

Environmental hazards in the workplace - Factory Noise as An Indicator - A Field Study at a Plumbing Factory In Oran (Algeria)

مخاطر بيئة العمل-ضوضاء المصانع كمؤشر-دراسة ميدانية بمصنع السباكة بهران (الجزائر)

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Abstract :

The present research paper aims to shed light on noise and its effects on employees' auditory systems, particularly in the steel foundry workshop of the foundry factory. To conduct this study, we relied on the descriptive approach, we used a questionnaire and given to a sample of 23 workers. (One sample T-Test) was used to assess the responses and determine the correlation coefficient, Pearson, and the significance of the differences.

The investigation established that the employed machinery and their concentration in one area cause significant noise levels. It also showed that the steel casting workshop had high levels of high-intensity noise, which had an impact on the workers' auditory systems. This is especially true given that there aren't enough resources for individual protection and prevention, and those resources are only available to those who work on high-intensity machines that exceed 100 decibels.

Keywords: Noise, Workplace Environment Hazards, Plumbing Factory

ملخص:

هدفت لدراسة الحالية إلى الكشف عن واقع الضوضاء وأثرها على الجهاز السمعي لدى عمال مصنع السباكة تحديدا بورشة سبك الصلب (the steel foundry). اعتمدنا على المنهج الوصفي ، عملنا على تطبيق استبيان ، وقد تم توزيعه على عينة مكونة من 23 عاملا . اعتمدنا على أساليب إحصائية- (One Sample T test) لإيجاد دلالة الفروق، معامل الارتباط بيرسون أثبتت الدراسة وجود مستويات عالية من الضوضاء بورشة سبك الصلب ناتجة عن الماكينات المستخدمة وعن تجمعها بمكان واحد. تواجد فقدان السمع بين العاملين بورشة سبك الصلب. كما كشفت أيضا عن وجود مستويات مرتفعة من الضوضاء ذات الشدة العالية مما اثر على الجهاز السمعي لدى العمال خاصة وان وسائل الوقاية والحماية الفردية غير متوفرة بالشكل الكافي كما ان توفرها يقتصر على العاملين على الماكينات ذات الشدة العالية تفوق 100 ديسيبال وبما ان المنصوح بارتدائها تحت مستويات ضوضاء تقل عن 85 ديسيبال حسب معطيات INRS.

كلمات مفتاحية: الضوضاء، مخاطر بيئة العمل، مصنع السباكة.

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Introduction:

"Noise" is one of the most dangerous hazards in the workplace, specifically in factories because it emerged with the rise of the industrial revolution as one of the most observable issues that came along with prosperity and industrial progress that resulted from the emergence of factories and machines, leading to many downsides that harmed human health, both psychologically and physically, and causing damages that are considered more acute as they occupy an advanced rank among the biggest types of pollution in terms of their effect on human health.

Factories are the most well-known locations where noise happens. In particular. It has been observed recently that machines and equipment of all kinds have spread, reducing the muscular effort needed to do the job; which in turn, encourages businesses and organizations to adopt them to a large extent in order to ensure more productivity and in a short amount of time, without considering the side effects resulting from them, especially those related to health. Because it produces more than just agitation and tension—including damage to the ear, which impairs hearing—it also causes injury to the human body. Since the negative effects of high noise range from psychological harm from annoyance and fatigue to physiological harm from the sagging of the ear muscles, health and safety laws as well as the international standards for human engineering (6385 o15) related to noise emphasize the need for the work environment to be free of acoustic influences that harm individuals (Muhammad, 2009, p. 249). According to research (Essam Issa Omran, Suad Muhammad Hail, and Abbas Abdel-Hussein 2008, p. 126), if the sound pressure level exceeded (85db), some working cadres were exposed to hearing loss after several years of labor, According to the findings of studies in the textiles industry, exceeding the noise level (90db) causes transient hearing damage, however long-term exposure to this noise level causes permanent hearing loss. Moreover, (88) decibels for a time of (120 minutes), (96) decibels for a time of (30) minutes, and 106 decibels for a time of (7 minutes) have one effect on the working individual, as the French Health Association, S.A., p.p.) considers that in case of exposure to noise during the working day (8 hours), the ear would be in danger, starting from (80) decibels (Environmental health association France, SANS.DATE), as is the case with work in some industries where loud noise is dispersed throughout, like the plumbing plant under study. To study this issue, we ask the following questions:

- What is the extent of noise spread in the factory, specifically in the steel casting workshop?
- What are the effects of the spread of noise?

1. Significance of the Study:

The study focused on a problem that affects workers in iron factories, namely that the damage caused by physical pollution associated with noise is not taken into account by the authorities. As well as the need to provide information on the effects of factory noise on workers as a tool for raising awareness among those workers and the need to permanently preventatively address the issue with measures.

