

Noise as a Health Hazard at Work, in the Community, and in the Home

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EXCESSIVE noise is an undesirable by-product of the tremendous increases in mechanization in industry, transportation, and the home in recent years. At the meeting of the Acoustical Society of America in New York City in May 1967, Dr. Vern Knudsen stated that noise levels in the United States are increasing at the rate of 1 decibel per year. In many instances noise causes annoyance; in more serious situations it causes loss of hearing. Dr. Aram Glorig stated, "The potential cost of noise-induced hearing loss to industry is greater than for any other occupational disease" (1).

Despite numerous proposals, definitive criteria for judging the adverse effect of noise have not been established. Measuring noise levels in many situations and evaluating their potential hazard to persons exposed to it is difficult because few medical, engineering, or other scientific personnel are qualified to evaluate noise problems.

The experts' repeated warnings about the seriousness of noise generally have been ignored. Preventing extraneous noise and sound distortion is a dominant consideration in engineering policy only in design of concert halls or other special-purpose listening areas. The apparent lack of concern extends even to public health workers. If corrective steps are not taken, the noise problem may reach the same magnitude as air and water pollution.

At Work

Noise associated with a person's work may cause a number of problems, including hearing loss, interference with perception of speech,

and inefficiency that cost industry an estimated several million dollars a year. Of these, noise-induced hearing loss is the major problem which provides the only clear evidence of physiological damage caused by noise.

Noise-induced hearing loss was observed centuries ago. Ramazzini in *De Morbis Artificum Diatriba* (1700) described how persons hammering copper "have their ears so injured by that perpetual din . . . that workers of this class became hard of hearing and, if they grow old at this work, completely deaf." Before the Industrial Revolution, comparatively few people were exposed to high-level noise.

In contrast to toxic chemical agents, which pose problems specific to certain industries, noise is one of the few environmental hazards common to nearly all industries. It has been estimated that more than 6 million workers in the United States are subjected to noise levels hazardous to hearing; the true figure is unknown (2). The Occupational Health Program, Public Health Service, is trying to collect data that will define the prevalence of hearing loss induced by noise in industry.

What do we mean by noise conditions that may be hazardous to hearing? These conditions

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are tentatively defined as noise levels that cause difficulty in conversing at close distances or produce temporary loss of hearing after a few minutes of exposure. Although several proposed standards are in close agreement, the consensus of experts on noise and hearing is that fairly continuous exposures to sound pressure levels below 85 decibels in the octave bands ranging from 300 to 9,600 cycles per second during a working lifetime pose no significant risk of hearing damage. (3).

One of the latest papers (4) published on this subject is the report of the Intersociety Committee on Guidelines for Noise Exposure Control, which was convened to consider guidelines for control of noise exposure to prevent hearing loss. This committee had representatives from the American Industrial Hygiene Association, American Conference of Governmental Industrial Hygienists, Industrial Medical Association, American Academy of Ophthalmology and Otolaryngology, and American Academy of Occupational Medicine. The group spent approximately 2 years deliberating and preparing their report. Several committee members advocated that scientists provide the data on which limits of exposure are based, but that the actual setting of limits be an administrative or management decision.

In specifying limits for noise exposure, as with any other contaminant, various questions arise. For example, how large is the segment of the population to be protected from noise exposure by the establishment of noise limits? What constitutes a significant hearing disability? Can impaired hearing be prevented by the proposed noise limit? Social, economic, and even moral considerations must be weighed in supplying answers to these questions.

The intersociety committee's report has provided data from which can be determined the percent of the population whose hearing for sound frequencies critical to speech perception would be protected, given various limits of noise exposure. It is necessary now for administrative groups to decide what level of protection is feasible for their work situation and to set appropriate limits to attain that level. Admittedly, liberal limit setting permits increased risk of disabling hearing loss and consequent compensation.

The American Conference of Governmental Industrial Hygienists has, for a number of years, set limits of exposure to chemical agents through its Threshold Limits Committee. This committee reviews data and establishes threshold limit values for various chemical agents. These limits have been widely accepted in the United States and in other countries.

In May 1967 the conference established a Physical Agents Committee to perform a similar function in relation to physical agents. Among the physical agents that the committee has been instructed to evaluate is noise. It is believed that the report expected from this committee in May 1968 will set forth limits for noise exposure. Perhaps these limits will be accepted as readily as the chemical threshold limit values. Workers should be protected against loss of hearing just as they are against other injuries and occupational diseases.

In the Community

Communities are steadily becoming noisier from transportation, construction work, increasing population density, industry, and widespread use of mechanical equipment by the homeowner. The bases for annoyance from noises appear to be interference with speech, hindrances to purposeful activities, and interruption of rest and sleep.

Consideration of the following factors is essential in evaluating noise problems in the community.

