African Journal of Advanced Pure and Applied Sciences (AJAPAS)
*Online ISSN: 2957-644X*
Volume 1, Issue 4, October-December 2022, Page No: 172-177
Website: *https://aaasjournals.com/index.php/ajapas/index*

# Effect of Cement Manufacturing Industry on Health, Safety, & Environment. A Case-study of El-Fataih Cement Plant

Hafed Idris Zaatout[1 *], Hadeel Tawfeq Elhisadi[2], Maryam Mansour Lairaj[3]

[1]Lecturer at Department of Public Health, College of Medical Technology, Derna, Libya
[2]Graduate student from Public Health Department, College of Medical Technology, Derna, Libya
[3]Graduate student from Public Health Department, College of Medical Technology, Derna, Libya

[*]*Corresponding author: hiazaatout@yahoo.com*

| *Received: October 18, 2022* | *Accepted: November 02, 2022* | *Published: November 04,, 2022* |
|---|---|---|

**Abstract:**

**Objective**: The main aim of this study was to know the impact of the cement industry on health, safety, and environment by knowing whether the cement manufacturing industry provides a safe environment for work and the extent to which occupational security and safety standards are applied to protect both the human element and the environment.

**Methods**: The study was conducted as a case in one cement factory in 2022. The data was collected using predesigned self-administrated questionnaire. A total of (100) employees working in El-Fataih Cement Plant, located in northeastern Libya, are randomly selected. After the study sample members wrote their personal data, they were asked to determine their response to (29) statements, which represent five scientific hypotheses according to the five-tiered Likert scale. The data was analyzed statistically by SPSS program and the Excel program was used to implement the required graphic forms in the study.

**Results**: The results of study indicated the verification of validity to all the constructed hypotheses. There are statistically significant differences between the answers and in favor of agreeing to all the statements of the study's hypotheses. Accordingly, the study confirmed the occurrence of accidents and occupational diseases among the workers, as well as the polluting impact of the factory on the environment.

**Conclusion**: This study concluded that a safe workplace in the cement industry plays a vital role in protecting both the human element and the environment. Through taking technical-engineering measures, adopting comprehensive HSE management solutions, such as changes in the work process, making replacements in parts and used machinery, installing recyclable systems, repairing and maintaining the system of air pollution protection, installing a warning and responsive system, implementing instructions can greatly reduce the negative effect on health, safety, and environment.

**Keywords**: Cement industry, Effect on health, safety, & environment, El-Fataih Cement Plant, Derna-Libya.

**Cite this article as:** H. I. Zaatout, H. T. Elhisadi, and M. M. Lairaj, "Effect of Cement Manufacturing Industry on Health, Safety, and Environment. A Case-study of El-Fataih Cement Plant", *African Journal of Advanced Pure and Applied Sciences (AJAPAS)*, vol. 1, no. 4, pp. 172–177, October-December 2022.



## Introduction

Cement industries playing vital role to development of countries and create employment opportunities and this is known as positive impacts. Safe workplace in cement industries plays vital role to prevent occupational health

diseases and increasing business opportunities. The cement sector is the third largest industrial source of pollution, emitting of sulphur dioxide, nitrogen oxide, and carbon monoxide and it effect to environment and health of people. Exposure of cement dust can develop lungs cancer, pneumoconiosis, respiratory system damage, skin irritation, dermatitis, skin burn, conjunctivitis, headache, fatigue, eye injury as well as stomach and colon problem. Occupational health and safety has become a public health priority in industrialized countries and a primary concern, especially in high-risk industries [1]. Cement manufacturing is one of these industries. It is one of the most widely used construction material on earth. Because cement has been used commonly, its health effects have become an important issue for both employees and the environment [2]. In addition to the various health hazards, cement workers are especially exposed to dust, which causes lung function impairment, chronic obstructive lung disease, restrictive lung disease, pneumoconiosis and carcinoma of the lungs, stomach and colon at various production process such as quarrying, crushing, raw material grinding, blending, kiln burning, cement grinding and packaging in cement industry [3]. Therefore, ensuring healthy and safe working conditions for employees and contractors is a fundamental key to corporate social responsibility, and is one of the most important issues for the cement industry [4]. In addition, with the increasing complexity of industrial tissue and with the rapidity that the techniques develop in the big factories, risks assessment becomes a crucial and strategic answer to preserve workers health and safety on the one hand and to maintaining a qualified labor on the other hand [5].

