



NIOSH HEALTH HAZARD EVALUATION REPORT

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**Society for the Prevention of Cruelty to Animals
Cincinnati, Ohio**

February 2007

**DEPARTMENT OF HEALTH AND HUMAN SERVICES
Centers for Disease Control and Prevention
National Institute for Occupational Safety and Health**



PREFACE

The Hazard Evaluation and Technical Assistance Branch (HETAB) of the National Institute for Occupational Safety and Health (NIOSH) conducts field investigations of possible health hazards in the workplace. These investigations are conducted under the authority of Section 20(a)(6) of the Occupational Safety and Health (OSHA) Act of 1970, 29 U.S.C. 669(a)(6) which authorizes the Secretary of Health and Human Services, following a written request from any employers or authorized representative of employees, to determine whether any substance normally found in the place of employment has potentially toxic effects in such concentrations as used or found.

HETAB also provides, upon request, technical and consultative assistance to federal, state, and local agencies; labor; industry; and other groups or individuals to control occupational health hazards and to prevent related trauma and disease. Mention of company names or products does not constitute endorsement by NIOSH.

ACKNOWLEDGMENTS AND AVAILABILITY OF REPORT

This report was prepared by Chandran Achutan and Randy L. Tubbs of HETAB, Division of Surveillance, Hazard Evaluations and Field Studies (DSHEFS). Field assistance was provided by Donnie Booher, Judi Eisenberg, and Charles Mueller. Desktop publishing was performed by Robin Smith. Editorial assistance was provided by Ellen Galloway.

Copies of this report have been sent to employee and management representatives at the Society for the Prevention of Cruelty to Animals-Cincinnati and the OSHA Regional Office. This report is not copyrighted and may be freely reproduced. The report may be viewed and printed from the following internet address: <http://www.cdc.gov/niosh/hhe>. Copies may be purchased from the National Technical Information Service (NTIS) at 5825 Port Royal Road, Springfield, Virginia 22161.

For the purpose of informing affected employees, copies of this report shall be posted by the employer in a prominent place accessible to the employees for a period of 30 calendar days.

Highlights of the NIOSH Health Hazard Evaluation

In April 2006, NIOSH investigators received a management request from the Cincinnati branch of the Society for the Prevention of Cruelty to Animals (SPCA-Cincinnati) to evaluate noise exposures and potential hearing loss among kennel workers at SPCA-Cincinnati. Between September and October 2006, noise assessments and hearing tests were conducted on SPCA-Cincinnati employees.

What NIOSH Did

- We measured personal noise exposures for kennel workers.
- We tested hearing levels of kennel workers, maintenance workers, animal rescue workers, office workers, and veterinary staff.

What NIOSH Found

- Noise levels exceeded the NIOSH recommended exposure limit on seventeen occasions and exceeded the Occupational Safety and Health Administration limit on four occasions.
- Nine of 19 employees including five kennel workers showed hearing loss.

What SPCA-Cincinnati Managers Can Do

- Enroll employees in a hearing loss prevention program.
- Require the use of ear plugs or ear muffs in the kennel area.
- Maintain ear muffs by making sure they are clean and replacing the cushions every 6 months or sooner if necessary.
- Post signs to show areas with loud noise, and have hearing protectors available to employees entering these areas.
- Cover the floors and ceilings with sound absorbing materials that are easy to clean and disinfect.

What SPCA-Cincinnati Employees Can Do

- Wear hearing protectors when working in the kennel areas.



What To Do For More Information:
We encourage you to read the full report. If you would like a copy, either ask your health and safety representative to make you a copy or call 1-513-841-4252 and ask for HETA Report #2006-0222-3037



Health Hazard Evaluation Report 2006-0222-3037 Society for the Prevention of Cruelty to Animals Cincinnati, Ohio February 2007

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SUMMARY

On April 25, 2006, the National Institute for Occupational Safety and Health (NIOSH) received a request for a health hazard evaluation (HHE) from the Society for the Prevention of Cruelty to Animals-Cincinnati (SPCA-Cincinnati) in Hamilton County, Ohio. The HHE request asked NIOSH to assess the noise levels experienced by kennel workers from barking dogs. On September 28 and 29, 2006, NIOSH investigators measured noise exposure levels for kennel workers. On October 11 and 16, 2006, NIOSH investigators returned to the facility to conduct hearing tests on employees working in the kennel area. Other employees including maintenance workers, veterinary technicians, animal rescue workers, and front-office personnel who frequent the kennel area were also invited to take a hearing test.

