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Medicolegal Aspects of Industrial Noise

Meyer S. Fox, M.D.*

OCCUPATIONAL HEARING LOSS MAY BE DEFINED as a hearing impairment in one or both ears, partial or complete, arising in, during the course of, or as the result of one's employment. It can occur suddenly as the result of a traumatic injury, intense blasts or explosions, or gradually due to prolonged exposure to excessive noise levels. Hearing losses resulting from blows, blasts, or explosions, as well as from foreign objects and burns, have usually been compensated under schedules of accidental injuries.

Industrial noise hearing loss is the accumulative loss of hearing, always of the nerve type, developing over a period of months or years of employment in hazardous noise levels. There is a general impression that noise-induced hearing loss is a new industrial development. Actually, the deafness occurring as the result of working in noisy occupations has been known for over a century. It was commonly accepted that braziers, blacksmiths and boilermakers would suffer loss of hearing as a result of prolonged exposure to noise in their occupations. As a matter of fact many workers prided themselves upon the fact that their hearing loss signified that they were good workers. It was during and shortly after World War II when industry expanded, high speed machines were introduced, and production greatly increased, that the resultant uncontrolled noise became more intense and more frequent. Numerous reports dealing with this problem appeared in the scientific literature, but little interest was shown until a large number of compensation claims appeared in the state of New York in 1947 and shortly thereafter in the state of Wisconsin. In 1947 the American Academy of Ophthalmology and Otolaryngology (the Board certifying membership of eye, ear, nose and throat specialists) became concerned with this problem. Its committee on Conservation of Hearing appointed

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a subcommittee (later known as The Subcommittee on Noise in Industry) to make extensive investigations of the problem and to recommend hearing conservation measures. About the same time, other scientific bodies of the military, and the American Standards Association likewise organized committees to investigate the problem. There were numerous reports and publications which dealt with the medical, acoustical, industrial and legal aspects of the industrial noise problem. The reader is referred to a recommended list of these publications for further information and guidance.¹⁻¹²

Generally speaking, the effects of industrial noise can be divided into the auditory and non-auditory effects. The auditory effects of intense industrial noise are: (1) It causes temporary and permanent hearing loss; (2) It interferes with communication. The non-auditory effects of industrial noise, such as ir-

¹ Noise Control: Bimonthly journal published by Acoustical Society of America, since Jan. 1955. 335 E. 45th Street, New York 17, N. Y.

² Glorig, A.: (a) The Acoustical Spectrum—Sound, Wanted and Unwanted, given by the School of Public Health and the Institute of Industrial Health, University of Michigan, Ann Arbor, Feb. 5-8, 1952; (b) The Practical Aspects of Ear Protection, 17 *Am. Ind. Hyg. A. Quart.*, 43-48 (March, 1956); (c) Noise in Industry, 14 *Am. Ind. Hyg. A. Quart.*, 3 (Sept., 1953).

³ Exploratory Subcommittee, Z-24-X-2 of the American Standards Association, The Relations of Hearing Loss to Noise Exposure, N. Y. Am. St. Assoc. (1954).

⁴ Kryter, K. D., The Effects of Noise on Man, Speech and Hearing Disorders, Monograph Supplement I. (Sept., 1950).

⁵ Symons, N., (a) A Lawyer Looks at the Industrial Noise Problem, Proceedings of the National Noise Abatement Symposium, Armour Research Foundation of Illinois, Institute of Technology, Chicago, Illinois, 42-63 (Oct., 1951); (b) Noise in Industry—Legal Aspects, Symposium on Medical Aspects of Workmen's Compensation sponsored by New York University Post-Graduate Medical School and Amer. Acad. of Compensation Medicine, New York, N. Y. (May, 1954).

⁶ Proceedings of National Noise Abatement Symposium, Armour Research Foundation of Illinois Institute of Technology, held annually, Chicago, Illinois, since 1950.

⁷ Davis, H., Hearing and Deafness, New York, Murray Hill Books, Inc. (1947).

