2007

Annual Report on Work-Related Noise-Induced Hearing Loss in Michigan

2007 Annual Report on Work-Related Noise-Induced Hearing Loss in Michigan

A Joint Report
of the
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Summary:

This is the fourteenth annual report on work-related noise-induced hearing loss (NIHL) in Michigan. Over 950 new people with hearing loss known or suspected to be caused by noise at work were reported in 2007 to the Michigan Department of Energy Labor and Economic Growth (MDELEG). Fifty-two percent of the audiograms of the individuals reported with hearing loss had sufficient loss to meet the Occupational Safety and Health Administrative (OSHA) criteria of material hearing loss that significantly affects the ability to understand speech. Fifty-four percent were bothered by tinnitus (ringing, roaring, or buzzing in their ears). Narratives and audiogram on four of the individuals reported are in Appendix I.

Work-related noise-induced hearing loss is affecting mainly men, with an onset at 35-60 years of age. Exposure to noise occurs in many industries but particularly in manufacturing, construction and farming.

Fifty of the 133 (37.59%) companies inspected as part of the surveillance system had no hearing conservation program or a deficient program despite the presence of noise levels above the legal limit (Table 15).

There were 929 health workplace inspections that were conducted by the Michigan Occupational Safety and Health Administration (MIOSHA) in calendar year 2007. Although these inspections were not initiated because of the noise-induced hearing loss surveillance system, 75 of the 929 companies were in violation of some portion of the noise standard. Fifty-eight of these 75 companies were cited for having the complete absence of a hearing conservation program. It is important to recognize that the majority of the 929 inspections were in response to a specific complaint or referral. Consequently, the scope of these inspections was primarily limited to the complaint or referral item and noise exposure would not have systemically been addressed unless it was observed to be a serious issue during the course of the inspection.

Noise-induced hearing loss is an insidious condition that may take years to develop to a stage where it affects an individual's ability to communicate at home and in the work place. The frequency of hearing loss increases with the duration of exposure to noise (Figure 8).

The current national system to assess the number of individuals who are developing work-related noise-induced hearing loss has been criticized by the National Academy of Sciences Committee (Board Health Sciences, 2006). Although Michigan is the only state that conducts surveillance for work-related noise-induced hearing loss, Michigan like other states lacks a comprehensive plan to address hearing loss among adults and meet 2010 Health People objectives to reduce hearing loss.

Approximately 1.4 million adults in Michigan have hearing loss. Work-related noise is a significant cause. The 2003 Behavioral Risk Factor Surveillance Survey estimated that 420,000 of the 1.4 million Michigan adults with hearing loss had work-related NIHL. A comprehensive effort to address the burden of this condition in Michigan from both work and non work-related causes is needed.

Background:

Facilities covered by the general industry noise standard (Part 380 Noise Exposure) are required to institute comprehensive hearing conservation programs to prevent noise-induced hearing loss if the 8-hour time-weighted average noise level is at or above 85 decibels. However, the construction industry is exempted from this comprehensive standard. Project SENSOR (Sentinel Event Notification System for Occupational Risks), the Michigan Department of Energy Labor and Economic Growth's surveillance program for NIHL, provides an estimate of the burden of NIHL in the state, identifies the type of industries where people are developing NIHL and identifies individual facilities that despite legal requirements to have a hearing conservation program lack such a program.

Nationally, one million workers are estimated to have work-related hearing loss, primarily from manufacturing-related exposures to noise (Weeks et al, 1991). Based on data from the National Health Interview Survey, one would expect approximately 86,000 individuals in Michigan to have noise-induced hearing loss related to work place exposures (Ries, 1994). Data from the 2003 Behavioral Risk Factor Surveillance System (BRFSS) provided an even larger estimate; that 420,000 Michigan residents have significant work-related hearing loss.

In 1992, the Michigan Department of Energy Labor and Economic Growth (MDLEG) (formerly the Michigan Department of Consumer and Industry Services) with financial assistance from the National Institute for Occupational Safety and Health (NIOSH) initiated a special emphasis program for work-related noise-induced hearing loss (NIHL). Funding assistance from NIOSH ended in September 2000, but was restarted in 2002. Direct funding for this project once again lapsed as of June 30, 2006. The State has continued to maintain work-related NIHL as a priority condition for targeting and intervention during the lapses of federal funding.

The surveillance program is based on Michigan's Occupational Disease Reporting Law, Part 56 of P.A. 368 of 1978, which specifies that any health professional that knows or suspects a patient has a work-related illness must report it to the MDELEG within ten days (Figure 1). The goal of the special emphasis program is to prevent additional work-related hearing loss by inspecting facilities where index cases experiencing NIHL worked. The sources used to identify persons with work-related NIHL are: (1) reports from audiologists, otolaryngologists and other health care providers and (2) reports from companies or health care professionals providing services to companies. Both non-company health professionals and those working for industry send reports to the Michigan Department of Energy Labor and Economic Growth.

An individual is considered to have occupational NIHL if a health professional determines the individual: (1) has audiometric findings consistent with noise-induced hearing loss and (2) has a history of exposure to sufficient noise at work to cause hearing loss.

The MIOSHA requirement for recording a standard threshold shift (STS) had been a 10 dB or greater decrease in hearing loss in either ear at an average of 2000, 3000 and 4000 Hz. Since January 1, 2003 the criteria for reporting a STS have changed. Now not only must the individual have the 10 dB STS average at 2000, 3000 and 4000 Hz in either ear but they must also have at least a 25 dB hearing loss in either ear. For consistency we recommend the 2003 criteria be used

for reporting a STS under the Michigan Occupational Disease Reporting Law.

In some cases a hearing health professional will not have access to a baseline audiogram to compare the current audiogram for changes in hearing ability. In response to this, the State advisory committee for work-related NIHL developed guidelines for reporting hearing loss that do not require a baseline audiogram. The following minimum hearing loss parameters can then be used as a suggested guideline:

> A fixed loss (suggested definitions: a 25 dB or greater loss in either ear at an average of: 500, 1000 and 2000 Hz, or 1000, 2,000 and 3000 Hz, or 3000, 4000, and 6000 Hz; or a 15-25 dB or greater loss in either ear at an average of 3000 and 4000 Hz).

Individuals with a standard threshold shift (STS) who are reported by a company medical department or a health professional providing screening services to a company are already enrolled in their company's hearing conservation program (HCP).

Those reported with a hearing loss by a private practice audiology clinic or by an otolaryngologist not part of a company's HCP are followed up by staff working on the NIHL surveillance program to determine if the company where they are or were exposed to noise has a HCP. The reported cases are administered a medical and work history questionnaire, including details on their occupational and recreational exposures to noise.

Beginning in 2003, audiograms have been requested on all individuals reported. These audiograms are used to determine hearing ability. Individuals who have an average hearing loss equal to or greater than 25 decibels at 1000, 2000 and 3000 Hertz are classified as meeting the OSHA criteria of material hearing impairment.

After the patient has been interviewed, a referral for an industrial hygiene investigation is forwarded to the appropriate MIOSHA district if: the individual reports they were exposed to noise and were not provided regular audiometric testing and hearing protection by their employer within the last five years; the facility is under MIOSHA jurisdiction; and the facility has not been inspected within the last five years where noise issues were addressed. Follow-up is typically not performed at companies for which the law does not require the provision of a comprehensive hearing conservation program such as in construction and agriculture. An industrial hygienist conducts monitoring for noise and reviews the completeness and quality of the company's hearing conservation program, if one exists. After the investigation is completed, a report of the results and any recommendations are sent to the company and union, as well as the reporting audiologist or otolaryngologist. If the company is cited for violations of any regulations, they must post the citations at or near the location of the violations for a minimum of three days or until the items have been corrected, whichever is later.

Results:

The results in the fourteenth annual report are presented in the following order: a description of all of the occupational disease reports submitted to the MDELEG for NIHL in the year 2007, results of interviews of individuals with hearing loss identified through Project SENSOR from 2003-2007, a summary of the MIOSHA inspections conducted to follow up individuals with hearing loss, and a summary of the violations of the noise standard that were found during MIOSHA inspections performed from January 1, 2006 to December 31, 2007 that were not conducted as part of project SENSOR.

2007 Work-Related Reports for NIHL

Figure 2 shows the number of reports of hearing loss since 1985. Approximately 8.6% of all occupational disease reports submitted to the Michigan Department of Energy Labor and Economic Growth are for hearing loss. Because of increased awareness of the reporting law by employers and health care providers, there was an increase in the overall number of reports received from 1989 through 2000, and an increase in the number of non-employer based reports received, especially from 1994 through 2001. In 2007, there were 968 reports of work-related hearing loss submitted to the Michigan Department of Energy Labor and Economic Growth. Company medical departments or contractors providing audiometric screening for companies submitted 702 of the 968 reports in 2007. Non-employer based audiologists, otolaryngologists and occupational medicine physicians submitted the other 266 reports. Table 1 shows the number of individuals with hearing loss reported by the non-employer based health professionals.

Demographics of Individuals with Hearing Loss

Ninety-one percent (888/968) of the reports where gender was listed are for men. Although requested, information on race was missing for 631/968 (65%) of the reports. Of the individuals for whom race was known, 82.2% were white, 15.4% were African American, 1.2% were Hispanic and 1.2% were of other descent. These percentages were similar for reports from employer based programs as well as from non-employer based health professionals. The mean age of individuals reported is 53 years, ranging from 19 to 87 years. Individuals reported by companies were generally younger than individuals reported by non-employer based health professionals (average age 51 and 59 years, respectively). Approximately 80% of the individuals reported by employer based programs were between 30 and 59 years of age compared to 51% of non-employer based health professionals in the same age range (Figure 3). Reports by non-employer based health professionals included retired individuals. All reports from employer based programs were of current workers.

Industry

Table 2 and Figure 4 show the number of employees working at the companies where the individuals were exposed to noise. Most of the reports were of individuals who had worked at large companies employing 500 or more employees. Table 3 is a distribution of industry type of the individuals reported. Most of the reports were for individuals working in manufacturing facilities. This corresponds to companies that are more likely to have hearing conservation

programs. However, the non-employer based health professionals reported more individuals from other types of industries, including services (10.6%), transportation and communication services (8.1%), construction (10.5%), and police (1.9%) than the employer based programs. Employer based programs report individuals with NIHL as part of their hearing conservation program (HCP). In contrast, the individuals reported by non-employer based health professionals would not necessarily be working at a company with a HCP.

Individuals with Hearing Loss, Reported by Employer Based Programs and Non-Employer Based Health Professionals in 2003-2007

A total of 6,400 of 6,459 (98%) individuals reported to the surveillance system by employer based programs and non-employer based health professionals since 2003 have been interviewed and/or data abstracted from medical records and included in the database. The interviews ask about all jobs where a person was exposed to noise. The data on the following pages in the Demographics and Industry sections are from the interviewed individuals reported in 2003-2007.

Demographics of Individuals with Hearing Loss

Ninety-six percent of the interviewed individuals reported in 2003-2007 were men. Of the interviewed individuals reported in 2003-2007 where race was obtained, 82.4% were white, 14.2% were African American, 1.8% were Hispanic, 0.8% were other, and 0.3% were Asian, and 0.2% were American Indian. Race was unknown for 4,043 (62.6%) individuals. Over 81% of the individuals reported were between the ages of 40 to 70 years and includes retirees with hearing loss.

