Occupational Noise Regulations

Boonchong Chawsithiwong[1]

Abstract

This documentary research is aimed to explore occupational noise standards in Australia, Europe, and the United States and compare those to Thailand's occupational noise standards. Results of this research reveal that Thailand's occupational noise exposure is of the responsibilities of Ministry of Industry and Ministry of Labor. Occupational noise standards of both ministries are compatible. The Thai occupational noise standards are similar to that of the OSHA , U.S.A. Hearing conservation program is required for any workplace with noise level above 85 dBA as well as noise labeling. Effective noise standard enforcement should be emphasized. Neighborhood noise annoyance should not be ignored and should be solved by social and political means.

---

[1] Associate Professor of the School of Social and Environmental Development, The National Institute of Development Administration

1. Introduction

Noise, commonly defined as unwanted sound, is an environmental phenomenon to which we are exposed throughout our lives. Noise can also be considered as an environmental pollutant. Noise is any sound that can produce an undesired physiological or psychological effect in an individual and that may interfere with social ends of individuals or groups. These social ends include all of our activities such as communication, work, rest, recreation and sleep. (Davis, M.L. and Masten, S.J., 2004:600)

As industry has become more mechanized, noise levels have usually become more intense and higher than those normally experienced outside the workplace. Workers' compensation laws now cover the loss of hearing because of noise exposure. These compensation laws have encouraged employers to control noise in the workplace. (Wentz, C.A. 1999:220)

Occupational hearing loss is a partial or a complete hearing impairment of one or both ears as a result of workplace exposures. Noise induced hearing loss and, to a lesser extent, acoustic trauma from sudden blasts or explosions are the main causes of occupational hearing impairment. Noise-induced hearing loss is the result of chronic, cumulative exposure to

hazardous noise over many years. It usually affects both ears equally and permanently. Acoustic trauma is severe damage to the inner ear from a single incident of sudden, intense acoustic energy. (Plog, B.A.et.al.,1988: 112)

The unit used for discussing the level of sound and, correspondingly, to judge noise levels as hazardous is the decibel, or one – tenth of a bel. One decibel represents the smallest difference in the level of sound that can be perceived by human ear. Table I shows decibel levels for various common sounds. The weakest sound that can be heard by a healthy human ear in a quiet setting is known as the threshold of hearing (10 dBA). The maximum level of sound that can be perceived without experiencing pain is known as the threshold of pain (140 dBA) (Goetsch, D.L.,2000: 157)

Table I Selected sound levels

Source	Decibels (dBA)	Remarks
- Whisper	20	Decibel measured on the a weighted network (an international standardized characteristic used in sound pressure weighting)
- Quiet office	50	
- Normal conversation	60	
- Noisy office	80	
- Power saw / chain saw	90	
- Grinding operations	100	
- Passing truck	100	
- Jet aircraft	150	
- Punch press	110	
- Lawn mower	90	
- Garbage disposal	80	
- Vacuum cleaner	75	
- Threshold of good hearing	10	
- Threshold of exceptional hearing	0	

Source: Goetsch.D.L.2000 : 157 and Wentz, C.A.1999 : 227

Industrial noise and lifestyle noise are the major causes of chronic hearing loss, which is usually irreversible. Heredity, aging, disease, noise, and ingested toxic substances can influence sensorineural hearing loss. Presbycusis, a hearing loss of the elderly, gradually changes the delicate labyrinth structures as people age. It may begin to become apparent at middle age. Presbycusis cannot be cured, but may be treated with a hearing aid. In addition, hearing impairments that are not induced by noise include the following: (Wentz, C.A.,1999: 224)

1. Physical blockage of the auditory canals by excessive wax or foreign objects
2. Diseases that infect the inner ear, for example, smallpox
3. Punctured eardrums by traumatic damage
4. Damage from drugs such as streptomycin, furosemide or quinine

Industrial noise effects both workers and neighbors. Recent evidence also shows that noise above 70 dBA can raise the cholesterol level, blood pressure, and heartbeat. It also can contribute to emotional stress reactions associated with mental disturbances. Rarely does noise beyond a manufacturing property line cause deafness. More often it is an annoyance - sometimes interfering with conversation, other times interfering with sleep patterns. To protect neighbors from industrial noise, it

is often necessary to locate such processes far enough from the company's property line to moderate the sound heard on adjacent property. (USEPA, 1977: 4-5)

