

NOISE AT PUBLIC EVENT

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Abstract

Recent years the noise is one of the leading pollutants in working and living environment. Although in some cases the noise levels do not exceed proposed levels, people often have the opposite impression. While for the most activities noise regulation exists, for public events this is not the case. There are certain guidelines, however established levels differ from country to country. In order to determine the noise level during public events the equivalent level of noise was measured at one public event on which approximately 50,000 people was present. The results show significantly high levels of noise, especially during rock concert and firework, when certain protective measures should be implemented.

Introduction

Industrialization, fast pace of life, traffic, transport and population growth make difficult for people to find quiet place to be. Lots of studies have shown that presently the noise is one of the leading problems in the environment and the second largest environmental cause of health problems [1]. Most of the population in the cities are constantly complaining about the traffic and street noise, loud music or about some other source of irritable sounds. People react differently to noise, but generally noise has negative impact on human health.

It increases anxiety, damages hearing, and it also causes cardiovascular and other diseases [2] and disturbs body immune response [3].

There are many studies on this subject, but little information can be found about the noise on public events, such as cultural and political events. In most cases they are held in city centre and they can last for a few days. In these circumstances the presence of people alone makes certain level of noise. Often visitors of these events consume alcohol and other stimulants which together with the noise increases the negative impact on human health. Young people are especially affected when going to loud places, by using headphones and playing video games. They often complain about tinnitus and headaches, and these can last for a few days after the exposure. Considering that the effect of hearing damage is cumulative, this observation can not be negligible.

It is also very important to mention that during public events noise protective measures are rarely implemented. Legislations provide punishment for every procedure that disturbs public peace and order. However, public events are excluded. Organizers of public gatherings, amusement and sport events and of other indoor and outdoor activities, in their notifications of the gatherings and similar activities are obliged to provide data on the noise protective measures if the use of different devices exceed allowed noise levels. For example, in Britain it is strictly prescribed that during concert or any other public event continuous equivalent noise level (dBA) can not exceed 107 dBA, while the audience should stand at least 3 meters away from the source of the sound. For the noise level higher than 96 dBA there should be a warning about the health risk concerning the exposure to noise [4]. However, it is known that

noise above 115 dB sound pressure level (SPL) can damage the inner ear and can induce enduring negative functional changes recordable in the central auditory nervous system [5].

In order to determine equivalent A-level sound pressure level of noise, the noise was measured during one cultural event in city centre. Tens of thousands people were present, and along with public speaking there were cultural and artistic activities followed by the firework. L_{eq} , L_{min} and L_{max} levels of noise were measured and frequency characteristics for 1/3 octave band in places where high noise level was noticed.

The environment surrounding is similar during political events, hence it would be desirable to compare these events in some of the upcoming research.

Materials and methodes

The study was conducted at public event that was held at the city center with nearly 10,000 inhabitants. This manifestation lasted for four days from 7pm to 4am, with nearly 50,000 visitors. Rock concert, dancing and firework was organized on the stage at the event.

The noise level was measured using the TES-1358A Sound Level Meter (SLM), with RS-232 Interface. The calibration procedure of the instrument was performed before the actual measurements using standard acoustic calibrator recommended by SLM manufacturer (TES Electrical). The desired response of SLM was set at "fast". When the measurements were made, the microphone was located in such a way as not to be in the acoustic shadow of any obstacle in appreciable field of reflected waves. Noise levels were measured at the position of the visitors head. The direction of SLM was towards the source of sound. For conducting the noise survey, Serbian guidelines for noise measuring were followed (RANLWE, 1992). The A-weighted levels on L_{eq} , L_{max} and L_{min} Sound Pressure Level (SPL) in dBA were collected. L_{eq} is the equivalent continuous noise level which at a given location and over a given period of time contains the same A-weighted sound energy as the actual fluctuating noise at the same location over the same period [4].

The measurements were taken over a period of 1min [4]. At the end of experiment the data were downloaded to a personal computer. With the help of utility software, the equivalent SPL and noise spectrum at each reading was obtained. The data were statistically analysed using Microsoft Excel. This was followed by a graphic representation of the means of L_{eq} SPL-s at different octave bands.

Results and discusion

Table 1. shows the results of L_{eq} , L_{min} , L_{max} measurements during one day of the festival. The maximum values of the equivalent sound pressure levels of noise were measured during the firework and the concert with values 92.5 and 101.9 dBA, respectively. It is well known that those values have a negative impact on human health [6].

Table 1. Results of the measurements for different activities held during the open space event.