Twelve employees contributed 19 personal noise measures over the 2-day survey. Seventeen of the 19 personal noise measures exceeded the daily allowable dose of 100% as calculated by the NIOSH recommended exposure limit criterion. In addition, 11 measures also exceeded the Occupational Safety and Health Administration (OSHA) action level and four measures exceeded the OSHA permissible exposure limit. Nine workers showed some degree of hearing loss (> 25 decibel hearing loss) at one or more test frequencies in one or both ears on the NIOSH-administered audiogram. Five workers with normal hearing showed notches (hearing levels worsen over test frequencies before improving in the highest frequencies, forming a “notch” configuration) in one or both ears at 4000 and 6000 Hertz perhaps indicating early signs of hearing loss. There were 21 notches in one or both ears of the 19 employees.

Kennel workers at SPCA-Cincinnati are exposed to excessive noise levels. Some kennel workers and others who frequent the kennel area have some hearing loss but it is not possible to determine whether this is related to noise exposures in the kennel. Recommendations are provided to reduce noise exposures and prevent further hearing loss. These recommendations include establishing a hearing loss prevention program, installing sound-absorbing materials in kennels, and wearing hearing protection devices when entering the kennel area.

Keywords: NAICS 813312 (Environment, Conservation and Wildlife Organizations), noise, dose, hearing loss, dog, notch, audiometric testing

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INTRODUCTION

On April 25, 2006, the National Institute for Occupational Safety and Health (NIOSH) received a management request for a health hazard evaluation (HHE) from the Society for the Prevention of Cruelty to Animals-Cincinnati (SPCA-Cincinnati) in Hamilton County, Ohio. The HHE request asked NIOSH to assess employee exposure to noise from barking dogs. An informal meeting was held between the principal NIOSH investigator, management, and an employee representative to explain the HHE process and to discuss the logistics of the evaluation. On September 28 and 29, 2006, NIOSH investigators measured noise exposure levels for kennel workers. On October 11 and 16, 2006, NIOSH investigators returned to the facility to conduct hearing tests for employees working in the kennel area. Employees who frequent the kennel area were also invited to take a hearing test.

BACKGROUND

Noise Exposures to Domestic Animal Handlers

Veterinary hospital workers, animal shelter employees, workers at facilities that board animals, and police officers with canine partners are potentially exposed to excessive occupational noise levels from barking dogs. However, few studies have examined noise exposures and the potential for hearing loss among these workers. One study measured noise levels as high as 108 decibels on an A-weighted scale (dBA) in veterinary establishments.¹ Another study in an outdoor animal shelter showed noise exposures in excess of the NIOSH recommended exposure limit (REL) for occupational noise.² This evaluation was conducted in the aftermath of Hurricane Katrina in St. Bernard Parish, Louisiana, and is not representative of typical veterinary staff noise exposure. Two studies examined noise exposures and hearing loss among canine police officers.^{3,4} Both studies found that police officers were exposed to excessive noise from

canines, and some officers had hearing loss. The design of these studies did not enable investigators to determine whether observed hearing loss was associated with occupational noise exposures.

SPCA-Cincinnati

The Cincinnati branch of the SPCA was formed in 1873 as a nonprofit organization dedicated to the welfare of animals in Hamilton County, Ohio. SPCA-Cincinnati finds homes for cats and dogs, rescues animals, provides veterinary services, and spays and neuters animals. The occupancy levels at the facility are usually at capacity.

Animals brought into SPCA-Cincinnati are processed in the intake area. Once processed, most animals are taken to the veterinary clinic for observation. Subsequently the animals are taken to the kennel area. The main kennels for dogs are adjacent to the intake area. There are three “runs” (or aisles); each run has approximately 40 cages evenly divided on each side of the run. Dogs that are put up for adoption are kept in Run 1. Usually, there is only one dog in each cage. Stray dogs are kept in Run 2. There may be up to five dogs per cage in Run 2. Aggressive dogs and dogs that are evidence in court proceedings are quarantined in Run 3. Across from the kennels are rooms that house puppies, kittens, and cats. In a separate wing of the facility called the auditorium is another kennel for dog adoptions. There are 40 cages in this area. Adjacent to the dog kennels is a veterinary clinic that is isolated from the auditorium. The clinic also has animal cages where sick animals are kept for observation. The veterinary clinic is staffed by a veterinarian and veterinary technicians. They are assisted by kennel staff who help restrain animals, clean animal cages, transport animals to the clinic and return them to the cages, and perform routine housekeeping duties.

