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L.H. Royster, J.D. Royster, D.P. Driscoll, and M. Layne

1 Noise Control and Hearing Conservation: Why Do It?

Elliott H. Berger

Contents

To my daughter Jessica
who brightens my life in countless ways.

> "At our company hearing conservation is more than a priority; it is a value. That is an important distinction, because although priorities may change, values never do."
>
> — Charles Robinson, Safety and Health Systems Manager
> NORPAC (Weyerhaeuser), Washington

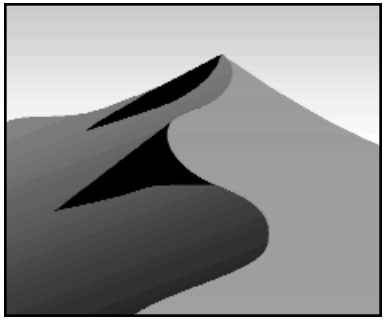
Introduction

It will come as no great surprise to readers of *The Noise Manual* that excessive exposure to noise causes hearing loss. Neither should they be surprised to be reminded that noise-induced hearing loss (NIHL) can be avoided by reducing the level or duration of the exposure or by the use of hearing protection. And many should also already be aware that beyond the potential loss of hearing due to noise, other issues might argue for the value of hearing conservation. But what the reader may fail to perceive is the true extent of noise in our society, the prevalence of NIHL, the importance of sound in the enjoyment, quality, and productivity of our daily existence, or the full justification for the existence of occupational hearing conservation programs (HCPs).

Therefore the purpose of this chapter is to frame the significance of noise and its effects in a compelling manner for those new to the field. Moreover, another goal is to provide concepts and resources that may strike a chord for all hearing conservationists to enable them to better accomplish their job of educating and motivating others to measure, assess, and control noise, and to protect the hearing of those who are exposed.

The Extent of the Noise Problem

Noise is virtually everywhere. In fact, silence, by which is meant in this context, complete absolute quiet, is so rare that for those few who experience it, they can likely cite the time and place — perhaps in a well-isolated acoustical test chamber during an auditory experiment or maybe in the deserts of the U.S. southwest in the moments between aircraft overflights. The opportunities to savor such an experience are few and far between. For example, nature recordist and sound tracker Gordon Hempton reported that of the 20 locations he surveyed in Washington state that had "noise-free" intervals in excess of 15 minutes in 1984, only three remained as pristine



5 years later (Grossmann, 1995). Even when one is willing to forgo total silence, quiet is elusive, especially as population density increases. In the European community 40% of the population is exposed to transportation noise with an A-weighted equivalent continuous sound level ($L_{Aeq,T}$) exceeding 55 dB daytime and 20% exceeding 65 dB, levels that are intrusive or annoying to many (WHO, 1995). Throughout our lives we are faced with noise from transportation, construction and public works, our neighbors and their pets, home appliances, and shop tools. Additionally, we willingly expose ourselves to noise from leisure activities such as target shooting and hunting, motor sports, snowmobiling, speed boating, attendance at public sporting events, concerts and movie theaters, and of course home stereos and Walkman-type devices. It seems as though we rarely can or do give our ears a rest.

The occupational scene is even more daunting. Noise is arguably the most pervasive hazardous agent in the workplace with estimates suggesting upwards of 5 million and perhaps as many as 30 million U.S. workers[1] are exposed to hazardous occupational noise levels (regular exposure above 85 dBA), with millions more at risk from other ototraumatic agents (NIOSH, 1996). Translating exposures to actual cases of NIHL is not straightforward, but a 1990s consensus conference concluded that hearing loss afflicts 28 million Americans, 10 million cases of which are "at least partially attributable to NIHL" (NIH, 1990).

