STANDARDS FOR HEARING HEALTH MONITORING OF AIRPORT GROUND HANDLING OPERATORS WORKING IN ENVIRONMENTS WITH EXCESSIVE NOISE LEVELS - CURRENT STATUS OF LEGISLATION IN THE USA AND THE REPUBLIC OF BULGARIA

Dorina Manahilova
University Hospital for Active Treatment "St. George", Plovdiv, Bulgaria, dmanahilova@abv.bg

Abstract: Noise is one of the leading risk factors of the work environment for airport ground handling workers. Noise above 85 dB(A) causes a variety of functional and structural impairments, reduces work capacity, makes it difficult to communicate verbally and monitor sound signals from the environment and work environment, thus indirectly affecting flight safety. Noise has a direct specific impact on the auditory analyzer and leads to a number of functional and degenerative changes that can be established during an audiometric hearing test. The purpose of the report is to make a comparative analysis of the legislative framework in the field of health monitoring of the auditory analyzer for airport ground handling operators working in an environment with excessive noise levels in the USA and the Republic of Bulgaria; to bring out good practices and examples, to make generalized conclusions of practical importance regarding the implementation of legislation in the researched area. A comparative study and analysis of legislation and hearing screening standards for workers at occupational noise levels above 85 dB(A) was conducted. The methods used are normative, documentary, formal-logical with analysis of official documents and data. The results of the comparative analysis show identity in the general legislative framework of the Act on Health and Safety at Work in Bulgaria and the Act on Health and Safety at Work in the USA, both laws introducing the general principles of prevention and obliging employers to provide health and safety conditions of workers' labor, including free preventive medical examinations with audiometric hearing tests for workers exposed to excessive noise. The difference between the two countries is that the US has introduced health screening standards and the Hearing Conservation Program for workers exposed to excessive noise, which also includes airport ground handling operators. In Bulgaria, the rules regarding the health screening of hearing for those working at excessive noise levels are not clearly regulated by law, there are no standards, which makes it difficult for doctors specializing in occupational medicine and aviation medicine. Early detection of hearing analyzer changes in airport ground handling operators exposed to excessive noise, hearing prevention and health monitoring should be the responsibility and obligation of every employer and a priority of every national legislation.
Keywords: legislation, noise, auditory analyzer, airports, health monitoring

1. INTRODUCTION

Modern aircraft in aviation are the main sources of high-intensity broad-spectrum noise, reaching 140 dB(A) and more. Sources of noise in aviation are the working aircraft engines, the turbulence of the boundary air flows outside the cabin, the vibrations of the details. The intensity depends on the type of aircraft and can reach up to 160-170 dB(A). The daily noise exposure level for Aircraft Start-up Mechanics is between 102-108 dB(A)8h, for Repair Shop Mechanics it is 87-95 dB(A)8h. According to the data of Stoilova, Valkov and Stefanova (2013), during the technical maintenance of the start of the aircraft, the noise levels vary from 81-122 dB(A)8h. A number of scientific studies, our measurements and analyzes prove that noise is an unavoidable factor in the working environment of airport ground handling workers and poses a risk to their safety and health. Noise has a direct specific impact on the auditory analyzer, which leads to organic, degenerative and biochemical changes in the neural structures of the auditory analyzer at high values of the sound level and duration of exposure. These changes can be detected during an audiometric hearing test in airport ground handling workers exposed to excessive levels of occupational noise./2,3,4,5/

The focus of the present analysis is aimed at researching the legislative frameworks in the USA and the Republic of Bulgaria in the field of health monitoring on the auditory analyzer for airport ground handling operators working in environments with excessive noise levels. The aim is to compare and analyze legal requirements and standards, to highlight specific problems if any, to present good practices in order to improve health monitoring, diagnosis and prevention of occupational hearing impairments in workers exposed to occupational noise over 85 dB(A), including for airport ground handling operators.

2. MATERIALS AND METHODS

The approach to conducting the analysis includes methods and tools for gathering and researching information from a variety of sources and documents regarding the Bulgarian regulatory framework and the US legal framework in the field of hearing health screening for workers at excessive noise levels above 85 dB(A). For the purposes of the analysis, a large number of publicly available normative documents, standards, articles, etc. were examined. relevant to noise and hearing health monitoring. The main research methods used in the analysis are: the normative method, which clarifies the meaning of legal norms; documentary; historical; the formal-logical method; the methods of logical connection and sequence, through which a scientific systematization and summary of the facts related to the matter under consideration is achieved.