⁸ Fox, M. S.: (a) Industrial Noise, Its Medical, Economic, and Social Aspects, 223 *Am. J. Med. Sc.*, 447 (April, 1952); (b) Occupational Hearing Loss, 27 *Ind. Med. & Surg.*, 1, 21-24 (Jan., 1958); (c) Occupational Hearing Loss, Wisconsin's Approach to the Problem, 25 *Ind. Med. & Surg.*, 7, 310-316 (July, 1956); (d) Occupational Deafness, *J. A. M. A.* (162) (Dec., 1956).

⁹ Cyril M. Harris (ed.), Handbook of Noise Control, McGraw-Hill Book Co., N. Y. (1957).

¹⁰ Grune and Stratton, Noise and Your Ear. (Edit. Aram Glorig, 1958).

¹¹ Guide for Conservation of Hearing in Noise, prepared by Subcommittee on Noise in Industry, 111 North Bonnie Brae St., Los Angeles, Calif. (1957).

¹² Williams, C. R., Instruments for Measuring Sound, 64 *Archives of Otolaryngology*, 414-25 (Oct., 1955).

ritability, decreased workers efficiency, and inability to sleep, are vague and ill-defined and are, at the present time, not scientifically established.

Most states afford Workmen's Compensation benefits, for loss of hearing resulting from a sudden accidental event. Loss of hearing is compensable as follows:

1. As a scheduled award for a fixed number of weeks of compensation for either partial or total loss of hearing function.
2. For loss of either wages or reduction of wage earning capacity, due to the loss of the hearing function.
3. For loss of hearing function expressed in terms of the patient as a working unit, i.e., disability of the man as a whole.
4. By means of a judgment at common law for damages.

Intense industrial noise can and does cause hearing losses in susceptible workers. The degree and extent of these hearing losses are dependent upon numerous physical, acoustical, anatomical and physiological factors.

The noise problem must be considered a national one. The legal developments and decisions of the higher courts in the states of New York and Wisconsin are particularly important and worth reporting. The courts of New York have already decided the following issues:¹³

- (1) That permanent loss of hearing caused by work in noisy environments is compensable;
- (2) That the loss of hearing so found is compensable under the schedule of the Compensation Law of New York state;
- (3) The question of where responsibility lies when two or more employers and insurance carriers are involved; and
- (4) The question of compensation for the associated tinnitus (ear noises).

By 1951 a large number of claims were filed with the Wisconsin Industrial Commission for alleged loss of hearing due to noise exposure. By July 1, 1953 over 500 cases had accumulated. The Wisconsin Industrial Commission, after hearing testimony of previous cases in which awards had been made, decided to

¹³ (a) *Slawinski v. Williams & Co.*, 298 N. Y. 546 (1948);
 (b) *Rosati v. Despatch Shops, Inc.*, 298 N. Y. 813 (1949);
 (c) *Russo v. Despatch Shops, Inc.*, 280 App. Div. (N. Y.) 1008 (1952);
 (d) *Gabor v. American Magnesium Corp.*, 275 App. Div. (N. Y.) 1014 (1949).

take the case of *Wojcik v. Green Bay Drop Forge Co.* and to use it as a test case.¹⁴ The Industrial Commission found liability, and held that the schedule for hearing loss applied even though Mr. Wojcik had not lost any time or wages. The case was then appealed to the Circuit Court of Dane County, which reversed the Commission's decision because of the absence of wage or time loss, which the Court felt was necessary for a claim for occupational disease. On appeal to the Supreme Court, the decision was reversed and the original findings of the Industrial Commission were affirmed. It was held that wage or time loss was not necessary in order to establish a claim for loss of hearing by prolonged exposure to noise; that the rule of the last day of work applied only in cases where an employee had actually quit his work, and that the Commission had properly fixed the day before the filing of the application as the date of liability. This is set as the approximate date of the examination on which the claim was based.

