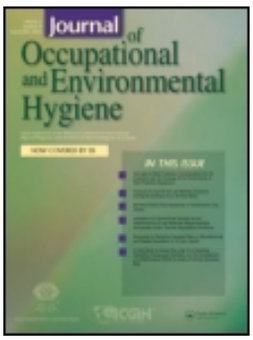

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Case Study
Occupational Noise Levels During Emergency Relief Operations in the Aftermath of Hurricane Katrina

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INTRODUCTION

In the aftermath of Hurricane Katrina in 2005, the Centers for Disease Control and Prevention (CDC) received a request from the City of New Orleans and the State of Louisiana to assist with public health activities. As part of the CDC response, the National Institute for Occupational Safety and Health (NIOSH) provided occupational health and safety support; this included response to concerns of local public health groups regarding occupational noise exposures.

Noise-induced hearing loss is an irreversible, sensorineural condition that progresses with exposure. Although hearing ability declines with age (presbycusis) in all populations, exposure to high noise levels can produce hearing loss greater than might occur as part of the natural aging process. Noise-induced hearing loss is caused by damage to nerve cells of the inner ear (cochlea) and, unlike some conductive hearing disorders, cannot be treated medically.[1] Whereas loss of hearing may result from a single exposure to a very brief impulse noise or explosion, such traumatic losses are rare. In most cases, noise-induced hearing loss is insidious. Typically, it begins to develop at 4000 Hz or 6000 Hz and spreads to lower and higher frequencies. Hearing range is 20 Hz to 20,000 Hz.

Often, clinically significant impairment has occurred before the condition is clearly recognized. It is not uncommon for noise-induced hearing loss to progress to a point where affected individuals experience considerable difficulty understanding speech in everyday situations. Although the primary frequencies of human speech range from 200 Hz to 2000 Hz, research has shown that the consonant sounds, which enable people to distinguish words such as "fish" from "fist," have still higher frequency components.[2] This is a major reason why people with noise-induced hearing loss experience difficulty understanding speech.

The activities typically carried out during a disaster relief operation such as installing and repairing damaged roofs, excavating the ground for new construction, and using heavy machinery to haul debris, are not very different from activities carried out in daily life. However, the duration and intensity of exposure can be very different from that of a typical workday.

This case study describes noise levels and the potential for hearing loss among emergency response workers after Hurricane Katrina. Some of the emergency response workers assessed were employed in construction trades where exposure to noise has been well documented. Likewise, noise exposures to agricultural workers working with livestock have been well documented.[3,4] However, this evaluation found overexposure to noise levels that exceeded the Occupational Safety and Health Administration (OSHA) permissible exposure limit (PEL) and the NIOSH recommended exposure limit (REL) among workers caring for domestic animals, an area that has not been evaluated fully in the past.

Personal noise dosimetry was conducted on 13 workers who were involved with building repair, setting up animal shelters, and removing debris. Six workers exceeded the NIOSH REL and one of the workers also exceeded the OSHA Action Level (AL). All volunteers at an outdoor animal shelter who participated in this evaluation exceeded the NIOSH REL.

METHODS

This work was not a systematic comprehensive survey of workers but rather a series of convenience samples of selected groups identified by and accessible to the public health agencies involved in the response.

Common work activities occurring in hurricane response efforts were targeted for evaluation of occupational noise exposure. These included building repair, setting up animal shelters, and removing debris. Personal noise dosimeters were worn by 13 employees performing those activities. Dosimeters were worn on 1 day per work site over a 2-week period. Data were collected throughout work shifts that ranged from less than 4 hours to approximately 8 hours. Most of the data collected during debris removal and building repair corresponded to the entire duration of the work shift; data collected at the outdoor animal shelter corresponded to only part of the work shift. The dosimeters that were used could record individual doses based on OSHA and NIOSH criteria. Spot noise measurements were recorded using a sound level meter (SLM).

EXPOSURE STANDARDS

The OSHA standard for occupational exposure to noise (29 CFR 1910.95)[5] specifies a maximum limit of 90 decibels on an A-weighted scale (dBA) for a duration of 8 hours per day using a 5 dB time/intensity trading relationship. The NIOSH REL[6] is 85 dBA for 8 hours. The NIOSH criterion also uses a more conservative 3 dB time/intensity trading relationship to calculate exposure limits. The OSHA standard and the NIOSH recommended standard also provide a formula based on the above limits for calculating daily dose: during any 24-hour period a worker is allowed up to 100% of his daily noise dose. The OSHA standard includes an action level (AL) of 50% dose; an employer is required to administer a continuing, effective hearing conservation program when the AL is exceeded.