Kennel workers are responsible for keeping the kennels clean at all times, feeding the animals, cleaning bathrooms, and taking animals to the front office for adoptions. Every morning, the kennel manager provides a list outlining the duty

stations and tasks to be completed by each employee. Approximately 10 employees work in the kennel area every day. They start work between 7:00 a.m. and 9:30 a.m., and leave work between 4:30 p.m. and closing (around 7:00 p.m.). They are given an hour for lunch; however most employees work through their lunch break. One employee comes in at 1:00 p.m. and stays until closing. This employee gets a 15-minute break at around 4:30 p.m. A veterinary technician, office workers, animal rescue officers, and a maintenance worker frequent the kennel as part of their daily tasks.

METHODS

Noise Assessment

On September 28–29, 2006, 12 kennel workers contributed 19 full-shift, personal noise measures. Quest® Technologies (Oconomowoc, Wisconsin) Model Q-300 Noise Dosimeters were worn by the kennel workers while they performed their daily activities. The noise dosimeters were attached to the wearer's belt and a small remote microphone was fastened to the wearer's shirt at a point midway between the ear and the outside of the shoulder. A windscreen provided by the dosimeter manufacturer was placed over the microphone during recordings. At the end of the workday, the dosimeter was removed and paused to stop data collection. The information stored in the dosimeters was downloaded to a personal computer for interpretation with QuestSuite for Windows® computer software. The dosimeters were calibrated before and after the measurement periods according to the manufacturer's instructions.

Hearing Loss Assessment

All SPCA-Cincinnati kennel workers were eligible for the hearing tests. Workers reported to a NIOSH mobile test facility prior to starting their work shift. Informed consent was obtained from each participant before they completed a short questionnaire about work history and self assessment of their hearing ability.

A Tremetrics (Eden Prairie, Minnesota) Model AR 901 Hearing Booth and OSCAR 7 Electro-Acoustic Ear and Octave Monitor (Eden Prairie, Minnesota) provided an appropriate acoustic environment for testing. The booth was located inside the mobile test facility. The area was controlled for conversations and other extraneous noises during the tests. Hearing tests were collected with a Tremetrics Model HT Wizard Audiometer that had received a routine calibration check within the past year. Hearing tests were conducted by one of the investigators who has current certification from the Council for Accreditation in Occupational Hearing Conservation (CAOHC). The audiometer tested the pure-tone frequencies of 500, 1000, 2000, 3000, 4000, 6000, and 8000 Hertz (Hz) in the computerized mode in each ear, left ear first.

Test results for each participant were interpreted immediately after testing and explained to the participant. In addition, each participant was sent a letter summarizing his or her results along with a copy of the audiometric test results.

EVALUATION CRITERIA

The primary sources of evaluation criteria for noise in the workplace are: (1) the NIOSH RELs,⁵ and (2) the U.S. Department of Labor, Occupational Safety and Health Administration (OSHA) permissible exposure limit (PEL).⁶ Employers are encouraged to follow the more protective NIOSH REL, although they are required to adhere to the OSHA PEL for compliance purposes.

Noise-induced hearing loss (NIHL) is an irreversible, sensorineural condition that progresses with exposure. Although hearing ability declines with age (presbycusis) in all populations, exposure to noise produces hearing loss greater than that resulting from the natural aging process. This noise-induced loss is caused by damage to nerve cells of the inner ear (cochlea) and, unlike some conductive hearing disorders, cannot be treated medically.⁷ While 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, NIHL is insidious. Typically, it begins to develop at 4000 or 6000 Hz (the hearing range is 20 Hz to 20000 Hz) and spreads to lower and higher frequencies. Often, material impairment has occurred before the condition is clearly recognized. Such impairment is usually severe enough to permanently affect a person's ability to hear and understand speech under everyday conditions. 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.⁸