**Material and methods:**

**Study population and sample:** It is considered the first era of Portland cement in Libya since the early seventies of the last century, where many cement factories were established in several regions of the country, including El-Fataih Cement Plant, 19 km east of the city of Derna - Libya, which was our target to apply this study starting on June 2022. The original study population consisted of technicians, labourers, and engineers. As for the study sample, it was randomly selected, where (100) questionnaires were distributed and the study response rate was %100. In order to produce as accurate results as possible, we made sure to diversify the study sample in terms of age groups, academic qualifications, and job descriptions.

**Study tool:** A self-administrated questionnaire was used to collect information from the study sample. The questionnaire included an explanation to the respondents in which they were enlightened on the subject, aim and purpose of the questionnaire. The first section of the questionnaire includes the personal data of the study sample members, as this part contains data about age, educational qualification, and job description. The second section of the questionnaire contains (29) statements. The respondents were asked to determine their response to what each statement describes according to Likert scale, which consists of five levels (strongly agree, agree, neutral, disagree, and strongly disagree), These statements were distributed on the hypotheses of study.

**Study tool application:** After verifying the validity of the study tool, which is the prepared questionnaire, it was distributed to the planned study sample (100) individuals. After that, the data and information were unloaded in the tables prepared for this purpose, where the nominal variables (strongly agree, agree, neutral, disagree, strongly disagree) were transformed into quantitative variables ( 5 – 4 – 3 – 2 - 1 ) respectively. The data were compiled into tables, with the preparation of the necessary graphic figures. After that, the median of the answers of the sample members to the five hypotheses was calculated, and the chi-square test was also conducted to indicate the differences for the answers to the study's hypotheses.

**Study's hypotheses:**

1) **The first hypothesis:** "implementation of laws and regulations according to the standard specifications". (Five statements).
2) **The second hypothesis:** "cement industry causes accidents and occupational diseases". (Four statements).
3) **The third hypothesis:** "cement industry causes environmental pollution". (Ten statements).
4) **The fourth hypothesis:** "the provision of PPEs and the commitment of workers to it". (Three statements).
5) **The fifth hypothesis:** "the work environment inside the factory is subject to safety and security conditions". (Seven statements).

**Statistical methods:** To achieve the objectives of the study and to verify their hypotheses, statistical methods such as frequency distribution of answers and percentages, median, and Chi-square test to indicate the difference between the answers have been used. For accurate results as much as possible, the statistical program was used SPSS and the Excel program was used to implement the required graphic forms in the study.

**Aim of the work:**

The specific aim of this study is to know the impact of the cement industry on health, safety, and environment by knowing whether the cement industry provide a safe environment for work and the extent to which security and safety procedures are applied to protect the human element and the environment. The importance of this study

lies in identifying the cement industry and its consequent accidents and occupational diseases, in addition to its polluting impact on the environment. Such studies is very important to develop solutions and implement more preventive measures, that protect both the human element and the environment.