The extent of the noise problem was demonstrated by the identification of NIHL in the 1980s as one of the 10 leading work-related diseases and injuries (NIOSH, 1988). This was reinforced a decade later when hearing loss due to noise exposure was listed as one of the eight most critical occupational diseases and injuries requiring research and development activities within the framework of the National Occupational Research Agenda (NIOSH, 1996). The experience in other countries is similar. For example in British Columbia where extensive workers' compensation records are maintained for all industry in that province, data on disabilities and fatalities from the years 1987 through 1996 indicate that claims for occupational NIHL[2] exceeded claims for each of the other physical agents for which data were recorded (with the exception of repetitive-motion injuries) by a factor of approximately three, and also exceeded the combined claims for all chemical agents (WCB, 1998). Similarly in Chile, the number of employers contending with noise in the workplace surpasses the next most common hazard (use of solvents) by a factor of five, and exceeds others such as pesticides, dust, and chemicals by even greater amounts (Dummer, 1997).

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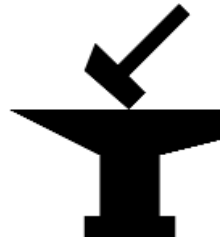
[1] Exact numbers are difficult to specify. NIOSH has estimated 30 million exposed workers (NIOSH, 1996), but their most recent publication provides a figure of 5 million (1998). Although based on more elderly data (Simpson and Bruce, 1981), the estimate of 9 million found in Table 16.1 may be one of the most reliable. The 1996 NIOSH estimate may be higher because it is based on sound levels and not 8-hr. exposures, because it includes additional occupational sectors not covered by Table 16.1, and because of other procedural differences.

[2] Accepted claims are those with a pensionable degree of hearing loss, defined as the average of 500, 1000, and 2000 Hz greater than 28 dB.

Brief Historical Overview and Perspective

The problem of hearing loss from occupational exposure to noise dates from at least the Middle Ages where workers in professions such as blacksmithing, mining, and church bell ringing were known to suffer such impairments (WHO, 1995). As early as 1831 "blacksmiths' deafness" with the concomitant feature of tinnitus (referred to as "ringing and noise in the ears") was cited in the medical literature (Fosboke, 1831). One-half century later another medical article referred to it as "boiler-maker's deafness," since the author at that time based his findings upon examination of 40 men from the steam-boiler shops in Portland, Maine (Holt, 1882). The effect, namely loss of hearing, was clearly identified, but the mechanism was poorly understood; Holt ascribed it to constant agitation of the joints of the ossicles, thereby causing ankylosis (stiffening due to the growth of a fibrous or bony union), especially of the stapes. Mechanisms of prevention were also not well known at the time, with Holt reporting that men tried stopping their ears with cotton wool and pads but derived no benefit therefrom; he had no alternative suggestions. At the same time in Scotland it was reported that men (also boilermakers) were prejudiced against use of cotton earplugs because it would predispose them to catching a cold when the plugs were removed at night (Barr, 1896). Other objections included interference with hearing and itchiness, bona fide complaints that are still voiced today.



In large part, serious and sustained interest in hearing conservation developed as a result of World War II, subsequent to which untold numbers of soldiers returned home with hearing loss. In fact, one of the earliest regulations dealing with hearing conservation was Air Force Regulation 160-3, issued in 1948 (Dept. of the Air Force, 1948). Industrial HCPs began to appear in the late 1940s and early 1950s with some of the first reported programs established in the aviation and metals industries (Bolger, 1956; Haluska, 1964; Hatton, 1956; Wilkins, 1956). Government noise regulations followed in the late 1960s (U.S. DOL, 1969) and became more prominent and widely enforced with the enactment of the Occupational Safety and Health Act (OSHA) of 1970 and promulgation of the noise standard in 1971 (OSHA, 1971). It took an additional decade for OSHA to produce the hearing conservation amendment (OSHA, 1981 and 1983), which specified the details of an occupational hearing conservation program that were only hinted at in the original 1971 standard. See Driscoll (1991) for a more complete historical overview, Appendix I for the complete OSHA noise standard, and Chapter 16 for a more extensive discussion of noise standards and regulations.