The dBA is the preferred unit for measuring sound levels to assess worker noise exposures. The dBA scale is weighted to approximate the sensory response of the human ear to sound frequencies near the threshold of hearing. The decibel unit is dimensionless, and represents the logarithmic relationship of the measured sound pressure level to an arbitrary reference sound pressure (20 micropascals, the normal threshold of human hearing at a frequency of 1000 Hz). Decibel units are used because of the very large range of sound pressure levels which are audible to the human ear. Because the dBA scale is logarithmic, increases of 3 dBA, 10 dBA, and 20 dBA represent a doubling, tenfold increase, and hundred-fold increase of sound energy, respectively. It should be noted that noise exposures expressed in decibels cannot be averaged by taking the simple arithmetic mean.

The OSHA standard for occupational exposure to noise (29 CFR 1910.95)⁶ specifies a maximum PEL of 90 dBA for a duration of 8 hours per day. The regulation, in calculating the PEL, uses a 5 dB time/intensity trading relationship, or exchange rate. This means that a person may be exposed to noise levels of 95 dBA for no more than 4 hours, to 100 dBA for 2 hours, etc. Conversely, up to 16 hours exposure to 85 dBA is allowed by this exchange rate. The duration and sound level intensities can be combined in order to calculate a worker's daily noise dose according to the formula:

$$\text{Dose} = 100 \times (C_1/T_1 + C_2/T_2 + \dots + C_n/T_n)$$

where C_n indicates the total time of exposure at a specific noise level and T_n indicates the reference duration for that level as given in Table G-16a of the OSHA noise regulation. During any 24-hour period, a worker is allowed up to 100% of his daily noise dose. Doses greater than 100% exceed the OSHA PEL.

The OSHA regulation has an additional action level (AL) of 85 dBA; an employer shall administer a continuing, effective hearing conservation program when the 8-hour time-weighted average (TWA) value exceeds the AL. The program must include monitoring, employee notification, observation, audiometric testing, hearing protection devices (HPDs), training, and record keeping. All of these requirements are included in 29 CFR 1910.95, paragraphs (c) through (o). Finally, the OSHA noise standard states that when workers are exposed to noise levels in excess of the OSHA PEL of 90 dBA, feasible engineering or administrative controls shall be implemented to reduce the workers' exposure levels.

NIOSH, in its Criteria for a Recommended Standard,⁹ proposes exposure criteria of 85 dBA as a TWA for 8 hours, 5 dB less than the OSHA standard. The criteria also use a more conservative 3 dB time/intensity trading relationship in calculating exposure limits. Thus, a worker can be exposed to 85 dBA for 8 hours, but to no more than 88 dBA for 4 hours or 91 dBA for 2 hours. The NIOSH REL for a 12-hour exposure is 83 dBA or less.

Audiometric evaluations of workers are conducted in quiet locations, preferably in a sound-attenuating chamber, by presenting pure tones of varying frequencies at threshold levels (i.e., the level of a sound that the person can just barely hear). Audiograms are displayed and stored as tables or charts of the hearing levels (HL) at specified test frequencies.¹⁰ Zero dB HL represents the hearing level of an average, young, normal hearing individual. In OSHA-mandated hearing conservation programs, thresholds must be measured for pure-tone signals at the test frequencies of 500, 1000, 2000, 3000, 4000, and 6000 Hz. Individual

employee's annual audiograms are compared to their own baseline audiogram to determine the amount of standard threshold shift (STS) that occurred between the two tests. Specifically, OSHA states that an STS has occurred if the average threshold values at 2000, 3000, and 4000 Hz have increased by 10 dB or more in either ear when comparing the annual audiogram to the baseline audiogram.⁶ The NIOSH recommended threshold shift criterion is a 15-dB shift at any frequency in either ear from 500–6000 Hz measured twice in succession.⁹ Practically, the criterion is met by immediately retesting an employee who exhibits a 15-dB shift from baseline on an annual test. If the 15-dB shift persists on the second test, a confirmatory follow-up test should be given within 30 days of the initial annual examination. Both of these threshold shift criteria require at least two audiometric tests. In cases where only one audiogram is available, a criterion has been proposed for single-frequency impairment determinations.¹¹ It employs a lower fence (the amount of hearing loss necessary before a hearing handicap is said to exist) of 25 dB HL. With this criterion, any person who has a hearing level of 26 dB HL or greater at any single frequency is classified as having some degree of hearing loss. The degree of loss can range from mild (26–40 dB HL) to profound (>90 dB HL).

