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Noise pollution is undesired sound that is disruptive or dangerous and can cause harm to life, nature, and property. It is often said that noise differs from other forms of pollution in that, unlike atmospheric pollutants for example, once abated, noise leaves no residual accumulation in the environment or the human body. Noise does leave behind its effects, however, and these can deteriorate after continued exposure to harmful sounds. So it is not true, strictly speaking, that “noise ... leaves no visible evidence” (Lai 1996, p. 389).

The hazardous effects of noise depend on its intensity (loudness in decibels), duration, and frequency (high or low). High and low pitch is more damaging than middle frequencies, and *white noise* covering the entire frequency spectrum is less harmful than noise of a specific pitch. Noise may be ambient (constantly present in the background) or peak (shorter, louder sounds).

Noise-induced hearing loss (NIHL) in humans is the major, though by no means only, problem stemming from noise pollution. In 1978 the U.S. Environmental Protection Agency (EPA) Office of Noise Abatement and Control estimated that around twenty million Americans were exposed daily to noise resulting in permanent hearing loss (EPA 1978). In 1990 about thirty million people in the United States were exposed daily to occupational noise levels above 85 decibels, compared with just over 9 million people in 1981. Exposure for more than 8 hours a day to sound in excess of 85 decibels is potentially hazardous. In Germany and other developed countries, as many as four to five million people, that is, 12 to 15 percent of all employed people, are exposed to noise levels of 85 decibels or more (World Health Organization 2001).

Loud, abrupt sounds can harm the eardrum, while sustained sounds at lower volume can damage the middle ear; both types of sounds can cause psychological damage. Noise disrupts sleep and communication, and numerous studies have documented the heart-related, respiratory, neurological, and other physiological effects of noise. Stress, high blood pressure, anger and frustration, lower resistance to disease and infection, circulatory problems, ulcers, asthma, colitis, headaches, gastrointestinal disorders, and many other physiological and psychological problems have been linked directly to noise. In addition, children have been shown to suffer from slower language development and disruption of learning as a result of noise. More than five million children in the United States, ages six to nineteen, suffer from noise-induced hearing impairment (Havas 2006). In the United Kingdom, Netherlands, and Spain, exposure to noise impaired children’s reading comprehension and caused a delay in reading skills development (Clark and Stansfeld 2005). In Austria, children in noisier neighborhoods were shown to suffer from increased stress and diminished motivation (Evans et al. 2001). A fetus exposed to noise may experience a change in heart rate, or it may suffer the impact of its mother’s noise-related stress.

In addition, noise can harm animals and the environment, as well as physical property. Livestock and pets are harmed by noise, as are animals in the wild. Noise can also disturb wildlife feeding and breeding. Noise-related property damage includes structural damage from vibrations induced by sound waves and economic harm in the form of lower property values. The true social costs of noise pollution also must include monetary losses from sickness, absenteeism, loss of productivity and earning capacity, and much more.

Noise pollution is not new, but it has become more problematic with the developments associated with industrialization and urbanization. Between 1987 and 1997, community noise levels in the United States were estimated to have increased by 11 percent and were predicted to continue increasing at that rate or more (Staples 1997). Commercial and industrial activities, construction, aircraft, vehicular traffic (highway and off-road), and the rapid increase in the use of machines and other

technologies are all associated with noise pollution. Modern household appliances and lawn and gardening equipment are increasingly common sources of noise. Like many other forms of pollution, noise appears to disproportionately affect poor and disadvantaged minority communities, and so is also an environmental justice issue.

In the United States, public policy to address noise pollution began in the early 1970s. The Noise Control Act of 1972 charged the federal government with protecting public health and welfare from noise pollution by establishing standards for noise emissions and by authorizing federal agencies to establish rules. The EPA created the Office of Noise Abatement and Control (ONAC) as a result of the Noise Control Act. The Quiet Communities Act of 1978 authorized the EPA to provide grants to state Page 364 and local governments for noise abatement. In the early 1980s the Occupational Safety and Health Administration (OSHA) set standards for industrial noise exposure and criteria for hearing protection. The OSHA guidelines resulted in a reduction of noise levels and hearing loss to workers, but some hearing loss can occur even at OSHA-approved levels. In 1981 Congress agreed to the Ronald Reagan administration's proposal to cease funding for ONAC, although Congress did not repeal the Noise Control Act when it eliminated ONAC's funding.

Noise pollution can be controlled through reduction at the source, interruption of transmission paths, or protection of the receiver. Reengineering machines and simply turning down volume when possible are methods of reduction at the source. Barriers, enclosures, and other forms of soundproofing can interrupt transmission paths. The use of hearing protection is the main form of receiver protection. Experts recommend a multifaceted approach, including appropriate training on the use of equipment and on why ear protection matters, enforcement of hearing-protection regulations, and the use of new technologies that reduce noise at the source (Lusk et al. 2004). Like many other environmental problems, addressing noise pollution is complicated by issues of shared responsibility and jurisdiction, making some conventional economic approaches less effective and inviting new interdisciplinary solutions. New active noise control (ANC) technologies may assist in dealing with noise pollution in the years ahead through the use of digital processors that convert analog sounds into digital signals, allowing computer-generated "antinoise" to erase sound with sound (Alper 1991).

While market-based approaches to pollution control have become more popular in recent years, there have not yet been any emissions trading or pollution permits schemes applied to noise. It should be recalled, however, that up until the time of the first government regulation of pollution, a market-based approach was the "default" mode of pollution control.

SEE ALSO *Pollution ; Pollution, Air ; Pollution, Water*

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