entrosur
e-ISSN:2706-6800

Evaluación de Riesgos de Seguridad e Higiénicos y Planificación de Medidas Preventivas en Estudios Geotécnicos SPT

Vera Guarnizo, Maria Claudia; Monroy Gutiérrez, Jackson Erminzul; Diaz Ochoa, Martha Liliana; Leal Forero, Lizeth; Hernández Giron, Sonia Elizabeth; Zuluaga Giraldo, Bibiana Andrea

Maria Claudia Vera Guarnizo
maria.vera@uniminuto.edu
Corporación Universitaria Minuto de Dios, Colombia
Jackson Erminzul Monroy Gutiérrez
martha.diaz@uniminuto.edu
Corporación Universitaria MinutodeDios, Colombia
Martha Liliana Diaz Ochoa
jackson.monroy.g@uniminuto.edu
Corporación Universitaria Minuto de Dios, Colombia
Lizeth Leal Forero lizeth.leal@uniminuto.edu
Corporación Universitaria Minuto de Dios, Colombia
Sonia Elizabeth Hernández Giron
sonia.hernandez@uniminuto.edu
Corporación Universitaria Minuto de Dios, Colombia
Bibiana Andrea Zuluaga Giraldo
bibiana.zuluaga@uniminuto.edu
Corporación Universitaria Minuto de Dios, Colombia

Centrosur
Instituto Superior Edwards Deming, Ecuador
ISSN-e: 2706-6800
Periodicity: Trimestral
vol. 1, no. 13, 2022
centrosuragraria@gmail.com

Received: 17 June 2021
Accepted: 11 November 2022

URL: http://portal.amelica.org/ameli/journal/646/6463152002/

Abstract: The high rates of accidents and occupational diseases presented in companies both in Spain and Colombia, have identified the importance of analyzing and evaluating occupational risks. Therefore, it is necessary to define preventive actions for the company A&C Soluciones Civiles S.A.S. in order to ensure the welfare in the health of workers, by identifying the hazards based on the specialties of Safety and Industrial Hygiene; the method used for the evaluation of hygienic risks generated by exposure to physical risk was based on the method of William T. Fine in conjunction with the use of Integrator Sonometer equipment as an instrument of environmental measurement for noise. The risk analysis begins with the recognition of the work area that is directly exposed to the risk in order to establish preventive measures, time and costs for the execution of actions to reduce risks and hazards, focused on the continuous improvement of the processes.

Keywords: evaluation, hygiene, prevention, risk, safety, security.

Resumen: Los índices altos de accidentes y enfermedades laborales presentados en las empresas tanto en España como en Colombia, han permitido identificar la importancia de analizar y evaluar los riesgos laborales. Por ende, se hace necesario definir las acciones preventivas para la empresa A&C Soluciones Civiles S.A.S. con el objeto de asegurar el bienestar en la salud de los trabajadores, mediante la identificación de los peligros fundamentados en las especialidades de Seguridad e Higiene Industrial; el método utilizado para la evaluación de los riesgos higiénicos generados por la exposición al riesgo físico se basó en el método de William T. Fine en conjunto con el uso del equipo Sonómetro Integrador como instrumento de medición ambiental para el ruido. Para realizar el análisis del riesgo se inicia con el reconocimiento del área de trabajo que se encuentra directamente expuesta al riesgo con el fin de establecer las medidas preventivas, el tiempo y los costos para la ejecución de las acciones, con el fin de reducir los riesgos y los peligros, enfocado en le mejora continua de los procesos.

Palabras clave: evaluación, higiene, prevención, riesgos, seguridad.

Introduction

Accordingly, with the growth of the regions, the construction industry is becoming more competitive every day, that is why companies seek to improve in all organizational processes, one of them is the Occupational Safety and Health (OSH) which is denoted as the articulating axis of all areas of an organization focused on the care and preservation of the lives of workers through the definition of preventive measures.

For this reason, the construction sector is one of the sectors with the highest number of fatal accidents, which is why occupational health and safety policies are becoming stricter and stricter every day in order to ensure that workers are properly cared for.