Industry

Table 4 shows all the industries where the individuals with hearing loss were ever exposed to noise. Overall, 85% of the 7,056 types of industries where the 6,461 individuals ever worked were in the manufacturing industry. The 7,056 industries identified are not unique companies; more than one patient may have worked at the same company. Therefore, the company would have been counted more than one time.

Table 5 shows the most recent industries in which the interviewed individuals were exposed to noise and whether the company provided regular hearing tests for their employees. The percentages of companies where the patient reported they did receive regular hearing testing ranged from 0% to 100% within industry types. Seventy-one percent of the most recent companies where the individuals were exposed to noise regularly tested their employees' hearing. The industries that are reported in Table 5 are not unique companies; more than one patient may have worked at the same company. Therefore, the company would have been counted more than once.

Table 6 shows whether individuals reported were provided hearing tests by the number of employees working in companies where the interviewed individuals were exposed to noise. Thirty-six percent of the workers, in companies with fewer than 100 employees, reported having

received regular hearing tests. The industries in Table 6 are not necessarily unique companies; more than one patient may have worked at the same company. Therefore, the company would have been counted more than once.

The interviewed individuals worked in noise for a variety of durations, ranging from less than five years to greater than 35 years. Over 75% were exposed to noise for 20 years or more (Figure 5).

Figure 6 shows the decade of the individuals' first exposure to noise. Some individuals were first exposed to noise many years ago; however, most individuals were first exposed to noise in the 1960's and later (91.2%).

Table 7 shows the decade when the interviewed individuals with hearing loss were most recently exposed to noise by industry. The percentage of individuals at companies with hearing tests increased over time within the industry types that have been required by OSHA (since 1972) to provide such hearing tests. Construction and agriculture industries had the lowest percentages of workers with regular hearing tests; these industries are not required by MIOSHA or OSHA to provide regular hearing tests.

Table 8 shows the decade when the interviewed individuals with hearing loss most recently worked, and whether they were provided with hearing protection (plugs or muffs) by industry type. Over time, the percentage of workers who were provided hearing protection increased in all industries. The percentage of manufacturing workers given hearing protection improved the most of any industry type, with none of the workers given hearing protection in the 1940s and 98% of workers given hearing protection in the 2000s.

Table 9 shows the decade when the interviewed individuals with hearing loss were most recently exposed to noise by company size. Companies with more than 100 employees had higher percentages of workers with regular hearing tests and had greater improvement over time than smaller companies.

Table 10 shows the provision of hearing testing and hearing protection, year began using hearing protection and work injuries by self-reports of how often the individual worked in a noisy environment. Hearing protection was generally not used until the late 1980s. Table 10 also shows self reports of injuries by how often the individual worked in a noisy environment.

Approximately, fifty-four percent of the individuals reported with hearing loss had tinnitus (ringing in the ears) (Table 11). If tinnitus was present then 59% of the time it occurred on a daily basis (Table 11). Table 12 shows the occurrence of non-occupational noise exposures. Target shooting and the use of chain saws were the only two activities where half or more of the respondents indicated they used hearing protection “always or usually.” If hearing protection was used, it was generally not used until the 1980s.

Twenty-one percent reported exposure to a chemical or heavy metal that has potential ototoxicity (Table 13). This information was only collected for jobs where there was also noise exposure.

For the 5,535 individuals for whom we were able to obtain the actual audiogram, 2,949 (52.2%) met the OSHA criteria of material hearing impairment (Figure 7). Race and industry type were very similar for those individuals with material hearing impairment and those with less severe hearing loss (Table 14). There was a significantly greater percent of men with material hearing impairment, 93.8% compared to women with 6.2%. Average age for those with material hearing impairment was 61.0 years, compared to 53.1 years for those with no material hearing impairment (Table 14). Figure 8 shows hearing loss by duration of exposure to noise at work. There is a clear exposure response with increased hearing loss at greater duration. Figure 9 shows that, on the average, hearing in the left ear is worse than the right ear. Individuals who also had exposure to chemical ototoxins were more likely to have material hearing impairment if they had been exposed to any chemical/solvent (58.7% versus 41.3%) (χ^2=.000) as well as for individual chemicals (Table 13).

Inspections

In response to the reports of hearing loss identified through the Project SENSOR Surveillance program, inspections were conducted at 133 companies where the person reported they had never received audiometric testing within the last five years. Of the 133 companies, the inspection showed that 66 (49.6%) were required to have a hearing conservation program (HCP) because they had noise levels at or above 85 dBA. Of those 66 companies, 50 (75.8%) had either no HCP or a deficient HCP. Fifty-five of the 66 companies requiring a HCP were in manufacturing, five were in services, four were in government, one was in the trade industry, and one was in agriculture. Sixty-seven of the 133 companies were not required to have a HCP because noise levels were below 85dBA. Table 15 lists the characteristics of the 133 companies inspected as part of the surveillance efforts. None were inspected in 2007.

In addition, three other companies were identified where the person reported they had never received audiometric testing; however, these three companies had been inspected for noise prior to the start of the State's follow-up efforts, between 1987 and 1992. Two of the three had noise levels above 85dBA and no HCP. The other company also had noise levels above 85dBA and a deficient HCP. All three of these companies were in manufacturing.

In the year 2007, there were industrial hygiene inspections assessing noise exposures that were conducted independently of those referred for inspections based on the patient interviews as part of Project SENSOR. In Michigan, limited scope complaint or referral MIOSHA inspections normally will include review of compliance with the noise standard if the company under investigation clearly has excessive noise levels and employees are observed not wearing hearing protection. During the 929 health inspections conducted in the year 2007, 75 facilities received a citation for a violation of the noise standard. These facilities were generally small. However, 2 (2.7%) of the facilities had more than 250 employees (Table 16). Fifty-eight (56.9%) of the companies were cited for a complete lack of a hearing conservation program despite exposures to excessive levels of noise. The other companies were cited for violations of sections of the noise standard (Table 17). The manufacture of fabricated metal products, primary metals, industrial and commercial machinery, and transportation equipment were the most common types of companies cited (Table 18).

Table 19 shows the estimates of the number of workers in Michigan industry currently working in conditions with noise levels of 85 decibels or greater.

Case Narratives

The clinical history and the most recent audiogram of four of the individuals who were reported are in Appendix I.

Discussion:

This is the fourteenth annual report of work-related noise-induced hearing loss in Michigan. There were 968 reports of hearing loss submitted to the Michigan Department of Energy Labor and Economic Growth in the year 2007. The reports submitted probably represent a substantial underestimate of the total number of individuals with work-related hearing loss. There are approximately 499 audiologists and 216 otolaryngologists in the state. Reports were received in the year 2007 from only four of the 85 estimated group practices in the state, and 13 of the 490 practitioners not known to be associated with a group practice. The number of health care practitioners reporting each year has decreased from previous years (high of 63 in 1994).

The potential number of individuals who should be reported is very likely to be much larger than the number of reports received. In Michigan, we estimate there are currently at minimum 137,158 manufacturing production workers, 19,564 construction workers, 370 oil and gas workers, 16,759 blue collar workers in wholesale and retail trade, and 8,606 workers in service industry environments exposed to daily noise levels of 85 dBA or greater (NIOSH, 1998 and Bureau of Labor Statistics, 2001) (Table 19). Based on 1994 data from the National Health Interview Survey, we would expect approximately 86,000 workers in Michigan to have occupational noise-induced hearing loss (Ries, 1994). A more recent analysis based on the 2003 BRFSS survey estimated 420,000 people in Michigan with occupational noise-induced hearing loss (SENSOR Newsletter, Fall 2004, www. oem.msu.edu). NIOSH has recently received recommendations from a National Academy of Sciences (NAS) Committee on how to improve surveillance for hearing loss. This NAS report noted the many limitations of the current National system to assess this condition (Board Health Sciences, 2006).

The reports submitted are mainly of men between the ages of 40 and 60, who work in large manufacturing companies. Follow-up of reports from employer based programs and non-employer based health professionals show that 71% of noisy companies where the individuals worked had a hearing conservation program when the individual worked there. Over time the numbers of companies that provide regular audiometric testing has increased, especially among manufacturing companies with more than 100 employees. This is not true for smaller manufacturing companies, and construction companies and the farming industry (Tables 7-9).

The Michigan Department of Energy Labor and Economic Growth has been focusing on hearing loss for 16 years now. In 1993, letters were sent to otolaryngologists, audiologists, speech and hearing clinics, occupational health nurses and mobile van units to educate these groups of health

professionals about the reporting law and the importance of reporting known or suspected work-related hearing loss. In 1995, a reminder letter was sent to the state's audiologists and otolaryngologists. Other outreach efforts include presenting mini-seminars at the Michigan Speech-Language-Hearing Association's annual conferences, exhibiting an educational booth about work-related hearing loss at various conferences including the new Michigan Academy of Audiology conference and providing information on the status of the surveillance efforts through various association newsletters. In 1998, we initiated a quarterly newsletter on occupational NIHL that is mailed to the state's approximately 950 audiologists, otolaryngologists, mobile vans and clinics. In 1998, an internet web site that contains the annual reports and newsletters was developed; it can be accessed at: www.oem.msu.edu.

In January 2000, a letter was sent to 719 Michigan hearing health professionals to provide them with a reminder about their obligation to report known or suspected occupational noise-induced hearing loss. In January 2001, a secure server was created to allow for electronic occupational disease report submission via the web site previously mentioned. In 2003, we added the ability to report the audiometric results electronically. Despite these efforts the number of hearing professionals reporting work-related noise-induced hearing loss has decreased. At the same time, the number of reports of hearing loss submitted by non-employer hearing health professionals have not shown a consistent trend, they increased until 1995, decreased in 1996, increased in 1997, decreased in 1998, increased in years 1999-2001, decreased in 2002, increased in 2003, decreased in 2004, increased in 2005 and 2006, only to decrease again in 2007. Further efforts in conjunction with the new licensing regulations for audiologists to encourage reporting are being planned.

In June 2000, MIOSHA initiated an Occupational Noise Exposure Local Emphasis Program (LEP) to comply with their Strategic Plan Goal to reduce NIHL/STS by 15%. Twenty-six categories of manufacturing industries were the focus of this initiative; these were industries known to have large numbers of noise-exposed workers. Inspections were conducted as planned program inspections (i.e. selected because they fell within the targeted industry categories) or as rollover inspections (i.e. the inspection was initiated for a reason other than noise but the facility falls within the LEP's targeted industry categories). At each inspection, the MIOSHA industrial hygienist provided the employer with informational handouts that were appropriate to the operations carried out at that facility. Just like any other MIOSHA enforcement inspection, the company was required to correct any violations of the Michigan noise standard.

The degree of hearing loss among individuals who were reported was significant. Over half met the OSHA criteria for material hearing impairment and would be expected to have difficulty hearing normal speech (Figure 7). Hearing was worse in the left ear as compared to the right (Figure 9) and was worse with increasing duration of exposure (Figure 8). Over half were bothered by tinnitus. Most individuals did not begin to use hearing protection until the late 1980s and most are still not using such protection in noisy activities outside of work. We will continue to see the adverse effects of this relatively recent initiation of the use of hearing protection. If noise cannot be engineered out of a work place or work process, then more effort is needed to ensure that individuals wear the appropriate hearing protection. This effort must cover work as well as recreational noise. Individuals must also be encouraged to use hearing protection during noisy activities outside of the work place.

