

Are workers in the construction sector overexposed to noise?

Marcos D. Fernandez, Samuel Quintana, Jose A. Ballesteros and Noelia Chavarria

*Escuela Universitaria Politecnica de Cuenca, Universidad de Castilla-La Mancha, Campus Universitario, 16071-Cuenca, SPAIN
Tel. +34969179100; Fax +34969179119. Email address: Marcos.Fernandez@uclm.es*

Noise is the most persistent physical contaminant in the human environment, especially in developed countries, where the models of social and economical organization, the technological development and the population are key factors in the increase of noise pollution. It is difficult to define what noise means as a physical contaminant. Normally, it is undesired sound. That concept is joined to a subjective perception, and therefore, a sound can be pleasant for some people but, at the same time, can also be annoying for some other people, or even the cause of physical or psychological illnesses. Even more, some sounds that can be acceptable in a certain period of time can change into annoying in other periods [1]. Unlike other contaminant agents, the effects of noise may be unnoticed instantaneously and its accumulation can lead to an obvious physical, psychic and social deterioration. The best studied effect of the overexposure to noise is the loss of hearing. The problem is that the exposed people are scarcely aware of the cause-effect relation given that it is produced slowly but progressively [2]. Every day, millions of European workers are exposed to noise and to all its consequent risks in their workplace. One out of five workers in Europe must raise his voice to be heard for more than half the working day and 7% of them suffer from hearing problems related to work [3]. According to European data [4], the loss of hearing caused by noise is the most common occupational illness in the European Union, and besides, noise is one factor that can increase the risk of accidents in the workplace. The safer and healthier a workplace is, the fewer probabilities of absenteeism, accidents and low performance, and consequently, cost savings will be achieved. A traditional approach for reducing risks due to noise in the workplace consists in a three-step process: assessment of risks; adoption of mechanisms for preventing or controlling risks; and, eventually, keeping a periodical monitoring and a revision of the effectiveness of the adopted mechanisms [5]. The construction working sector is especially noisy [6], and specifically in Spain, where this is the most important and numerous working sector, for housing or industrial buildings based on concrete structures, which are the majority in Spain.

DEVELOPMENT OF THE STUDY

The current regulation in the European Union regarding protection of workers is based on the Directive 2003/10/CE [7], which in Spain corresponds to the Royal Decree 286/2006 [8]; and in addition, it has to be considered in Spain the law 31/1995 about prevention of risks at work [9]. These documents state a set of minimum disposals with the aim of protecting the workers from the risks for their safety and health, caused or that may be caused by noise exposure, focusing on the hearing risks. They insist on mechanisms directed to the avoidance or reduction of exposure, so that the risks derived from exposure could disappear in their origin or might be reduced to the lowest possible level.

The indexes used for assessing the noise level in each workplace are the daily equivalent level ($L_{Aeq,d}$) and the peak level (L_{peak}). $L_{Aeq,d}$ represents the cumulative sound energy along the working day, whereas L_{peak} indicates the highest impulsive noise level registered.

Generally, in this directive, and also in the Royal Decree, the noise exposure is strictly limited, as it is stated that, in no case, the real exposure of a worker may exceed the limit values of $L_{Aeq,d} = 87$ dB(A) and $L_{peak} = 140$ dB(C). So, those limits are the maximum, even considering the attenuation given by the personal hearing devices used by each worker. In detail, those limits are:

- The initial alarm levels are $L_{Aeq,d} = 80$ dB(A) and $L_{peak} = 135$ dB(C). There is no danger below these levels.
- Between $L_{Aeq,d} = 80 - 85$ dB(A) and/or $L_{peak} = 135 - 137$ dB(C), information to workers must be provided and optional preventive measures should be adopted.
- Between $L_{Aeq,d} = 85 - 87$ dB(A) and/or $L_{peak} = 137 - 140$ dB(C), medical hearing check-up of workers must be done at least once every three years and personal hearing devices must be given to all the workers exposed.
- Over the top limits of $L_{Aeq,d} = 87$ dB(A) and/or $L_{peak} = 140$ dB(C), the causes for this excess must be analysed and a technical programme must be developed to reduce the generation or propagation of the noise. If, for any circumstance, the noise cannot be reduced below these limits, then, medical hearing check-up must be done, at least, every year, all the workers must use personal hearing devices and if it is reasonable and technically possible, the workplaces will be delimited and with a restricted access whenever the risk is very high.

There are several noise sources in the construction sector that may affect the workers along the whole construction work. So, seven different construction sites have been considered (three housing blocks, three of single family dwellings and one warehouse), where 40 workers have been measured. That number is representative enough for the average number of workers (around 15) belonging to a small and medium-sized construction enterprise in Spain who develops an average construction work in that country.

Whenever possible, according to the current regulations, measurements must be done in absence of the affected

worker by placing the microphone at the same height as his ear. If the worker has to be present, the microphone will be placed preferably in front of his ear, approximately at a distance of 10 centimetres. Measurements for this study were performed according to ISO 1999:1990 [10], ISO 9612:1997 [11], and the Spanish and European rules about noise at work [7,8].