**Results:**

**I. Personal data:**

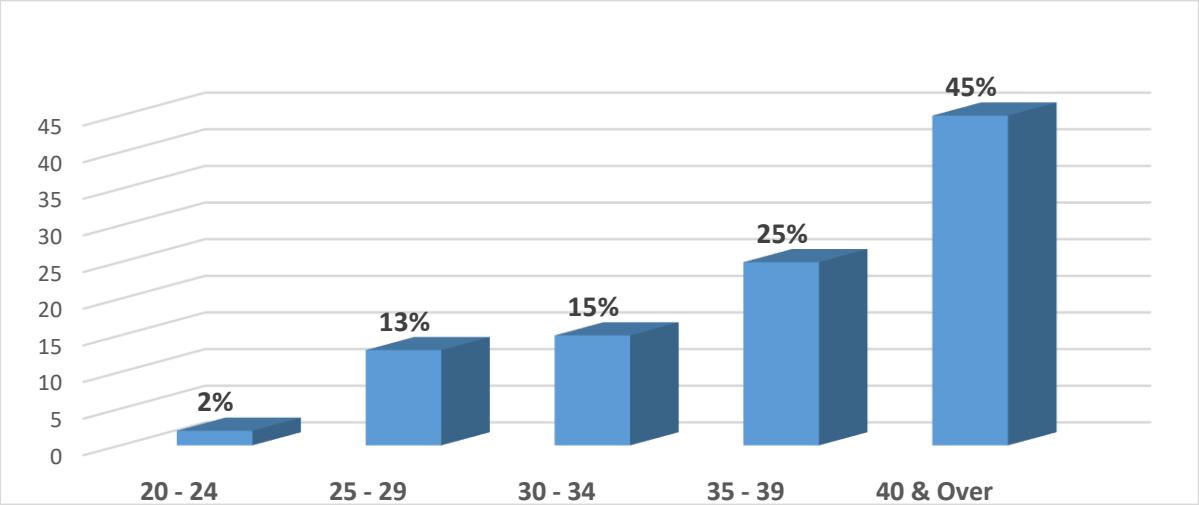


**Figure (1):** the study sample according to the age variable.

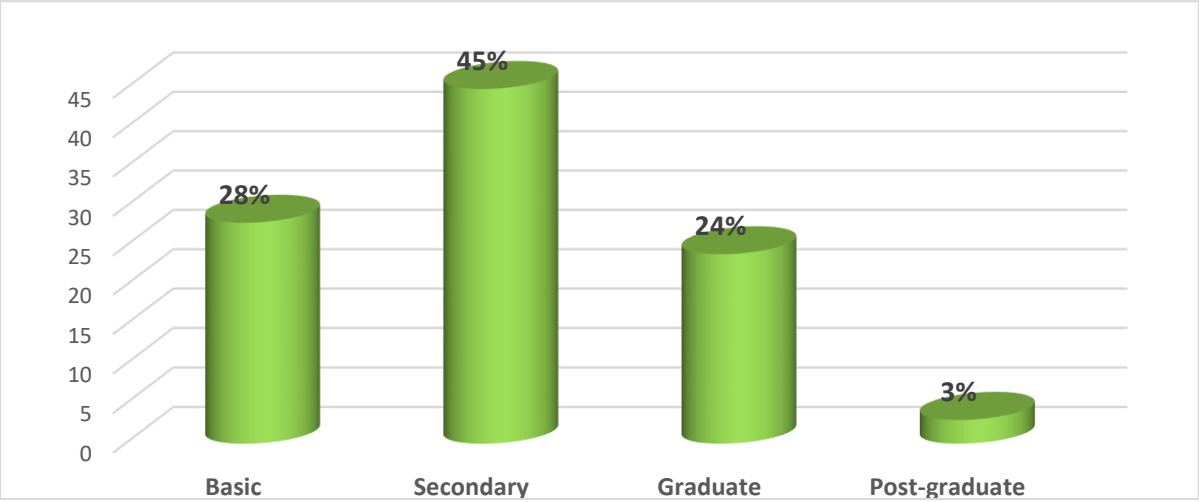


**Figure (2):** the study sample according to the educational qualification variable.

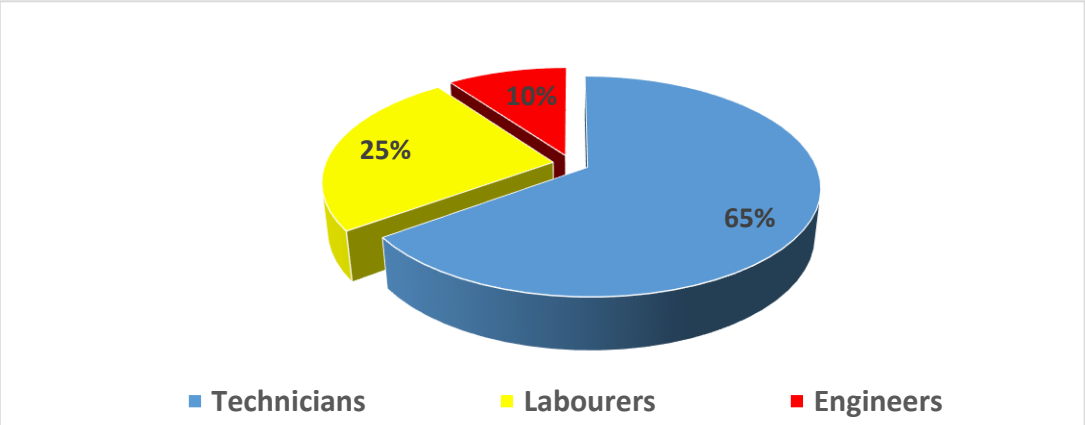


**Figure (3):** the study sample according to the job description.

**II. The study's hypotheses:**

**Table (1):** answers of the study sample members to all the statements of the 1st hypothesis.

| Answers | N (%) | Median | d.f. | $X^2$ | P-Value |
|---|---|---|---|---|---|
| Strongly Disagree | 14 (2.80) | 4.3760 | 4 | 698.40 | 0.000 |
| Disagree | 25 (5) | | | | |
| Neutral | 38 (7.60) | | | | |
| Agree | 242 (48.40) | | | | |
| Strongly Agree | 181 (36.20) | | | | |
| **Total** | **500 (100)** | | | | |

