

REPORTED NOISE-INDUCED HEARING LOSS AMONG MINERS

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ABSTRACT

The Mine Safety and Health Administration (MSHA) requires mine operators to report all diagnosed or compensated cases of occupational hearing loss to MSHA. All hearing loss cases reported to MSHA from 1980 through December 1994 (2365) were examined. After separating the hearing loss cases by causal factor, a population of 2287 cases of noise-induced hearing loss (NIHL) remained for further study. This study was conducted to identify the commodities and states with the highest number of NIHL cases. The NIHL cases were separated by coal (1572 cases) and metal/nonmetal mining (715 cases). Between 1980 and 1994 the average employment in coal mining was 186,950 miners. This compares to an average of 233,420 in metal/nonmetal mining. All but one NIHL case in coal mining were associated with bituminous coal. NIHL cases were reported to be associated with 25 metal/nonmetal commodities. The three metal/nonmetal commodities with the highest number of NIHL cases were molybdenum (142 cases), limestone (103 cases), and gold (87 cases). NIHL cases were reported from 10 states for coal mining and from 35 states for metal/nonmetal mining. The geographic distribution was not uniform and exhibited clustering. This effect was more pronounced for coal mining than metal/nonmetal mining. The cause of the clustering was not readily apparent. West Virginia (1403 cases), Virginia (116 cases), and Washington (20 cases) were the three coal mining states with the highest number of reported NIHL

cases. For metal/nonmetal mining, the three states with the most NIHL cases were Colorado (160 cases), Arkansas (121 cases), and South Dakota (86 cases). The above results indicate that NIHL is a serious problem affecting the health of U.S. miners.

Key words: Noise-induced hearing loss, mining, reporting of noise-induced hearing loss

INTRODUCTION

Excessive noise exposure is one of the most pervasive health hazards in mining. Prolonged exposure to hazardous noise causes a loss of hearing acuity. This loss of hearing acuity, which occurs gradually, is known as noise-induced hearing loss (NIHL). The progression of NIHL is insidious since often the recipients are unaware that they are losing their hearing acuity until the damage results in a handicap. In extreme cases the individual becomes deaf. NIHL is a permanent, chronic irreversible health effect. No amount of medical treatment (including the use of a hearing aid), rest, and/or lack of exposure will restore the lost hearing acuity. Furthermore, an NIHL affected individual will continue to lose hearing acuity, even if removed from hazardous noise, because of presbycusis.

In 1976, the National Institute of Occupational Safety and Health (NIOSH) published the results of a survey of the hearing acuity and noise exposure of coal miners.⁽¹⁾ According to this report working coal miners had substantially poorer hearing than the general population.

Under 30 CFR Part 50 the Mine Safety and Health Administration (MSHA) requires mine operators to report all diagnosed or compensated cases of occupational injuries and illnesses to MSHA. Among the examples of occupational

illnesses listed in 30 CFR Part 50, under disorders associated with repeated trauma, is NIHL. All reported cases of occupational injury and illness are included in MSHA's data base. The Part 50 data can be used to evaluate the effectiveness of MSHA's programs. Further, the data can be used to target causes of excessive injuries or illnesses for special emphasis or additional study. This retrospective study examined the reported cases of occupational hearing loss to determine the commodities and states from which the highest number of NIHL cases were reported.

PROCEDURE

Records of all occupational hearing loss cases reported to MSHA between January 1980 and December 1994 were obtained. These records included information on the nature of injury/illness (hearing loss); source of injury/illness; occupation, age, sex, and work experience of the miner; mining methodology; commodity mined; location of the mine (state); and a brief narrative of the incident. From this information, each occupational hearing loss case was reviewed and then classified as resulting from prolonged noise exposure, a traumatic event, or an unknown cause. The narrative and source of injury information were relied on heavily for classifying the type of hearing loss. Hearing loss caused by a single event (including noise) was considered traumatic.

Unfortunately, there was no opportunity to confer with the mine operator [nor the affected miner] who provided the data on the occupational hearing loss case in order to correct any obvious inconsistencies such as unknown ages, work experiences, and/or occupations or to validate the reported data. All data, except for the obvious inconsistencies, were assumed to be correct. Thus, the results of the analysis may be biased for this reason.

The initial step was to identify the NIHL cases among the 2365 occupational hearing loss cases. The subsequent analyses of the geographic and commodity distributions were limited to the 2287 NIHL cases.

STUDY LIMITATIONS

Limitations of the data restrict the conclusions which can be drawn from the data. Therefore, prior to discussing the results several cautions must be presented. First, the severity of each NIHL case could not be determined because the minimum hearing loss necessary for reportability is not defined quantitatively. Instead, it is defined qualitatively. Although many narratives contained information as to the reason for reporting the NIHL case, others only listed the illness as hearing loss.

Secondly, the minimum requirements for awarding workers' compensation differ by state.⁽²⁾ Therefore, it is not possible to project data from one state to another. This lack of uniformity in workers' compensation regulations also makes it difficult to compare and contrast the number of NIHL cases among the states. Only the simplest of analyses is valid.