However, according to Martinez (2015) in his article called Occupational Risks in Construction: A Sociocultural Analysis states that despite the various preventive measures to avoid or prevent risks, the construction sector remains one of the most affected, therefore, states that many of the consequences are given by not taking the necessary measures, ignorance, economic factors or the impact of the culture itself, before this (BOE, 2012, 2015, cited by Martinez, 2015) express:

In order to minimize risks and prevent them from materializing in accidents or illnesses of occupational origin, legislation requires a series of action plans and preventive protocols, and periodical inspections are carried out to supervise their implementation. In this way, companies are obliged to comply with actions for the benefit of workers' safety, such as providing and enforcing the use of personal protective equipment (PPE) or various means of collective prevention, as well as training and informing about the risks and the best ways to avoid them (p.69). (p.69) Likewise, Villacís et al. (2018) address the issue of occupational risk prevention indicating that they are methods that are focused on the physical health, emotional and intellectual well-being of workers, given from the firm commitment of senior management with a continuous and permanent monitoring of middle management and the incorporation of workers to the system, with which is evidenced in the decrease in the reduction of sick leave and increasing the production of companies.

In the same way, for the management and implementation of the risk prevention plan, these may be carried out by means of risk assessment and action planning.

The first general principle of preventive action is to avoid the risk, and to evaluate those that cannot be avoided beforehand. Therefore, the employer is obliged to evaluate the risks that cannot be avoided, taking into account, in general, the nature of the activity, the characteristics of the existing jobs and the characteristics of the workers who must perform them. If the results of the assessment reveal risk situations, the employer shall carry out the necessary preventive activities to eliminate or reduce and control such risks. (Romeral, 2012) It is considered that "the result of a risk assessment should serve to make an inventory of actions, in order to design, maintain or improve risk controls. To plan the implementation of the precise control measures after the

risk assessment" (Miranda, 2016, p. 27). Likewise, "proper risk management is essential in the construction sector to minimize losses and maximize profits, thus refuting the old view that management is an expense that makes construction projects more expensive" (Romero et al., 2012).

In this same context, apart from occupational risks, there are hygienic risks due to exposure to noise, which is defined according to the Real Académica de la Lengua Española as a disturbing signal in a circuit produced by its components, thus Royal Decree 286 of 2006, provides for the protection of the health and safety of workers from exposure to noise, which establishes in its article 4 that the risks derived from exposure to noise must be eliminated or reduced to the lowest level at its origin, therefore, to achieve this, the choice of adequate work equipment must be taken into account, implementation of the mandatory use of individual and collective protection equipment, contemplation of workplaces, adequate training for exposed workers, maintenance of equipment, workplaces and workstations.

In accordance with the above, and according to Ganime et al. (2010) in their article El Ruido Como Riesgo Laboral: A Review Of The Literature, mentions that noise is one of the most predominant risks in the industrial sector, such that in many cases there are permanent casualties noticing in cases of retirements in young people, these effects are caused as a result of the operation and handling of machines and equipment of various sizes and year of manufacture, so much so that the effects that workers may present are psychophysiological ranging from irritation, stress, hypertension, loss of appetite, insomnia, circulatory and respiratory disturbances to hearing loss (p.7-8). Finally, in order to prevent risks, it is necessary for each worker to wear Personal Protective Equipment (PPE) according to the work being performed, as well as to establish preventive measures from engineering controls, environmental measurements, personnel rotation to minimize the risks to which workers are exposed.

For the above mentioned, the objective of this work is focused on assessing the occupational safety and health risks of exposure to noise for the planning of preventive activities of the company A&C Soluciones Civiles S.A.S., located in the municipality of Girardot - Cundinamarca. This company has been working since 2015 without any occupational health and safety system, therefore, its analysis and evaluation is urgently required.

It is for this reason that this document presides over the procedures for the identification, evaluation and recommendations given from the analysis of some jobs identified from two specialties such as occupational hazards and physical hygienic risk such as noise, it should be noted that in the book Methods of occupational risk assessment by Rubio (2004) describes that risk assessment has been used for several decades both as a legislative obligation and for technical reasons, in order to anticipate accidents and incidents and thus take appropriate measures in advance.

Finally, it is established that the prevention of occupational hazards, more than an obligation given by laws and decrees, should be incorporated as a habit of healthy living in the conservation of human life, likewise applying the law of God as an example of life in his commandment given as "love thy neighbor as thyself", generating with this a great connotation to collective conservation.

Materials and methods

The research work raises a process of observation directed to the work center of the company A&C Soluciones Civiles S.A.S. which is located at Calle 20 number 21 - 30 in the neighborhood Las Quintas in the Municipality of Girardot - Department of Cundinamarca in Colombia, the company was incorporated in the month of October 2015, the services offered by the company both in the public and private sector are: construction of one and two-story housing, construction of roads, construction of swimming pools, remodeling and adaptations, construction consulting, construction supervision, construction supervision, architectural designs, manufacture of pegacor, pathology studies, seismic vulnerability and geotechnical studies. The company currently performs only geotechnical studies for designers or developers who hire the services; these studies are performed to verify the characteristics of the soil and determine the stresses and resistance of the soil prior to the construction of any civil works.