The three broad types of industrial noise are available - wide band, narrow band and impulse noise. Wide band noise is noise that is distributed over a wide range of frequencies. Most noise from manufacturing machines is wide band noise. Narrow band noise is noise that is confined to a narrow range of frequencies. The noise produced by power tools is narrow band noise. Finally, impulse noise consists of transient pulse that can occur repetitively or non-repetitively. The noise produced by a jackhammer is non-repetitive impulse noise. (McDonald, O.F., 1987: 37)

In Thailand, both Ministry of Industry and Ministry of Labor promulgated noise regulations. How are these compatible to each other and to those of developed countries? This question should lead us to explore and compare noise regulations. Then, documentary research was employed.

2. Results

Results of exploration of noise regulations in Australia, Europe and United States and comparison of those to Thailand's noise regulations are as follow:

2.1 Australian Standard for Occupational Noise

Part 3 of the Occupational Health and Safety Regulation 1994, imposes responsibilities and duties on

employers, employees, contractors, manufacturers, suppliers and installers. This part is on occupational noise, and it stipulates the following objectives: (Comcare of Australian Government. 2006 : online)

To ensure that employees and contractors at work are not subject to noise in excess of the exposure standard, and to ensure that appropriate personal protective measures are implemented, if the taking of all reasonably practicable steps does not reduce noise to or below the exposure standard.

National occupational noise standard and national code of practice were revised in the year 2000 and 2004, respectively. The objective of this National Standard for Occupational Noise is to reduce significantly the incidence and severity of occupational noise induced hearing loss. (Department of Employment and Workplace Relations, 2006: online)

The national exposure standard for noise in the occupational environment is an average daily exposure level of 85 decibels. This is consistent with overwhelming scientific evidence which indicates that exposure levels above 85 decibels represent an unacceptable risk to the hearing of those exposed. Many other developed countries have introduced legislation base on this standard. For peak noise, the national standard is a peak sound pressure level of 140 decibels.

The national code of practice provides practical guidance on how the national standard can be achieved. The national code of practice is intended to assist employers, employees, unions, management, health and safety committee representatives, safety officers, occupational health and safety professionals and others requiring guidance on understanding and reducing workplace noise exposure.

The level specified in the national standard are the maximum acceptable exposure levels for noise in the workplace. However, over long periods, repeated noise exposure between 75 and 85 decibels may be a small risk to some people. With progressively increasing levels, the risk becomes greater. Workplace noise levels lower than 85 decibels are, therefore, desirable, if practicable.

The code of practice on noise provides practical guidance to assist employers, employees, manufacturers and suppliers to understand their responsibilities and duties. (Comcare of Australian Government, 2006: online)

Under the regulations, employers have a number of duties, including:

- Limiting noise exposure. The regulations set noise exposure limits and require employers to take specific actions where noise exposure to employees is likely to exceed these limits. Specifically, the noise exposure limits imposed by the regulation are:

- an 8 hour equivalent continuous A – weighted sound pressure level, $L_{Aeq.8h}$ of 85 dBA referenced to 20 micro pascals; or
- a C – weighted peak noise pressure level of $L_{c, peak}$ of 140 dBC

This limits are referred to as the exposure standard.

Under the regulations, an employee or a contractor must:

- Comply with any noise control measures implemented to reduce noise exposure; and
- Inform their employer, as soon as practicable, of any defect that they become aware of with any noise control equipment at their work place.

If an employee or a contractor is given a personal hearing protector to use, they must use the protector and inform their employer, as soon as practicable, of any defect that they become aware of with that protector.

The regulations set out requirements for the design, manufacture, supply and installation of plant to ensure that the noise emitted by plant is safe for employees and contractors and represents no risk to their health. Manufacturers and suppliers are required to take all reasonably practicable steps to provide employers with information on the noise emitted by the plant and ways to minimize the noise levels.

2.2. The European Union (EU)

In 1986, the EU adopted a directive with the aim of providing protection to workers from noise at work. This was implemented though the Noise at Work Regulation 1989, which apply to all work situations. (Camden, 2006: online)

The Regulations require employers to assess noise levels in the workplace. Three action levels are specified:

- First action level – a daily personal noise exposure of 85 dBA – at this level, ear defenders must be made available to employees who ask to use them.
- Second action level – a daily personal noise exposure of 90 dBA – at this level, employers must ensure that ear defenders are used and employees are obliged to wear ear protection provided.
- Peak action level – a peak sound pressure of 200 pascals (140 dBA) – as with the second action level, employers must ensure that ear defenders are used and employees are obliged to wear ear protection provided.

