

Technical Note

Industrial noise levels and annoyance in Egypt

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ARTICLE INFO

Article history:

Received 27 January 2010

Received in revised form 27 September 2010

Accepted 1 November 2010

Available online 3 December 2010

Keywords:

Industrial noise

Levels

Annoyance

Egypt

ABSTRACT

Annoyance and increase of accident risk of workers from industrial noise levels in Egypt were studied. 683 workers from 15 Egyptian sites of industry, ranging from food to metal industry were evaluated. The goals of this study are to carry out measurements to evaluate industrial noise levels, are these levels exceeded the permissible levels set by Egyptian noise standard and policy to protect public health of workers?, to examine worker's attitudes towards industrial noise, to know the relationship between industrial noise levels and degree of annoyance. Results showed that equivalent continuous noise levels ranged from 70 to 100 dB (A). Annoyance of respondents showed that 47.1% were highly annoyed, 5.8% their hearing were harmed. There was a strong relationship between industrial noise levels and percentage of highly annoyed respondents. By increasing industrial noise level possibility of workers to make accident was also increased. Respondents suggest less maximum daily exposure duration than those set by Egyptian law.

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1. Introduction

In the last decades due to rapid industrialization in Egypt, sources of noise spread in industrial areas in Egyptian cities and noise affected extremely large number of individuals. Nowadays high noise level is considered to be the commonest reason of annoyance and permanent hearing loss. [1].

In the USA, more than 20 million (in Egypt more 2 million) industrial workers have been subjected to occupational noise in excess of 85 dB (A), which induces a gradual sensorineural hearing loss. This is a kind of common and serious problem of modern industrial world which can cause great expenditure and severe health problems. [1,2].

The general effect of industrial noise on the annoyance of workers has been a topic of debate among scientists. [2–11] Regulations limiting noise exposures of industrial workers have been instituted in many places. For example in the US, Occupational Noise Exposure Regulation states that industrial employers must limit noise exposure of their employees to 90 dB (A) for an 8-h period. [4] Primary prevention of hearing impairment is appropriate term in medicine, but the technical term exposure control would be more appropriate [1].

2. Methods

2.1. Site selection

The survey covered 15 sites representing all kinds of industry ranging from food to metal industry. Each site consisted of an industry, which was the source of industry noise. Some of industrial and maintenance sites were located in residential area as beverage, furniture, grinder of wheat, power plant, and maintenance of vehicle. Others were located in educational area as laundry of hospital and printing establishment. The rest were located in industry area. Finally, the areas were chosen to have a wide geographical distribution within Egyptian cities.

2.2. Field measurements

Industrial noise measurements were carried out by author at investigation areas. The locations were chosen to represent all kinds of industrial workplaces. The measurement time interval was adjusted for 10 min (an equivalent level measured each 10 min). The (A) weighted sound pressure level was measured by a precision sound level meter type ONO SOKKI LA-5120. The sound level meter was positioned at a height of 1.2 m above the ground. The microphone was placed in the centre of hall and far from any reflecting surface with more than 1 m. Measurement were carried out for every kind of industry for 8 h (from 8 am to 16 pm). The output of the sound level meter was fed to a digital printer type ONO SOKKI RO-110.

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2.3. Social survey

The subjective response to industrial noise was measured by means of a social survey [8,9,12]. The survey was carried out simultaneously with industrial noise measurements and at the same sites (15 sites representing all kinds of industry ranging from food to metal industry, each site considers source of the industry noise, the areas were chosen to have a wide geographical distribution within Egyptian cities, representing all industrial noise levels from 70 to 100 dB (A)), to investigate individual attitudes and opinions in respect of different aspects of the industrial noise in Egypt. The questionnaire contained questions about demographic data, educational level, annoyance, interference with other activities, psychological and physiological effects, reactions against industrial noise; agency should control industrial noise, and maximum daily exposure duration. The questionnaire was distributed by hand. The respondents completed the questionnaire themselves. A total of more than 1000 questionnaires were distributed and completed questionnaires were either collected. A total of 683 questionnaires were finally collected.

3. Results of measurements

Measurements were carried out for every kind of industry for 8 h. Levels were measured each 10 min in mentioned time.

$L_{Aeq8-16}$ was calculated for the 15 different sites by using the following equation [8]:

$$L_{Aeq8-16} = 10 \log_{10} 1/n \left(\sum_{i=1}^n 10^{L_{Aeqi}/10} \right). \quad (1)$$

where n is the number of 10 min measurements between 8:00 and 16:00.

Results showed that some $L_{Aeq8-16}$ were higher than 90 dB (A). Fig. 1 shows measured industrial noise levels for selected sites of industrial noise in Egypt.