Hearing loss is one of the most common medical conditions in the state. The 2003 BRFSS survey estimated there were 1.4 million adults in Michigan with hearing loss. The Nation's public health goals for 2010 include objectives to reduce hearing loss from noise (USHHA, 2000). An effort to develop strategies to increase awareness of the hazards of noise exposure in both occupational and environmental situations and the development of strategies to increase preventive actions is needed.

Ongoing and renewed outreach efforts are needed to increase the number of workers covered by hearing conservation programs, and improve the effectiveness of existing hearing conservation programs. We will continue to encourage health care practitioners to report their patients who have work-related noise-induced hearing loss.

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Figure 1.

Michigan Department of Labor and Economic Growth — Management and Technical Services Division

Known or Suspected Occupational Disease Report

(Information will be held confidential as prescribed in Act.)

EMPLOYEE AFFECTED

Name (Last, First, Middle)	Age	Sex M F	Race: ◯ White ◯ Black ◯ Hispanic ◯ Other
Street	City	State	Zip
Home Phone Number	Social Security Number		

CURRENT EMPLOYER

Current Employer Name	Worksite County		
Worksite Address	City	State	Zip
Business Phone	If Known, Indicate Business Type (products manufactured or work done)		
Number of Employees ◯ < 25 ◯ 25-100 ◯ 100-500 ◯ > 500			
Employee's Work Unit/Department	Dates of Employment From: _____ To: _____ Mo Day Year Mo Day Year		
Employee's Job Title or Description of Work			

ILLNESS INFORMATION

Nature of Illness or Health Condition (Examples: Headache, Nausea, Difficulty Breathing, Cough, etc.)		Date of Diagnosis _____ Mo Day Year
Suspected Causative Agents (Chemicals, Physical Agents, Conditions)	Did Employee Die? Yes ◯ No ◯	If Yes, Date of Death _____ Mo Day Year
If Physician, Indicate Clinical Impression for Suspected Occupational Disease, or Diagnosis of Confirmed Occupational Disease		

ADDITIONAL COMMENTS

_____

_____

REPORT SUBMITTED BY

If Report Submitted by Non-Physician, Did Employee See a Physician? *If yes, record information below.*	Yes ◯ No ◯ Don't Know ◯		
Physician's Name	Phone		
Office Address	City	State	Zip
Name of Person Submitting Report	Physician ◯ Non-Physician ◯		
Address	City	State	Zip
Signature	Phone		Date

The Michigan Department of Labor and Economic Growth is an equal opportunity, affirmative action employer, service provider and buyer.

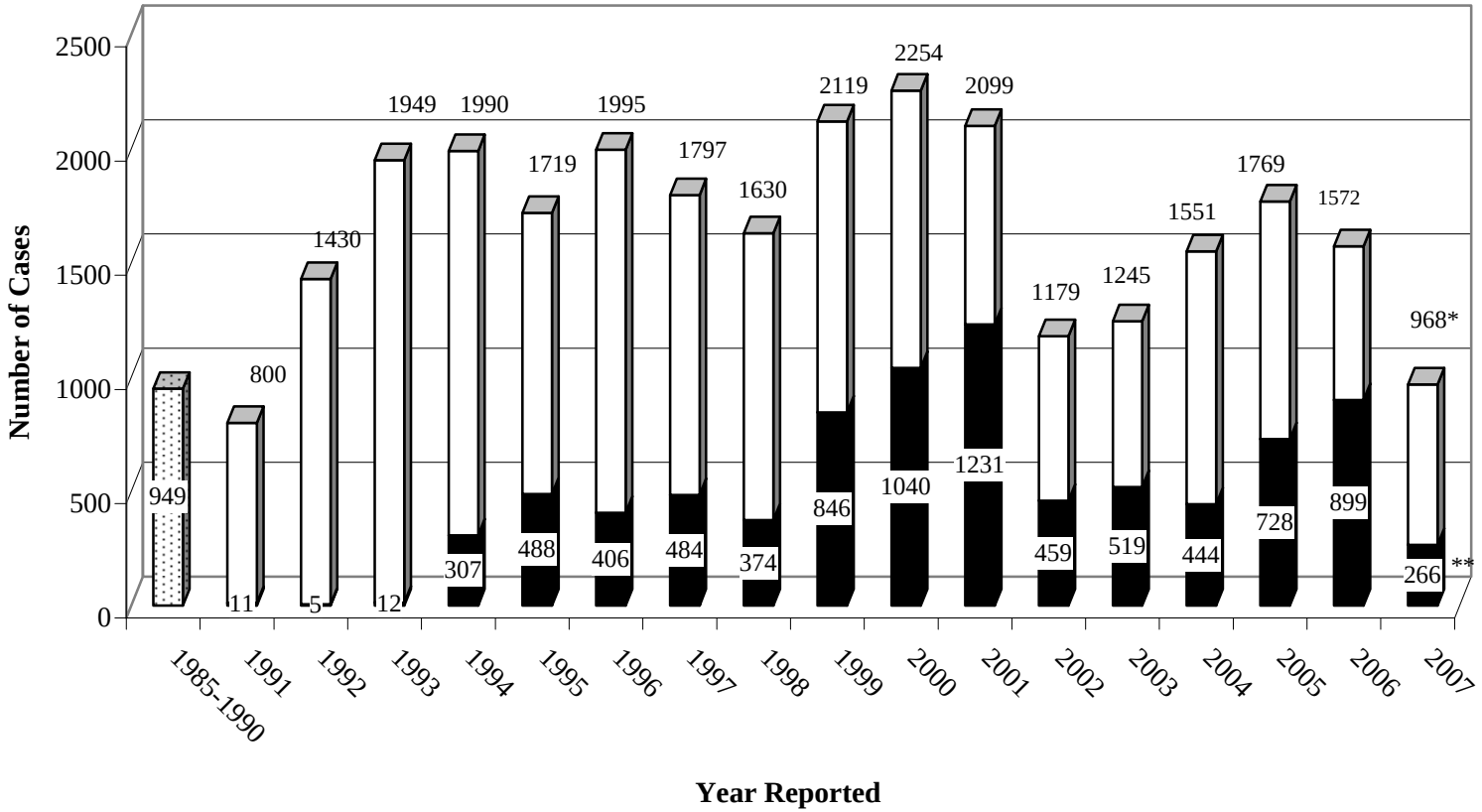
Return completed form to:

Michigan Department of Labor and Economic Growth
Michigan Occupational Safety and Health Administration
Management and Technical Services Division
7150 Harris Drive, P.O. Box 30649
Lansing, MI 48909-8149

MIOSHA-MTSD-51 (12/03)

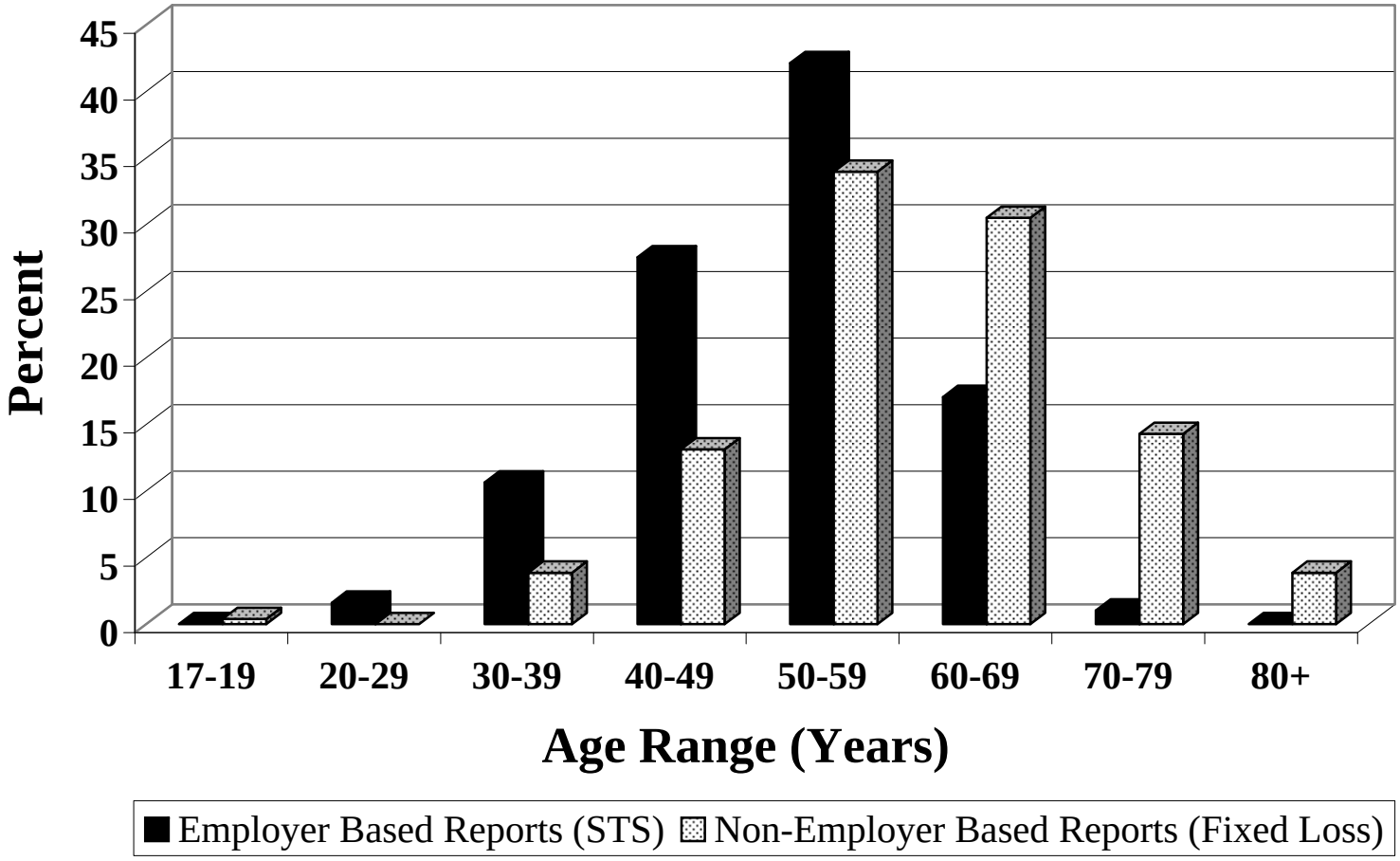
Authority: P.A. 368 of 1978
Completion: Required
Penalty: Misdemeanor

Figure 2. All Individuals with Noise-Induced Hearing Loss Reported to the Michigan Department of Energy Labor and Economic Growth: 1985 - 2007



