Implementation of a risk analysis method to identify the degree of danger in a company in the industrial blacksmith sector.

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Abstract

The following article is an applied research focused on Industrial Safety and Hygiene in the Industrial Blacksmithing Sector and its objective is to identify and analyze occupational risks within the production area, since according to studies by the Mexican Institute of Social Security (IMSS) this industry represents a high level of danger for Mexican workers. The purpose of this analysis is to detect improvement opportunities with which the working conditions of the associates can be strengthened without neglecting the legal framework of the area.

Keywords*—Occupational risks, Safety and Industrial Hygiene, Working conditions*

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1. INTRODUCTION

The presence of occupational hazards in the workplace is unavoidable, for this reason it is important that companies and executives take care to carry out proper Health and Safety management in order to prevent possible accidents or occupational diseases.

Work accidents represent any unwanted or expected event, which can cause a minimal, serious injury or even the death of the worker. Whether caused by an unsafe act or condition, accidents can arise in the execution of a work process, since they are present and can cause harm to the worker.

Organizations must worry at all times about having preventive actions that avoid the risk of work, for this it is important to evaluate all those that cannot be avoided. This means that the employer must evaluate all the risks found in the work area taking into account the nature of the activity, the job position and the characteristics of the workers who are going to perform it. (Romeral, 2012)

In 2016 the Mexican Institute of Social Security released a list of the economic activities with the highest number of accidents and occupational diseases nationwide.

Table 1
Economic activities with the highest number of occupational accidents and diseases

	2014 Cases	2015 Cases	2016 Cases
To t a l	409248	437072	406824
Supermarkets, self-service stores and specific departments. By market line.	34585	36598	34398
Construction of infrastructure works and buildings in public works.	26080	30487	27960
Sale of food, drink and / or tobacco, with transport	22449	22526	21609
Professional and technical services	18354	21666	19959
Food preparation and serving	19833	21331	17723
Temporary accommodation services	11530	13068	12710
Protection and custody services	7928	9622	8983
Freight transport	8580	8990	8176
Manufacture of plastic products	7199	7356	7302
Social security	7227	7320	7196
Construction of buildings; except public works	6239	7221	6972
C/v mat. p/const. Like wood and steel w/transp. and/or prep. or the market.	6419	6872	6793
Cleaning and cleaning services with machine and / or motorized equipment	6166	6751	6555
Manufacture of other machined metal products	6152	6503	6119
Agriculture	5984	6445	5801
Various lower frequency	214523	224316	208568

Source: (IMSS. 2016)

As shown in Table 1, the preparation of merchandise such as steel and the manufacture of other metallic products are among the most dangerous activities in the country, being positions number 12 and 14 respectively on the list. We can realize the high level of danger that the blacksmith industry represents in the country for Mexican workers and above all

that there are high percentages of an accident at work in these companies.

In order to make an improvement contribution to the area of Industrial Safety in the economic sector of the Smithy, a practical study was carried out in a work center dedicated to the Manufacture of structures based on materials such as steel and metal (Herrería) in order to carry out an applied investigation in each production process and thus be able to identify the work risks to which the worker is exposed in their working day. This investigation seeks that companies in this sector have a decent and safe workplace that workers can enjoy; helping to increase work motivation caused by a workspace that meets the optimal conditions to carry out their work.

2. METHODOLOGY

The research developed in this analysis is descriptive since it is essential to know the industry and especially the company studied, this is through interviews with administrative personnel, visits to the workplace and appointments to obtain all possible information and necessary.

For data collection, a checklist and data collection instrument were designed to obtain reliable statistical data in the evaluation of risks found.

As an administrative tool, a PDCA was used in which the objectives and activities to be carried out are shown step by step to fulfill the objective of the project, which is shown below.

Table 2
Development of the administrative tool PDCA

PLAN - PLANNING	1. Know the current situation of the company and industry. 2. Selection of the method for risk analysis. 3. Development of an instrument for data collection. 4. Perform checklist.
DO	1. Application of the instrument for data collection. 2. Checklist app. 3. Statistical analysis of the data obtained. 4. Application of the William T. Fine risk analysis method. -Consequences -Exposition -Probability of the accident 5. Identify Risks with Medium and High Degree of Danger
CHECK	Verify that the objectives set are met. 1. Data analysis graphs. 2. Degree of danger (William T.Fine) 3. NOMS-STPS applicable to the risks found and evaluated.
ACT	1. Recommendations.