The duty of assessing occupational noise exposure does rest with employers and they have a duty to carry out a noise assessment where it is likely that noise exposure may exceed the second or peak action levels.

The Noise at Work Regulation 1989 is replaced by the Control of Noise at Work Regulation 2005 which has come into

force since 15 February 2006. The main change is the reduction by 5 dB of the exposure levels at which action has to be taken, and the introduction of a new exposure limit value and a specific requirement on health surveillance. In practice this means that there will be a requirement to ensure that noise exposure levels are reduced to meet the new regulations. (IOM, 2006: online)

2.3. The United States

Noise induced hearing loss affects 10 million Americans, and tragically, it is entirely foreseeable and preventable. (NPC.,2006: online)The incidence of noise – induced hearing loss can be reduced or eliminated through the successful application of engineering controls and hearing conservation programs. (Occupational Safety & Health Administration, U.S. Department of Labor.2006: online)

Occupational noise exposure is included in Occupational Safety and Health Standards No.1910.95 of the U.S. Regulation (Standards – 29 CFR). Protection against the effects of noise exposure shall be provided when the sound levels exceed those shown in Table II when measured on the A scale of a standard sound level meter at slow response. When employees are subjected to sound exceeding those listed in Table II, feasible administrative or engineering control shall be utilized. If such controls fail to reduce sound levels within the levels of Table II,

personal protective equipment shall be provided and used to reduce sound levels within the levels of the table.(Occupational Safety & Health Administration, U.S. Department of Labor, 2006: online)

Table II Permissible Noise Exposure

Duration per day, hours	dBA
8	90
6	92
4	95
3	97
2	100
1.5	102
1.0	105
0.5	110
0.25 or less	115

Note: When the daily noise exposure is composed of two or more periods of noise exposure of different levels, their combined effect should be considered, rather than the individual effect of each.

Source: Lehtola C.J. et.al., 2006: online

When information indicates that any employee's exposure may equal or exceed an 8 – hour time – weighted average of 85 decibels, the employer shall develop and implement a monitoring program.

The sampling strategy shall be designed to identify employees for inclusion in the hearing conservation program and to enable the proper selection of hearing protectors.

All continuous, intermittent and impulsive sound levels from 80-130 decibels shall be integrated into the noise measurements.

NIOSH (National Institute for Occupational Safety and Health), Centers for Disease Control and Prevention recommends an occupational noise exposure limit at 85 decibels, A- weighted, as an 8 hr time – weighted average (85 dBA as an 8- hr TWA). For workers whose noise exposures equal or exceed 85 dBA, NIOSH recommends a hearing loss prevention program that includes exposure assessment, engineering and administrative controls, proper use of hearing protectors, audiometric evaluation, education and motivation, recordkeeping, and program audits and evaluations. (Rosenstock, L.1998: online)

NIOSH also recommends limits on exposure time to 90 dBA for 4 hours, 95 dBA for 2 hours, 100 dBA for 1 hours, 105 dBA for 30 minutes, 110 dBA for 15 minutes, 115 dBA for 7.5

minutes. Moreover, The American Conference of Governmental Industrial Hygienists (ACGIH) suggests that exposure time to 115 dBA should be 28.8 seconds and exposure to 140 dBA should be 0.1 seconds, the duration of a rifle shot or a hammer blow. (NIOSH,2006: online)

Comparison of permissible noise exposure by OSHA, NIOSH and ACGIH is shown in Table III.