The audiogram profile is a plot of the hearing test frequencies (x-axis) versus the hearing threshold levels (y-axis). Hearing threshold levels are plotted in reverse (the highest hearing level up to 0 or -10 dB). For many workers, the audiogram profile tends to slope downward toward the high frequencies with an improvement at the audiogram's highest frequencies, forming a "notch."¹² A notch in an individual with normal hearing may indicate the early onset of hearing loss. Although there is no universal criterion to define what constitutes a "notch," several mathematical models that attempt to identify notches are presented in the scientific literature.^{13,14,15} The relative strength and weaknesses of these models have also been reviewed.¹⁶ For this evaluation, a notch is defined as the frequency where the hearing level

is preceded by an improvement of at least 10 dB at the previous test frequency and followed by an improvement of at least 5 dB at the next. The notch from occupational noise exposures can occur between 3000 and 6000 Hz, depending on the frequency spectrum of the noise, and the anatomy of the individual's ear.^{17,18} It is generally accepted that a notch at 4000 Hz is indicative of occupational hearing loss.¹⁹ Some researchers have argued that the notch at 6000 Hz may not be a good marker for occupational hearing loss because it is widely seen in young adults and others with little documented occupational noise exposure.²⁰ An individual may have notches at different frequencies in one or both ears.¹²

RESULTS AND DISCUSSION

Twelve kennel workers contributed 19 personal noise measures over 2 days. Seventeen of these measures exceeded the NIOSH REL. Eleven also exceeded the OSHA AL, and four exceeded the OSHA PEL. The full-shift TWA values for comparison with the NIOSH REL ranged from 81.7 dBA to 96.1 dBA. The highest TWA values for the OSHA criteria were 93 dBA. One of the two employees whose personal noise exposure did not exceed the REL only worked for a half-day on the day of the evaluation. The other employee worked primarily at the veterinary clinic. Table 1 summarizes these results. The highest full-shift dose exceeded 1300% (96.1 dBA) as calculated by the NIOSH method. This means that this employee exceeded his daily allowable dose by a factor of 13. The NIOSH investigators communicated the findings after the first day's measurements to the employees and encouraged them to wear hearing protectors, which were available from the employer. One employee wore ear plugs on the second day of the survey; others said ear plugs were too cumbersome. One of the SPCA managers mentioned that OSHA had performed a noise survey at the facility a few years ago and stipulated that employees who work in Run 3 (aggressive and court evidence animals) should wear hearing protectors. OSHA did not

recommend the use of hearing protectors for employees in other parts of the kennel.

The jobs with the lowest noise exposure levels were done by employees assisting the veterinary staff and processing animals dropped off at the shelter.

Hearing tests were given to 19 SPCA-Cincinnati employees. These included 15 kennel workers and four employees who often frequented the kennels (a maintenance worker, a veterinary technician, an office worker, and an animal rescue officer). The mean age of the 19 employees was 32.9 years (range = 19–54). The mean age of the kennel workers was 28 years. The median hearing levels and inter-quartile ranges for these employees are shown in Figure 1. The data showed considerable variability among individuals (as measured by the interquartile range). Nine of the 19 workers showed hearing levels at one or more frequencies that exceeded 25 dB HL, indicating hearing loss. Five of the nine were kennel workers. Five workers with normal hearing showed notches (hearing levels worsen over test frequencies before improving in the highest frequencies, forming a “notch” configuration) in one or both ears at 4000 and 6000 Hz perhaps indicating early signs of hearing loss. There were 21 notches in one or both ears of the 19 employees. Table 2 shows the relationship between hearing test results and notch formation.