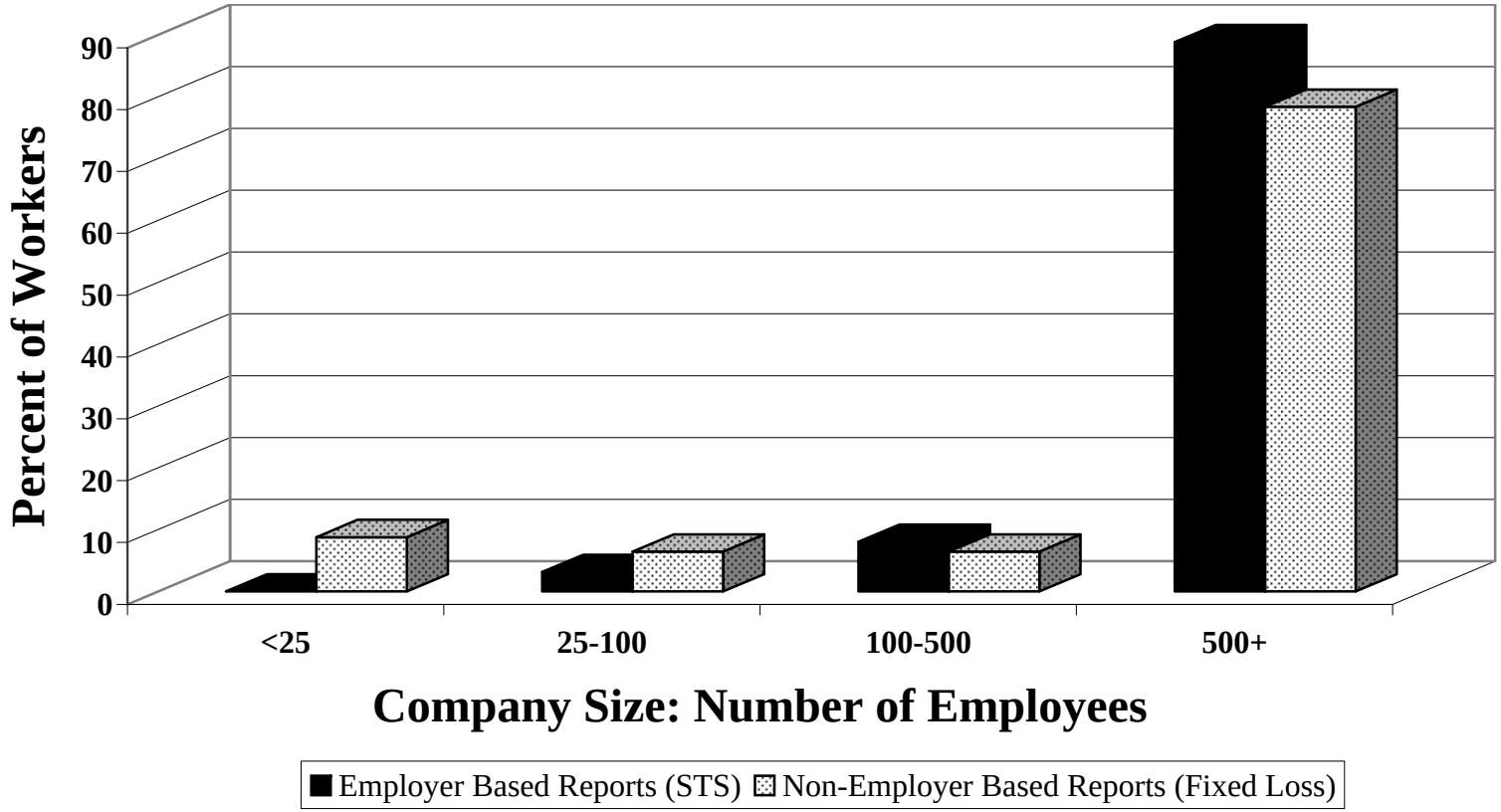
*All reports combined (Fixed Loss and STS).
**Fixed Loss Reports.

Figure 3. All Individuals Reported with Noise-Induced Hearing Loss in 2007: Age Range* by Reporting Source



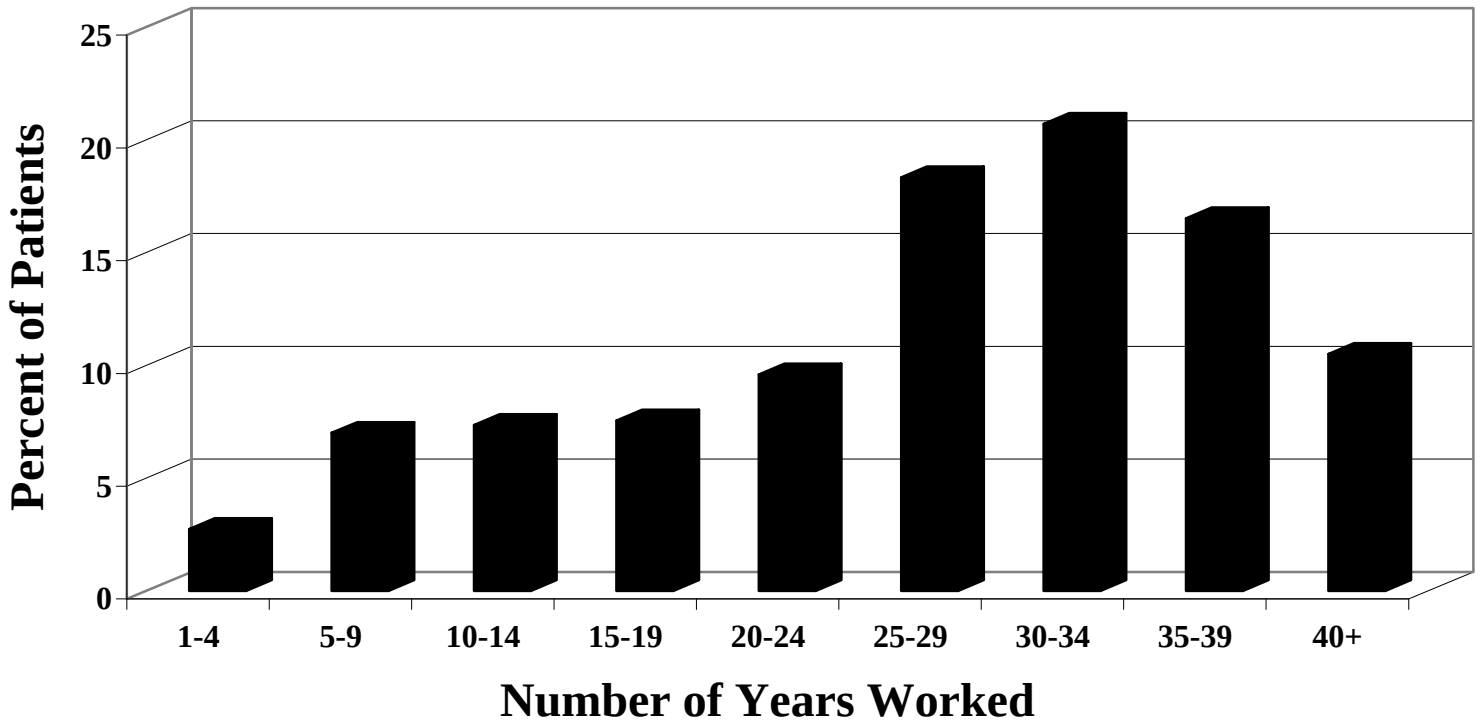
*Age was unknown for 16 individuals reported by employer based programs and 7 individuals reported by non-employer based hearing health professionals.

Figure 4. All Individuals Reported with Noise-Induced Hearing Loss in 2007: Number of Employees* at the Company Where Exposure to Noise Occurred



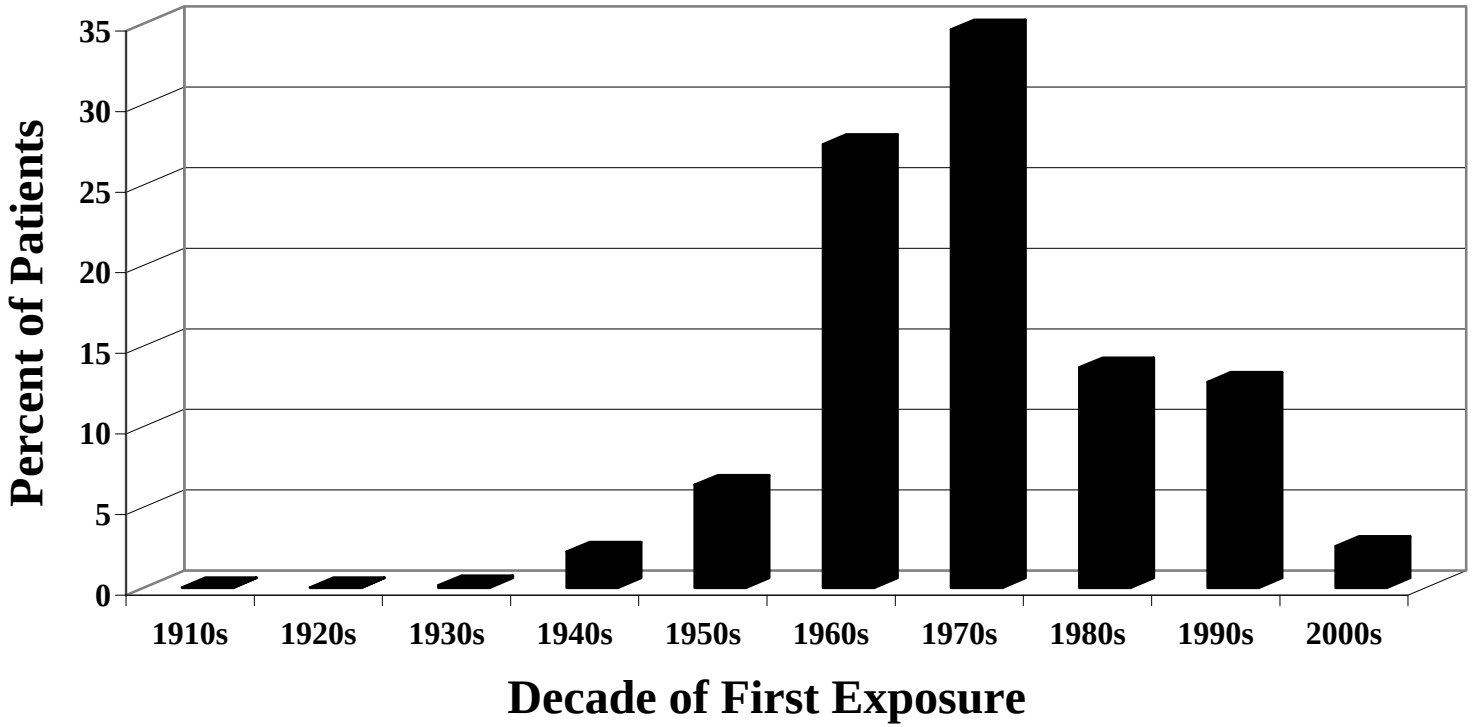
*Number of employees was unknown for 4 individual reported by employer based programs and 40 individuals reported by non-employer based hearing health professionals.

Figure 5. All Interviewed Individuals with Hearing Loss: Total Duration of Years Worked* in Noise, Michigan 2003-2007



*Duration was unknown for 1,563 individuals identified in 2003-2007.

Figure 6. All Interviewed Individuals with Hearing Loss: Distribution of Decade of First Exposure* to Noise, Michigan 2003-2007



*Decade was unknown for 1,573 individuals identified in 2003-2007.

