

Noise Monitoring and Establishment of a Comprehensive Hearing Conservation Program

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Here we discuss the importance of monitoring noise in contemporary animal facilities. Noise surveys and monitoring should be an integral part of an institution's Occupational Health and Safety Program. If noise levels equal or exceed 85 dB, then a Hearing Conservation Program must be initiated in accordance with Occupational Safety and Health Administration standards. The tenets of a comprehensive Hearing Conservation Program are outlined.

Abbreviations: dBA, decibels on the A scale of standard sound level metered at slow response; HCP, hearing conservation program; HPD, hearing protective device; NIHL, noise-induced hearing loss; OSHA, Occupational Safety and Health Administration

Workers in contemporary animal facilities are exposed to various noises. Current literature contains several citations that highlight the deleterious effects of noise on research animals.¹³ Strikingly, extensive literature reviews have failed to reveal any published data on noise exposure or the consequences thereof on the animal care workers. Occupational exposure of animal care workers to potentially hazardous noise can not be disregarded based on several premises. First, the General Duty Clause of the Occupational Safety and Health Act of 1970 (Williams-Steiger Act) states that "employers shall furnish to each of his employees employment and a place of employment which are free from recognized hazards that are causing or are likely to cause death or serious physical harm to his employees."²² Second, the Occupational Safety and Health Administration (OSHA), which was created in order to implement and enforce the Occupational Safety and Health Act of 1970, recognizes noise as an occupational health hazard and has established a standard that addresses noise exposure.¹⁴ Third, exposure to noise and its hazardous consequences has been associated with loss of concentration, fatigue, speech difficulties and tinnitus.^{11,16} Finally, the effects of noise in the workplace can have economic ramifications because noise-induced hearing loss (NIHL) is compensable and can be an irreversible occupational injury.²¹

Noise is defined as sound that lacks agreeable quality or is noticeably loud.⁸ Regrettably, controlling hazardous noise exposure and establishing hearing conservation programs have not been priorities in our society as manifested by the continued incidence of NIHL. Over the past several decades, both OSHA and the National Institute for Occupational Safety and Health have initiated efforts to better understand and limit the occurrence of hearing loss associated with excessive noise exposure. Although the incidence continues, workers typically do not complain about reductions in hearing acuity but rather about injuries that produce acute or chronic pain. Although painless, one stark reality exists: hearing loss due to noise is irreversible.¹ Despite the pervasiveness of NIHL, it is a preventable injury, therefore surveying and monitoring hazardous noise in animal facilities should be an integral part of an institution's

occupational health and safety program.

Occupational NIHL is the end result of exposure to continuous or intermittent loud noise in the work environment. The OSHA noise standard limits employee exposure of noise to 90 decibels on the A scale of a standard sound level metered at slow response (dBA) averaged over an 8-h work shift.¹⁵ The incidence of NIHL is associated with chronic exposure and is most pronounced during the first 10 to 15 y of work at levels above 85 dBA for an 8-h time weighted average. NIHL has the following characteristics: 1) NIHL is usually a bilateral condition because exposures are often symmetrical; 2) NIHL is sensorineural and associated with permanent nerve damage; 3) NIHL is not a profound hearing loss; 4) NIHL does not progress once noise exposure is discontinued; 5) the rate of NIHL decreases as threshold increases; and 6) continuous noise is more damaging in terms of NIHL than is intermittent noise.¹

Inside animal facilities, noise, especially at times of feeding or blood sampling, can reach temporary levels in excess of 100 dBA.¹⁸ Machinery associated with animal facilities such as cage washers, high-pressure cleaning equipment, and wet vacuuming systems also can produce unacceptable noise.¹⁷ Dangerous noise levels should be suspected in areas where normal conversation can not take place. As a rule of thumb, if a person must raise his or her voice to be heard by another person standing 3 ft away, the ambient noise level probably exceeds 85 dBA.⁶ Experienced animal care technicians attest that conversation can be difficult in many canine and swine housing area.¹² Similarly cagewash bays can be a source of hazardous noise.¹¹ An industrial hygienist should conduct a noise level survey in any area of the animal facility where hazardous noise levels are suspected. If noise levels equal or exceed the 85 dBA time-weighted average, a hearing conservation program (HCP) must be initiated in accordance with OSHA standards.¹¹ HCPs are mandated by OSHA and must have the following elements: 1) monitoring; 2) engineering and administrative controls; 3) audiometric testing (baseline and annual); 4) hearing protection; 5) training and supervision; and 6) recordkeeping.