Noise control strategies in dog kennels are complicated. Sound-absorbing materials such as spray-on foam and fibrous mineral wool, which are usually used in industry and other indoor settings to reduce noise exposures, are not appropriate in kennels because they are difficult to clean while maintaining dryness in order to avoid mold and mildew. One approach may be to use sound-absorbing material on surfaces that do not need to be cleaned routinely, such as ceilings. Acoustical ceiling tiles that are waterproof and washable can be installed to reduce noise.²¹ In addition, floors can be covered with rubber mats to absorb sound from the barking dogs and to reduce noise from feeding

and drinking dishes hitting on hard (concrete and tile) surfaces. These approaches may offer some reduction in noise levels. Such approaches, however, does not eliminate the direct noise path from the dog to the worker. A noise survey should be conducted after these controls are in place to determine if personal noise exposures to workers are reduced. If there are plans for building a new facility or expanding the current facility, an acoustical engineer can assist in designing dog confinement areas that may reduce noise exposures.

A possible administrative noise control strategy would be to train all kennel workers to assist at the veterinary clinic and the intake area, and rotate them on a daily basis. This strategy alone may not be adequate to reduce exposures below the REL, but could be done in conjunction with the use of hearing protectors. Hearing protectors, if worn properly all of the time, offer adequate protection. However, as far as possible, the preferred ways of controlling for noise is engineering, followed by administrative, and lastly through the use of hearing protectors.

A noise survey should be conducted after any controls are in place to determine if personal noise exposures to workers are reduced. If there are plans for building a new facility or expanding the current facility, an acoustical engineer can assist in designing dog confinement areas that may reduce noise exposures.

CONCLUSIONS

This evaluation showed that kennel workers with the SPCA-Cincinnati are exposed to hazardous noise levels. Some kennel and non-kennel workers who participated in this evaluation showed hearing loss. However, because of the small sample size, inability to control for other sources of noise, and the relative youth of the workers with respect to time needed to develop hearing loss, it is not possible to determine whether the observed hearing loss is related to noise exposure at the kennel.

RECOMMENDATIONS

Based on the observations and findings of this evaluation, the following recommendations are offered to better protect the hearing of workers at SPCA-Cincinnati.

1. Establish a hearing loss prevention program for the kennel workers. The basic elements of the program should, at a minimum, meet the requirements for a hearing conservation program as outlined in the OSHA hearing conservation amendment (29 CFR 1910.95).⁶ Other sources for defining effective hearing conservation programs are also available.^{12,22,23}
2. Wear hearing protection devices (ear muffs or ear plugs) when working in the kennel areas. Employees should be trained on the proper fit, selection, and maintenance of hearing protectors. For example, ear plugs should be deeply inserted into ear canals, and cushions on ear muffs should not be cracked or creased, and the head bands not sprung.
3. Place warning signs that identify loud noise areas on doors and require employees entering these areas to wear hearing protectors.
4. Consider using sound-absorbing materials that are easy to keep clean and dry on ceilings and floors of kennel areas.
5. Consult an acoustical engineer when considering any future design changes to the facilities to determine whether noise exposures can be reduced.

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TABLES

Table 1
Full-Shift Personal Dosimetry Results
for 12 SPCA-Cincinnati Kennel Workers

Sample Duration (hh:min)	Noise Levels (Percent Dose)		
	OSHA AL	OSHA PEL	NIOSH REL
8:29	110.7	98.5	973.1
11:24	34.3	28.5	300.1
9:28	120.3	100.1	1060.6
10:32	163.3	145.8	1338.2
9:52	86.5	79.5	607.9
10:16	65.0	49.6	600.9
9:23	15.1	11.9	94.1
9:20	51.7	33.4	321.7
3:47	11.6	5.9	47.2
5:57	31.4	22.4	213.2
8:58	78.0	66.1	528.1
9:30	136.3	121.3	1173.8
6:55	27.0	16.7	136.5
9:46	104.2	89.3	985.7
9:10	162.5	157.8	1300.8
9:24	26.4	21.0	174.6
9:09	96.1	82.9	854.5
8:31	17.8	13.3	146.7
5:38	25.9	18.1	179.1

The various dose percentages are the amounts of noise accumulated during a work day, with 100% representing the maximum allowable daily dose.