Although today we have a much improved understanding of the mechanisms of NIHL (damage to the hair cells of the inner ear as discussed in Chapter 5), a wealth of successful and innovative engineering noise control measures at our

disposal (see Chapter 9), and a broad panoply of hearing protection devices (HPDs; see Chapter 10), the affliction is still prevalent, and some would say that hearing conservation has been unsuccessful. This is unfortunate indeed since long-term occupational NIHL is a completely preventable injury. As was stated over a decade ago in *The Development of a National Noise Strategy* (Berger and Royster, 1987, p. 40), and is still true today,

> "In large part what is needed is *not* the development of new solutions, but rather the broad dissemination of existing techniques plus the education and motivation of management and labor alike to speed the implementation of effective programs."

Unfortunately this hasn't yet occurred. According to a late 1980s estimate based on a U.S. national occupational exposure survey of approximately 4500 establishments, compliance with the law is sketchy at best, as shown in Table 1.1 (Franks and Burks, 1998). It would appear that in small industry hearing conservation merely consists of providing hearing protection devices. It would probably be safe to presume that this equates solely to making HPDs available without the substantial commitment to education, motivation, training, and enforcement that is necessary to make them work. Regrettably, few approach hearing conservation with the zeal expressed by the quote at the beginning of this chapter.

TABLE 1.1
Percent of companies surveyed, by size, with sound levels above 85 dBA, providing elements of a hearing conservation program (from Franks and Burks, 1998).

Company Size	*Monitoring*	*Audiometry*	*Hearing Protection*
Small	0	0	16
Medium	4	5	38
Large	29	19	84

A more focused set of data is available from the state of Michigan, which was involved from 1994–1997 in a special emphasis program for NIHL (Rosenman et al., 1998). Follow-up of approximately 1800 reported cases of hearing loss indicated that 46% of the noisy companies where the persons worked did not have an HCP at the time of employment of the individual. Although they found that over the 4 years studied the number of companies not providing regular audiometric evaluations had decreased among manufacturing companies with more than 100 employees, this was not the case in smaller companies or in the construction and farming sectors. Remember, *these data do not even examine the potential effectiveness of current HCPs, but simply whether or not the required components of the programs exist*.

Much remains to be accomplished. Whether we call our efforts a "hearing conservation program," as has been popular since the 1950s, and is the term used in *The Noise Manual*, or a "hearing loss prevention program," as defined by NIOSH

(Franks et al., 1996; NIOSH, 1998), or a "noise management program" as it is called in Australia and New Zealand (SA/SNZ, 1998), it is apparent that management, workers, regulators, in short, society in general, must be galvanized to act. The ideal would be to design new equipment and retrofit existing installations to reduce noise to safe levels, but the costs, difficulties, and maintenance aspects of addressing many noise problems through engineering controls suggest that relying solely on such an approach is doomed to failure. Similarly, directing one's efforts toward simply assessing the noise, or measuring hearing thresholds, or dispensing hearing protection, cannot adequately resolve the problem. A concerted multi-faceted approach is required. An overview is provided in Chapter 6.

Value of Hearing Conservation

Quality of Life: The Value of Good Hearing

Some have argued that of all our senses, hearing is the most vital (Gasaway, 1985); such a contention may be debated. Regardless, it is clear that hearing is fundamental to language, communication, and socialization. Language is so overwhelmingly oral that of the many thousands of languages spoken in the course of human history only around 100 have ever been committed to writing to a degree sufficient to have produced a literature, and most have never been written at all (Ong, 1982). And, whether or not a language is committed to text, as poet and author Maya Angelou has observed,

> "Words mean more than what is set down on paper. It takes the human voice to infuse them with shades of deeper meaning."

Moreover, sound by its nature is evanescent — it ceases to exist even as it is produced; by the time the last syllable of a word is uttered, its initial sounds have faded. Another unique characteristic of sound as compared to the other principal sense, vision, is that sounds pour into the hearer's ears whereas sight places the observer on the outside looking at, or looking in. Vision comes to the viewer from one direction whereas sound confronts us from all directions and places us in the center of an auditory space (Ong, 1982; Schafer, 1993), enveloping us and hence often greatly impacting attitudes and emotions.