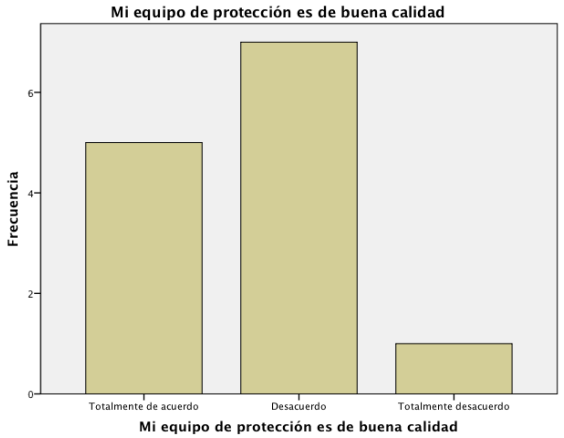
Source: (Own elaboration)

3. RESULTS

3.1 RESULTS OF THE TEST

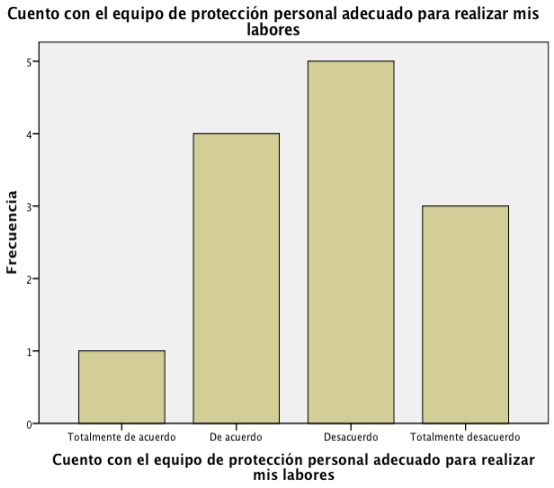
According to the results that were obtained through the application of the instrument, it was possible to detect certain critical points where an improvement can be made, among the most important data the following stand out:

Table 3 Quality of protective equipment.



Source: (Own elaboration)

Table 4 Appropriate personal protective equipment.

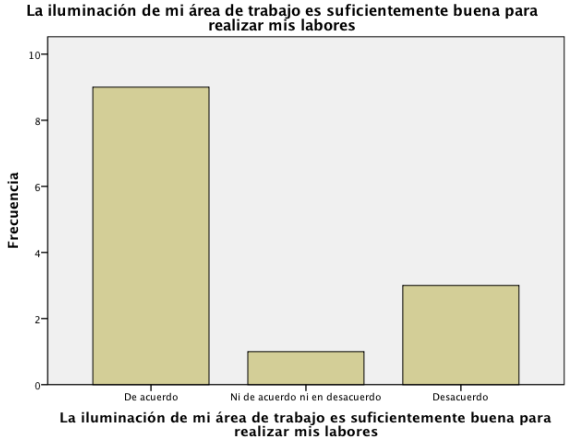


Source: (Own elaboration)

Regarding the quality of the protection equipment, we have that 61.5% of the associates consider that their equipment is not of good quality since their responses were disagreement and totally disagree and the other 38.4% totally agree that their equipment personal protection is of good quality, the percentages obtained were the same in terms of whether the equipment is adequate for the activities carried out.

Personal protection is made up of those elements that the worker uses in order to reduce or avoid injuries or health losses that may be caused by accidents and exposures to occupational diseases. (Rodellar, 2008)

Table 5 Work area lighting

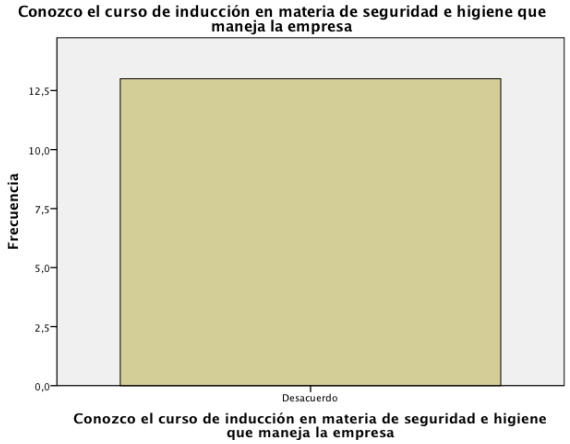


Source: (Own elaboration)

On the subject of Lighting, it is possible to detect an important opportunity in which it is necessary to deepen the risk assessment because 23% of the associates answered that they disagree with good lighting and 7.69% answered Neither Agree nor Disagree.