SPCA: Society for the Prevention of Cruelty to Animals

OSHA: Occupational Safety and Health Administration

NIOSH: National Institute for Occupational Safety and Health

AL: Action Level

PEL: Permissible Exposure Limit

REL: Recommended Exposure Limit

Table 2
 Relationship between Hearing Loss (> 25 decibels) and Notch Formation
 for SPCA-Cincinnati Kennel and Non-Kennel Workers

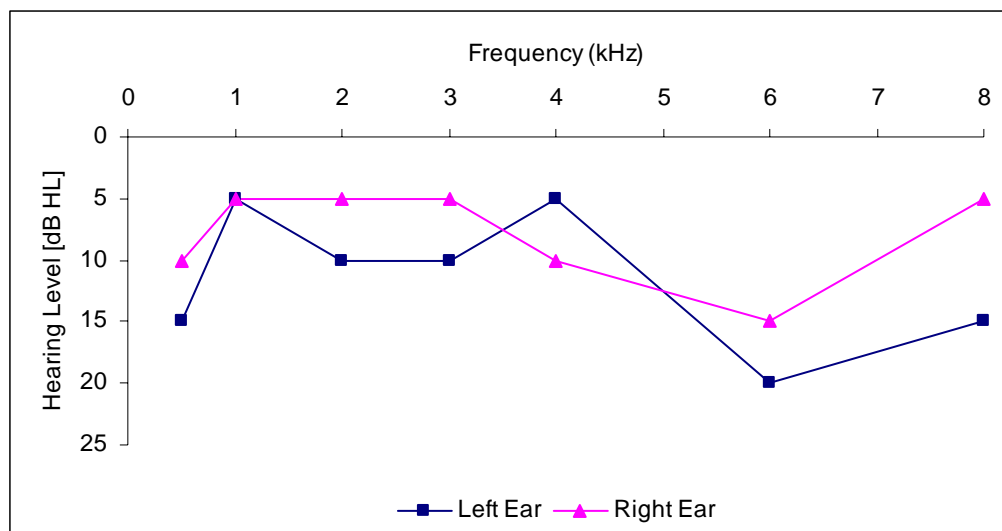
Employee ID	Hearing Loss		Notch (Hertz)	
	Left Ear	Right Ear	Left Ear	Right Ear
A	No	No	4000	4000
B	Mild to Moderate	Mild to Moderate	3000–4000*	6000
C	No	No	No	No
D	No	Mild	No	6000
E	No	No	No	No
F	No	No	No	No
G	No	No	3000, 4000	No
H	Mild hearing loss	Mild to Moderate	6000	6000
I	No	No	6000	6000
J	No	No	No	6000
K	No	No	No	No
L	Moderate hearing loss	Mild	3000, 6000	4000, 6000
M	Moderate hearing loss	Mild to Moderate	3000	6000
N	No	No	No	No
O	Mild to Moderate	Mild to Moderate	6000	No
P	Mild to Moderate	None	No	No
Q	No	Mild	6000	6000
R	No	No	No	No
S	Mild to Moderate	Mild	No	No

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*Hearing levels formed a plateau at 3000 and 4000 Hertz before improving at 6000 Hertz

FIGURE

Figure 1
 Median Hearing Levels and Inter-Quartile Ranges
 for 19 SPCA-Cincinnati Kennel and Non-Kennel Workers

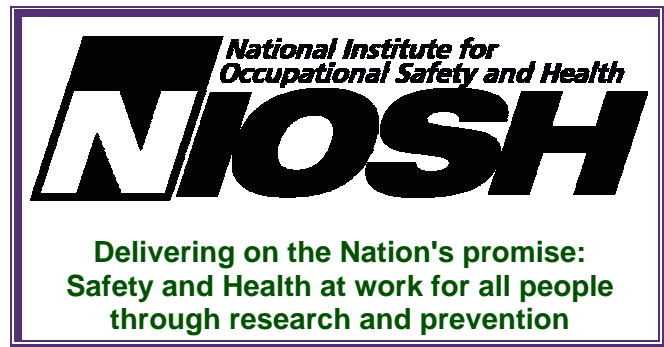


Frequency (kHz)	Left Ear		Right Ear	
	25 th percentile	75 th percentile	25 th percentile	75 th percentile
0.5	10	18	10	15
1	5	10	5	8
2	5	10	3	15
3	0	20	5	15
4	0	23	3	23
6	5	28	0	33
8	3	35	-5	23

SPCA: Society for the Prevention of Cruelty to Animals

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