RESULTS

Of the 13 employees who were monitored (Table I), 5 were involved in building repair, 4 in animal shelter setup, and 4 in debris removal. The veterinarian, veterinary assistant, and two veterinary technicians providing care at an outdoor animal shelter consistently experienced high noise exposures, primarily from barking dogs. Secondary noise sources included fans, generators, and metal-to-metal contact when kennels were opened and shut. These workers exceeded their daily allowable dose as determined by the NIOSH REL. One of the veterinary technicians also exceeded the OSHA AL. Spot noise measurements taken by an SLM averaged 95 dBA.

Considerable work being done in New Orleans at the time of the NIOSH evaluation focused on the removal and reduction of vegetative debris. Of the four workers studied at typical debris removal sites (where trucks filled with debris convened at a fixed location, emptied their contents, and drove off to bring back more debris), one individual (a "team leader" who was exposed to high noise levels from trucks and other heavy equipment) was exposed to noise levels exceeding the NIOSH REL. Two other workers involved in the debris reduction and removal process had doses of 81% and 98% of the daily dose

TABLE I. Noise Level Measurements

Activity	Location	Job Description	Sampling Time (Hours)	Percentage Dose for Actual Time Worked[A] (%)	
				NIOSH REL[B]	OSHA AL[C]
Roof installation	Naval air station	Roofers (n = 4)	3.5	13–54	2–14
		Forklift operator	5	226	41
Canine care	Outdoor animal shelter	Veterinarian	5	128	36
		Veterinary assistant	5	136	36
		Veterinary technician I	5	199	42
		Veterinary technician II	5	337	63
Debris reduction	Debris site I	QC[D] inspector	6	10.5	3.1
		Trackhoe operator	6	81	31.6
Debris reduction	Debris site II	Team leader	9	207	38.4
		Backhoe operator	9	98.5	28.1

[A] The dose percentages are the amounts of noise accumulated during a workday, with 100% representing the maximum allowable daily dose. If the OSHA Action Level exceeds 50%, an employer is required to administer a continuing, effective hearing conservation program.
[B] NIOSH REL: National Institute for Occupational Safety and Health, recommended exposure limit.
[C] OSHA AL: Occupational Safety and Health Administration, Action Level.
[D] QC = quality control.

allowed by the NIOSH recommended standard. Spot noise measurements taken by an SLM averaged 80 dBA.

Noise levels measured by personal dosimetry conducted on four roofers repairing a rooftop at a U.S. naval base were relatively low. Spot measurements taken during the roof repair activities were also low (approximately 80 dBA). However, the forklift driver who supplied materials to the roofers and to other construction sites on the base had a dose of 226% of the daily dose allowed by the NIOSH recommended standard.

DISCUSSION

The high noise levels recorded in this evaluation underscore the importance of hearing loss prevention, even during an emergency situation. It was recommended that employers and workers exposed to excessive noise should wear hearing protection devices (HPDs). To minimize the distortion of speech associated with conventional HPDs and to improve communication, workers and employers were informed of the availability of HPDs that are flat (hearing protectors that reduce frequencies from 125 Hz to 8 kHz by about the same amount). Flat hearing protectors generally have moderate attenuation characteristics, i.e., less noise reduction. Consequently, users would be protected from noise exposure without being "over protected," which can lead to communication problems with co-workers and an inability to hear other important sounds. Spot measurements taken during debris removal and roof repair activities were low enough that the flat HPDs would offer adequate protection.

Workers and employers were also advised that if workers continuously experience similar exposures while performing their work, employers should establish baseline hearing levels and obtain an annual hearing test for these employees. If personal dosimetry levels exceed the OSHA AL, workers must be enrolled in a hearing conservation program as specified by the OSHA hearing conservation amendment [29 CFR 1910.95(c) through (p)].[5] Other sources of information about providing hearing loss prevention programs are also available.[7–9]

Because we were unable to determine the total number of workers who may have been exposed to excessive levels of noise, the noise exposure assessment was limited to a small number of representative workers who were typical of emergency response workers performing similar work duties.

Because of the level of the exposures and the relatively short duration that an employee does recovery work, it is unlikely that workers would have experienced significant permanent hearing loss. However, employees consistently exposed to high noise levels (such as the 128–337% dose observed at the animal shelter) over a 30-year working life are at high risk for permanent hearing loss.

The noise exposures to the animal shelter workers that we measured during work activities may be an underestimate of the actual exposure because many of the workers lived at the temporary shelter all of the time during the crisis and thus may have been exposed to excess noise levels for periods exceeding 8 hours.

CONCLUSIONS

This evaluation has brought to light the potential for emergency response workers to be exposed to excessive noise levels that could contribute to hearing loss. If these workers had similar exposures in their daily jobs, they would be enrolled in a hearing loss prevention program by their employers. This evaluation also highlighted a potential noise hazard to workers who care for domestic animals, such as employees of veterinary practices and animal shelters. Emergency response plans should consider noise exposures in shelters and structures used to house animals and should consider engineering and administrative controls in addition to providing HPDs to workers.

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