The ability to hear is undeniably a key quality-of-life issue, from communication with coworkers, family, friends, and loved ones, to times of relaxation or appreciation, to hearing warning sounds and other signals. Many of life's joys involve activities and social interaction. That interplay is generally acoustic and oral in nature — conversing over a meal, playing at the beach, or listening to one's mate, or child, or someone special, whisper "I love you." The impact of hearing loss is often felt as much by the family of the impaired person, as by the person him or herself. In particular, spouses have reported that the hearing loss limits companionship and intimate communications, with only the most serious matters discussed because more casual conversation can take too much effort

(Hetu et al., 1995). Hearing loss can also create tension between the partners and make the children feel uneasy (Hetu and Getty, 1991).

Alone time can also be listening time, and this too can be diminished by hearing loss. Whether it be a restful afternoon at home tuned in to a favorite musical recording, daydreaming to the evocative sounds of sleet on a cold and frosted window pane, or chuckling at the rapid sniffing of one's new puppy as it investigates a dirty sock, those joys can be lost to the hearing impaired. For a worker, good hearing can mean the ability to identify the ping of a small spring-loaded part flying off the work bench so that it can be more easily located as it lands on the floor, or the detection of changes in a machine spectrum distinctive of poor production quality or a failure mode, or the ability to distinguish a warning sound indicating the need for immediate action.

Because NIHL is a cumulative effect that often takes many years to fully develop, it is revealing to examine its impact on the elderly. Bess et al. (1989) studied the relationship between hearing loss and functional disturbance for 153 patients over age 65 who were seeing primary care internists for conditions such as diabetes, hypertension, and osteoarthritis. Using a standardized questionnaire that assessed physical and psychosocial function in a behavioral context they found an association between degree of hearing impairment and functional disability. Comparing the scores they reported to other data in the literature for unimpaired adults, patients one year after a heart transplant, those with chronic pulmonary disease, and terminally ill cancer and stroke patients, they concluded the hearing impairment was associated with a clinically significant level of functional impairment having a lasting degrading impact on the quality of life.

In a similar vein Sixt and Rosenhall (1997) posited that hearing impairment in the elderly results in social inactivity and isolation, which can lead to a reduction in life span. This was based on their finding that hearing impairment was correlated with factors indicative of poor health and increased mortality in a group of approximately 1600 elderly with ages ranging from 70 to 88.

Because of the terrible personal toll of hearing loss, one might hope, or suppose that the impairment could be ameliorated by the use of hearing aids, much like eyeglasses can restore normal vision. Such is not the case. Eyeglasses correct for the inability of the lens of the eye to properly focus light on the sensory cells in the retina, whereas the hearing aid, although it can amplify and filter sound, cannot rectify a situation in which the sensory cells affected by noise exposure are absent altogether. Regardless of the auditory information presented to the inner ear, the nerve cells specifically designed to respond to certain sounds

are absent and others must fill in. Although audition is improved with amplification, it is not restored to its pre-noise pristine state.

And finally, consider the stigma of hearing loss. Those with such impairments are subject to stereotyping and prejudice; they are often presumed to be rude or stupid or both (Noble, 1996). For example the common retort, "Are you *deaf*!" rarely is an actual inquiry into the hearing ability of the listener. Instead it conveys the demeaning message, "Are you so *socially inept* as to be unable to respond appropriately to me or even to be able to respond to me at all?" Even worse, among coworkers, even when it is apparent that fellow workers' hearing loss is due to job-related conditions to which they are all exposed, it is often found that hearing impairment is best concealed. Otherwise, the impaired are made fun of, taken advantage of, experience restrictions on job advancement, and also have less job security (Hetu, 1996).

It is no small wonder with such barriers facing the hearing impaired that use of a hearing aid, which is a visible indication and reminder of their impairment, is frequently shunned. Eyeglasses are often a fashion accessory if not a fashion statement, whereas the "best" hearing aid is one that is so tiny as to not be seen at all.