The company has permanent and temporary workers, when geotechnical studies are carried out, workers are hired to handle the SPT equipment, it should be noted that these works are not daily, therefore, 4 to 6 studies are carried out per month and each one varies in the number of soundings to be made, that is, a minimum geotechnical study has one sounding and the maximum number depends on the loads of the building, the seismic hazard zone and the area of the construction. The time spent to perform the geotechnical study depends on the number of soundings and the depth of the rejection, but usually each sounding takes between 2.5 hours to 3 hours.

The job to analyze and evaluate health and safety risks is that of the Field Resident because he is in direct contact with this activity. The specific functions are to perform the SPT test in situ, the packaging of the extracted samples and the characterization tests for which he must; transport manually the SPT equipment and other complements from the warehouse area to the transporter vehicle, transport manually with the personnel the SPT equipment and other complements to the place where the drilling is done (the accessibility of these works is done in open field where there are irregular soil roads and extensive vegetation), assemble the SPT equipment and other complements with the personnel, execute each one of the borings with the SPT equipment where a series of blows must be made with the hammer or anvil lifting it from the height of the blow head to the total distance of elongation of the arms, transport the SPT equipment and other complements to the transporting vehicle from the place where the boring is made and carry out the tests corresponding to the analysis of the samples, such as washing, granulometry, limits and unconfined compression.

It establishes the procedures carried out by the field resident in the execution, development of functions and activities in which they may be exposed to Health and Safety risks that have not yet been identified and evaluated to establish their respective planning of preventive and corrective activities for the employer.

For the identification of these risks is applied from the mixed deepening through the quantitative and qualitative evaluation of each of the activities that are contemplated, establishing a methodology that facilitates research from the professional discipline, resulting in the integration of educational, research and

social aspects, thus achieving a more efficient and effective problem solving in the field of occupational hazards.

The identification and evaluation of safety risks uses the William T. Fine method and in hygienic risks of direct exposure to noise will be established by means of equipment for taking measurements such as the sound level meter. To carry out the study, the risk is evaluated by means of mathematical calculations taking into account three factors: probability, consequence and exposure; the possibility that, once the risk situation is presented, the accident originates, where the complete sequence of events that trigger the accident must be taken into account, the damage, due to the risk that is considered the most serious possible, including personal misfortune and damage to property and the frequency with which the risk situation is presented. Being such that the first undesired event will initiate the accident sequence. The methodology of action for the measurement of noise for the analysis of working conditions, is carried out through the general data of the company such as the organization chart, departments, workstations, production lines, production data, possible important acoustic events, possible previous acoustic measurements with possible previous acoustic measurements, possible previous acoustic measurements with which the definition of groups of homogeneous exposure and the study of a nominal working day is performed to select the appropriate strategy for noise measurement that can be based on the task, based on the job or based on the whole working day, for the analysis of this research the strategy based on the task was used by means of a measuring equipment such as the sound level meter.

Result

The identification of hazards is established for risk assessment, estimating the work environment inside and outside the workplace according to the activities to which the company is dedicated; for this identification, a follow-up was made to the work station of the Field Resident, where a working day was available to accompany them in a Soil and Geotechnical Study. In this working day it was evidenced that the company urgently needs to establish the identification of risks where a plan of action is proposed before the possible dangers and thus suggest the implementation so that the company can establish the necessary controls, assuming the management of the top management as leader and achieving the participation and commitment of the other workers, whether permanent or temporary.

The risks found are the result of activities that have generated an alert for the implementation of preventive actions, where the slightest carelessness in the work can cause serious injuries or even death in the handling of the SPT equipment, as well as activities that can generate casualties as a result of falls where it is transited either by wet or damp soils at the time that this equipment is being manually loaded. The SPT equipment is made up of several elements that have different weights, and it can also be seen that this work is carried out in areas with abundant vegetation and that it is necessary to travel along these roads, where animals that can affect health may be encountered.

The analysis and risk assessment in noise hygiene by means of the sound level meter identifies the equipment in the activity in which the employee is exposed,

in order to identify whether in the execution of geotechnical and soil studies in the field the worker may present an occupational disease. In the use of the equipment we have the SPT, equipment that is composed of a hammer or anvil that must be impacted with the tapping head, where a series of repetitions is executed for every 15 centimeters of penetration to the ground, in this procedure the resident must make the effort to lift the hammer and let it fall freely to the head and that contact is where a noise is produced, noise that is constant and that is made throughout a survey, which can last between 2.5 to 3 hours, this activity is done manually so it must be done by two workers under the same conditions and in the series of 15 cm there is a pause at the end to rest. The field resident and other workers do not wear personal protective equipment (PPE) for noise protection, showing that they are within the exposure limits because the equivalent daily exposure level was 94 decibels dB and the recommended maximum limit is 85 decibels dB per day, which means that the conditions are not suitable for the worker.