In the state of New York an administrative ruling that the hearing loss could not be considered stabilized, and that awards cannot be made until the worker is removed from the injurious noise exposure for a period of six months, has resulted in holding back awards for the time being. In the state of New Jersey 232 claims were filed against a shipbuilding industry. These claims were filed originally at law, under the Longshoremen's and Harborworkers' Compensation Act, and the New Jersey Compensation Act. These cases were later settled by the parties involved, under the New Jersey Workmen's Compensation Act. The New Jersey act was amended January 1, 1950 to provide compensation for all occupational diseases, and numerous additional claims for loss of hearing have been made under the new provision since that time. Claims for loss of hearing due to noise exposure have also appeared in the states of California, Minnesota,¹⁵ Indiana, Missouri,¹⁶ Washington and Kansas.

As the result of these Industrial Hearings as well as higher court decisions it became apparent that there were many thorny

¹⁴ *Green Bay Drop Forge Co. v. Industrial Commission and Albert Wojcik*, 265 Wisc. 38, 60 N. W. 2d 409 (1953).

¹⁵ *Shir v. American Hoist and Derrick Co.*, Cases settled by compromise agreement.

¹⁶ *Schramm v. Industrial Commission of Missouri* regarding Rule 23. (Rule 23 adopted August 27, 1954 by Industrial Commission of Missouri for Measurement of hearing loss.)

questions that had to be answered. Some of the more troublesome medical questions were as follows:

1. At what level of sound intensity and over what period of exposure does hearing damage take place?
2. What was the status of the employee's hearing when he came to work for the employer? (It should be pointed out that in practically all the litigated cases there were no accurate hearing records of the employee's hearing when he began his work.)
3. What tests should be used for determining the hearing ability of the worker?
4. What formula should be used to evaluate these hearing tests and to express the results in terms of hearing handicap and disability?
5. Which of several hearing tests made by several otologists at various times should be used to evaluate the hearing loss?
6. Are some workers more susceptible to noise-induced hearing loss than others?
7. How are we to determine the permanency of the hearing loss of the worker if he continues at his noisy employment?
8. What consideration should be given to loss of hearing which accompanies age (presbycusis)?
9. What consideration should be given to medical and degenerative conditions that might affect the hearing loss?

Some of the legal questions that presented difficulty, particularly as to the intent and interpretation of existing compensation laws concerning noise-induced hearing loss, and which still need further clarification are:

1. Is the law as written intended to compensate a man for loss of hearing when it does not interfere in his every-day work and he suffered no wage loss?
2. How is the time of injury in these cases to be defined?
3. How much of the hearing loss actually found could be considered to be an occupational disease?
4. How is the statute of limitations to be applied?
5. When a worker had been employed by various industries each of which may have contributed to his hearing loss, how is the apportionment of the hearing loss to be made?

Controversies between the law and medicine develop when considering methods used for determining hearing loss and converting this loss into terms of hearing handicap. These questions arise: "What is hearing loss and when does a hearing loss become a hearing handicap?" "What kind of tests are used? How is the handicap determined from these tests?" A discussion of these questions is found in the report of the Committee of Eight.¹⁷

The State of Wisconsin has been a leader in Workmen's Compensation, and for many years has maintained an Advisory Committee composed of representatives of the Industrial Commission, industry, labor and insurance carriers. The purpose of this committee is to discuss and formulate Workmen's Compensation legislation. When the Industrial Commission and the above Advisory Committee were faced with industrial noise claims they recognized the humanitarian, social, medical, legal and economic aspects of the problem. A Medical Advisory Committee was appointed, consisting of four otologists and an industrial physician. The function of this group of physicians was to advise the Industrial Commission and its Advisory Committee on the medical aspects of the problem.

The Advisory Committee to the Industrial Commission held many meetings to consider the acceptance of the medical committee report and to formulate amendments which covered such aspects as how, when, and to what extent the worker is to be compensated for his hearing loss.

The new Wisconsin amendments¹⁸ pertaining to occupational hearing loss became effective July 1, 1955. These amendments define occupational deafness and the industrial environment capable of producing it. A schedule has been provided for partial as well as for total hearing loss. This schedule, recently amended in 1957, allows up to 36 weeks for compensation for total deafness of one ear, and 180 weeks for total deafness of both ears. Employees may file claims for occupational loss of hearing six months after any of the following events, provided that they remain away from injurious noise for that length of time:

1. Transfer because of occupational deafness to non-noisy environments.
2. Retirement.

¹⁷ Principles For Evaluating Hearing Loss, 157 J. A. M. A., 1408-1409 (Apr. 16, 1955).

