

INDUSTRIAL NOISE

sure time are continuous. Continuous exposure should not produce the same effect as when the exposure is interrupted by rest periods. For example, the effects to the ear of four hours of continuous exposure to 110 db are considerably different than those from eight hours of exposure to the same level with varied rest periods between the exposure periods, even though the total energy may be the same in both cases. The ear that has had a chance to rest between exposures is probably more resistant to permanent loss than the ear that has been exposed continuously without intermittent rest periods.

Effects of noise-exposure

At first glance the problem of evaluating the effects of noise-exposure may appear to be deceptively simple. Measurements of noise are fairly standard physical measurements, lengths of exposure periods can be read from a clock, and the biologic effects of noise on man can be measured. But— which of the myriad noise-exposures should we measure? Which methods of measurement should be used? Which of the many effects of noise-exposure do we wish to evaluate? Which parameters of noise-exposure are responsible for which biologic effects? In what order of importance to the community and to the individual should these biologic effects be studied? Thus an evaluation of the effects of noise-exposure involves many arbitrary decisions and presupposes the existence of information, often in fact nonexistent, about many related issues.

Although ultimately safety men would like to be able to predict and control the effects of any noise-exposure on any individual or group of individuals, the chance of being able to do so is very small, not so much because of the difficulty of measuring noise-exposure, but because of the wide variation of human responses to noise. While the measurement of intermittent and irregular noise-exposure does pose some difficult problems, once techniques of measurement have been developed, they probably can be measured with reasonable accuracy.

There is not as much optimism about measuring the effects of noise-exposure. Individual responses to noise-exposure are highly variable, and measurement of these individual responses necessarily encompasses

a wide range of values. There are many causes of this variability including, among others, individual differences in susceptibility to noise-induced hearing loss, differences in total time spent in industrial work, frequent changes of type of occupation, non-occupational disease, and nonoccupationally-induced changes in hearing that accompany advancing age.

There are so many different possible individual responses to a given noise-exposure, that all that can be said with certainty is what responses will occur *on the average*. The concept of a statistical average implies the existence of persons whose responses are not average and whose behavior, therefore, may differ widely from that of the average group. This means that damage risk criteria correction factors for nonoccupational hearing loss that accompanies age (so-called "presbycusis corrections") or rating scales for establishing compensation payments that will "fit" everyone cannot be established whenever it is necessary to set standards for any effects of noise-exposure, these standards will be determined from the average response and not from the individual response.

In spite of the many difficulties that beset the study of the effects of noise-exposure on man some headway is being made. With the urgent need for a solution to many of the problems caused by noise, further advances should be forthcoming in the immediate future.

The known effects of noise-exposure are of two types: *nonauditory effects* which cause interference with communication by speech or which otherwise influence behaviour and *auditory effects* which consist of temporary hearing loss and permanent hearing loss. Consider first the nonauditory effects of noise-exposure.

Nonauditory effects

Speech interference Perhaps the best understood nonauditory effect is speech interference. Noises that are not intense enough to cause a hearing loss may interfere seriously with communication by speech. In checking a noise the average of the sound pressure levels in three octave bands, 300 to 600, 600 to 1,200 and 1,200 to 2,400 c, is a good indicator of the amount of interference that noise will have on