4. Maximum noise levels permitted by Egyptian law

Maximum permissible noise level inside places of productive activities is 90 dB (A) [13]. Table 1 indicates the maximum noise

Table 1

Range of permissible noise levels (L_{Aeq} dB) for different land use areas [13].

Type of area	Range of permissible noise levels (L_{Aeq} dB) for different land use areas					
	Day		Evening		Night	
	From	To	From	To	From	To
Commercial, administrative and downtown areas	55	65	50	60	45	55
Residential areas with some workshops or commercial establishments or located on a main road	50	60	45	55	40	50
Residential areas in the city	45	55	40	50	35	45
Residential suburbs and educational area with low traffic	40	50	35	45	30	40
Residential rural areas, hospitals and gardens	35	45	30	40	25	35
Industrial areas (heavy industries)	60	70	55	65	50	60

Day from 7 am to 6 pm, evening from 6 pm to 10 pm, night from 10 pm to 7 am.

levels permitted by Egyptian law for different land use areas [13]. The limits are used for industrial noise to protect public health of workers. According to Egyptian law shown in Table 1 the maximum permissible noise levels (L_{Aeq} dB (A)) in residential areas with some workshops are 60 dB (A) while the measured noise level was 91.5 dB (A) (in power plant which located in residential area!!). The maximum permissible noise levels (L_{Aeq} dB (A)) in educational areas are 50 dB (A) while the measured noise level was 89.3 dB (A) (in printing establishment which located in educational area!!). The maximum permissible noise levels (L_{Aeq} dB (A)) in industrial areas are 70 dB (A) while the measured noise level was 98.5 dB (A) (in iron factory).

5. Maximum daily exposure duration levels set by law

The maximum daily exposure duration to industrial noise levels permitted by Egyptian law are shown in Fig. 4a [13]. The limits are used to protect public health of workers. By comparing Egyptian law with actual maximum daily exposure duration to industrial noise, we found as example in case of noise levels from 95 to less than 97 dB (A), the maximum daily exposure duration are 3 h but workers perform 8 h. In case of noise levels from 97 to less than 100 dB (A), the maximum daily exposure duration are 2 h but workers perform 8 h. This means that maximum daily exposure duration which set by Egyptian statutory standard regulations to protect public health of workers was not taken in consideration for any level of industrial noise in Egyptian factories.

6. Results of social survey

The majority of the respondents were male (84%). The ages of interviewed people exhibit a wide range: 17% were 20–30 years, 39% were 30–40 years, 36% were 40–50 years, and 8% were 50–60 years. 36% were educated in prep schools, 55% in intermediate schools (technical schools), and 9% in higher education (universities). 74.2% of respondents were annoyed by industrial noise, the rest said that they are not annoyed because they consider that is the consequence of their work and they must be patient related that matter.

Attitudes to industrial noise were elicited by means of a five step semantic scale [10,12]. 47.1% of the respondents declared themselves to be “highly annoyed”, 13.7% “rather annoyed”, 9.1% “moderately annoyed”, 4.3% “little annoyed”, the rest “not annoyed”.

Fig. 2a shows that there was a strong relationship between industrial noise levels and percentage of respondents who felt

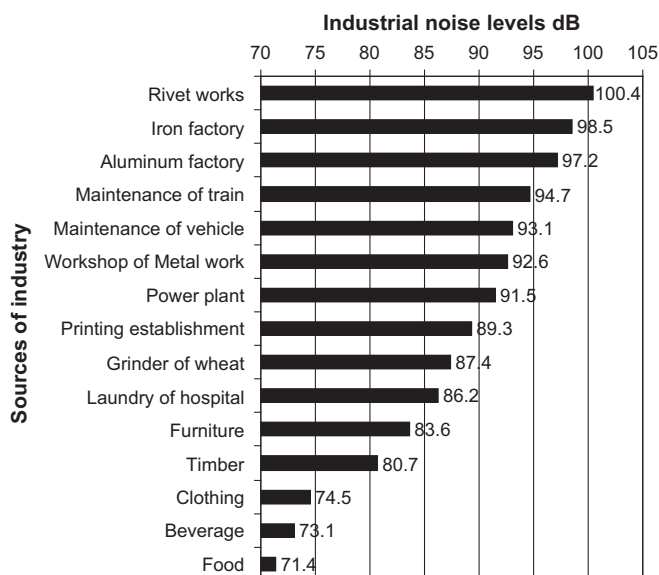


Fig. 1. Measured industrial noise levels for selected sites of industrial noise in Egypt.

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