Figure 7. Distribution of the Average of the Hearing Threshold Level (HTL) at 1000, 2000, 3000 Hz in Both Ears, for 5,535 Individuals with Audiometric Testing Results, Michigan 2003-2007

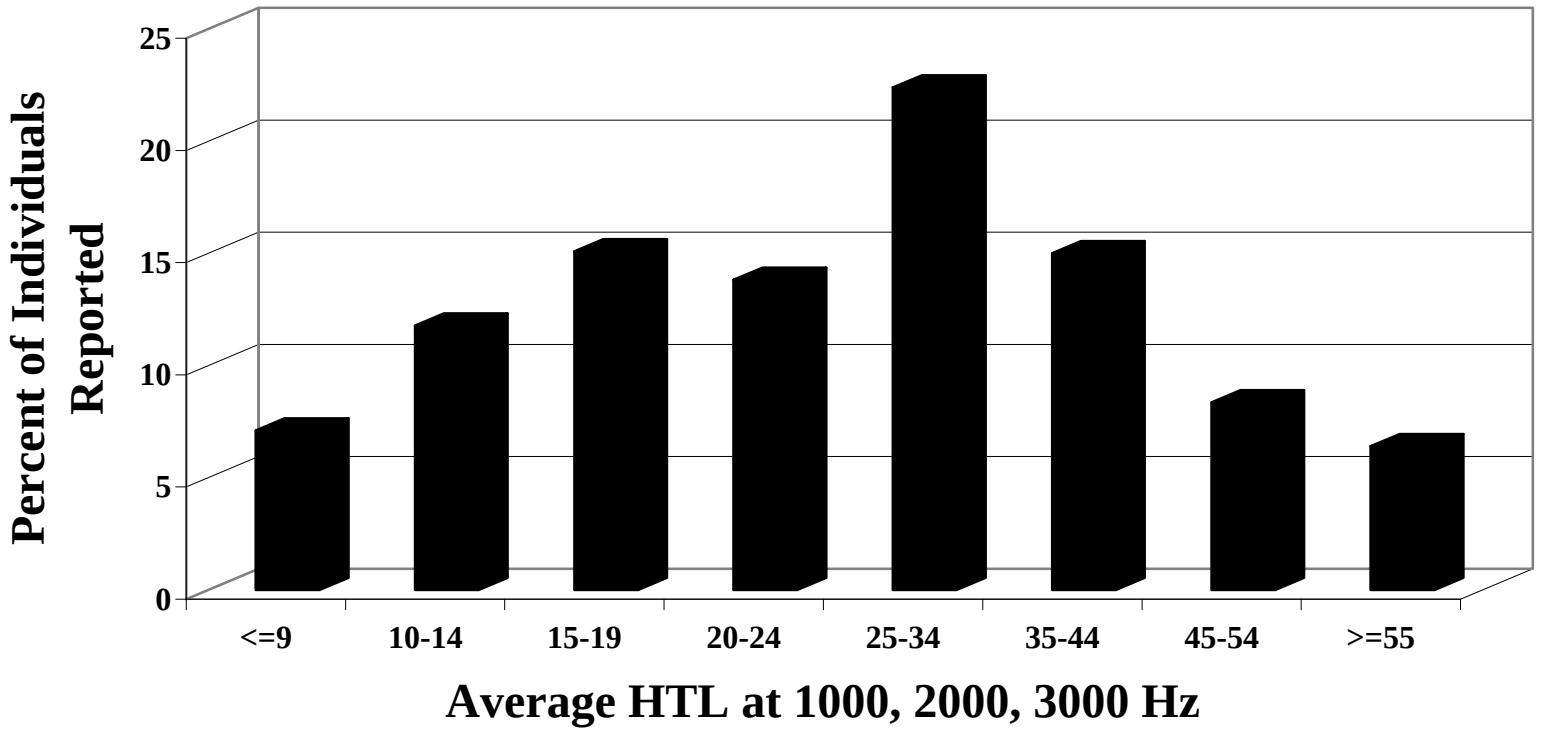


Figure 8. Average Hearing Threshold Levels at 250 to 8000 Hz by Years Worked in Noisy Environment (Worst Ear), Michigan 2003-2007

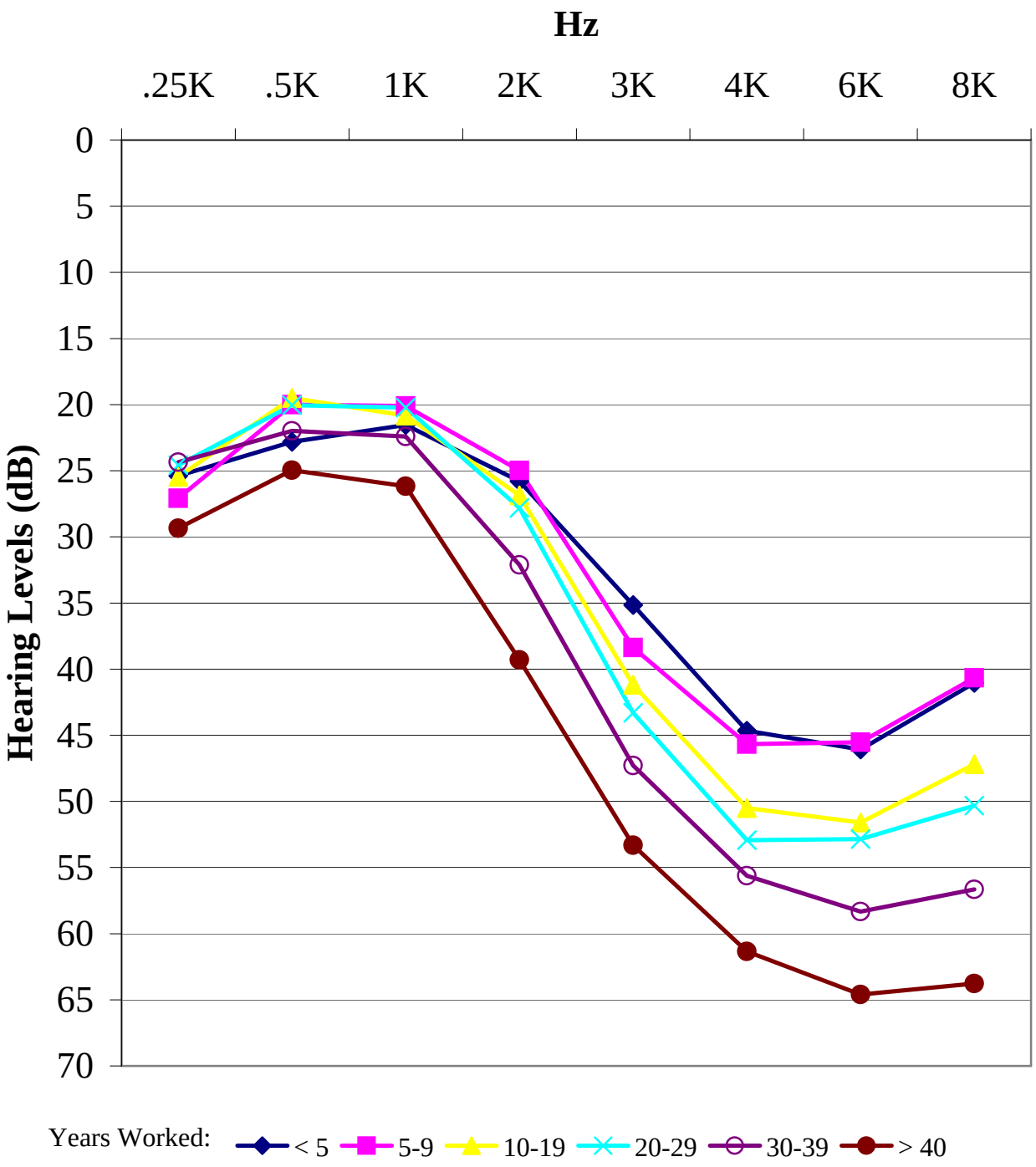


Figure 9. Average Hearing Threshold Levels at All Test Frequencies, Michigan 2003-2007

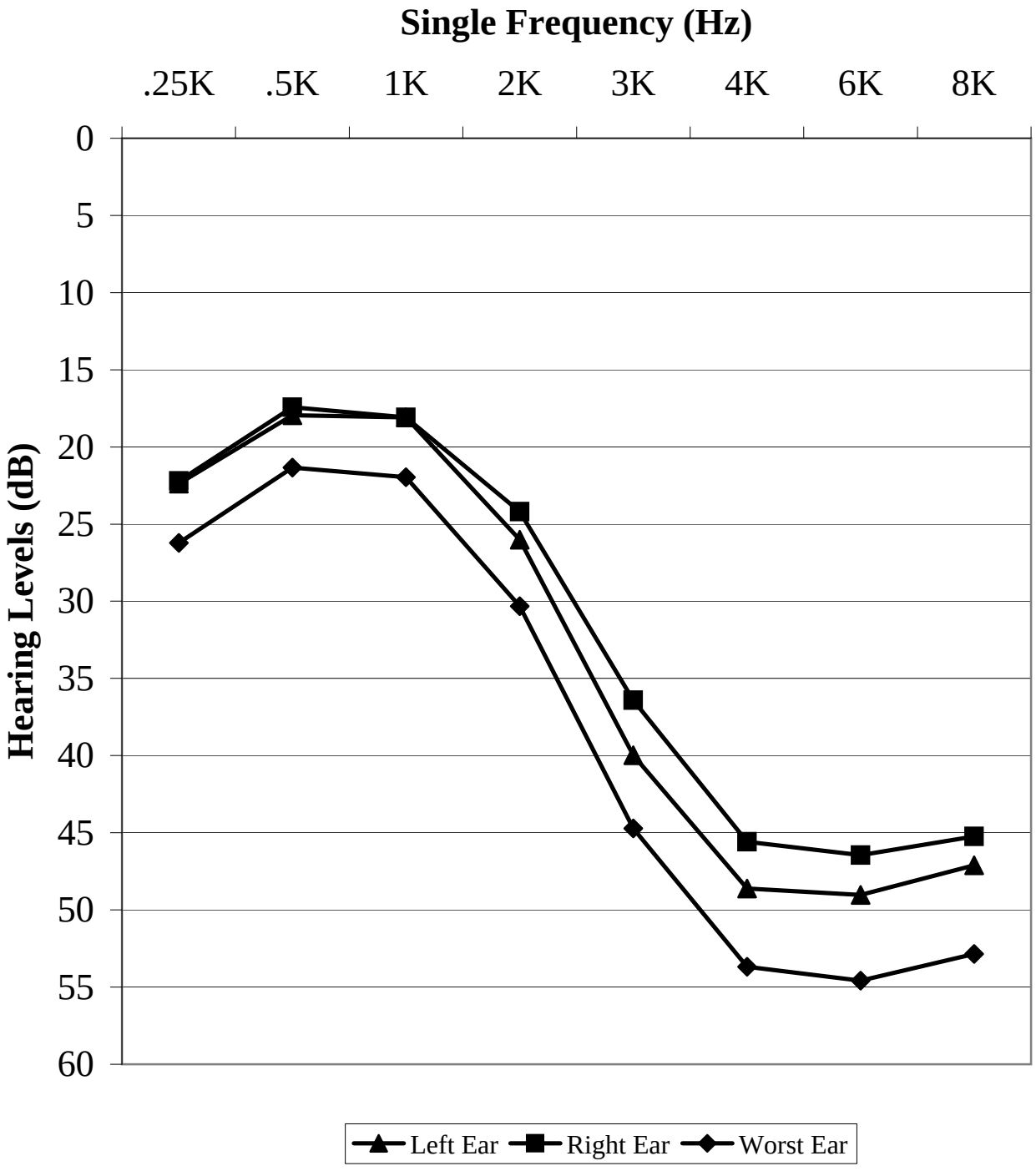


Table 1. Number of Non-Employer Based Health Professionals Reporting Individuals with Noise-Induced Hearing Loss in Michigan in Calendar Year 2007

Range of Individuals Reported	Health Professionals		Total Number of Individuals Reported
	Number	Percent	
1	9	50.0	9
2-10	7	38.9	15
11-50	0	0.0	0
51+	2	11.1	242
TOTAL	18 *	100.0	266

*This includes four group practices.