1. The level, spectra, and nature of the intruding noise.
2. Whether the impacted area is residential, urban, commercial, or industrial.
3. The time of day the noise occurs or recurs.
4. Standards of home construction.
5. Possible effects of noise on property values.
6. Whether the noise invokes fear.

These factors must be evaluated separately to determine acceptable and unacceptable noise levels in each community.

Currently, there are little data to indicate that intermediate noise levels which produce the major proportion of the complaints of annoyance also constitute health hazards. Despite the lack of data however, frequent references are made to health effects resulting from annoying

noise because the person cannot obtain proper sleep, cannot relax or concentrate, and, in general, is made miserable.

Legislative Control of Noise

Laws to control community noise have been of two general types: antinoise ordinances and zoning regulations.

Antinoise ordinances. Most cities have antinoise ordinances that are qualitative in nature, that is, they identify or describe sources of noise conditions that are unlawful, such as undue horn blowing, loud playing of radios, and discharge of motor exhaust except through a muffler. Although enumeration of illegal noises seems inferior to a quantitative scale as a standard for governing all kinds of sound, it does provide for flexibility in gauging the seriousness of a noise problem.

Memphis, Tenn., has a qualitative noise ordinance and through strict enforcement has earned the reputation for being the quietest city in America. Other cities with similar ordinances have not been as successful, presumably because enforcement has been lax.

A noise control ordinance passed in Coral Gables, Fla., in November 1966 specifies limiting noise criteria for machinery operating outdoors anywhere in the city. Separate limits are given for day and night uses in areas zoned for single family houses, apartments, and commercial establishments. Changes are made in these noise limits depending on character of the noise (hum or screech) and percentage of daytime operation.

Zoning regulations. A few cities have set a limit on the amount of noise that can be produced at the boundaries of manufacturing or commercial districts. These limits are specified by sound pressure levels in octave bands, and in some cases no provisions are made for allowances or adjustments for other factors that may influence annoyance. In other noise performance standards, allowances are made for duration, time of day, or characteristics of neighborhood.

When antinoise legislation in which specific limits are to be established is contemplated, it would be desirable to make sound level measurements in the community to determine whether the proposed limits are reasonable. Unreason-

able limits probably will not be enforceable. The Occupational Health Program has reviewed numerous proposals for legislation and will continue to do so when requested.

In the Home

Noise levels in the home are increasing because the homemaker is using many additional mechanical labor-saving devices. Despite much interior noise, annoyance is caused more often by noise originating outside.

Data from a survey of 1,400 persons in London (5) about the origin of the noise that disturbed people when they were at home indicated that 82 percent were disturbed by noise outside the building, 16 percent by noise from adjoining apartments, and 1 percent by noise inside their own apartment. Of the persons questioned, only 1 percent were not disturbed by noise in their homes. Although a similar study has not been made in the United States, it is expected that conditions here do not differ appreciably.

Annoying noises in the home could be eliminated by providing quieter household appliances, improving home construction to prevent intrusion of noise, and reducing noise levels in the community. The demand for quieter appliances has been met by manufacturers of refrigerators and, to a lesser extent, by manufacturers of individual air-conditioning units. There is still room for considerable improvement in reducing the noise from washing machines, clothes dryers, dishwashers, garbage disposals, and commodes.

Considerable work needs to be done in improving home construction. At present, New York City is in the process of adopting noise control requirements in its building codes. No other city in the United States has such code requirements (6). The New York code carries stipulations to reduce transmission of internal noise in multifamily dwellings. The building code does not pertain to intrusion of noise from outdoors. The same is true of the Federal Housing Authority's impact noise control requirements for apartments (6). In contrast, many European countries have had noise control requirements in their building codes for several years (7).

A statement (8) in the London Times, July 3,

1963, is appropriate: "Britain should be considerably quieter than it is, and unless something is done the situation will soon become intolerable." This statement applies equally to the United States. It is time for public health workers to recognize noise as a problem, become knowledgeable about its consequences, support legislation that will help alleviate the problem, and promote programs aimed at noise control and prevention.

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Laser Equipment in Cancer Research

The National Cancer Institute, Public Health Service, will conduct research with laser beams to study their effects on cancer. The laser instrument, designed by the U.S. Army Missile Command at Redstone Arsenal, Ala., in cooperation with Institute scientists, is being modified during installation in a cancer research area at the National Institutes of Health.

Earlier experimentation at Redstone Arsenal included exposure of both internal and external malignant growths in laboratory animals to pulses of infrared radiation from high-energy lasers. The experiments proved that the radiation could destroy some cancer cells under certain circumstances.

The National Cancer Institute proposes to use the laser instrument in a program of experimental work on laboratory animals. The results may indicate whether lasers could be used to treat malignant tumors in humans. While many of the results of laser irradiation upon tissue are poorly understood thus far, the experimental findings are sufficiently significant to justify further animal experimentation and refinements in laser equipment.