3. RESULTS AND DISCUSSIONS

- UNITED STATES OF AMERICA

In 1971, the US Congress created the Occupational Safety and Health Administration (OSHA) within the Department of Labor with authority to issue occupational health and safety regulations, set and enforce standards, training, offering good practices, etc./5/

In SEC. 6. of the Law on Safety and Health at Work, the introduction of Standards for Safety and Health at Work are determined. In the introduction of standards relating to harmful physical agents, incl. noise in the working environment, it is chosen to introduce this standard, which guarantees to the highest degree that, with regular exposure to the hazard throughout his working life, no worker will suffer significant damage to his health.

Under the US Occupational Safety and Health Act, employers must comply with hazard-specific Standards promulgated by OSHA.

OSHA Noise Standards:

- Standard 29 CFR 1904 - Recording and Reporting Occupational Injuries and Illness (29 CFR 1904) in 1904 subpart (C) section 1904.10 Recording criteria for cases involving occupational hearing loss.
- Standard 29 CFR 1910 General Industry, 1910 Subpart G- Occupational Health and Environmental Control, 1910.95, Occupational Noise Exposure. /10/

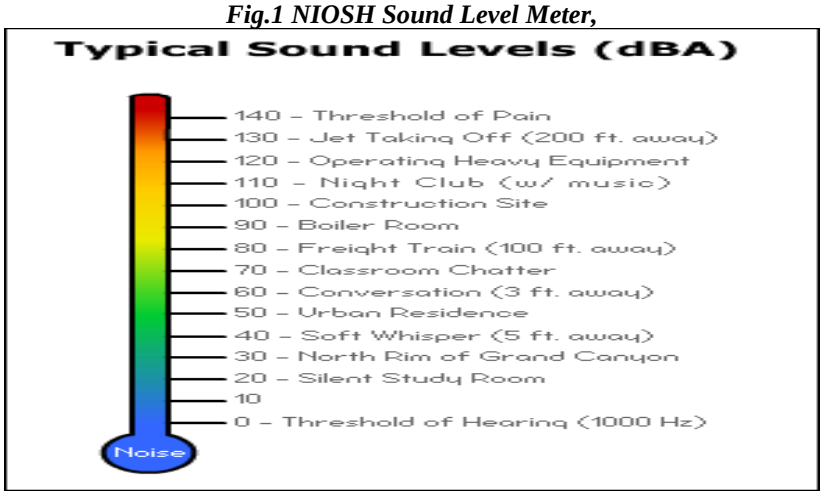
OSHA sets the permissible exposure limit Lex,8h=90 dB(A) and imposes the requirement, for any increase in noise of more than 5 dB, to cut work times in half.

According to the OSHA noise standard, noise exposure must be reduced by implementing engineering measures, noise control, monitoring, the application of personal protective equipment for hearing protection to reduce noise levels to values specified in Table G- 16 and Table G-16A at 29 CFR 1910.95(b)(1). /9/

The National Institute for Occupational Safety and Health (NIOSH) states based on scientific studies that at noise levels defined by OSHA Lex,8h=90 dB(A) significant hearing loss occurs. In its Publication No. 98-126, (June 1998)-Occupational Noise Exposure, NIOSH addresses the prevention of hearing loss in workers in noisy environments and recommends that noise be controlled below a level, Lex,8h=85 dB(A) , specifying that for an increase of 3 dB, the exposure time should be halved.

Fig. 1 shows an application of the NIOSH Sound Level Meter with examples of the different noise levels in different types of activities./9/

Fig.1 NIOSH Sound Level Meter,



In the US, National Consensus Standards and recommendations from other professional organizations have been introduced, e.g. The American National Standards Institute (ANSI) establishes standards that are not as mandatory as OSHA's standards, but provide guidelines to protect workers.

- S3.44, Determination of occupational noise exposure and estimation of noise-induced hearing impairment.
- S3.1, Maximum permissible ambient noise levels for audiometric test rooms. Specifies maximum permissible ambient noise levels (MPANL) allowed in audiometric test rooms.
- S3.6, American National Standard Specification for Audiometers. Includes specifications and tolerances for audiometers and standard reference threshold levels for audiometric transducers.
- S12.6, Methods for measuring the real-ear attenuation of hearing protectors Specifies laboratory-based procedures for measuring, analyzing and reporting passive noise reducing capabilities of hearing protection devices./10/

In 1981, OSHA introduced new requirements for employers, requiring them to implement a Hearing Protection Program where workers are exposed to Lex,8h= 85 dB(A) of 85 dB(A) or higher.

- **Hearing conservation program**

In 1983 OSHA develops a Hearing Protection Program that establishes procedures and rules to protect the hearing of workers exposed to noise above 85 dB(A).