¹⁸ Amendments to the Wisconsin Workmen's Compensation Act, Chapter 281, Section 102.555. (July 1, 1955).

3. Termination of employer-employee relationship.

4. Layoff for one year, the last six months of which is away from injurious noise.

Hearing disability is to be determined on the basis of pure tone audiometry and a formula recommended by the Medical Advisory Committee to the Wisconsin Industrial Commission.

HEARING DISABILITY TABLE.

Average Decibel Loss	% of Compensable Hearing Loss	Average Decibel Loss	% of Compensable Hearing Loss
17	.8	49	53.3
18	2.2	50	55
19	3.6	51	56.7
20	5	52	58.3
21	6.7	53	60
22	8.3	54	61.7
23	10	55	63.3
24	11.7	56	65
25	13.3	57	66.7
26	15	58	68.3
27	16.7	59	70
28	18.3	60	71.7
29	20	61	73.3
30	21.7	62	75
31	23.3	63	76.4
32	25	64	77.8
33	26.7	65	79.2
34	28.3	66	80.6
35	30	67	82
36	31.7	68	83.4
37	33.3	69	84.8
38	35	70	86.2
39	36.7	71	87.6
40	38.3	72	89
41	40	73	90.4
42	41.7	74	91.8
43	43.3	75	93.2
44	45	76	94.6
45	46.7	77	96
46	48.3	78	97.4
47	50	79	98.8
48	51.7	80 and over	100

Method—Add the pure tone air conduction losses in decibels for the three (3) frequencies 500, 1000 and 2000 c.p.s. and divide by three (3) to obtain average decibel loss. Find this average in the vertical column on the left (marked average decibel loss) and the percentage of compensable hearing loss for that ear is given directly opposite.

For Binaural Percentage of Hearing Loss use the following formula:

Four times the percentage of lesser loss;
Add the percentage of greater loss;
Divide total by five.

The resulting percentage is the loss of hearing in both ears and is applied to the schedule allowance for loss of hearing in both ears.

In one provision the Wisconsin act states: "An employer will be liable for the entire occupational deafness to which his employment has contributed. However, if deafness previous to that which the employment has contributed is established by a hearing test or other competent evidence the employer shall not be liable for such previous loss." This points out the need for pre-employment pure tone audiometric tests, and for consultation with otologists in supervising hearing conservation programs.

Pre-employment hearing testing programs and information regarding industrial noise hearing conservation measures are furnished by the Subcommittee on Noise in Industry of the Committee on Conservation of Hearing of the American Academy Ophthalmology and Otolaryngology. A recently revised booklet entitled *Guide for Conservation of Hearing in Noise* is available. Intensive research in all phases of the industrial noise problem, and particularly in the area of industrial hearing conservation, has been and is being carried on by members of the research staff. Requests for information should be forwarded to the Director of Research of the Subcommittee on Noise in Industry, 111 North Bonnie Brae Street, Los Angeles, California.

Summary

Occupational hearing loss is assuming increasing importance in our everyday life. It is the outgrowth of our rapidly expanding industrial development. The industrial noise problem is a complicated one because it involves many technical and professional fields. While the remarks herein have been based upon experiences in the states of Wisconsin and New York, it is hardly necessary to point out that similar working conditions, noise exposure and workers involved are present in practically all states. The difference that exists is in the compensation acts of the various states and in the legal interpretation of these acts. While claims for loss of hearing resulting from noise exposure have brought this problem to the forefront, certainly it is not the most important part of the problem. Conservation and protection of human hearing is most important. Occupational hearing loss is not a partisan problem. Labor and management, compensation boards, insurance carriers, the medical, legal and allied professions all have an interest in it. If all interested parties cooperate, proper measures will be forthcoming and a desired solution to this problem can be achieved.