Quality of Life: Quiet Ears

Almost as important as the ability to hear sound is the ability to hear "quiet." For many this is not possible. It is estimated that as many as 36 million Americans suffer from tinnitus, sounds heard within the head in the absence of actual sounds in the environment. For about 7 million the tinnitus is severe (Shulman, 1991). Tinnitus can be experienced in many forms, such as ringing, hissing, whistling, buzzing, or clicking. It can be disabling, dramatically affecting and diminishing the quality of life. An apt optical analogy would be a bright red dot in the middle of one's visual field, a dot that never, ever goes away. The sound of tinnitus can be equally as intrusive and disconcerting.

Although there are many causes of tinnitus, major epidemiologic studies of tinnitus in the adult population have revealed that both age and hearing loss are significant, with hearing loss the more significant. Thus, another important reason to preserve good hearing and avoid NIHL is to retain the ability to appreciate ears that make no sounds of their own. Also to be considered is that in some states tinnitus is compensable under the workers' compensation system (see Chapter 18).

On-the-Job Communication

Besides the far-reaching long-term effects on the quality of life due to hearing loss caused by noise, there are also the immediate communications problems that noise creates — the masking of sounds that must be heard (see Chapter 14). This affects those with normal hearing, and to an even greater extent, those already hearing impaired. Face-to-face, telephone, or even amplified communications can be difficult or impossible, and messages can be lost or misunder-

stood. The costs and difficulty of specifying, purchasing, and maintaining electronic communications systems to overcome these problems in critical environments must also be considered.

Extra-Auditory Effects: Productivity, Lost-Time Accidents, and Related Issues

Unprotected workers in high-noise environments have more lost-time accidents, are less productive, and in general experience more problems than do those with lower noise exposures. Over 60 years ago Weston and Adams (1935) studied the effects of wearing hearing protection on English weavers with a noise exposure of 96 dBA. In their initial experiment one group of 10 weavers spent alternate weeks either protected or unprotected for a period of 6 months. In a second study, 10 controls with no hearing protection and 10 experimental subjects wearing hearing protection were studied for a period of 1 year. The initial study found a 12% increase in personal efficiency and the latter one a 7½% increase, an effect of considerable magnitude in a purely manual process and one that would certainly cost justify an HCP.

Subsequent behavioral studies of weavers in India and Egypt have also examined the effects of noise. The Indian study included 100 weavers who were tested with coordination and dexterity tasks in their work environment (approximately 103 dBA). Those wearing hearing protection were found to perform significantly better than those without (Bhattacharya et al., 1985). The Egyptian study covered 2458 workers exposed to average noise levels from 80 to 99 dBA, so comparisons were actually between different departments rather than for one department under differing conditions of hearing protection (Noweir, 1984). Nevertheless the results indicated that workers in lower noise had less disciplinary actions and absenteeism, and statistically significant greater productivity than those with higher exposures, but the productivity gains (about 1%) were not as great as reported by Weston and Adams.

Another study, this time of boiler plant workers with exposures of approximately 95 dBA, examined issues beyond simple personal efficiency or productivity (Cohen, 1976). Data were compared for 2-year periods, before and after the advent of an HCP involving the use of hearing protectors. Results indicated fewer job injuries, medical problems, and absences in the post-HCP period, as typified by the results in Figure 1.1. Since a control population of low-noise-exposed workers exhibited no pre/post-HCP reduction in absenteeism, but the high-noise group did, it is likely that reduced noise exposure as a result of HPD usage was the controlling variable. Another significant finding was that comparisons of injury data before and after the advent of the HCP suggested that use of HPDs reduced rather than increased the number of mishaps. This provides evidence to counter the notion that wearing HPDs increases the likelihood of accidents by interfering with the ability to detect warning sounds and other acoustic cues in a background of noise. (See Chapters 10 and 14 for additional related discussions.)