The hearing protection program aims to prevent initial occupational hearing loss, educate workers about specific risks of working in excessive noise conditions and provide them with effective protective equipment to protect the hearing analyst. /7,8,12/

The hearing protection program requires employers to measure noise levels in the work environment, provide their workers with free annual hearing analyzer medical examinations, hearing protection, training and evaluations of the adequacy of personal hearing protection devices used, except if no changes are made in production technology, replacement of work equipment with quieter ones, change in work schedules so that workers are exposed to noise lower than 85 dB(A).

The Hearing Conservation Program specifies the specific requirements for the location, the room for conducting the audiometric hearing test, the requirements for background noise levels in the room for conducting audiograms, and the calibration of the audiometers, which must meet certain specifications specified in the SC- 1969 of the American National Standards Institute ANSI.

OSHA's Hearing Conservation Program outlines the requirements and methods for the Audiometric Hearing Test. The requirement is that employers have a Program for audiometric testing of workers exposed to a noise level Leq 8h = 85dB(A) or more. A certified otorhinolaryngologist or other doctor is responsible for the implementation of the Program. Audiometric testing is conducted by physicians or trained technicians, with the program physician responsible for monitoring and conducting the tests, providing an opinion on abnormal audiograms, and determining whether a person with an audiogram change needs to be referred for clarification elsewhere. If diagnostic clarification is needed, the employer refers the employee to a clinical audiological evaluation or an examination by an otolaryngologist.

There are two types of audiograms in OSHA's Hearing Conservation Program

- Basic audiogram so called a baseline audiogram against which the worker's future audiograms are compared. It takes place within 6 months of the worker's initial exposure to noise at or above Leq 8h =85dB(A). Before it takes place, employees are required not to be exposed to noise for 14 hours or to wear antiphons during this period of time.
- Annual audiogram - conducted within 1 year of baseline noise exposure to determine whether there is hearing loss in workers exposed to near or above noise levels in the work environment. Annual audiograms are compared to baseline audiograms to assess whether the worker has a hearing loss or had a standard threshold shift /STS/. STS is an average hearing analyzer change of 10 dB or more at 2000, 3000, and 4000 Hz. This allows employers to take timely protective measures to preserve the hearing of workers.

After evaluation of the audiograms, the employer must notify, within 21 days of their completion, any employee who has a shift in the STS threshold and provide him with appropriate personal protective equipment for the worker's hearing analyzer, train him in its use and requires the employee to wear them at work. For some workers, where there are suspicions of pathology and problems with the auditory analyzer, additional tests are carried out and the employer advises the worker to see a doctor.

When conducting follow-up audiometric tests, they are compared with the baseline audiogram of each worker. /6,7/

Since 2003, under Standard 29 CFR 1904 - subpart (C) section 1904.10 Recordkeeping criteria for cases involving occupational hearing loss, US employers are required to report to OSHA all cases of work-related hearing loss when A worker's audiogram shows significant hearing loss. Employers can correct age-related hearing loss by seeking the advice of a medical professional to determine whether the hearing loss is work-related or age-related.

According to OSHA, research shows that workplaces with effective Hearing Protection Programs have lower rates of absenteeism and higher levels of productivity. /6,7/

- LEGAL FRAMEWORK IN THE REPUBLIC OF BULGARIA

In Bulgaria, the health monitoring of airport ground handling operators exposed to excessive noise in the work environment is carried out according to the general regulatory framework, which includes workers exposed to noise above the upper exposure value for taking action Lex,8h=85 dB(A). The requirement is under Section III of Ordinance No. 6/ 15.08.2005. on the minimum requirements for ensuring the health and safety of workers in case of risks related to noise exposure in the working environment and is carried out according to Ordinance No. 3/28.02.1987. for the mandatory preliminary and periodic medical examinations of workers. Ordinance No. 3/1987 does not meet modern requirements, medical achievements and good practices in this field. There are no clearly regulated requirements regarding the room and environment in which the audiometric hearing test will be performed, requirements for the type of audiometry equipment, the rules for conducting it, the evaluation criteria of the auditory analyst, the consideration of age-related changes in hearing, etc. All this leads to the formal performance of preventive medical examinations and screening audiometric hearing tests. The lack of a developed standard and rules for comparability of the results of previous years does not allow dynamic monitoring of the auditory analyst and the health status of the workers. This makes it difficult for medical specialists and occupational health and safety management to take adequate measures to protect the hearing of workers, as well as to evaluate the effectiveness of the technical and organizational measures taken to reduce the risk of exposure to excessive levels of noise in the work environment. It becomes difficult to assess the effectiveness of the workers' hearing protection devices and the selection of suitable antiphons. /1/

4. CONCLUSIONS

The similarity between the two systems is in the main preventive approaches by improving working conditions enshrined in the Act on Health and Safety at Work in Bulgaria and the Act on Occupational Safety and Health in the USA. The main authority for controlling legislation in this area for the USA is the Occupational Safety and Health Administration under the Ministry of Labor of the United States, and for Bulgaria it is the Executive Agency "Main Labor Inspection" under the Minister of Labor and Social Policy.