Thirdly, since NIHL is a chronic illness, the appropriate metric to show the impact on a population is the prevalence. Unfortunately, the Part 50 data can only be used to determine the incidence of NIHL.

Ideally, individual audiograms of miners would be examined to determine the severity and progression of NIHL. Furthermore, the audiometric record would include the miner's noise exposure. However, this was not possible.

RESULTS AND DISCUSSION

The results are divided into two sections: coal mining and metal/nonmetal mining. Each are discussed separately. This is consistent with MSHA's enforcement divisions and is the traditional manner of presenting the data.

A. Coal Mining

Figure 1 shows the distribution of NIHL cases by the year in which they were reported. The number of reported NIHL cases has varied from a low of 0 in 1982 to a high of 357 in 1987. Between 1980 and 1994 the average employment in coal mining was 186,950.⁽³⁾ For the first six years only a few NIHL cases were reported. Beginning in 1986 there was a large increase in the number of reported NIHL cases. This was probably the result of targeting the noise program for improvement in fiscal year 1984.⁽⁴⁾ The average number of NIHL cases prior to 1986 was about 4 per year. This contrasts with an average of about 172 cases per year thereafter. Since 1987, the number of cases has been generally decreasing.

Over the past 15 years, coal mine operators reported 1572 cases of NIHL from ten states. These states represent approximately half the states which mine coal. Table I presents the geographic distribution of the reported NIHL cases.

From Table I, it is readily apparent that the geographic distribution exhibits the epidemiological phenomenon known as clustering. One state, West Virginia, had more reported cases of NIHL than the other nine states combined. In fact, 89.2% of the reported NIHL cases among coal miners occurred in West Virginia. Even when adjusting the data for the number of working coal miners or tons of coal

mined in each state, the clustering could not be explained. Further, differences in the workers' compensation eligibility requirements (from requiring total loss to awarding compensation for partial loss) could not account for the clustering. However, in West Virginia, an employee can be awarded workers' compensation for a slight hearing loss.

All, but one, NIHL cases were associated with bituminous coal mining. The other case was associated with anthracite coal mining.

B. Metal/Nonmetal Mining

Figure 1 shows the distribution of NIHL cases by the year in which they were reported. The number of reported NIHL cases has varied from a low of 1 in 1980 to a high of 110 in 1993. Between 1980 and 1994 the average employment in metal/nonmetal mining was 233,420.⁽³⁾ For the first six years relatively few NIHL cases were reported. As a result of MSHA targeting the noise program for improvement in 1984, more cases of NIHL were reported.⁽⁴⁾ The average number of NIHL cases prior to 1986 was about 25 per year. Since then the average has been nearly 63 cases per year. Because of the large variability, no obvious trend in the number of NIHL cases is evident.

Over the past 15 years, metal/nonmetal mine operators reported 715 cases of NIHL from 34 states and one U.S. territory. Every state has metal/nonmetal mining operations. Table II presents the geographic distribution of the reported NIHL cases.

As in coal mining, the geographic distribution of NIHL exhibits the epidemiological phenomenon of clustering. The clustering for metal/nonmetal mining is not as readily apparent as in coal mining. Mine operators in most states either reported a minimal number or no NIHL cases. However, the three states with the most reported NIHL cases (Colorado, Arkansas, and South Dakota) accounted for approximately half of the cases. Adjusting the data for the number of working miners in each state could not explain the distribution of NIHL cases. Further, differences in the workers' compensation eligibility requirements could not account for the clustering.

Table III presents the commodities associated with the NIHL cases. MSHA's classification of commodities, based on the Bureau of Labor Statistics classification system, recognizes 85 metal/nonmetal commodities. Mine operators reported NIHL cases among miners for 25 different commodities.

The distribution of commodities exhibited clustering. The three commodities which had the highest number of associated NIHL cases (molybdenum, limestone, and gold) accounted for 46.4% of the NIHL cases.

Moreover, each state had a few commodities associated with the majority of the reported NIHL cases. Table IV presents the commodities associated with the reported NIHL cases by metal/nonmetal mine operators from those states with the greatest number of reported NIHL cases. The commodities were: molybdenum (88.8% of the NIHL cases) in Colorado, granite and limestone (43.0% and 37.2% of the NIHL cases, respectively) in Arkansas, and gold (86.0% of the NIHL cases) in South Dakota.

SUMMARY

Virtually all (96.7%) of the reported occupational hearing loss cases in mining are the result of prolonged noise exposure. The remaining cases were the results of explosions, infections, ruptured ear drums, etc. During the past 15 years, 2287 cases of NIHL were reported. Of these NIHL cases, 68.7 percent were incurred by coal miners. During the periods of 1980 to 1985 and 1993 to 1994, metal/nonmetal operators had reported more NIHL cases than coal operators.

Currently, there are approximately 80,000 more metal/nonmetal miners than coal miners.

The reported number of NIHL cases varied considerably over time, with coal mining showing a greater variability than metal/nonmetal mining, but coal mining showed less variability during the past few years. Coal mining also showed a greater geographic concentration.