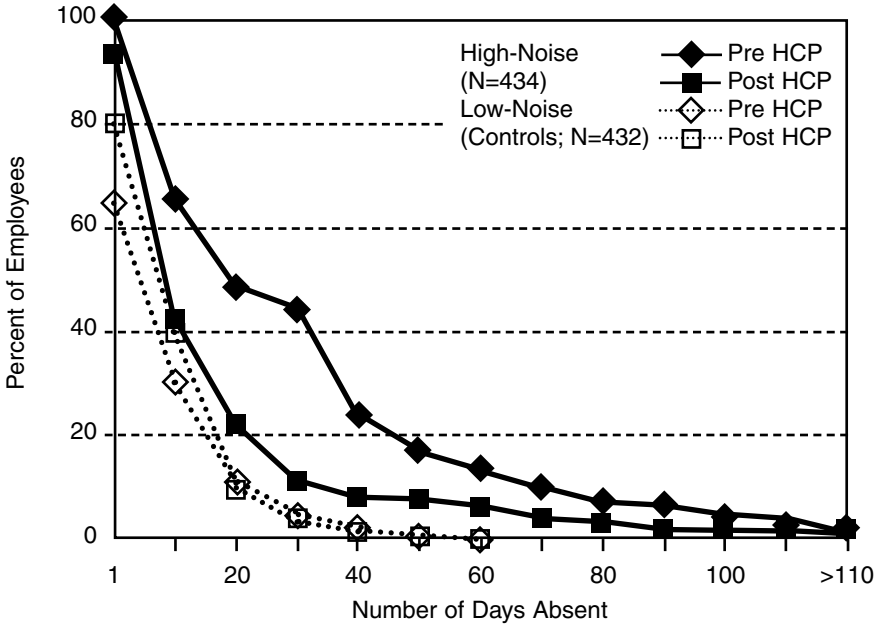


Figure 1.1 — Cumulative frequency distribution of workers with specifiable number of days absent, separated into high- and low-noise groups. Each point represents percentage of workers having had as many or more days absent as read from the abscissa. After Cohen (1976).

Schmidt et al. (1982) conducted a study similar to Cohen's, in which they examined industrial injury data for 5 years preceding and 5 years following the implementation of an HCP at a cotton yarn manufacturing plant. They too found a significant reduction in reported injuries for the approximately 150 workers who were studied. Of equal interest was the finding, based on audiometric records, that females wore their HPDs more effectively and received better protection, and it was they who showed a greater reduction in industrial injuries, thus demonstrating a direct link between HPD usage and reduced injury rates.

Although the use of hearing protection does not generally increase the likelihood of accidents, hearing loss well might. In one case-controlled study of 300 manual workers in a Dutch shipyard who experienced injuries, vs. 300 who did not, the odds ratio for occupational injuries (ratio of the odds that workers with hearing loss experience injuries to the odds that workers without hearing loss experience injuries) was found to be 1.9 for hearing loss of greater than 20 dB at 4 kHz (van Charante and Mulder, 1990). In a much larger study based on data for about 450,000 workers aged 18 to 65 who were participants in a U.S. National Health Interview Survey, hearing impairment (defined by self report during an interview) was found to be associated with a 55% increased risk of occupational injury (odds ratio of 1.55 with a 95% confidence interval of 1.29 –

1.87), which was equal to that found for epilepsy (Zwerling et al., 1997). With the exception of blindness and deafness, which had odds ratios of 3.21 and 2.19, respectively, hearing impairment also exceeded all other risk factors (e.g., visual impairment, extremity impairment, arthritis, etc.). It would appear that there are sound reasons to maintain good hearing.

And finally, a very positive study on the benefits of engineering noise controls was reported by Her Majesty's Chief Inspector of Factories in England (Staples, 1981). A ball bearing grinder generating noise levels from 103 to 114 dBA was fitted with enclosures that cost about $20,000 and netted approximately a 20-dB noise reduction. Besides the obvious and valuable protection of hearing that was provided, absenteeism in the department, which had been excessive, was reduced to a level no higher than elsewhere in the factory, and productivity of the machine operations increased by about 20% — a valuable payback indeed.

Extra-Auditory Effects: Health

Although extra-auditory effects of noise exposure have been frequently hypothesized and reported widely, especially in the lay press, there is disagreement as to the validity and interpretation of the supporting data. Clearly the principal consequence of noise is upon the organ designed to respond to it, namely the ear. The one health effect that has been identified most often is that prolonged equivalent daily exposures of at least 85 dBA "may contribute to increased blood pressure and hypertension" (Smoorenburg et al., 1996).