Monitoring

Employers are responsible for determining whether they must institute an HCP.⁷ Such determinations are made by measuring or monitoring the ambient noise levels. Although initially used to determine whether there are noise hazards in the work

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environment, the monitoring process is valuable for several other reasons. Noise monitoring should be used to answer these pertinent questions. What are the specific sources of the noise hazard? How can the noise levels be prioritized, characterized, and controlled? Which employees need to be included in the HCP? Are noise levels presenting a safety hazard by preventing employees from being aware of fire alarms or other warning signals?²⁰ The answer to these questions provides guidance when fashioning a responsive HCP for an institution.

Noise monitoring can be done in several different ways, and OSHA allows the employer to determine how noise surveys will be performed. For example, in a cagewash bay, measurements might be taken with either a sound-level meter or a personal noise dosimeter.⁴ In addition, the facility manager and industrial hygienist should note that OSHA provides workers the right to observe all noise-monitoring procedures and mandates notification of results. OSHA also requires that the institution (employer) ensure that instruments used for monitoring are calibrated properly.¹⁴

Engineering and Administrative Controls

Ideally, hazardous noise controls should be engineered or administratively programmed into all newly designed animal facilities. It is important to ensure that all the equipment is properly maintained and that noise is not associated with disrepair. Noise control can be engineered by isolation, damping, cushioning, and enclosing.⁸ Noise from some equipment can be resolved by using cushioning materials such as rubber or plastic. These engineering measures are best considered during the initial planning and design of the facility, and resources should be allotted for this purpose. Equipment with prescribed noise standards should be purchased. Noise specifications below OSHA's action level of 85 dBA are one of the marketing lures of some cagewash manufacturers. An effort to engineer noise control in the work environment is the uncontested optimal method to reduce NIHL. One reference states that "if prevention of occupational deafness is to be taken seriously, it will require a decisive shift to engineering noise control."²

If the noise can not be engineered into an acceptable range, then administrative controls are considered. The goals of such controls should be to identify all sources of hazardous noise and determine feasible abatement forms. An assessment should be performed to determine which administrative controls might work in concert with established engineered forms of abatement; such collaboration will benefit both workers and the institution. Administrative controls to consider include: logical work scheduling, restricted access to noisy areas, safely locating break and lunch rooms in quieter areas, and facilitating open communication between occupational health officers, facility managers, and animal care technicians.

Audiometric Testing

One of the central features of an HCP is audiometric testing. Audiometric testing provides one of the few quantitative measures of assessing HCP effectiveness. Audiometric testing should be performed in a hearing booth with use of pure tones at frequency levels of 250 to 8000 Hz. The normal range for auditory threshold is 0 to 25 dBA.¹⁹ Audiometric testing should be performed by a technician who has been certified by the Council for Accreditation in Occupational Hearing Conservation. The audiometer gives quantifiable information on the caretaker's response to different pure tone sounds at various intensities. It is important to ensure that the audiometer is calibrated yearly, with in-depth recalibration every 5 y. An initial audiogram

should be performed within 6 mo after an employee begins working in an area where noise levels equal or exceed 85 dBA. The purpose of this initial audiogram is to establish a baseline and determine the hearing status of the worker prior to noise exposure. All subsequent annual audiograms are compared with this baseline to determine whether any changes in hearing status have occurred. The annual audiogram detects early changes in hearing status and serves as a means of assessing the effectiveness of the HCP. Results of audiometric testing must be reviewed and interpreted by an audiologist or physician. Audiometric testing provides an opportunity for one-on-one contact between the worker and the occupational health physician.¹⁹ The consultation with the occupational health physician is an excellent time to educate workers regarding prevention of NIHL and discuss the results of the audiogram. The effectiveness of the HCP should be evaluated in terms of losses prevented individually and programmatically.⁵ All audiometric testing and subsequent referrals to an audiologist or otolaryngologist must be done at no expense to the worker, as mandated by the OSHA noise standard.