The unsafe condition represents a dangerous situation in the workplace that may be present in the environment, machine, equipment or facilities. Examples of unsafe conditions include adequate lighting. (Chinchilla, 2002)

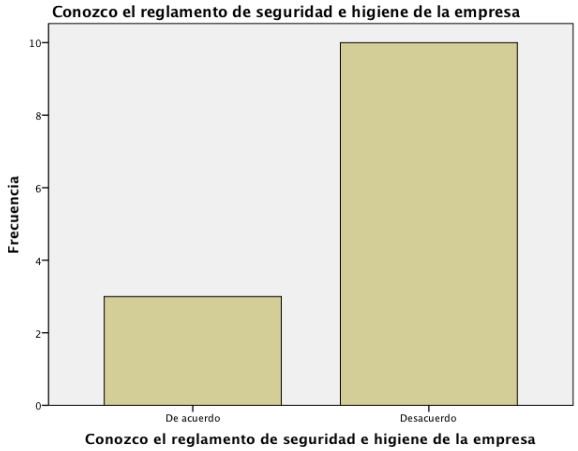
Table 6 Induction in Safety and hygiene.



Source: (Own elaboration)

Very outstanding results were obtained that will undoubtedly be useful in the selection of recommendations and improvements. We realized that 100% of the employees did not take an induction course in Safety and Hygiene before starting their work in the company. On the other hand, 76.92% of the associates do not have knowledge about the Safety and Hygiene Regulations of the company, only 23% said they knew about this document.

Table 7 Safety and hygiene regulations.



Source: (Own elaboration)

Training is an activity planned and based on real needs of a company or organization and oriented towards a change in the knowledge, skills and attitudes of the collaborator. Therefore, it can be understood based on his words that for the general objective of a company to be fully achieved, the training function is necessary, which collaborates by providing the company with properly trained, trained and developed personnel to perform their functions well having previously discovered the real needs of the company. (Siliceo, 2004)

3.2 CHECKLIST RESULTS

In order to strengthen the information collected, physical verifications were carried out through tours in each Operation of the production area, these tours were carried out in the company of the company's administrative staff.

Among the risks that were detected in the different work areas we have the Mechanical type where the employees did not receive training on the correct use of protective equipment and there is also the projection of particles, in this case welding burrs in operations welding, grinding and assembly. Physical, Chemical, Safety and Psychosocial risks were also identified.

Regarding the physical risks identified within the work operations, there are those generated by lack of lighting in the work area and by excessive noise. In addition, the lack of eyewashes was registered in all work areas, which represents a chemical risk for workers.

Another risk that was identified and was repetitive on several occasions due to the different operations within production is the risk on Safety issues because the company does not have a Safety and Hygiene regulation, therefore the workers do not have information on the subject Likewise, there is no visible policy, norms or regulation in the production area. On the other hand, the company has not been concerned about the issue of safety signs within the facilities.

On the subject of psychosocial risks, it can be detected that in the welding operation the workload is greater, so this can generate stress or fatigue in the employee, thus causing a careless accident at work.

3.3 HAZARDS WITH A MEDIUM AND HIGH DEGREE OF HAZARD.

The method that will be used to identify risks with a medium and high degree of danger is the William T. Fine Method, published in 1971.
This method provides us with the defined probability of risk as the process develops, which consists of three variables: exposure, probability, and consequences. (Rubio, 2005)

Table 8 Risks with a medium and high degree of danger

Risks with a medium and high degree of danger		
Operation	**Risk**	**Observations**
Welding	*Mechanical*	-Employees are not trained in the correct use of personal protective equipment, which can lead to a workplace accident. -The Welding operation generates projection of welding burrs at high speed and constantly.
	Physical agent	-The lighting in the welding operation is not adequate, which reduces the visibility of the operator and increases the probability of suffering a work accident.
	Chemical	-Lack of eyewash in Welding area.
	Security	-The lack of safety regulations in the company causes discipline in the work area, which can lead to an accident.
Cut	*N/A*	No risks were identified with a Medium or High degree of danger.
Grinding	*Mechanical*	-In the Grinding area, a great opportunity for improvement was detected in terms of Protective Equipment since the employees do not have training for its use and this is not adequate because the projection of particles was detected as well as the area of Welding.
	Physical	-The lighting in the Grinding operation is not adequate, which reduces the visibility of the operator and increases the probability of suffering a work accident.
	Chemical	-Lack of eyewash in the Grinding area.
	Security	-The lack of safety regulations in the company causes discipline in the work area, which can lead to an accident.
Assemble	*Mechanic*	-Employees are not trained