Recently, two independent studies have examined the presence of cortisol and other stress hormones in noise-exposed workers, as well as subjective assessments of fatigue and postwork irritability (Melamed and Bruhis, 1996; Sudo et al., 1996), and have confirmed the findings of an earlier study (Ising et al., 1979). In the best-controlled of the three studies (Melamed and Bruhis, 1996), 35 textile workers who were exposed to noise levels of 85–95 dBA were examined one day before and on the last day of a 7-day working period, during which they wore earmuffs. Decreased cortisol levels and reduced fatigue and postwork irritability were observed in the hearing-protected condition, suggesting that chronic noise exposure increases stress and reduces the quality of life for those exposed. A concomitant observation of Melamed and Bruhis was that reduction of noise at the ear by HPDs, as opposed to reduction of the noise in which the person is immersed, was sufficient to influence the extra-auditory health effects of the noise exposure. This supports the prevailing knowledge that potential stress effects of noise are mediated by the auditory system (Suter, 1989) and thus it is necessary to hear the noise for adverse effects to occur.

Worker Attitude

As can be inferred from the preceding section on extra-auditory effects of noise on productivity etc., reducing noise exposures via either noise controls or hearing protection can improve worker attitudes, with consequent benefits derived therefrom. Just as hard hats, respirators, safety shoes, and good work-

place design are valued and implemented in modern business, so too should an HCP be considered an integral aspect of the overall safety program. Not only can this improve employee morale on the job, but if the educational program is well-designed employees will be alerted to the need and value of taking safe hearing practices home to their private lives, thus providing enrichment for all concerned. (See Chapter 8 for additional details.)

Some have argued that hearing health should be viewed as a "wellness" issue in the same context as other health-related company benefits (James, 1998). They contend that hearing relates directly to job safety and performance and as such it must be accounted for if we expect workers to function in teams and communicate effectively. Companies should include hearing health as part of overall health campaigns, even inviting employees' families to participate, thus expanding the hearing conservation message to spouses and children. The potential for audiograms to detect other medical pathologies, besides NIHL, is a benefit to all employees.

Personalizing Hearing Conservation

In talking to employees about the prominence of our sense of hearing and the poignancy of its loss, it often has greater impact if one imparts a personal story that might also directly relate to lives of those listening, perhaps about an incident or time when the vital nature of hearing was brought into sharp focus. In one recent article an audiologist shared four "true-life" incidents that highlighted the importance of her hearing, and hopefully, in so doing, reached her intended audience at a gut level. The events related to everyday occurrences in life such as listening to an audiocassette of her daughter at age 2, enjoying the myriad instrumental details in a bluegrass music recording, spending a few hours in "girl talk" with a best friend, and listening to her congregation intone a favorite hymn (Watkins, 1997). One story that I have shared relates to my love of the wilderness.

> Over Thanksgiving I had the thrill of joining a close friend for a hike up Mount Moosilauke in the White Mountains of New Hampshire. The morning was cool as we started our climb, just above freezing, the breeze slight, and the mountain remote and devoid of people. Just past the trailhead we hiked along a small stream, stopping to listen to the water flowing over rocks and through and beneath the encrusted ice. That gentle soothing sound was our companion until we split from the stream and headed sharply up slope in a few inches of snow.
>
> As the creek was lost from view, so too was its acoustic presence. We were then set free in a soft, almost soundless winter snowscape. Soon we stopped for a break and a "listen" — a peaceful moment to use our ears to their fullest. I wanted to hear what you can't in a town, or near neigh-

bors or airports or highways or anywhere in the proximity of civilization. I listened to a pristine silence, punctuated by the barely audible and deliciously delicate crinkling sound of a nearly frozen brook trickling just under the snow, an occasional twittering bird, and the whispering of a sporadic breeze through fir and stands of leafless birch. ... AND THEN, AND NOT UNTIL THEN, I noticed the view ... what a breathtaking occasion, sound and sight merged into one incredible experience!