2. Objectives of the Study:

The study seeks to reveal the reality prevalence of noise in the casting factory, especially within the steel casting workshop, according to the viewpoint of workers, as well as the extent of the impact of continuous exposure of workers to high noise levels on their auditory system through their answers and examinations with the work doctor of some of them. The investigation also sought to reveal the factory-approved preventive strategies and means for reducing noise levels

3. Procedural Definitions:

3.1. Noise:

Noise represents an undefined collection of sounds generated by one or more sources that create air vibrations. Depending on your tolerance for each, the outcome will be somewhat embarrassing. as it is consisted a combination of unwanted sounds with high frequencies that surpass (80) decibels (a unit of sound measurement) and is considered to be hazardous to the ears by employees when no noise protection is applied.

Furthermore, noise has been recognized as a source of occupational diseases since 1963 (Table 42 of occupational diseases induced by loud noise). The average cost of occupational deafness covered by social security is almost €100,000, making it one of the most expensive occupational disorders.

Depending on the tolerance of each noise, the outcome will be more or less unpleasant. Noise has been recognized as a cause of occupational disorders since 1963 (table no. 42 of occupational diseases pertaining to deafness produced by harmful noise). The average cost of occupational deafness covered by social security is close to 100,000 euros, making it one of the most expensive occupational disorders for. (CIDB), (no date),

3.2. Hearing loss:

Damage caused by prolonged exposure to loud noises manifests in employees' auditory systems as a gradual loss of effectiveness. Continuous tinnitus is one of the signs of ear damage, and it is assessed both subjectively using a questionnaire tool and objectively by looking at various medical records for the employees' auditory system

4. Theoretical Concepts:

4.1. The Concept of Noise:

A collection of improper and unwanted noises that the ear perceives as unpleasant and destructive are collectively referred to as noise (B. Karima, 2009, p.73)

4.2. Permissible Noise Levels:

It refers to the range of noise levels that a regular person can operate at without endangering their health. Permitted noise levels vary from one country to the next based on each nation's laws, culture, and scientific and practical research on the subject (Abdel Salam, 2009).

The National Institute for Research and Prevention (INRS, 2011) states that a noise level of (80) decibels is considered to be the minimum level of exposure to it for eight hours per day, whereas the OSHA specifications state that (90) dB is the permissible limit for exposure to it for a period of (8) hours per day for a period of (5) days a week without harm, and it also considers DB (85) to be the minimum at which steps must be taken to protect workers (OSHA, 2006).

Additionally, the majority of European health rules mandate that anyone working around noise for eight hours a day should not be exposed to a noise that is louder than that (90 dB). (Mebarki, 2004)

4.3. The auditory system:

One of the five senses for interacting with the outer world is hearing. The human ear is geared for particular vibrations and noises between 20,000 and 20,000 per second. (Mounia al Yamani, 2006)

4.4. Effect of Noise on the Auditory System:

Noise's harmful effects start above the levels that are considered to be acceptable for exposure since it damages the auditory system more intensely and for a longer period of time that it is exposed to. (Yahya)

4.5. Temporary Auditory Effect:

Since repeated exposure to loud noise causes the sensory hair cells in the spiral body of the inner ear to twitch, it is observed that when exposed to loud noise, a worker experiences temporary auditory fatigue, which is characterized by partial deafness (Khoja, 2009). However, after several hours, roughly 16 to 48 hours after the end of the workday, the sense of hearing returns to normal (NIDCD 2008).

4.6. Lasting Auditory Effect:

The sensitive capillary cells in the spiral body of the inner ear begin to deteriorate after prolonged exposure to noise, especially if the noise level is above 85 dB (Hikmat, 1988, p. (NIDCD, 2008). Among the reasons for the latter is that the intense sound may induce a strong mechanical force that physically shakes the membrane cells. It may take years for deafness to appear (Al-Sharaki, 2012). Noise also causes another ear damage known as tinnitus.

4.7. Tinnitus:

This term refers to the sound that our ears pick up and means that it "may be whistling, buzzing, hissing, or like the sound of moving machines and other sounds that do not emanate from an external source" (A. Segueni, 2011, p: 09).

Tinnitus is brought on by exposure to loud noises greater than 120 dB that irritate the eardrums. Hearing loss and ear fatigue also accompany the pain in the auditory nerve (Consumer Care Center, 2006).

5. Research Method:

The descriptive approach was utilized, consequently, the researchers used the descriptive method in this study because it is compatible with the subject of the research, which derives from the description and interpretation of the phenomenon, the subject of the research, in order to reach significant generalizations

6. Parameters of the Study:

6.1. Spatial Parameters:

The field study was conducted at The Oran-ALFON foundry company is an industrial unit whose major activity is the production and marketing of castings from iron, steel, and non-ferrous metals through the combination of mechanical machining and industrial boiler manufacturing.

