greater the damage to the human hearing mechanism By examining these properties of noise carefully, one immediately recognizes approaches to noise control or to hearing conservation (Fig 40–1)

Sound pressure or intensity follows the inverse-square law that is, as the distance from the source increases the sound level decreases as the square of the distance High-frequency sound waves are more readily absorbed by fibrous, spongy, and soft materials of construction Finally, by limiting exposure time, workers' hearing conservation can be accomplished

The decibel

The ear is a remarkable organ, responding to sound pressures from 0 0002 to 2000 dynes per square centimeter (Table 40-A) To avoid working with unwieldy large numbers in evaluating sound intensity, however, a logarithmic scale is used with the decibel as the unit of measure Because decibels are logarithmic units, they cannot be added or subtracted arithmetically In fact, if the intensity of a sound is doubled, there will be a corresponding increase of only three decibels, not double the number For example, if one machine caused an exposure of 90 dB, a second identical machine placed adjacent to the first would result in a noise exposure of 93 dB, not 180 dB On the decibel scale, zero (decibels) is the threshold of hearing, and 120 decibels is the threshold of pain

Frequency

Frequency is the number of variations in