A comparative study of the legislation related to hearing health monitoring standards for airport ground handling operators working in environments with excessive noise levels in the USA and Bulgaria reveals several significant differences between the two countries.

In the US, OSHA has the authority to issue, set, and enforce workplace health and safety standards, which is regulated in SEC.6. of the Occupational Safety and Health Act. In the area of noise and hearing health monitoring for workers in environments with excessive noise levels, mandatory Safety and Health Standards and a Hearing Conservation Program have been implemented by OSHA. They introduce clear procedures and rules for noise control, health screening of hearing through audiograms, evaluation of the effectiveness of measures taken to reduce noise and protection of the auditory analyzer of the workers.

In the USA, various professional organizations have introduced National Consensus Standards and Recommendations in various areas, including in the field of occupational noise, e.g. American National Standards Institute (ANSI). These standards provide guidance related to the protection of workers and the provision of health and safety in the workplace.

In Bulgaria, there are still no established standards with a specific algorithm for conducting health monitoring, screening for early hearing impairments and preventive medical examinations of workers. The lack of clear criteria and standards in the field of prevention greatly complicates the work of specialists in occupational medicine and aviation medicine. It is important to clearly regulate the legal framework and to introduce standards with clear criteria, with the guiding principle being the better protection of the health and safety of workers by dynamically tracking the changes in the auditory analyzer for those working in environments with excessive levels of occupational noise. For airport ground handling operators exposed to excessive noise above 85 dB(A)8h, the main objective is to detect early changes in the auditory analyzer, establish early health effects of noise exposure and promptly take measures to manage occupational risk, preserve health, maintaining working capacity, accident prevention, incl. flight safety.

ACKNOWLEDGMENTS

of Prof. Lubomir Alexiev,Ph.D Head of the Department of "Aviation and Maritime Medicine" and Eng. Krasimir Vatov, chief expert in the Department of "Military Medical Training and Support", Military Medical Academy - Sofia, for the help and support in the creation and correct structure of the article.

REFERENCES

Georeva, P., Bakova, D., Karamfilov, K., Zlatareva, D., & Hadjiiolova, R. (2015). Example of assessment of suitability for operation in an environment with excessive noise. Scientific works of the Union of Scientists - Plovdiv. Series D: Medicine, Pharmacy and Dentistry, 17, 15-18.

Stoilova, I., Valkov, A., & Stefanova, P. (2013). Health problems in air transport workers, Faculty of Public Health, Medical University, Pleven, Science§Technologies, Volume III, Number 1, Medicine, 2013, 283-287

Tsvetkov, D., & Angelova, M. (2007). Infrasound, ultrasound, noise and vibration, Medicine and physical education, 2007, p.85-89

Tsvetkov, D. (2014). Hygiene Occupational medicine Occupational hygiene Occupational diseases, BNAM, 2014, volume II, 149-160; 408-410

About OSHA, U.S.Department of Labor, Occupational Safety and Health Administration, , Retrived March 14, 2023 https://www.osha.gov/aboutosha

Hearing Conservation. OSHA Publication 3074, (Revised 2002). Summarizes the required component of OSHA's hearing conservation program for general industry. Covers monitoring, audiometric testing, hearing protectors, training, and recordkeeping requirements. Retrived March 14, 2023 from https://www.osha.gov/sites/default/files/publications/osha3074.pdf

Hearing Conservation for the Hearing-Impaired Worker. OSHA Safety and Health Information Bulletin (SHIB), (December 27, 2005).

Ogunyemi, Adekunle, "Occupational Noise Exposure Evaluation of Airline Ramp Workers" (2018). *USF Tampa Graduate Theses and Dissertations.* https://digitalcommons.usf.edu/etd/7205

Occupational Noise Exposure, Overviw, U.S.Department of Labor, Occupational Safety and Health Administration, Retrived March 14, 2023 https://www.osha.gov/noise

Occupational Noise Exposure, Standards, U.S.Department of Labor, Occupational Safety and Health Administration, Retrived March 14, 2023 from https://www.osha.gov/noise/standards

Occupational Noise Exposure, Hearing Cinservation Program, U.S.Department of Labor, Occupational Safety and Health Administration, Retrived March 14, 2023 from https://www.osha.gov/noise/hearing-programs