Hearing Protective Devices

Hearing protective devices (HPDs) consist of 3 basic types: inserts (devices that insert into the ear canal proper), semi-inserts (devices that cover the entry of the ear canal and are held in place by a band or other type of suspension device), and muffs (devices that completely encapsulate the auricle or pinna). No single type is best for all users. For example, some HPDs may not accommodate the anatomic features of the wearer.⁹ One of the reasons NIHL continues to rise in our society is over-reliance on HPDs. In the mid-1980s, OSHA made a crucial decision that allows substitution of HCPs in lieu of engineering controls or noise control. At the time of this decision, both were thought to be equally beneficial. However, the effectiveness of HPDs is affected by many variables. HPDs are evaluated based on noise reduction ratings (NRR) by use of the American National Standard Institute cited in the controlling Environmental Protection Agency (EPA) protocol.¹⁰ This rating provides an indication of *potential* protection offered by the devices under optimal conditions. This rating is exclusively a measure of the *capability* of the HPD. HPDs are marketed based on their maximum protection. In addition to the potential capability of the HPD, the following human factors should be taken into consideration: comfort, tolerance in work conditions, effect of removal for short periods, and cost.¹⁰ Furthermore, the use of HPDs may place the worker at a distinct disadvantage with regard to hearing warning signals, verbal communication, or machinery. The occupational health official and the animal care staff should both be involved in the process of selecting HPDs. Employees should be offered a wide selection of HPDs at no personal cost.

Training and Supervision

One of the most important components of an effective HCP is adequate training for the participants. The following topics must be conveyed during training sessions: 1) the causes of hearing loss; 2) how to protect hearing; 3) the types of HPDs; and 4) the importance of the HCP. The supervisory staff should model proper use of HPDs and initiate disciplinary action for noncompliance. Training and education must be complementary processes. The animal care staff can provide crucial information relevant to noise control and protection from noise. HPD usage, the nature of the work, the comfort of the unit, and access, shelf-life, cleaning, and storage of HPDs are all topics best discussed with users. Noncompliance and related disciplin-

ary actions should be investigated and sufficiently addressed to ensure overall success of the HCP.

Recordkeeping

Recordkeeping and preplacement histories and examinations are important whenever a worker is evaluated for NIHL. NIHL develops over years, and proving cause-effect relationships will rely on documentation from a well-managed HCP. Records should include clinical documentation, results of noise surveys, and dates of HCP training, audiometric monitoring, and calibration of audiometers. Persons responsible for managing the HCP must ensure that documentation has chronology and clarity, to facilitate the extensive review process that will take place in instances of NIHL claims.

Conclusions

Noise in an animal facility is a potential occupational health concern. Although obviously needed, there are no published studies regarding occupational noise levels in animal research facilities. With the assistance of the institutional industrial hygienist, monitoring noise levels are standard in many facilities. If institutional noise surveys deem an HCP necessary, a comprehensive program can prevent deleterious effects of hazardous noise on animal care staff. Institutions must ensure that their occupational health and safety program's risk assessment screens for noise hazards and, when necessary, has a relevant HCP tailored for their unique needs. Although NIHL has largely been ignored in laboratory animal science, as workers' tenures lengthen, chronic occupational hazardous should become more of a concern for our community. We hope that this discussion raises awareness of this potential hazard and that documentation regarding noise levels in animal facilities will soon follow.

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