Table 2. Individuals with Noise-Induced Hearing Loss Reported in Calendar Year 2007: Number of Employees at the Company Where Exposure to Noise Occurred

Number of Employees	Total		STS**		Fixed Loss***	
	Number	Percent	Number	Percent	Number	Percent
<25	15	1.7	0	0.0	15	8.8
25-100	33	3.8	22	3.2	11	6.4
101-500	67	7.7	56	8.0	11	6.4
>500	753	86.8	619	88.8	134	78.4
TOTAL*	868	100.0	697	100.0	171	100.0

* Number of employees was unknown for 5 individual reported by employer based programs and 95 individuals reported by non-employer based hearing health professionals.

** STS=Standard Threshold Shift, reported by employer based programs.

*** Fixed=reported by non-employer based health professionals.

Table 3. Individuals with Noise-Induced Hearing Loss in Calendar Year 2007: Industry of Individuals Reported

			STS***		Fixed Loss****	
Standard Industrial Classification (SIC)*	Number of Individuals	Percent	Number of Individuals	Percent	Number of Individuals	Percent
Agricultural Production & Services (01-08)	2	0.2	1	0.1	1	0.5
Mining (10-14)	1	0.1	1	0.1	0	0.0
Construction (15-17)	22	2.4	0	0.0	22	10.5
Manufacturing (20-39)						
Food and Kindred Products (20)	10	1.1	10	1.4	0	0.0
Sawmills and Planing Mills, General (24)	1	0.1	1	0.1	0	
Printing and Publishing (27)	2	0.2	1	0.1	1	0.5
Chemicals (28)	15	1.7	11	1.6	4	1.9
Rubber and Misc. Plastics Products (30)	52	5.7	52	7.5	0	0.0
Mens Footwear, Except Athletic (31)	2	0.2	2	0.3	0	0.0
Stone/Clay/Glass (32)	4	0.4	3	0.4	1	0.5
Primary Metals (33)	46	5.1	15	2.2	31	14.8
Metal Fabrication (34)	188	20.7	186	26.7	2	1.0
Machinery (35)	4	0.4	0	0.0	4	1.9
Electronics (36)	16	1.8	16	2.3	0	0.0
Transportation (37)	440	48.5	357	51.2	83	39.5
Measuring, Analyzing, Crtl Instr. (38)	0	0.0	0	0.0	0	0.0
Miscellaneous Mfg Industries (39)	4	0.4	2	0.3	2	1.0
Transport./Comm. Svcs. (40-49)	20	2.2	3	0.4	17	8.1
Retail Trade (50-59)	10	1.1	0	0.0	10	4.8
Finance, Insurance & Real Estate (60-67)	3	0.3	0	0.0	3	1.4
Services (70-89)						
Beauty Shops (72)	1	0.1	0	0.0	1	0.5
Welding Repair (76)	1	0.1	0	0.0	1	0.5
Amusement and Recreation Services (79)	1	0.1	0	0.0	1	0.5
Health (80)	2	0.2	0	0.0	2	1.0
Education (82)	46	5.1	30	4.3	16	7.6
Social Services (83)	0	0.0	0	0.0	0	0.0
Membership Organizations (86)	0	0.0	0	0.0	0	0.0
Engineering/Management (87)	1	0.1	0	0.0	1	0.5
Private Households (88)	0	0.0	0	0.0	0	0.0
Public Administration (91-97)						
Government (91)	3	0.3	2	0.3	1	0.5
Police (92)	6	0.7	2	0.3	4	1.9
Admin. Economic Programs (96)	2	0.2	2	0.3	0	0.0
National Security (Military) (97)	2	0.2	0	0.0	2	1.0
Total	907	100.0	697	100.0	210	100.0

*Standard Industrial Classification (1987 Manual).

**SIC was unknown for 6 individuals reported by employer based programs and 55 individuals reported by non-employer based health professionals.

***STS=Standard Threshold Shift, reported by employer based programs.

****Fixed=reported by non-employer based health professionals.

Table 4. All Interviewed Individuals with Hearing Loss: Type of Industry Where Exposed to Noise, Michigan 2003-2007

Standard Industrial Classification (SIC)*	Number of Reports by Industry	Percent
Agricultural Production & Services (01-08)	43	0.6
Mining (10-14)	17	0.2
Construction (15-17)	288	4.1
Manufacturing (20-39)		
Food (20)	24	0.3
Textile Goods, NEC (22)	1	0.0
Cutting-Up and Needle Trade (23)	1	0.0
Wood (24)	15	0.2
Furniture (25)	18	0.3
Paper (26)	17	0.2
Printing (27)	21	0.3
Chemicals (28)	109	1.5
Petroleum Refining (29)	5	0.1
Rubber (30)	121	1.7
Stone/Clay/Glass (32)	10	0.1
Primary Metals (33)	725	10.3
Metal Fabrication (34)	765	10.8
Machinery (35)	109	1.5
Electronics (36)	101	1.4
Transportation (37)	3,852	54.6
Measuring Instruments (38)	1	0.0
Miscellaneous Mfg Industries (39)	72	1.0
Transportation/Communication Services (40-49)	207	2.9
Retail Trade (50-59)	103	1.5
Finance, Insurance & Real Estate (60-67)	12	0.2
Services (70-89)		
Hotels (70)	8	0.1
Personal Services (72)	2	0.0
Business (73)	10	0.1
Automotive Repair (75)	39	0.6
Repair (76)	14	0.2
Recreation (79)	9	0.1
Health (80)	18	0.3
Legal Services (81)	1	0.0
Education (82)	196	2.8
Social Services (83)	2	0.0
Membership Organizations (86)	6	0.1
Engineering/Management (87)	5	0.1
Services, NEC (89)	1	0.0
Public Administration (91-97)	108	1.5
Total	7,056 **	100.0

*Standard Industrial Classification (1987 Manual).

**SIC was unknown for 601 work locations from individuals identified in 2003-2007.

Table 5. All Interviewed Individuals with Hearing Loss: Type of Industry and Performance of Regular Hearing Testing at Most Recent Company Exposed to Noise, Michigan 2003-2007

Standard Industrial Classification (SIC)*	Number of Reports by Industry	Percent Have Hearing Testing
Agricultural Production & Services (01-07)	20	17
Mining (10-14)	10	40
Construction (15-17)	162	6
Manufacturing (20-39)		
Food (20)	13	100
Cutting-Up and Needle Trade (23)	1	0
Wood (24)	14	50
Furniture (25)	14	92
Paper (26)	9	75
Printing (27)	15	25
Chemicals (28)	91	78
Petroleum Refining (29)	2	0
Rubber (30)	110	71
Stone/Clay/Glass (32)	9	50
Primary Metals (33)	654	67
Metal Fabrication (34)	700	90
Machinery (35)	56	46
Electronics (36)	98	80
Transportation (37)	3,515	85
Miscellaneous Mfg Industries (39)	32	20
Transportation/Communication Services (40-49)	128	53
Retail Trade (50-59)	46	29
Finance, Insurance & Real Estate (60-67)	8	0
Services (70-89)		
Lodging Places (70)	6	0
Business (73)	5	0
Automotive Repair (75)	9	20
Repair (76)	5	0
Recreation (79)	4	0
Health (80)	13	0
Legal Services (81)	1	0
Education (82)	179	54
Social Services (83)	1	0
Membership Organizations (86)	6	0
Engineering/Management (87)	2	0
Public Administration (91-97)	82	38
Total	6,020 **	71

*Standard Industrial Classification (1987 Manual).

**SIC was unknown for 439 work locations from individuals identified in 2003-2007.

Table 6. All Interviewed Individuals with Hearing Loss: Number of Employees in Most Recent Company Exposed to Noise by Status of Hearing Testing, Michigan 2003-2007

Company Size: Number of Employees	Number of Reports by Size of Company	Number of Reports by Size of Company Where Information on Hearing Test Available	Have Hearing Testing	
			Number	Percent
<25	132	85	15	18
25-100	136	87	47	54
101-500	233	101	62	61
>500	4,740	1,204	1,027	85
TOTAL	5,241 *	1,477	1,151	78

*This total excludes 673 individuals identified in 2003-2007 with unknown number of employees.

Table 7. All Interviewed Individuals with Hearing Loss: Decade Last Worked and Status of Regular Hearing Testing at Most Recent Company Exposed to Noise, by Industry Type*, Michigan 2003-2007

	Decade Last Exposed to Noise and Hearing Testing Status																	
	1910s		1920s		1940s		1950s		1960s		1970s		1980s		1990s		2000s	
Industry Type (SIC)**	No. of Pts.	% Have RHT***	No. of Pts.	% Have RHT	No. of Pts.	% Have RHT	No. of Pts.	% Have RHT	No. of Pts.	% Have RHT	No. of Pts.	% Have RHT	No. of Pts.	% Have RHT	No. of Pts.	% Have RHT	No. of Pts.	% Have RHT
Agriculture/Forestry (01-08)	0	--	0	--	1	0	0	--	1	0	1	0	3	33	0	--	12	17
Mining (10-14)	0	--	0	--	0	--	0	--	0	--	0	--	2	0	2	0	5	100
Construction (15-17)	1	0	0	--	0	--	2	0	0	--	3	0	17	10	27	0	83	8
Manufacturing (20-39)	0	--	1	0	6	0	6	0	18	0	55	14	212	38	453	68	4039	88
Transportation (40-49)	0	--	0	--	1	0	0	--	1	0	1	0	15	20	23	56	75	61
Trade (50-59)	0	--	0	--	0	--	0	--	0	--	3	0	3	0	1	0	27	32
Finance (60-67)	0	--	0	--	0	--	0	--	0	--	0	--	0	--	1	0	5	0
Services (70-89)	0	--	0	--	0	--	1	0	0	--	0	--	7	0	10	0	184	49
Public Administration (91-97)	0	--	0	--	0	--	1	--	1	0	2	0	3	100	13	36	49	28

*For 980 individuals, either industry type or decade last exposed to noise was unknown.
**Standard Industrial Classification (1987 Manual).
***Regular Hearing Test.