**Table (2): answers of the study sample members to all the statements of the second hypothesis.**

| Answers | N (%) | Median | d.f. | $X^2$ | P-Value |
|---|---|---|---|---|---|
| Strongly Disagree | 39 (9.75) | 4.4328 | 4 | 495.30 | 0.000 |
| Disagree | 75 (18.75) | | | | |
| Neutral | 61 (15.25) | | | | |
| Agree | 149 (37.25) | | | | |
| Strongly Agree | 76 (19) | | | | |
| **Total** | **400 (100)** | | | | |

**Table (3):** answers of the study sample members to all the statements of the third hypothesis.

| Answers | N (%) | Median | d.f. | $X^2$ | P-Value |
|---|---|---|---|---|---|
| Strongly Disagree | 81 (8.10) | 4.5833 | 4 | 264.90 | 0.000 |
| Disagree | 259 (25.90) | | | | |
| Neutral | 123 (12.30) | | | | |
| Agree | 348 (34.80) | | | | |
| Strongly Agree | 189 (18.90) | | | | |
| **Total** | **1000 (100)** | | | | |

**Table (4):** answers of the study sample members to all the statements of the forth hypothesis.

| Answers | N (%) | Median | d.f. | $X^2$ | P-Value |
|---|---|---|---|---|---|
| Strongly Disagree | 4 (1.30) | 4.3943 | 4 | 698.40 | 0.000 |
| Disagree | 45 (15) | | | | |
| Neutral | 23 (7.70) | | | | |
| Agree | 142 (47.30) | | | | |
| Strongly Agree | 86 (28.70) | | | | |
| **Total** | **300 (100)** | | | | |

**Table (5):** answers of the study sample members to all the statements of the fifth hypothesis**.**

| Answers | N (%) | Median | d.f. | $X^2$ | P-Value |
|---|---|---|---|---|---|
| Strongly Disagree | 28 (4) | 4.3348 | 4 | 346.90 | 0.000 |
| Disagree | 71 (10.10) | | | | |
| Neutral | 67 (9.60) | | | | |
| Agree | 339 (48.40) | | | | |
| Strongly Agree | 195 (27.90) | | | | |
| **Total** | **700 (100)** | | | | |

**Discussion**

According to figure (1) the majority of the study sample members were aged 40 years old and over (45%). Here it is worth noting that the answers obtained from this study are issued, in their entirety, by individuals with a degree of experience in the field of work and specialization. As shown in figure (2), 28 individuals at a rate of (28%), were of basic level, 45 individuals at a rate of (45%) of secondary level, 24 individuals at a rate of (24%) of graduate level, and 3 individuals at a rate of (3%) of post-graduate level. The selected sample included all levels

of educational qualifications and was free of illiterates. By looking to figure (3), we will notice that the groups working in the factory included technicians at a rate of (65%), followed by the laborers category at a rate of (25%), and finally the category of engineers at a rate of (10%). Here, it is worth mentioning that the types of job description of the study sample ensures the diversity of the answers and opinions as a result of the contrast of experiences and tasks, which is an important factor in the study findings. To verify the validity of all hypotheses in this study, it is necessary to know the direction of the study sample's opinions regarding to all statements. It can be seen from the tables (1,2,3,4,5) the median value of the answers to the statements of all hypotheses amounted to more than (4). This value means that the majority of the sample members agree with the statements of the study's hypotheses, thus proving their validity. This can be checked definitively by applying Chi-square test. The value of Chi-square calculated was amounted to more than the tabular chi-square value in each hypothesis at the degree of freedom (4) and the level of significance (0.05). This indicates that there are statistically significant differences between the answers and in favor of the answers of agreeing to the statements of all hypotheses ($P < 0.05$). From the foregoing, we conclude that all hypotheses of the study have been verified. The occurrence of accidents and occupational diseases in El-Fataih Cement Plant was in agreement to some extent with a similar study conducted in Saudi Arabia, indicating that the cement industry is largely responsible for many of accidents and occupational diseases [19]. As for the close link between the cement industry process and environmental pollution, this study corresponds to some extent with similar studies conducted in Nigeria and Sri Lanka, which confirms [20, 21].