> Both my friend and I are blessed with good hearing — hearing that we have protected. Had we been careless and let noise rob us of our hearing ability, the adventure on Mt. Moosilauke would have lost much of its fullness and joy; if the loss had been compounded by noise-induced tinnitus our experience would have also been marred by noises in our own ears that would have imprinted an ugly blemish on the sound pictures.

The joy in telling this story is seeing the expression on some of the faces in the audience indicating that the tale also touched a part of their experience. Direct and immediate feedback after the lecture confirmed its meaningfulness. Especially gratifying were the remarks I received the following year from a couple of the employees who had been in attendance. They related how, when in the woods some months later, they recalled my message concerning their hearing, and of its splendor and the importance of preserving it.

Another key to personalizing hearing conservation is to remind listeners of how many of their exciting, moving, and joyful life experiences rely heavily on sound. Film is one of those experiences. In a review of a riveting 1994 thriller *Blink*, starring Madeline Stowe as a blind woman recovering from eye surgery who witnesses a murder, or thinks she does, David Ansen (1994) wrote:

> "But the secret ingredient of this adrenaline-pumper is the sound mix, supervised by Chris Newman, who also happened to work on *The Exorcist*, *The French Connection*, and *The Silence of the Lambs*, tense movies all. We're rarely conscious of it, but what really frightens us in the movies is often not what we see but what we hear. Not the guy with the knife but the man at the dials, splicing in an electronic 'boo'!"

Concluding Remarks

Occupational hearing loss is often overlooked because it usually occurs insidiously, without dramatic consequences such as bleeding, deformity, or death.

Nevertheless, NIHL has a terrible impact on the quality of life and human interaction. Those who suffer its debilitating effects say things like,

- "My daughter no longer seems to speak clearly."
- "I always miss the punch lines and my friends get tired of repeating themselves."
- "To get the sound from things, now you have to see them."
- "I miss the birds. I miss the whispers. I miss all the good sounds."
- "You always have this ringing in your ears."
- "It kind of puts you away from the outside world, kind of leaves you out by yourself. I feel lost. I feel I'm in a place by myself. There are people around me. I can see them, but I can't hear them."

And years later, those who ameliorate the impact of NIHL by purchasing and using hearing aids may likely exclaim, "I had no idea (or I had forgotten) what all I was missing!"

For a particularly telling viewpoint we turn to the words of Helen Keller, a woman who had neither her hearing nor her vision. When asked to compare her loss of vision with her loss of hearing, she is reputed to have said (Walker, 1986),

> "Blindness cuts people off from things; deafness cuts people off from people."

An alternative and fanciful perspective that demonstrates the spiritual aspect of sound can be gleaned from the Native American culture, wherein the following creation myth is told by the Hopi of the southwest (Schafer, 1993).

> "Palongawhoya, traveling throughout the earth, sounded out his call as he was bidden. All the vibrating centers along the earth's axis from pole to pole resounded to his call. The whole earth trembled; the universe quivered in tone. Thus, he made the whole world an instrument of sound, and sound an instrument of carrying messages, resounding praise to the creator of all."

The ability to hear and to hear well — clearly, deeply, and keenly, is an important aspect of life and living. The ability to experience and hear a range of sounds from those near the threshold of hearing to sounds that are full, bright, boisterous, and moving, adds depth and beauty to life. The value of preserving that ability should be self-evident; nevertheless, it has been argued at length in the preceding paragraphs. Hearing conservation is the key, both occupationally where millions of people are noise exposed and programs are often regulated, and in nonoccupational settings where it usually requires personal motivation and the perseverance of individual action.

In industry, programs can be nominally compliant and accomplish little except perhaps avoidance of OSHA citations, or they can be meaningful and prevent hearing loss. The cost differential is often trivial, and effective HCPs as noted above, deliver a supplementary return on investment in terms of benefits such as enhanced employee attitudes, improved productivity, and a better company image. It's the employer's choice whether to implement the additional efforts required to achieve a truly effective HCP. If you want to, this book will tell you how.

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