	No.	r [m]	L_{Aeq} [dB]	L_{Amax} [dB]	L_{Amin} [dB]
Country dance					
	1.	5 (on the left)	76.2	83	70.3
	2.	5 (in front)	81.5	85	73.9
Speech					
	3.	5 (in front)	86.2	92.6	72.5
Fireworks					
	4.	5 (in front)	92.5	102.1	82.4
No performance					
	5.	5 (on the left)	76.1	87.9	69.7
	6.	5 (in front)	76.2	85.6	69.8
Concert					
	7.	5 (in front)	101.9	110.3	90.1
	8.	10 (on the right)	91.4	98	80.5
	9.	10 (behind)	81.9	88.5	73.9
	10.	200 (on the right)	66.4	79.9	59.5

Figure 1 shows frequency characteristics 1/3 octave of the equivalent noise level measured on 4 places which were 5 meters, 10 meters (in the centre of the venue and on the right side of the stage) and 200 meters from the stage. By looking at the Table 1 and Graphic 1 we can conclude that the further the stage is the level of the noise decreases. At 5 and 10 meters distance the levels of noise were high, above 80 dBA, for frequencies between 200 and 1250 Hz. The result is very interesting concerning that high noise levels at frequencies below 1 kHz produced interference with human communication, since much of the human speech is between 300 and 700 Hz, creating different subjective experience of the noise intensity. It can be said with certainty that at the distance of 200 meters the level of the noise on all frequencies is below values that can affects *human well-being and psychophysical condition*.

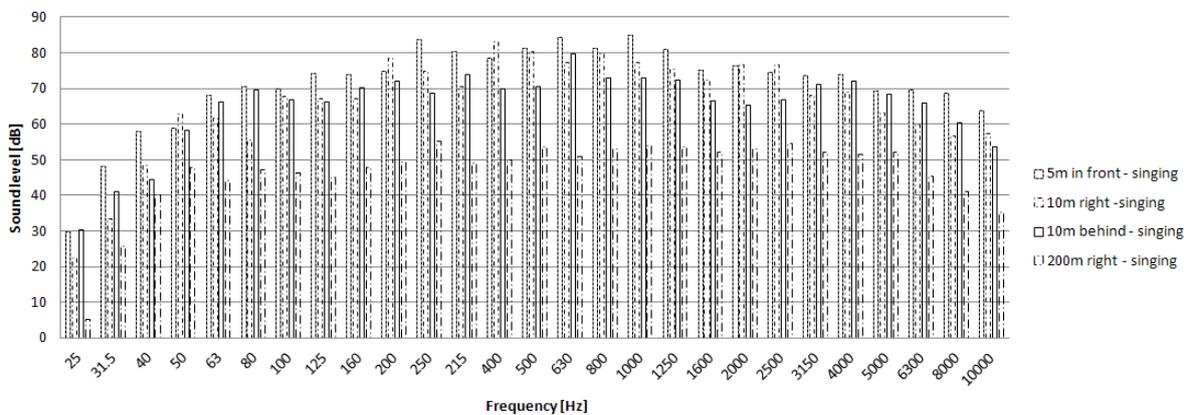


Figure 1. L_{eq} 1/3 octave band at different locations from stage

On the figure 2 frequency characteristics at 1/3 octave band for different activities on the stage was shown. Measurements were done at the distance of 5 meters. In all circumstances high levels of noise were detected, nearly and above 80 dBA, especially during the firework and concert. During speeches high levels were also detected. This situation is very similar with political events which are usually organised on stage with one or more spokesmen.

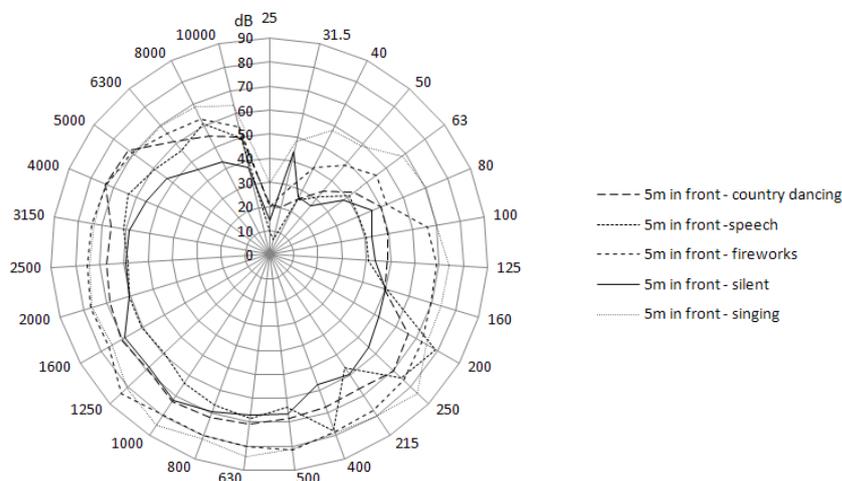


Figure 2. Frequencies analysis of L_{eq} at 5 meters from stage

In this case the noise is fluctuating with maximum level of the sound pressure level of 86.2 dBA between frequency of 200 and 400 Hz. It is interesting to mention that even during breaks, when there are no activities on the stage, the noise caused by the crowd had maximum values L_{eq} between 60 and 70 dBA for frequencies from 500 to 1600 Hz.

Conclusion

Based on the given results we can conclude that during public events people are exposed to considerable noise levels which can have impact on human health. Although these events are occasional, the protective measures must be taken against the excessive exposure to noise. Especially because its effects are cumulative and are not detected immediately. The authorities should make the organizers of such events to constantly monitor the noise during the event and, if for longer period of time the noise exceeded determined levels, to implement adequate measures. Nevertheless, along with the measurement of the noise level it is necessary to take future steps and to provide other protective measures during public events.

Acknowledgements

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