In metal/nonmetal mining, the variability was not limited to geographic distribution. The distribution of commodities also showed clustering.

Despite the limitations of the data and the variability and the phenomena of clustering in both coal and metal/nonmetal reporting, the large number of reported NIHL cases over the past 15 years indicates that NIHL remains a major occupational illness among U.S. miners.

TABLE I. Geographic distribution of NIHL reported by coal mine operators,
1980-1994

STATE	NUMBER OF REPORTED NIHL CASES
Colorado	5
Illinois	3
Kentucky	15
Ohio	1
Oklahoma	3
Pennsylvania	4
Utah	2
Virginia	116
Washington	20
West Virginia	1403
TOTAL	1572

TABLE II. Geographic distribution of NIHL reported by metal/nonmetal mine operators, 1980-1994

State or Commonwealth	Number of Reported Cases of NIHL	State or Commonwealth	Number of Reported Cases of NIHL
Alabama	1	New Mexico	1
Alaska	1	New York	51
Arizona	4	North Carolina	2
Arkansas	121	Ohio	1
California	43	Oklahoma	19
Colorado	160	Oregon	17
Florida	8	Pennsylvania	1
Hawaii	2	Puerto Rico	1
Indiana	11	South Carolina	1
Iowa	1	South Dakota	86
Kansas	1	Tennessee	2
Maryland	1	Texas	71
Massachusetts	1	Utah	71
Michigan	1	Virginia	3
Minnesota	1	Washington	21

TABLE III. Commodity distribution of NIHL reported by metal/nonmetal mine operators, 1980-1994

Commodity	Number of Reported Cases of NIHL	Commodity	Number of Reported Cases of NIHL
Alumina	79	Mica	1
Aluminum	2	Molybdenum	142
Boron	13	Nonmetal, nec ^A	2
Cement	50	Perlite	1
Clay	3	Phosphate	41
Copper	33	Sand & Gravel	18
Gilsonite	1	Sandstone	1
Gold	87	Silver	1
Granite	55	Stone	9
Gypsum	19	Talc/soapstone	8
Iron ore	1	Traprock	1
Lead/zinc	40	Uranium	4
Limestone	103		

^Anec = Not Elsewhere Classified

TABLE IV. The three states with the greatest number of reported NIHL cases by metal/nonmetal mine operators and the associated commodity.

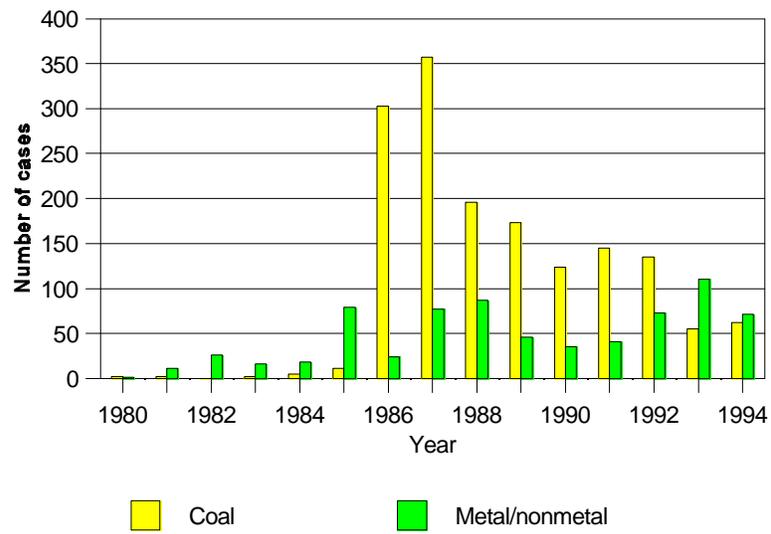
STATE	COMMODITY	PERCENT OF CASES IN THE STATE
Colorado	Cement	7.5
	Limestone	0.6
	Molybdenum	88.8
	Sand & Gravel	0.6
	Uranium	2.5
Arkansas	Alumina	18.2
	Aluminum	1.6
	Granite	43.0
	Limestone	37.2
South Dakota	Cement	4.7
	Gold	86.0
	Limestone	9.3

REFERENCES

1. National Institute for Occupational Safety and Health: Survey of Hearing Loss in the Coal Mining Industry, HEW Publication No. (NIOSH) 76-172, NIOSH, Cincinnati, OH (1976).
2. Fodor, W. J.; Oleinick, A.: Workers' Compensation for Occupational Noise-Induced Hearing Loss: A Review of Science and the Law, and Proposed Reforms. Saint Louis University Law Journal 30(3):703-804 (1986).
3. Krowczyk, C. J.: Personal communications, MSHA, Office of Injury and Employment Information, Denver, CO (1995).
4. Tinney, G. R.: MSHA Preliminary Recommendations for Noise Program Improvements. Annals of the American Conference of Industrial Hygienists. 14:371-373 (1986).

FIGURES

FIGURE 1. Reported cases of NIHL to MSHA by year, 1980-1993



NOTE: 1994 is a partial year