Its name is derived from "Unité Fonderie d'Oran UFO" which is established by C. DUCROS & BRUSTLEIN in 1921, under the name "Ateliers et Fonderie CELESTIN DUCROS AFCD", first appeared in the manufacture of small iron parts, over the years, this enterprise has grown to lead to the manufacture of parts for weapons and tractors through the ironing process from 1926 to 1940.

The company "C. DUCROS" has been provided with professional persons and structures that have set them to develop further the foundry, automation, and boiler sector activities.

Prior to independence, this business secured a contract to manufacture "BERLIET" parts. After independence, it maintained operating under the new AFCD acronym until November 1974, when it was nationalized under the aegis of the former SONACOME company.

The latter enhanced the company's capabilities by conducting two operations, one in investment and the other in the appraisal of foundry workshops, machine shops, and boiler industries.

Following the industrial restructuring of the companies in 1983, the unit was placed under the auspices of the National Foundry Company (ENF SPA), resulting from "SONACOME" and "SN-METAL", as it maintained the same activities while building a new unit: a miniature activity in aluminum and bronze casting.

ALFON has demonstrated its worth in a variety of sectors, including beautiful general lighting and interior design, and has also established competence in the field of urban furniture, offering a range of products divided by market segment and styling products differentiated by a model manufactured. Retrieved from the website <https://fondal-dz.com/a-propos/> 05/12/2022

6.2. Temporal Parameters:

The study lasted January 2014

6.3. Sample:

An intended sample was chosen that included (23 workers) in the steel casting workshop.

7. The Study Tool:

The researcher created a noise questionnaire that included two dimensions. The first dimension was concerned with "noise". The second dimension was concerned with the impact of noise on the auditory system, and ways, and means of noise prevention.

8. The Psychometric properties of the scale:

The researcher created a noise questionnaire that included two dimensions. The first dimension was concerned with "noise". The second dimension was concerned with the impact of noise on the auditory system, and ways, and means of noise prevention

8.1. Honesty:

The questionnaire consisting of (24) items was presented to a number of professors at the Department of Humanities and Social Sciences, then the researchers modified some items according to the suggestions and observations

of the professors. Thus, the number of items in the questionnaire in its modified and final form became (24) items.

8.2. Stability:

The stability of the study tool was calculated and found using Cronbach alpha. The results are shown in Table N°. (1).

Table 1

The Stability Coefficient of the Study Tool Using Alpha Cronbach

<i>The Variable</i>	<i>The test</i>		<i>Number of Paragraphs</i>	<i>The Sample</i>
The Noise Questionnaire	Cronbach Alpha	0.74	8	23

Source: Act on the results of the SPSS program

- As shown in the table, the stability obtained in the current investigation using the Alpha Cronbach method was quite satisfactory and trustworthy.

We conducted the fundamental study to address the research issue by depending on the same method utilized and developed in the exploratory study, and as a consequence, the questionnaire in its final form became prepared for application.

9. Geographical and temporal scope:

The study was conducted in the casting factory in Oran, and the study lasted until January 2014.

10. The Sample:

A random sample was selected that included (23 male workers) in the steel casting workshop.

11. Sample specifications:

All of the study samples were males

12. Tools used in the study:

The questionnaire developed by the researcher was used in the exploratory study.

13. The statistical methods used:

The following statistical methods were used to analyze the results of the research by employing the statistical package for social sciences (SPSS) as follows:

- One Sample T-test to find the significance of the differences between the mean scores of the individuals and the hypothetical mean

14. The Results:

What is the extent of the impact of noise on the auditory system of the workers in the workshop?

To answer the question posed, the One Sample T-test was used, and the results are shown in the following table

Table 2

Frequency Distribution and T-Test for Noise Resolution in the Steel Casting Workshop

<i>Variable</i>	<i>Number</i>	<i>Average</i>	<i>Standard</i>	<i>SMA</i>	<i>Value t</i>	<i>Result7</i>
Noise	23	22	5.40	32.4	2.11	Significant

Source: Act on the results of the SPSS program

The above table shows that the arithmetic mean of the correspondents' responses is calculated to be (32.4), which is higher than the study's hypothetical mean, which is predicted to be (24) and has a standard deviation value of (5.4). The fact that the difference between the two averages is 8.4 at the level of significance ($0.01 = \text{sig}$, at the degree of freedom = 22, with a value of $t = 2.11$), along with the level of significance's other parameters being $0.01 = \text{sig}$, 22 df, and 2.11, suggests that the workers have a high perception of the effect of noise on their hearing abilities.