Table 8. All Interviewed Individuals with Hearing Loss: Decade Last Worked and Status of Hearing Protection at Most Recent Company Exposed to Noise, by Industry Type*, Michigan 2003-2007

	Decade Last Exposed to Noise and Offered Hearing Protection Device																	
	1910s		1920s		1940s		1950s		1960s		1970s		1980s		1990s		2000s	
Industry Type (SIC)**	No. of Pts.	% Have RHT***	No. of Pts.	% Have HPD	No. of Pts.	% Have HPD	No. of Pts.	% Have HPD	No. of Pts.	% Have HPD	No. of Pts.	% Have HPD	No. of Pts.	% Have HPD	No. of Pts.	% Have HPD	No. of Pts.	% Have HPD
Agriculture/Forestry (01-08)	0	--	0	--	1	100	0	--	1	0	1	0	3	0	0	--	12	78
Mining (10-14)	0	--	0	--	0	--	0	--	0	--	0	--	2	100	2	50	5	100
Construction (15-17)	1	0	0	--	0	--	2	0	0	--	3	0	17	33	27	55	83	69
Manufacturing (20-39)	0	--	1	0	6	0	6	25	18	40	55	62	212	60	453	89	4039	98
Transportation (40-49)	0	--	0	--	1	0	0	--	1	0	1	0	15	57	23	67	75	73
Trade (50-59)	0	--	0	--	0	--	0	--	0	--	3	0	3	0	1	--	27	46
Finance (60-67)	0	--	0	--	0	--	0	--	0	--	0	--	0	--	1	0	5	50
Services (70-89)	0	--	0	--	0	--	1	0	0	--	0	--	7	60	10	43	184	76
Public Administration (91-97)	0	--	0	--	0	--	1	0	1	100	2	0	3	67	13	83	49	64

*For 980 individuals, either industry type or decade last exposed to noise was unknown.
**Standard Industrial Classification (1987 Manual).
***Hearing Protestion Device (ear plugs or muffs).

Table 9. All Interviewed Individuals with Hearing Loss: Decade Last Worked and Status of Regular Hearing Testing at Most Recent Company Exposed to Noise, by Industry Size*, Michigan 2003-2007

	Company Size (Number of Employees)							
	<25		25-100		101-500		>500	
Decade	Number of Patients	% Have RHT**	Number of Patients	% Have RHT	Number of Patients	% Have RHT	Number of Patients	% Have RHT
1920s	0	--	0	--	0	--	1	0
1940s	1	0	0	--	0	--	3	0
1950s	1	0	0	--	0	--	5	0
1960s	1	0	3	0	2	0	10	17
1970s	3	0	2	0	4	0	33	17
1980s	8	29	7	0	9	17	119	46
1990s	12	9	10	40	16	50	312	77
2000s	92	19	94	62	140	74	3,815	90

*For 1,772 individuals, either company size or decade last exposed to noise was unknown.
**Regular Hearing Test.

Table 10. All Interviewed Individuals with Hearing Loss: Provision of Regular Hearing Testing, Hearing Protection, Year Began Using Hearing Protection and Occurrence of Work Injuries by Self Report of Noise, Michigan 2003-2007

	Noisy All the Time		Noisy Most of Time		Noisy Sometimes		Noisy Seldom		Noisy Rarely/Never	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Regular Hearing Testing	1149	62.3	164	46.5	163	38.1	29	34.1	16	29.6
Hearing Protection	1533	80.5	258	70.7	296	65.9	53	53.5	24	35.3
Avg Year Began Using Hearing Protection	1070	1986	185	1987	183	1988	21	1990	12	1981
Work Injuries	806	42.4	134	36.2	118	26.8	16	15	14	17.9

Table 11. All Interviewed Individuals with Hearing Loss: Bothered by Ringing, Roaring or Buzzing, Michigan 2003-2007

	Number	Percent
No	900	45.9
Yes	1059*	54.1
Daily Symptoms	612	59.4
Weekly Symptoms	179	17.4
Monthly Symptoms	120	11.7
Seldom Symptoms	119	11.6

*Forty-four individuals did not report frequency of symptoms.

Table 12. All Interviewed Individuals with Hearing Loss: Non-Work Noise Exposures, Michigan 2003-2007

	Number Answered Question	Had Non-Work Noise Exposure		Hearing Protection Always or Usually with Non-Work Noise Exposure		Average Year Began Using Hearing Protection Always or Usually
		Number	Percent	Number	Percent	
Hunting	1952	680	34.8	138	21.1	1983
Target Shooting	1950	423	21.7	336	80.8	1982
Snowmobiling	1945	251	12.9	92	37.2	1978
Power Tools	1949	475	24.4	220	47.1	1987
Chain Saw	1947	412	21.2	209	51.9	1988
Loud Music	1951	305	15.6	9	3.1	1993
Motor Boat/Jet Ski	1949	252	12.9	7	2.9	1984
Lawn Work	1949	1411	72.4	451	32.8	1991
Other	1962	311	15.9	142	46.9	1985
Any	6461	1664	25.8	919	14.2	1985

Table 13. Average Hearing Threshold Level (HTL) at 1000, 2000, and 3000 Hz in Both Ears, Among Individuals Exposed to Chemicals and Solvents at Work, Michigan 2003-2007

	Exposed at Any Job with Noise Exposure		Average Hearing Threshold Level at 1000, 2000, and 3000 Hertz Among Individuals with Chemical/Solvent Exposure			
			Non-Material Hearing Impairment (average < 25 dB)		Material Hearing Impairment (average ≥ 25 dB)	
Chemical/Solvent Exposure	Number	Percent	Number	Percent	Number	Percent
Other Solvents	637	11.5	280	44.0	357	56.0
Lead	380	6.9	149	39.2	231	60.8
Acetone	386	7.0	161	41.7	225	58.3
Unknown Chemical	338	6.1	130	38.5	208	61.5
Trichlorethylene	320	5.8	133	41.6	187	58.4
Toluene	166	3.0	60	36.1	106	63.9
Xylene	153	2.8	59	38.6	94	61.4
Trichlorethane	137	2.5	44	32.1	93	67.9
MEK	128	2.3	45	35.2	83	64.8
Styrene	94	1.7	35	37.2	59	62.8
Perchloroethylene	88	1.6	35	39.8	53	60.2
Pesticides	74	1.3	29	39.2	45	60.8
Any Chemical/Solvent Exp.	1185	21.4	489	41.3	696	58.7

Table 14. All Interviewed Individuals with Hearing Loss: Meet OSHA's Criteria of "Material Hearing Impairment," Michigan 2003-2007

	Average 1000, 2000 and 3000 Hertz			
	< 25 dB		≥ 25 dB	
	Number	Percent	Number	Percent
Gender				
Male	2381	90.0 **	2711	93.8 **
Female	265	10.0	178	6.2
Race				
White	799	79.5	1069	83.6
African American	176	17.5	158	12.4
Asian/Pacific Islander	4	0.4	3	0.2
White Hispanic	17	1.7	23	1.8
Alaskan/American Indian	1	0.1	4	0.3
Other Hispanic	2	0.2	6	0.5
Other	6	0.6	15	1.2
Age (Years)	53.1 **		61.0 **	
*Standard Industrial Classification (SIC)**				
Agricultural Production and Services (01-08)	6	0.2	12	0.5
Mining (10-14)	3	0.1	4	0.2
Construction (15-17)	38	1.5	108	4.1
Manufacturing (20-39)	2301	90.5	2280	86.6
Transport./Comm. Svcs. (40-49)	40	1.6	74	2.8
Wholesale Trade (50-51)	6	0.2	13	0.5
Retail Trade (52-59)	8	0.3	14	0.5
Finance, Insurance & Real Estate (60-67)	5	0.2	3	0.1
Services (70-89)	111	4.4	88	3.3
Public Administration (91-97)	25	1.0	36	1.4

*Standard Industrial Classification (1987 Manual).

**$p < 0.05$

Table 15. One Hundred Thirty-Three Companies Inspected Where Individuals Reported They Had Not Received Audiometric Testing, Michigan 1992-2007

Industry (SIC)*	Total Inspections		Hearing Conservation Program (HCP) Required		Citation Issued				Total Number of Employees Exposed to Noise	
					HCP Deficient		HCP Absent		HCP Deficient	HCP Absent
	#	%	#	%	#	%	#	%	#	#
Agricultural Services (07)	1	(0.8)	1	(100.0)	0	--	0	--	--	--
Construction (15-17)	3	(2.3)	***	--	0	--	1	(33.3)	--	562
Manufacturing (20-39)	96	(72.2)	55	(57.3)	24	(43.6)	18	(32.7)	3,251	1,630
Transportation (40-49)	4	(3.0)	0	--	0	--	0	--	--	--
Trade (50-59)	9	(6.8)	1	(11.1)	0	--	1	(100.0)	--	14
Services (70-89)	13	(9.8)	5	(38.5)	0	--	3	(60.0)	--	40
Government (91-97)	7	(5.3)	4	(57.1)	3	(75.0)	0	--	708****	--
TOTAL	133	(100.2)**	66	(49.6)	27	(40.9)	23	(34.8)	3,959	2,246

* Standard Industrial Classification (1987 Manual).
** Percentage does not add to 100% due to rounding.
*** Construction has separate regulations that require a less comprehensive program.
**** Number employees unknown for one company.

Table 16. MIOSHA Inspections Conducted 01/01/2007 to 12/31/2007: Size of Companies Cited for Violations of the Noise Standard in Michigan

	Companies		
Number of Employees	Number		Percent
≤ 50	54		72.0
51 - 250	19		25.3
251+	2		2.7
TOTAL	75	*	100.0

*For one additional company, we were unable to determine the size of the facility.

Table 17. MIOSHA Inspections Conducted 01/01/2007 to 12/31/2007: Violations of the Noise Standard in Michigan

Standard Violated (Part 380. Occupational Noise Exposure)	Number of Citations	Companies Cited for Standard Percent*	Percent**
Hearing conservation program (R325.60107)	58	56.9	76.3
Permissible noise exposure; noise controls (R325.60104)	9	8.8	11.8
Evaluation of audiogram (R325.60115)	1	1.0	1.3
Employee training program (R325.60123)	6	5.9	7.9
Annual audiogram (R325.60114)	7	6.9	9.2
Noise monitoring program (R325.60108)	6	5.9	7.9
Audiometric testing program (R325.60112)	1	1.0	1.3
Follow-up procedures (R325.60116)	7	6.9	9.2
Baseline audiogram (R325.60113)	2	2.0	2.6
Recordkeeping (R325.60125)	1	1.0	1.3
Access to information and training materials (R325.60124)	2	2.0	2.6
Records, retention, provision, access, transfer (R325.60126)	1	1.0	1.3
Hearing protectors (R325.60121)	1	1.0	1.3
Total	102	100.0	

*Percentages based on a total of 102 violations.
**A company may be cited for more than one type of violation, therefore these percentages are based on a total of 76 companies cited.

Table 18. MIOSHA Inspections Conducted 01/01/2007 to 12/31/2007: Type of Industry Cited for Violations of the Noise Standard in Michigan

	Companies	
Standard Industrial Classification (SIC)*	Number	Percent
Manufacture of (20-39)		
Fabricated Metal Products (34)	28	36.8
Primary Metal (33)	9	11.8
Industrial and Commercial Machinery (35)	8	10.5
Transportation Equipment (37)	7	9.2
Lumber (24)	4	5.3
Rubber and Misc. Plastics Products (30)	3	3.9
Stone/Clay/Glass (32)	1	1.3
Electric, Gas, & Sanitary Services (49)	4	5.3
Wholesale Trade (50-51)		
Wholesale-Durable Goods (50)	3	3.9
Wholesale-Non-Durable Goods (51)	1	1.3
Miscellaneous Retail (59)	1	1.3
Amusement and Recreation Services (79)	1	1.3
Public Administration (91-97)		
Executive, Legislative, General Gov't (91)	6	7.9
TOTAL	76	100.0

*Standard Industrial Classification (1987 Manual).