For this study, it has been used an integrative and averaging sound level meter, of class 1 with spectrum analyzer, calibrated and according to ISO standards, and also a dosimeter, calibrated and according to ISO standards and the Spanish Royal Decree 286/2006. The dosimeter was worn by the worker and the sound level meter was placed very closed to the worker. Both measured, simultaneously, common indexes like $L_{Aeq,d}$ and L_{peak} , so as to validate the measurements, for which a tolerance of 2 dB was allowed between the measure of the sound level meter and the measure of the dosimeter. Furthermore, to avoid the effect of a possible aware influence of the worker in the measurement, he was warned that only 2 hours would be selected at random of the whole time he was wearing the dosimeter and that he would be observed periodically during the measurement. Moreover, the first measurements taken in a construction site were ruled out to avoid any deliberate influence and so that the workers of the site could get used to the measurement procedure. Through these techniques, uncertainty can be reduced [12].

EXPOSURE LEVELS

The daily equivalent A-weighted level is shown in the chart of figure 1. It clearly shows that most of the workers, 27 out of 40 (67.5%), suffer a daily exposure that exceeds 80 dB(A), which is the lower limit that implies an action according to the current regulation. But, what is worse, is that 20 out of 40

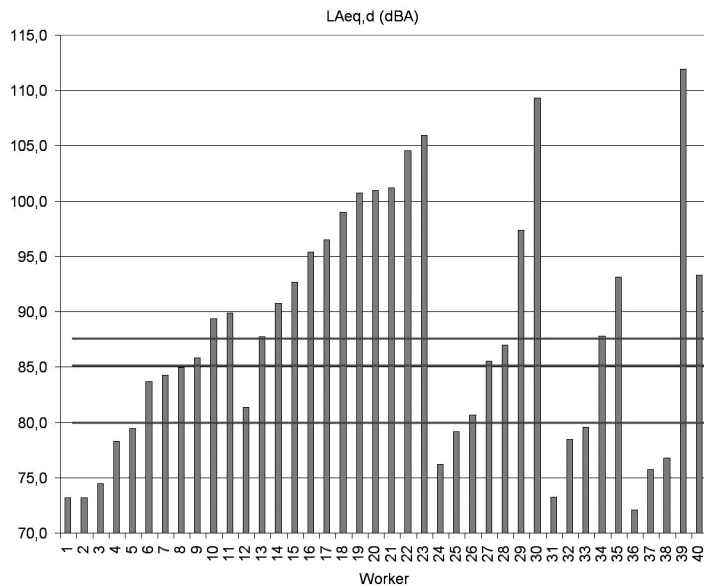


Figure 1. Daily equivalent levels.

workers, 50,0%, exceed 87 dB(A), which is the top limit. The workers that suffer more than 90 dB(A) said explicitly that they needed machines for their tasks, whereas those with levels below 85 dB(A) hardly ever used machines in the working day.

An attempt has been made to differentiate the assessed workers into two sets: the workers that must use machines continuously for their tasks and the workers that may scarcely use machines. The results given in the chart of figure 2 indicate through the average spectrum measured for both sets that, despite the great difference of levels, all the occupations that require machinery have in common that the level increases as the frequency does. That is probably due to the fact that most of the machines

have their frequency components of noise emission at the high frequency range. On the other hand, the workers that do not require machinery have a spectrum that decays at high frequency. The components of low and medium frequency are predominant and that fact states a great difference with the other set of workers. Furthermore, that is a determinant conditioning for choosing the most suitable personal hearing device for each worker, given that the protection assigned to each worker must be according to the noise suffered. In addition, the average A-weighting equivalent levels are 96.7 dB(A) for the workers that must use machines and 83.3 dB(A) for the others. This states that the former group of workers must wear hearing personal devices and

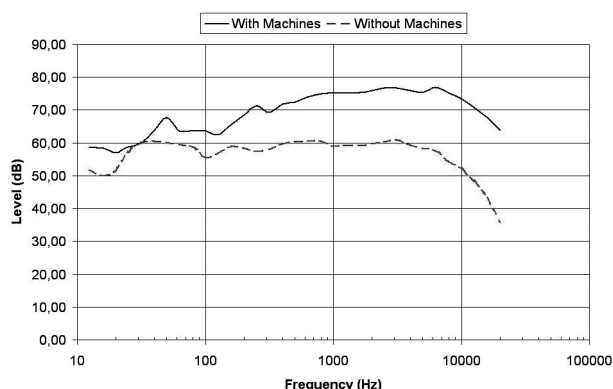


Figure 2. Noise spectrum suffered by workers that use machines usually or scarcely.

actions must be taken to reduce the noise according to the current regulations, but despite that, the workers do not wear those devices intentionally and few preventive actions are taken.

HOW THE NOISE PROBLEM CAN BE MANAGED

In general, it can be stated from the data achieved that the sound environment which the construction workers are within is quite noisy and potentially harmful to health, since the lower limit of 80 dB(A) is exceeded in most of the cases, and even more, the percentage of cases that go beyond the top limit of 87 dB(A) is quite high. Similar results have been obtained in studies carried out in Germany by the *BIA – BG Institute for Occupational Safety and Health* [13], which validates this study.