15. Discussing the Hypothesis:

We draw the conclusion that the impact of noise on the auditory system is high according to the perceptions of the workers in the steel casting workshop based on the high value of the arithmetic mean (32.4) compared to the theoretical mean of the equal dimension (24). This may be due to the high levels

of noise in the workshop as well as the fact that it contains heavy and old machines that operate the transmission of vibrations as a result of the acoustic pressure emanating from them. The majority of the research sample stated that the noise is irritating and that even the preventive measures in the form of ear covers are of a poor type in terms of quality (they break fast), aside from the fact that they "reduce approximately 30 decibels from the sound frequency" (Issa Abdel Salam, 2009, p. 23); It is only given to whoever is in charge of the machine from which the noise is emitted; and not the other workers around. For instance, there are 3 décocheuses with a maximum noise level of (95.8). A study conducted in the workshop under study found that this "increases the noise level by (03) decibels between every two machines of the same noise level" (Brahmi.S.2011) (L. ThieryP. Canetto 2009, p.17a). There are more than ten machines in the workshop, each of which is little more than one meter apart; In addition to everything mentioned above, we also noted that the factory sections were opened up to one another. especially considering that 8 hours, or one-third of a worker's life, are spent working under these levels of noise every day for the duration of his or her career; According to Alan B (1967), one of the most significant effects left by the latter is hearing loss after eight hours of continuous exposure to a noise that is louder than (85). (Bl, 1967, p.11). According to a study by Toneef (cited by Hussein Shaker Mahmoud, 2009, p. 16), "Hearing loss depends on the duration of exposure to noise and how loud the voices are," and that "noise or noise whose intensity falls within the limits of 80 to (120) decibels causes permanent impairments in the hearing organs." It has been noted that workers who have been exposed to loud noise for more than 20 years, eight hours a day, tend to have shifted in their hearing threshold. For instance, the worker (x) in a steel foundry workshop operates the machine (décocheuse) for eight hours with an average noise level of 93.95 dB. It was determined through the audiogram performed by the work doctor, shifts in his hearing threshold, and the results of the audiogram that the worker has a significant loss of hearing of the bilateral type (both sides), caused by exposure to high levels of noise for an extended period of time exceeding (85dB). This means that if changes are not made to his workstation, personal protection, or even by providing rest breaks for the worker after a period of stressful exposure, he is ineluctably exposed to occupational deafness. Additionally, what is available in the workshop exceeds that without the worker acquiring individual noise protection measures, and since some health regulations require the worker to put individual protection measures starting at (80) decibels, (INRS. 2009). Due to sound pressure levels

surpassing their threshold of (85) decibels and above, the cadres operating in every area of the workshop will be subject to the risk of hearing damage after a number of years. If ergonomic measures are not taken to reduce noise levels, either at the level of the work environment or by lessening their impact on the level of the worker, those who work in environments where noise levels are prevalent at (90) decibels will unavoidably experience hearing loss after a few years.

Conclusion:

According to the findings of the current study, there is a high level of worker awareness of noise in the workplace, as well as high levels of noise, both continuous and intermittent, in the "ACIER" steel casting workshop. This is because the latter has old, heavy machines that work to make iron pieces by melting, lifting, and transferring the product from one machine to another in a predetermined sequence, by forming molds and giving the pieces different shapes. All of this necessitates a collection of machines that assist in producing large quantities at a certain moment, but also generate a lot of noise while numerous people are exposed to it, for a variety of reasons, such as machine aging and component collisions. We do not place all the blame here on the organizational side of the institution in terms of machines and tools, but also on the institution that must work on training courses on the dangers of working conditions and noise and particularly, how to prevent it.

It is required that all employees abide by the laws of preventive measures followed in the institution so that it is not just the worker in charge of the work center from which the noise is emitted, but also the worker next to him who may be susceptible to gradual hearing loss.

Everyone must wear earmuffs to protect their ears from manufacturing noise in order to prevent even minor hearing loss, thus both the worker and the institutions are required to work together to ensure that the workplace is safe and conducive to good health.

Recommendations:

There are a number of recommendations that may contribute, even a little, to protecting the worker from reducing the noise level, if taken into consideration:

- Continuous monitoring and periodic maintenance of machines, with this step we can reduce noise.
- Replace old machines that are subject to frequent and sudden breakdowns with modern machines that can reduce noise and results from the latter's footprint.
- Providing preventive means from the noise for all workers in the workshop, and it is noted that most of the workers in the workshop do not have them, and if that is the case, they do not apply the laws stipulated for prevention before entering the workshop, which is found at the entrance of the workshop as ink on paper, so the management must intervene firmly to implement the standards of prevention from noise.

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