Table 19. Estimates of the Number of Blue-Collar Workers in Michigan Exposed to Excessive Levels of Noise, by Industry Type

Industry (SIC)*	Total No. of Workers**	% Exposed to Noise***	No. Workers Noise-Exposed
MINING			
Oil and Gas Extraction (13)	1,600	23.1	370
CONSTRUCTION			
General Building Contractors (15)	23,700	15.8	3,745
Heavy Construction (16)	11,900	24.0	2,856
Special Trade Contractors (17)	83,100	15.6	12,964
MANUFACTURING			
Food and Kindred Products (20)	17,700	28.9	5,115
Textile Mill Products (22)	700	42.6	298
Apparel and Other Textiles (23)	9,900	13.9	1,376
Lumber and Wood Products (24)	8,800	41.3	3,634
Furniture and Fixtures (25)	18,500	28.3	5,236
Paper and Allied Products (26)	9,100	33.8	3,076
Printing and Publishing (27)	15,000	21.4	3,210
Chemicals and Allied Products (28)	13,200	17.3	2,284
Petroleum and Coal Products (29)	500	19.9	100
Rubber and Plastics (30)	28,400	22.8	6,475
Leather (31)	2,000	6.5	130
Stone, Clay and Glass (32)	9,300	21.5	2,000
Primary Metals (33)	18,500	32.7	6,050
Fabricated Metals (34)	63,100	29.3	18,488
Industrial Machinery (35)	53,000	14.9	7,897
Electronic Equipment (36)	16,800	8.1	1,361
Transportation Equipment (37)	123,700	18.2	22,513
Instruments and Related (38)	6,200	8.7	539
Miscellaneous Manufacturing (39)	3,400	9.4	320
TRANSPORTATION			
Freight (42)	25,100	7.0	1,757
TRADE			
Wholesale Durable Goods (50)	68,500	20.9	14,317
Wholesale Nondurable Goods (51)	34,600	5.3	1,834
Retail (55)	43,500	1.4	609
SERVICES			
Business (73)	246,800	1.5	3,702
Automotive Repair and Parking (75)	30,000	10.6	3,180
Health Services (80)	287,400	0.6	1,724
TOTAL	1,274,000	10.8	137,158 ****

*Standard Industrial Classification (1987 Manual).

**Source: Bureau of Labor Statistics, Current Employment Statistics (CES). 2001 Annual Report of Michigan Production/NonSupervisory Workers adjusted by 2007 CES employees on nonfarm payrolls.

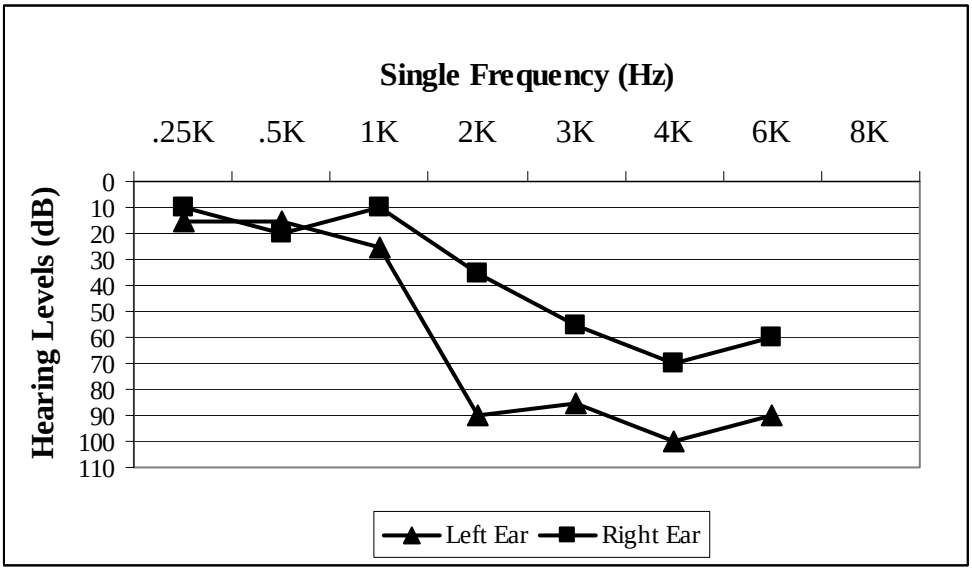
***Source: National Institute for Occupational Safety and Health, Criteria for a Recommended Standard, Occupational Noise Exposure Revised Criteria 1998. June 1998, DHHS (NIOSH) Publication No. 98-126, Table 2-1. Percentages are estimates based on data collected in the National Occupational Exposure Survey (NOES). Excessive noise is defined as at or above 85dBA.

****Total includes individual rows not shown in table.

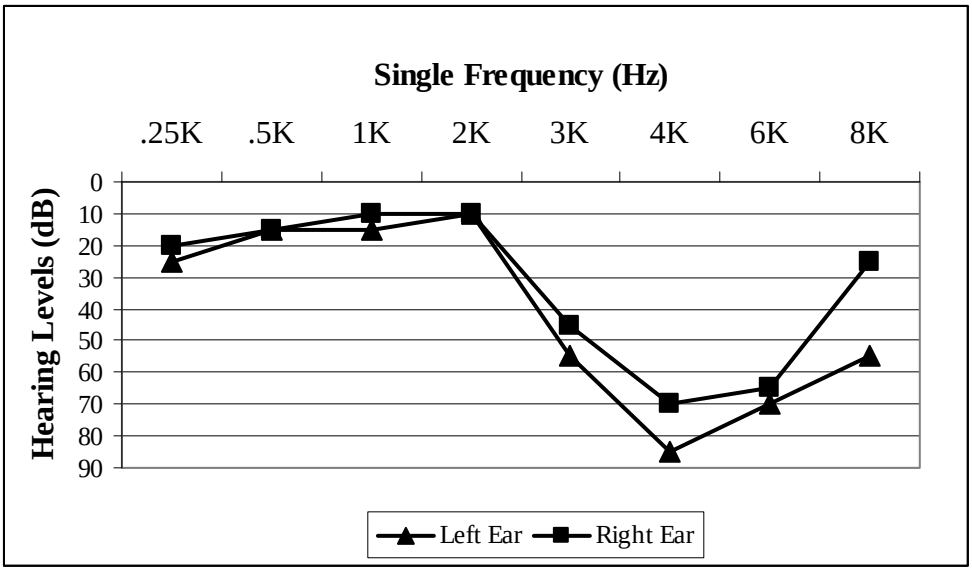
APPENDIX I

Narratives of Four Individuals with Noise-Induced Hearing Loss in 2007

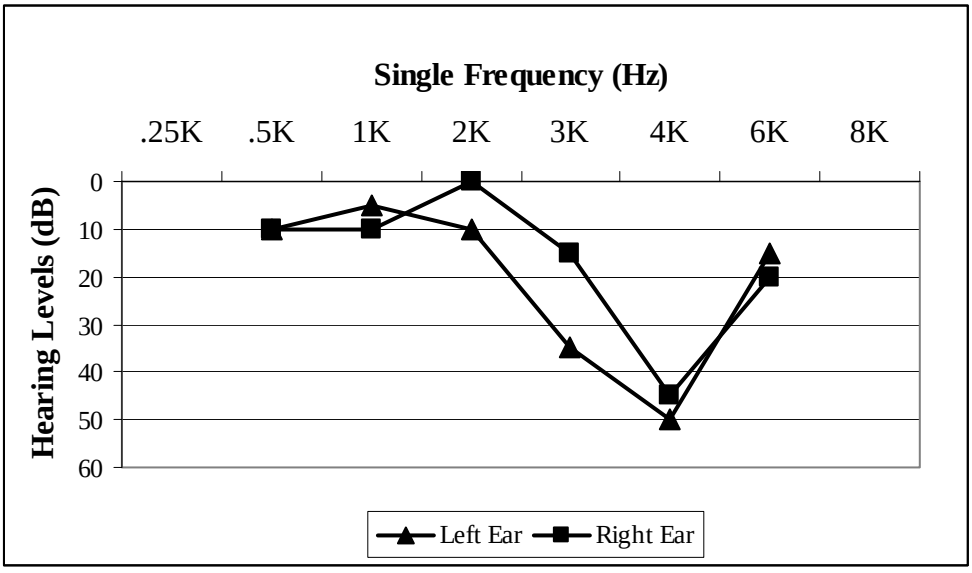
Case 1. A man in his mid 60s had hearing loss identified after seeing an audiologist. He had worked in the automotive industry for 31 years. Even though he was enrolled in the company's hearing conservation program and was offered hearing protection, he only reported almost always wearing foam plugs or muffs in the last 10 years. His hearing had been checked upon beginning work for the company in 1965 and had regular hearing tests throughout his employment. He had one other job where he was exposed to noise for two years prior to his career in the automotive industry. He reported having tinnitus daily. He was also exposed to noise outside of work. The activities in which he had noise exposure included hunting for 50 years, hobbies with power tools for 30 years, and lawn work with power tools for 56 years. He never wore hearing protection during these non-work activities.



Case 2. A man in his late 40s had hearing loss identified after seeing an audiologist. He worked as a heavy equipment operator on pipeline and various land clearing/excavation jobs. As he worked for multiple companies on discrete excavation jobs, he reported that he was exposed to noise all the time, and was offered hearing protection (foam plugs/muffs) for two of the jobs listed. He almost always or usually wore protection for all but 10 years he operated heavy equipment. He had never been in the military. He reported having tinnitus daily for approximately the last ten years. He was also exposed to noise outside of work. These activities included hunting, target shooting, using a chain saw, motor boating/jet skiing, and lawn work with power tools. He indicated that he always wore hearing protection while hunting, using a chain saw, and performing lawn work with power tools, but not while motor boating/jet skiing. He was told that his hearing loss was possibly work related.



Case 3. A man in his early 30s had hearing loss which was identified through his company's hearing conservation program. He worked for three companies over the last 10 years in landscaping, construction, and most recently gardening. He stated that it was noisy all day every day. He was provided a hearing test at hire for his most recent job, as well as ear plugs/muffs that he reportedly wore almost always. He did not report having tinnitus. He indicated that he was a hunter, listened to loud music, participated in motor boating/jet skiing, and performed lawn work with power tools outside of his job for the past 9 years. He indicated that he always wore hearing protection when performing lawn work with power tools. He had not been told why he had hearing loss.



Case 4. A man in his late 50s had hearing loss identified after seeing an audiologist. He worked in the automotive industry for 32 years and farmed part time using a cab-less tractor for 15 years. He reported to be exposed to noise in both jobs. He also worked in a funeral home for 8 years where he reported that it was rarely noisy. He was part of a hearing conservation program while working in the automotive industry and was offered hearing protection (foam plugs/muffs) which he indicated that he almost always wore over the last ten years. He reports that he has been bothered by tinnitus daily for over twenty years. While working in the automotive industry, the gentleman reported he was exposed to lead, xylene, acetone, trichloroethylene, trichloroethane, and other solvents. He also reported being exposed to pesticides while farming. Outside of work he had exposure to noise while hunting, target shooting, working with power tools, listening to loud music, performing yard work with power tools, and riding motorcycles. He indicated that he always wore hearing protection while riding his motorcycle. He was told that his hearing loss was a result of noise exposure.