Table III. Permissible Noise Exposure by OSHA, NIOSH and ACGIH

dBA	Time Limits		
	OSHA	NIOSH	ACGIH
85	-	8 hrs	-
90	8 hrs	4 hrs	-
95	4 hrs	2 hrs	-
100	2 hrs	1 hr	-
105	1 hr	½ hr	-
110	½ hr	¼ hr	-
115	¼ hr or	7.5 min.	28.8 sec.
140	less	-	0.1 sec.
	-		

2.4. Thailand

Ministry of Industry and Ministry of Labor are responsible for the enforcement of laws on occupational noise. Occupational noise exposure is included in the Ministry of Industry Announcement on Industrial Safety Measures in Workplace Environment, 2003 (พ.ศ.2546). This regulation prohibits working within any areas with noise over 140 dBA. It is the responsibility of industrial management to comply with noise standard as indicated in Table IV. (Office of Cabinet Secretariat, 2003: 11-13)

Table IV Industrial Noise Standard of the Ministry of Industry

Duration per day (hrs)	Permissible Noise (dBA)
12	87
8	90
6	92
4	95
3	97
2	100
1.5	102
1	105
0.5	110
0.25	115

Note: Whenever duration per day is not indicated in the above table, calculation the permissible noise can be computed by this formula:

$$T = \frac{8}{2^{(L - 90) / 5}}$$

When T = duration per day (hrs)

L = permissible noise, dBA

Not all industries have to do noise assessments. There are only 21 types of industries which must have noise assessment programs as indicated in the regulations.

Under the regulations for occupational noise exposure of the Ministry of Labor, employers have to comply to occupational noise standards which are consistent to noise standards of the Ministry of Industry. The regulation requires employers to implement noise conservation program. Standards for ear plugs and ear muffs are also indicated in the regulations. (Office of Cabinet Secretariat. 2006: 19)

3.Comparison of Noise Exposure Standards

Below is a brief comparison of noise exposure standards in U.S.A., EC, Australia and Thailand, as shown in Table **V:**

Table V Comparisons of noise exposure standards of some countries

Countries	dBA Permissible levels for 8 hrs	Response Time	Weighting	Ceiling Levels
U.S.A. OSHA	90	slow	A	115 dBA (slow) 140 dBA (instantaneous)
NIOSH	85	slow	A	115 dBA
ACGIH	-	-	-	115 dBA for 28.8 sec. 140 dBA for 0.1 sec.
EC	85 90 (Hearing Conservation)	slow	A	140 dBA for the second action level
Australia	85	slow	A/C	140 dBC for peak noise level

Countries	dBA Permissible levels for 8 hrs	Response Time	Weighting	Ceiling Levels
Thailand	90 Above 85 dBA hearing conservation program is required	slow	A	140 dBA

The table above shows that Thailand's noise standard is similar to that of the OSHA, U.S.A. It should be noted that hearing conservation program is required in Thailand wherever workplace noise level is above 85 dBA. Comparison to EC, hearing conservation program is required wherever workplace noise level is at 90 dBA and above.

4. Hearing Conservation Program

In The United States, OSHA requires that individuals working in high noise areas participate in a hearing conservation program. The Office of Environmental Health and Safety conducts noise surveys to determine the areas that exceed the permissible exposure limit. If engineering controls cannot be implemented, then employees must participate in the hearing conservation program. (The Ohio State University, 2006: online)

When information indicates that any employee's exposure may equal or exceed the action level, the employer must develop and implement a monitoring program. Monitoring must be repeated whenever a change in production, process, equipment or controls increases noise exposure to the extent that additional employees may be exposed at or above the action level or when the attenuation provided by hearing protectors being used by employees may be rendered inadequate.(Lehtola, C.J., 2006: online)

University of Louisville employees whose occupational noise exposure exceeds 85 decibels for an 8 hour time – weighted average must be enrolled in a Hearing Conservation Program. Annual training is an integral part of this program. The training provides information on complying with the OSHA Noise Standard, establishing an effective hearing conservation program, the effects of noise on hearing, the purpose of hearing protectors and the various types available, and the purpose of audiometric testing. (University of Louisville. 2006: online)

OSHA Occupational Noise Training Requirements and Resources includes various documents and forms as indicated in the regulations such as: (Ohio State University. 2006: online)

- Noise exposure computation
- Methods for estimating the adequacy of hearing protector attenuation
- Audiometric measuring instruments
- Audiometric test rooms
- Calibration of audiometers
- Monitoring noise levels non - mandatory informational appendix

In Australia, University of NSW (New South Wales) has a training course on Occupational noise. The Defense Occupational Noise course is designed to provide selected personnel with information and practical experience in basic noise measurements, regulations, management and control. The course includes human perception of sound and explains noise measurement and assessment with particular emphasis on standards and regulations relevant to the defense occupational environment. The course also covers the basic concepts of noise control and lectures are supplemented with practical measurement sessions an tutorial exercises using instrumentation available within Defense. Course fees are centrally funded. Participants' Parent Units are responsible for organizing and paying for all costs associated with travel, accommodation and meals. (Department of Defense, Australian Government. 2006: online)