In addition, the use of personal hearing devices in the population studied is very low although their use is compulsory in many occasions in accordance with the new provisions of EU Directive 2003/10/EC [7]. This fact reveals two fundamental aspects to deal with the problem of noise at work: first, the workers are not aware of this problem and they are the first that overlook their own hearing health by rejecting the use of the personal hearing devices; and second, many companies are not persistent with the observance of the directives against noise.

It should be advisable to develop a noise management procedure to avoid the noise problem. A few enterprises have become aware of the problem noise at work poses and have already stated strategies for managing noise risks for the workers [14] and for the neighbourhood [15]. Some of the actions to control the noise can and must be planned in advance, like for instance a planning of the working processes to reduce the noise exposure of the workers to the minimum. Usually,

three types of actions are considered in the working procedures of the industrial hygiene to try to control the noise [16]: on the source (for instance by using machines with less noise emissions and properly labelled [17]), on the environment (for instance by using enclosures and barriers) and on the worker (essentially by using hearing protection devices).

Consequently, it seems necessary to find a reasonable combination of worker's behaviour and preventive strategies in the construction site. Unfortunately, it was found experimentally in the study that such a combination is absent for small and medium-sized construction companies. Regarding that, this study [18], and other similar ones like that from the BIA, are encouraging the workers, the construction companies and the authorities to become aware of the problem with the noise at work.

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FARMER WARNED TO QUIETEN COCKERELS

A farmer has been warned to keep his cockerels quiet or pay a £5,000 fine because a new neighbour complained about their crowing. After using microphones to monitor the noise, Hertsmere Borough Council issued Mr Haworth with a noise abatement notice and told him to silence the birds or face a £5,000 fine. Efforts to put up a new hedge to muffle the crowing and find the three-year-old birds a new home have failed. Mr Haworth, 52, said: "It's impossible to stop them from making noise. I don't know what more I can do. If they cannot be re-homed I fear they will have to be put down. I find it surprising that someone who does not like animal noises buys a house next to a farm."

CHURCH SILENCED BY NEIGHBOUR'S NOISE COMPLAINT: RELIGIONISM?

A church in Waltham Forest, London says its ability to praise God has been taken away after the local council subjected it to noise restrictions following a complaint from a Muslim neighbour. Immanuel International Christian Centre has seen congregation numbers dwindle from 100 to 30 since the restrictions on amplified music and sermons were enforced. The church has now lost a court appeal to lift the noise ban imposed after a complaint from Baha Uddin who lives nearby. Mr Uddin claims that noise from the church prevented him from using his garden at weekends and disturbed his one-year-old daughter. He said: "It's been a nightmare. I've not been able to use my garden or living room on a Sunday because of the church services. "The amplified music, drums and the loud sermons made having a conversation impossible. The noise made me depressed", he added. Waltham Forest Magistrates Court ordered the church to pay £2,250 costs and it is only allowed to play music for 20 minutes on Sundays between 11.30am and 11.50am. Other neighbours say the noise is not a problem, but church leaders claim that a council official told them "this is a Muslim borough, you have to tread carefully".

JAIL THREAT FOR CREATING PEACE

Two elderly parish councillors have been charged with criminal damage after they disabled a faulty burglar alarm at an empty cottage which had been keeping residents awake for months. Edmund Done, 67, the chairman of Hagworthingham parish council in Lincolnshire, and his 72-year-old deputy, Michael Curtis, were applauded by villagers when they silenced the alarm by cutting its wires. They had decided to take action after all efforts to trace the owner of the cottage - as well as appeals to the police and district council - had got them nowhere.

'WIND TURBINE SYNDROME'

Living too close to wind turbines can cause heart disease, tinnitus, vertigo, panic attacks, migraines and sleep deprivation, according to research to be published later this year by an American doctor. Dr Nina Pierpont, a leading New York paediatrician, has been studying the symptoms displayed by people living near wind turbines in the US, the UK, Italy, Ireland and Canada for more than five years. Her findings have led her to confirm what she has identified as a new health risk, wind turbine syndrome (WTS). This is the disruption or abnormal stimulation of the inner ear's vestibular system by turbine infrasound and low-frequency noise, the most distinctive feature of which is a group of symptoms which she calls visceral vibratory vestibular disturbance, or VVVD. They cause problems ranging from internal pulsation, quivering, nervousness, fear, a compulsion to flee, chest tightness and tachycardia - increased heart rate. Turbine noise can also trigger nightmares and other disorders in children as well as harm cognitive development in the young, she claims. However, Dr Pierpont also makes it clear that not all people living close to turbines are susceptible. Until now, the Government and the wind companies have denied any health risks associated with the noise and vibration emitted by wind turbines. Acoustic engineers working for the wind energy companies and the Government say that aerodynamic noise produced by turbines pose no risk to health, a view endorsed recently by acousticians at Salford University.