	al	in the correct use of personal protective equipment, which can lead to a workplace accident. -The Assembly operation generates projection of welding burrs at high speed and constantly.
	Physical	-The lighting in the assembly operation is not adequate, which reduces the visibility of the operator and increases the probability of suffering a work accident.
	Chemical	-Lack of eyewashes in the Assembly area.
	Security	-The lack of safety regulations in the company causes discipline in the work area, which can lead to an accident. -It was identified that the employees of the assembly area are not aware of using their protective equipment when carrying out their activities.
Struck out	*N/A*	No risks were identified with a Medium or High degree of danger.

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Source: (Own elaboration)

4. CONCLUSIONS.

Without a doubt, Industrial Safety and Hygiene is a complex and important area for the proper functioning of organizations. Upon obtaining the final results of the applied research, we realize the opportunities that the company has to improve the working conditions it provides to its employees.

Sánchez, Villalobos and Cirujano (2007) They tell us that the company's management must carry out evaluations every certain period established in order to know the state of the security management system in each element that makes it up and analyze whether it meets the expected objectives, the Evaluations help to know the level of satisfaction of the workers and the regulatory authorities that regulate it, we will also know if there is a need to introduce any improvement change to the program and if it is the case to do so and in case they do not have a clear vision of the program to be able to solve in a timely manner the problems that arise.

As mentioned in the previous paragraph, through Safety and Hygiene evaluations we can know the regulations issued by the authorities and that the employer is obliged to comply with when planning activities to implement the company's Safety and Hygiene system. According to this research, the applicable Official Mexican Standards of the Ministry of Labor and Social Welfare are: NOM-017-STPS-2008 focused on Personal Protection Equipment, NOM-025-STPS-2008 that tells us about Lighting in the centers of work and the NOM-027-STPS-2008 focused on the activities of Welding and Cutting.

5. REFERENCES

[1] Chinchilla, R. (2002) Salud y seguridad en el trabajo. Costa Rica: editorial universidad estatal a distancia. Recovered from https://books.google.com.mx/books?hl=es&lr=&id=Y35TDM74KmUC&oi=fnd&pg=PA1&dq=equipos+de+seguridad+en+produccion&ots=FhYKojmiop&sig=5tF5BS7NimlEnPleLqoeGrRa3oY&redir_esc=y#v=onepage&q=equipos%20de%20seguridad%20en%20produccion&f=false

[2] Rodellar, A. (2008). Seguridad e Higiene en el trabajo. Barcelona: Marcombo.

[3] Romeral, J. (2012) Gestión de la seguridad y salud laboral, y mejora de las condiciones de trabajo. México. Biblioteca jurídica. Recovered from http://www.scielo.org.mx/pdf/bmdc/v45n135/v45n135a12.pdf

[4] Rubio, J. (2005) Manual para la formación de nivel superior en prevención de riesgos laborales. España. Edigrafos, S.A. Recovered from: https://books.google.com.mx/books?id=DK9aB3LK3EgC&pg=PA46&dq=metodo+william+t+fine&hl=es&sa=X&ved=2ahUKEwjejOiaqJnqAhXMJzQIHSvyCN8Q6AEwAXoECAMQAg#v=onepage&q=metodo%20william%20t%20fine&f=false

[5] Sanchez, A., Villalobos, F. & Cirujano, A. (2007) Manual de gestión de la prevención de riesgos laborales. Madrid. IMAGEN. Recovered from https://prevencion.fremap.es/Buenas%20prcticas/LIB.005%20-%20Libro%20Manual%20Gestion%20PRL.pdf

[6] Siliceo, A. (2004) Capacitación y desarrollo de personal. México: Limusa. Recovered from https://books.google.com.mx/books?id=CJhlsrSuIMUC&printsec=frontcover&dq=capacitaciones+de+personal&hl=es&sa=X&ved=0ahUKEwjgn8aA58zjAhWOvZ4KHaYLDTkQ6wEIKjAA#v=onepage&q=capacitaciones%20de%20personal&f=false

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