In Thailand, Noise regulations of The Ministry of Labor requires employers of the workplaces with noise level over 85 dBA to establish hearing conservation program. Audiometric assessment and training courses shall be provided (Office of Cabinet Secretariat. 2006: 19). Noise regulation of the Ministry of Industry requires industrial management with non - compliance with noise standards to have noise warning labels in the workplaces. (Office of Cabinet Secretariat.2003: 11-13)

5. Conclusion and recommendation

Thailand's Occupational noise exposure is of the responsibilities of the Ministry of Industry and the Ministry of Labor. Both organizations use the same standards of occupational noise exposure. Thai occupational noise standards are similar to that of the OSHA. U.S.A. Hearing Conservation Program is required for any workplaces with noise levels above 85 dBA as well as labeling. It is recommended that effective enforcement of noise regulation should be emphasized.

Problem of noise annoyance to neighborhood should not be ignored. Noise annoyance is regarded as a psychological problem. Such problem cannot be solved by noise standard. Psychological condition should not rest on noise measurement and monitoring. Social and political means of solving a noise annoyance would be more appropriated.

Bibliography

Camden. 2006. **Occupational Noise**. (www.camden.gov.uk – 26/5/2006).

Comcare of Australian Government. 2006. **Occupational Noise**. OHS Fact Sheet No.1. (www.comcare.gov.au/1/6/2006).

Davis, M.L. and Masten, S.J. 2004. **Principle of Environmental Engineering and Science**. McGraw – Hill. Boston.

Department of Defense, Australian Government. 2006. **Defense Occupational Noise Course**. (www.defence.gov.au – 18/3/2006).

Department of Employment and Workplace Relations. 2006. **Occupational Noise**. OHS Fact Sheet No.1. (www.nohsc.gov.au – 1/6/2006).

Goetsch, D.L.2000. **The Safety and Health Handbook**. Prentice – Hall. New Jersey.

IOM (Institute of Operation Management). 2006. **Occupational Noise**. (www.iom – world.org – 26/5/2006).

Lehtola C.J. et.al. 2006. **Occupational Noise Exposure: OSHA Standard 1910.95**. (www.ifas.ufl.edu – 2/5/2006).

McDonald, O.F. 1987. "Noise: How Much is Too Much". **Safety & Health**. Vol.136. No.5. pp.37.

NIOSH (National Institute of Occupational Safety and Health). 2006. **Occupational Noise and Hearing Conservation Selected Issues**. (www.cdc.gov./niosh - 6/3/2006).

NPC (Noise Pollution Clearinghouse). 2006. **Hearing Loss and Occupational Noise Library**. (www.nonoise.org – 13/5/2006).

Occupational Safety & Health Administration, U.S. Department of Labor. 2006. **Noise and Hearing Conservation**. (www.osha.gov – 25/5/2006).

Occupational Safety & Health Administration, U.S. Department of Labor. 2006. **Regulations (Standards – 29CFR) Occupational Noise Exposure – 1910.95.** (www.osha.gov – 1/6/2006).

Office of Cabinet Secretariat, 2006. "Safety, Health and Environment Management Standards for Heat, Illumination and Noise". **Official Gazette**. 123(23ก). 6 March 2006. pp.19.

Office of Cabinet Secretariat. 2003. "Ministry of Industry Announcement on Industrial Safety Measures in Workplace Environment". **Official Gazette**. 120.(138ง). 3 December 2003. pp.11 – 13.

Ohio State University. 2006. **Occupational Noise Exposure and Hearing Conservation**.(www.ehs.ohio.edu – 15/5/2006).

Plog, B.A., et.al., 1988. **Fundamentals of Industrial Hygiene**. 3rd ed. National Safety Council, Illinois.

Rosenstock, L. 1998. **Occupational Noise Exposure**. (www.cdc.gov – 8/3/2006).

University of Louisville. 2006. **Occupational Noise and Hearing Conservation**. (www.Louisville.edu – 21/5/2006).

USEPA (United States Environmental Protection Agency). 1977. **Noise at Work**. Office of Public Affairs. Washington. D.C.

Wentz, C.A. 1999. **Safety, Health and Environmental Protection**. McGraw – Hill. Boston.