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OCCUPATIONAL AND COMMUNITY NOISE

The hubbub of the city – the phrase conveys the excitement, the hustle and bustle of urban life, the throng of crowds and traffic, traders, shoppers, rowdy diversion and entertainment. In ancient Rome the clatter of iron wheels of wagons on the stone pavements disturbed the sleep and so annoyed citizens that legislation was enacted to control movement. Some cities of mediaeval Europe prohibited horse and carriage traffic to protect the sleep of the inhabitants.

The noise problems of the past are incomparable with those plaguing modern society: the roar of aircraft, the thunder of heavily laden lorries and the thumps and whines of industry provide a noisy background to our lives. But such noise can be not only annoying but also damaging to the health, and is increasing with economic development.

Health impact

The recognition of the noise as a serious health hazard as opposed to a nuisance is a recent development and the health effects of the hazardous noise exposure are now considered to be an increasingly important public health problem .

- Globally, some 120 million people are estimated to have disabling hearing difficulties. (ref. Guidelines p.X)
- More than half citizens of Europe live in noisy surroundings; a third experience levels of noise at night that disturb sleep. (ref. Guidelines p.XII)
- In the USA in 1990 about 30 million people were daily exposed to a daily occupational noise level above 85 dB, compared with more than nine million people in 1981; these people mostly in the production and manufacturing industries. (ref Noise Sources p.85)
- In Germany and other developed countries as many as 4 to 5 million, that is 12-15% of all employed people, are exposed to noise levels of 85 dB or more. In Germany, an acquired noise-related hearing impairment that results in 20% or more reduction in earning ability is compensatable; in 1993, nearly 12 500 new such cases were registered. (ref Noise Sources p.85 and p. 86)
- Prolonged or excessive exposure to noise, whether in the community or at work, can cause permanent medical conditions, such as hypertension and ischaemic heart disease. (ref. Guidelines p.XII)
- Noise can adversely affect performance, for example in reading, attentiveness, problem solving and memory. Deficits in performance can lead to accidents. (ref. Guidelines p.XII)

- Noise above 80 dB may increase aggressive behaviour. (ref. Guidelines p.XIII)
- A link between community noise and mental health problems is suggested by the demand for tranquillizers and sleeping pills, the incidence of psychiatric symptoms and the number of admissions to mental hospitals. (ref. Guidelines p.XII)

Noise can cause hearing impairment, interfere with communication, disturb sleep, cause cardiovascular and psycho-physiological effects, reduce performance, and provoke annoyance responses and changes in social behaviour. The main social consequence of hearing impairment is the inability to understand speech in normal conditions, which is considered a severe social handicap.

Whereas in the developed world hearing impairment is mostly restricted to the work setting, in cities in the developing world the problems are worse, with increasing hearing impairment due to community noise.

Sound and the ear

At birth the inner ear is fully developed and has its full complement of hair cells, supporting cells and nerve fibres. Unlike most other tissues in the body, mammalian hair cells and nerve fibres do not regenerate when damaged. (ref. Pathophysiology of the Ear p. 40)

The response of the human ear to sound depends both on the sound frequency (measured in Hertz, Hz) and the sound pressure, measured in decibels (dB). A normal ear in a healthy young person can detect sounds with frequencies from 20 Hz to 20 000 Hz. (Ref. Guidelines p. IX). Speech frequency ranges from 100 to 6000 Hz. (ref Guidelines p.XI).

Community noise

Noise-induced hearing impairment is by no means restricted to occupational situations – noise levels associated with impairment are experienced at open-air concerts, discotheques, motor sports events etc. (ref. Guidelines p.XIV).

Such non-industrial noise is referred to as community noise, also known as environmental, residential or domestic noise. The main indoor sources are ventilation systems, office machines, home appliances and neighbours. Other typical sources of neighbourhood noise include the catering trade (restaurants, cafeterias etc.), live or recorded music, sports, playgrounds, car parks, barking dogs.

For most people, life-time's continuous exposure to an environmental average noise level of 70 dB will not cause hearing impairment. An adult person's ear can tolerate an occasional noise level of up to 140 dB, but for the children such an exposure should never exceed 120 dB. (ref. Guidelines p.XI).

Continued growth in transport systems – highways, airports and railways – generate more noise. Many countries have regulations on community noise from rail, road, construction and industrial plants based on emission standards, but few have any regulations on neighbourhood community noise, probably owing to difficulties with its definition, measurement and control. This and the insufficient knowledge of the effects of noise on people handicap attempts to prevent and control the problem.

Occupational noise

Occupational sources of noise

The many and varied sources of noise in industrial machinery and processes include: rotors, gears, turbulent fluid flow, impact processes, electrical machines, internal combustion engines, pneumatic equipment, drilling, crushing, blasting, pumps and compressors. Furthermore, the emitted sounds are reflected from floors, ceiling and equipment. Noise is a common occupational hazard in many workplaces.

The major sources of noise that damages hearing are impact processes, material handling and industrial jets. (ref Noise Sources p. 89)

- Air jets – widely used, for example, for cleaning, drying, power tools and steam valves – can generate sound levels of 105 dB. (ref Noise Sources p. 89)
- Workers in a cigarette factory in Brazil involved in compressed air cleaning were exposed to sound levels equivalent to 92 dB for 8 hours. (ref. Noise Sources p.96)
- In the woodworking industry the sound levels of saws can be as high as 106 dB. (ref Noise Sources p. 95)
- Average sound levels range between 92 and 96 dB in industries such as foundries, shipyards, breweries, weaving factories, paper and saw mills. The recorded peak values were between 117 and 136 dB. (ref Noise Sources p. 100)
- In most developing countries, industrial noise levels are higher than those in developed countries.
- Noise-induced hearing impairment is the most common irreversible (and preventable) occupational hazards world-wide.