The risk assessment was carried out in the two specialties given in Safety and Hygiene in terms of noise, choosing the William T. Fine method as the method of risk assessment in safety and hygiene in noise using the integrating sound level meter equipment, for the job of the Field Resident by means of his functions and the activities that derive from these. Therefore, the implementation should be carried out in the company to help guide the employer in eliminating, controlling, minimizing or reducing as much as possible, work accidents and the affectation to the health of the workers.

Conclusions

Hygienic risks derived from noise and safety risks were identified through the risk factors to which the company's field resident is exposed, through a monitoring of the workplace in the areas inside and outside the workplace, the identified risks to which the company's field resident is exposed were evaluated, It was determined that the field resident is at risk levels that compromise the integrity of the worker, for which drastic changes should be made by the employer, with the purpose of reducing the probability of the occurrence of accidents or occupational diseases.

References

Bestratén B, M., Bernal D, F., Castillo M, M., Cejalvo L, A., Hernández C, A., Luna M, P., Turmo S, E. (2000). Evaluation of working conditions in small and medium enterprises practical methodology. https://www.insst.es/documents/94886/211340/Condiciones_trabajo_PYMES.pdf/0452 965e-d0bb-408d-9806-fac257562168.

Ganime, J.F., Almeida da Silva, L., Robazzi, ML do C.C., Valenzuela Sauzo, S., and Faleiro, S.A. (2010). Noise as an occupational hazard: a review of the literature. Global Nursing, (19). https://scielo.isciii.es/scielo.php?script=sci_arttext&pid=S1695- 6141212010000200020.

Gonzales B., C., and Inche M., J. (2004). Model of analysis and evaluation of occupational accident risks for a textile company. Industrial Data, 7(1),33-41. https://www.redalyc.org/articulo.oa?id=81670106

National Institute of Safety and Hygiene at Work. (2003). NTP 638: Estimation of effective attenuation of hearing protectors. https://www.insst.es/documents/94886/326775/ntp_638.pdf/ec7cda7b-d636-48de8d05-020cd25857a9

National Institute of Safety and Hygiene at Work. (2012). NTP 950: Strategies for measuring and assessing noise exposure (I): measurement uncertainty. https://saludlaboralydiscapacidad.org/wp-content/uploads/2019/05/NTP-950- Estrategias-de-medici%C3%B3n-y-valoraci%C3%B3n-de-la-exposici%C3%B3n-a-ruido-1.pd.

National Institute of Safety and Hygiene at Work. (2012). NTP 951: Noise exposure measurement and assessment strategies (II): Types of strategies. https://www.insst.es/documents/94886/326879/951w.pdf/fc57e51d-5251-4662-ba16- e1b3a6a8706d.

National Institute of Safety and Hygiene at Work. (2012). NTP 952: Strategies for measuring and assessing noise exposure (III): examples of application. https://www.insst.es/documents/94886/326879/952w.pdf/d79df9a8-406e-45b9-bf32- 48c1f0b546db

Law 31 of 1995. Occupational Risk Prevention. November 8. "BOE" no. 269, November 10, 1995. https://www.boe.es/buscar/pdf/1995/BOE-A-1995-24292- consolidated.pdf

Martínez, Guirao, J. E. (2015). Occupational hazards in construction. A sociocultural analysis. Universitas, XIII (23), pp. 65-86.

Ministry of Labor. (December 01, 2017). MinTrabajo calls attention to the construction sector to implement measures to lower accident rates. https://www.mintrabajo.gov.co/mintrabajo-llama-la-atencion-al-sector-de-la-construccion-para-implementar-medidas-que-permitan-bajar-indices-de-accidentalidad

Miranda, H. D. (2016) Development of a risk and major accident control plan for Transmacar S.A. company. [Degree work, Universidad Politécnica Salesiana del Ecuador]. https://dspace.ups.edu.ec/bitstream/123456789/13384/1/UPS-GT001746.pdf

Royal Decree 39 of 1997. Approving the Prevention Services Regulations. January 17, 1997. "BOE" No. 27, January 31, 1997.

Royal Decree 286 of 2006. On the protection of the health and safety of workers against risks related to noise exposure. March 10, 2006. "BOE" no. 60, of March 11, 2006.

Royal Decree 486 of 1997. Establishing the minimum safety and health provisions in the workplace. April 14, 1997