**Conclusion**

Through the conduction of this study, we concluded that the workers in El-Fatiah Cement Plant suffer from work-related accidents and diseases. The working environment of the factory was not safe enough while the safety precautions and control measures adopted by the factory management were to some extent in accordance with the recommended procedures. As for the polluting impact of the cement industry on the environment, the factory management does not care much about the solid pollutants produced by the factory such as kilns wastes or gaseous pollutants such as gases and cement dust, which are among the most prominent pollutants associated with such industry. The occurrence of accidents and occupational diseases among the factory's workers, as well as the polluting impact of the factory on the environment are both constitute the challenges facing the factory management, which the solutions must be found to deal with as soon as possible.

**References**


[1] Rachid, C, Ion V, Irina, C, Mohamed. 'Preserving & improving the safety & health at work', Safety Science, Vol. 76, 2015.

[2] Koh, D-H, Kim, T-W, Jang, SH, Ryu, H-W. 'Cement industry and cancer', Safety and Health at Work, Vol. 2, 2011.

[3] Meo, SA, 'Health hazards of cement dust', Saudi Medical Journal, 2004, Vol. 25, 2004.

[4] WBCSD (World Business Council for Sustainable Development), 'Health and safety in the cement industry: Examples of good practice', Cement Sustainability Initiative (CSI), 2004.

[5] Tomar, MK, 'Study of Occupational Health, Safety and Environmental Aspects in Major Cement Manufacturing Industry (Ultratech Cement Limited)', Journal of Environment and Earth Science, 2014, Vol. 4, 2014.

[6] PA (Environmental Protection Agency), 'Emission factor documentation for AP-42, section 11.6: Portland Cement Manufacturing, Final report, EPA Contract 68-D2-0159, MRI Project No. 4601-0, 1994.

[7] Kema, Inc., 'Industrial Case Study: The Cement Industry', Report No. PGE0251.01, 2005.

[8] EPA (Environmental Protection Agency), 'Available and emerging technologies for reducing greenhouse gas emissions from the Portland cement industry', Sector Policies and Programs Division, Office of Air Quality Planning and Standards, 2010.

[9] The Europan Cement Association, 'Cement manufacturing processes, viewed 3 January 2015. http://www.cembureau.be/about-cement/cement-manufacturing-process.

[10] LAFARGE, 'Manufacturing Process, viewed 4 March 2015. http://www.lafarge.com/wps/portal/4_3_5_2-Procede_de_fabrication.

[11] Cumbane, AJ, 'Environmental Health and Safety Aspects in the Cement Industry', 2011, Viewed 27 March 2015. http://www.spin.bam.de/en/spin_media/spin_environmental_health_and_safety_aspects.

[12] Canfeng, Z. Shujie, Y. Dong, 'Comprehensive Control of the Noise Occupational Hazard in Cement Plant', Procedia Engineering, Vol.43, 2012.

[13] IFC (International Finance Corporation), 'Environmental, Health, & Safety Guidelines for Cement and Lime Manufacturing', 2007, viewed 3 March 2015. http://www.ifc.org/wps/wcm/connect/f74848804951d04eb75cb719583b6d16/

[14] TRIA Project, 'Training material for assessing the risk in cement industry', viewed 26 March 2015. http://www.aulbremen.de/triatria/en/en_modules/en_m01/en_module_0101.html.

[15] Kumar, S. S., Nagpure, A. S., Kumar, V., Sunisha, B., Preeti, S., Deepali, S., & Nath, S. R. Impact of dust

emission on plant vegetation in the vicinity of cement plant. Environmental Engineering and Management Journal, 2008, 7 (1), 31-35. https://doi.org/10.30638/eemj.2008.006
[16] OSHA, 'Worker Safety Series Concrete Manufacturing', viewed 17 March 2015. https://www.osha.gov/Publications/concrete_manufacturing.html
[17] Joseph LaDou. Occupational & Environmental Medicine. 2nd edition. USA. Simon and Schuster Company, 1997.
[18] Marlowe, I. and Mansfield, D,: 'Environment, Health & Safety Performance Improvement', World Business Council For Sustainable Development, 2004.
[19] Arshad H. Rahmani1 et al. 'Effect of Exposure to Cement Dust among the Workers': An Evaluation of Health Related Complications. Macedonian Journal of Medical Sciences. Published on June 13, 2018. https://doi.org/10.3889/oamjms.2018.233
[20] Mmemek-Abasi Etim et al. 'Health Risk and Environmental Assessment of Cement Production in Nigeria', MDPI Journals, Vol. 12, 2021. https://doi.org/10.3390/atmos12091111
[21] Mohanty.B. Technology, Energy efficiency and environmental externalities in the cement industry, Asian institute of technology, Thailand, 1997.