Cheaper, more cost-effective production is a driving force in economic development. However, new processes introduced on grounds of cost-effectiveness are often noisier than previous ones. The associated rise in noise levels is often overlooked. Thus, even though noise-reducing measures may have been incorporated in the design of machinery, greater output may generate higher noise levels. For example, for every doubling of the speed of rotary machines the noise emission rises by about 7 dB, of warp knitting looms – 12 dB, of diesel engines – 9 dB, of petrol engines – 15 dB, and of fans – between 18 to 24 dB.

- Exposure for more than 8 hours a day to sound in excess of 85 dB is potentially hazardous. (ref. Exposure criteria p. 78)

After exposure to a typical hazardous industrial sound around 90 dB for an 8-hour work day, the ear tires and hearing is temporarily impaired. (ref Pathophysiology of the Ear p.42)

- Industrial workers exposed to noise often turn the volume of their car radios up when they leave work, but turn it down in the morning, because it is too loud. After a time, hearing recovery becomes less complete and impairment becomes permanent. (ref Pathophysiology of the Ear p.42) This can be noticeable within

6-12 months of starting a job where levels of sound are hazardous.(ref Pathophysiology of the Ear p.45)

- Transient tinnitus (ringing in the ear) is a common occupational hearing condition, especially in people exposed to impact noise. It should be considered as a warning of excessive exposure to sound and a trigger for appropriate preventive action. (ref. Pathophysiology of the Ear p.42)

Warning sounds: one sound can sometimes interfere with the perception of another. Because lower frequency sounds can mask higher sounds, warning sounds should be pitched at lower frequencies than the dominant industrial background noise. (ref Fundamentals of Acoustics p.22)

Occupational exposure limits

Occupational exposure limits specify the maximum sound pressure levels and exposure times to which nearly all workers may be repeatedly exposed without adverse effect on their ability to hear and understand normal speech. An occupational exposure limit of 85 dB for 8 hours should protect most people against a permanent hearing impairment induced by noise after 40 years of occupational exposure.(p.65, Exposure Criteria)

Noise reduction (ref Noise Sources p100)

Noise-induced hearing impairment is preventable.

- Protection against hazardous noise exposure should be included into overall hazard prevention and control programmes in workplaces.(p218) The dangers of noise should be recognized before workers start complaining of hearing difficulties.

Machine safety: A European Union Directive requires that the machines are so designed and constructed that hazards from the noise emissions are minimized. Declarations of the noise emissions of machines are required, to allow potential buyers not only to select the least hazardous equipment but also to calculate the noise impact at workplaces and to help with noise-control planning. (ref Noise Sources p.100 –101)

- It is 10 times less expensive (unit cost per decibel reduction) to make noise-generating processes quieter than to make a barrier to screen the noise.(ref Engineering Noise Control p. 231)

Noise levels can be lowered by the use of noise-control enclosures, absorbers, silencers and baffles and by the use of personal protective equipment, such as earmuffs. Where technical methods are insufficient, noise exposure may be reduced by use of hearing protection and by administrative controls – such as limiting the time spent in noisy environment and scheduling noisy operations outside normal shifts or at distant locations.

Essential elements of noise control programmes are education and training of the workers as well as regular hearing tests. (ref. Hazard Prevention and Control Programmes p.221)

WHO response

WHO has responded in two main ways: by developing and promoting the concept of noise management, and by drawing up community noise guidelines. The field is marked by a scarcity of literature, especially for developing countries. Some 20 years after its last publication on noise, WHO has issued Guidelines for Community Noise. This publication, the outcome of a WHO expert task force meeting in London in March 1999, includes guideline values for community noise (listing also critical health effects ranging from annoyance to hearing impairment), for example: (ref Guidelines p. XVIII)

Environment	Critical health effect	Sound level dB(A)*	Time hours
Outdoor living areas	Annoyance	50 - 55	16
Indoor dwellings	Speech intelligibility	35	16
Bedrooms	Sleep disturbance	30	8
School classrooms	Disturbance of communication	35	During class
Industrial, commercial and traffic areas	Hearing impairment	70	24
Music through earphones	Hearing impairment	85	1
Ceremonies and entertainment	Hearing impairment	100	4

*The ear has different sensitivities to different frequencies, being least sensitive to extremely high and extremely low frequencies. (ref Fundamentals of Acoustics p. 19) Because of this varied sensitivity, the term "A weighting" is used: all the different frequencies, that make up the sound, are assessed to give a sound pressure level. The sound pressure level measured in dB is referred to as "A-weighted" and expressed as dB(A). (ref Guidelines p.IX and X).

The guidelines also offer recommendations to governments for implementation, such as extending (and enforcing) existing legislation and including community noise in environmental impact assessments. The role of WHO is to provide leadership and technical support.

The Internet address for the Guidelines for Community Noise is www.who.int/peh/.

For further information, journalists can contact Office of the Spokesperson, WHO, Geneva. Telephone (+41 22) 791 25 99. Fax (+41 22) 791 4858. Email : inf@who.int All WHO Press Releases, Fact Sheets and Features as well as other information on this subject can be obtained on Internet on the WHO home page <http://www.who.int/>

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