Analysis of The Working Safety Conditions in A Company in The Mexican Energy Sector

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Abstract. This article analyzes the actual occupational safety conditions in a Mexican energy sector company, focusing on key points such as worker consultation, key performance indices and legal compliance.

1. Introduction

Occupational accidents and diseases represent a human and economic problem that constitutes a serious concern throughout the world. Despite global efforts to address the occupational safety and health situation, the International Labor Organization estimates that every 15 seconds, one worker dies from work-related accidents or illnesses and 153 workers have a work accident. Every day 6,300 people die from accidents or work-related diseases, this is more than 2 million deaths per year (Social, 2017).

2. Backgrounds

Prior to the armed movement of the Mexican Revolution, the first attempts to take measures for the protection of workers in Mexico began to be made; there is a record that José Vicente Villada, Governor of the State of Mexico, in 1904 promoted the Law of Work Accidents of the State of Mexico, which at the time was the only one in the country; this law required employers to compensate workers who suffered an accident at work (Social, 2017).

3. Methodology

The purpose of this research is to investigate the current situation with respect to safety and hygiene in a company in the Mexican energy sector. The types of research are:Quantitative, descriptive, documentary and historical.

4. Development
4.1. Consultation of workers

The object of this research is the entire technical and administrative staff of a company that sells electricity in Mexico, attached to all the departments of the organization, since they develop their activities directly in the productive processes of the same, both in offices as in the field, and with their experience they can provide useful data for the study, for this, the entire staff was taken into account, since it is a small number, (40 workers), so a sample calculation will be omitted.

4.2. Design of the instrument for data collection

It is a questionnaire aimed at personnel working in the company and is structured in seven variables: training, personal protective equipment, safety equipment, machinery and equipment, official Mexican standard, occupational risk, facilities, personal perception and access to the information, giving a total of 19 questions.

4.3. Data collection instrument validation

A validation of the instrument was carried out through the participation of 40 workers who reviewed the questionnaire in its entirety, of which 5 indicated that question 3 was confusing, in addition that it was repetitive with respect to question 10, which gave a guideline to eliminate it.

4.4. Cronbach's coefficient

To calculate the reliability coefficient of the instrument of this research, Cronbach's alpha coefficient was used, which oscillates between the values 0 and 1, where zero means null reliability and one a maximum.

Once the data had been collected and recorded in a database, the calculation was carried out in the minitab statistical-computer program, which is licensed, the following result is presented:

An alpha coefficient of 0.91 was obtained, which indicates that the instrument is reliable.

Alpha

0.9153

Image 1. "Cronbach's alpha coefficient for the pilot test"
Source: Own elaboration, licensed by the minitab
software (2021)

5. Data Analysis and Interpretation
5.1. Training topic
Respondents were asked if the company trains them in general safety issues, their quality, and if they considered they were consistent with their work activities.

Image 1.2 "Graph on training".
Source: Own elaboration, licensed by the minitab
software (2021)

6. Results
29 respondents perceive their training from regular to very good, in addition to considering it consistent with their activities, and of quality, which speaks well of the organization, while the remaining 11 consider it regular.

6.1. Personal protective equipment topic
The respondents were asked if the company provides the personal protective equipment in a timely manner.

33 of the respondents have good expectations about the PPE that the company provides them, they think that it is given in a timely manner, according to their activity and in good physical condition, while the remaining 7 show values from fair to bad.

6.2. Safety equipment theme
The staff was asked if the company provides the safety equipment in a timely manner, in addition to whether it was in good general condition.

In the case of the variable "safety equipment", in general, the trend is positive, since only 3 negative results are observed corresponding to classes 9 and 11, which are 3 individuals, while the remaining 37 present values of good to excellent, since they consider that the company

provides them with the necessary safety equipment, according to their activity, and in good physical condition.

Image 1.4 "Graphic about safety equipment"
Source: Own elaboration, licensed by the minitab
software (2021).

6.3. Machinery and equipment theme
For this matter, the personnel were asked if the machinery and equipment of the company are in good physical condition, derived from good maintenance schemes, both preventive and corrective.
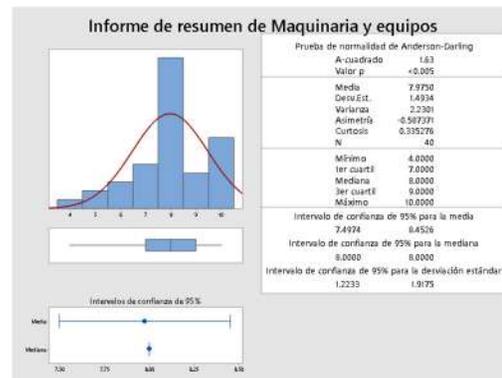
Image 1.5 "Graphic on machinery and equipment"
Source: Own elaboration, licensed by the minitab software (2021).

For the variable "machinery and equipment", it is observed that 29 of the employees assigned values from good to excellent, (class 8.9 and 10), since they think that the organization assigns them machinery and equipment in good condition, in addition to they believe they are able to operate them, while 11 of them have assigned regular values.

6.4. Organizational key performance indices
The case study company presents the following indices, from 2018 to 2020, it should be noted that these indices are reflected at the end of the year and made known

to the staff, in accordance with the ISO 45001-2018 standard.

Table 1.8: "key company performance indices"

Key performance indices

Accidents for year	Days lost per year due to accidents	Type of accidents (in 3 years)
2018- 1 accident	2018- 7 days	Fall to the same level-1
2019- 2 accidents	2019- 40 days	Aggression-1
2020- 0 accidents	2020- 0 days	Burn from contact with electric arc- 1

Source: own elaboration, based on the company case study (2021).

6.5. Analysis of key performance indicators

The indicators of the company case study show 3 accidents from 2018 to 2020, of which 2 are low impact and one of consideration (contact with heat by electric arc), however, in terms of lost days, same level falls are the cause that most affected this indicator, with 30 days, while the high impact indicator 2 days, so attention must be paid to each and every one of the company's work safety processes and procedures.

In general, the organization has a low work accident rate, taking into account that it performs 4 of the 5 activities considered high risk in the industry (work at risky heights, electrified live lines, cutting and welding, in confined spaces), but the objective of every organization must be zero accidents, since these affect the worker, his family, and the company in general.

6.6. Analysis of the causes of accidents in the company case study

Having identified that the problem is work accidents because they represent effects on the company's indicators and the worker's well-being, the causes are identified, based on prior knowledge of safety conditions, legal compliance and interviews in work site to staff, the following conclusions are reached:
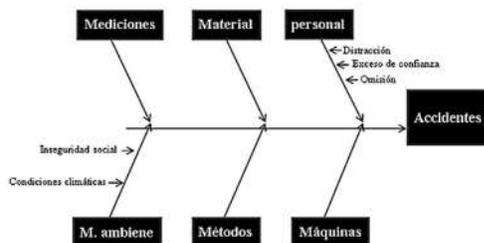

Image 1.2 "Ishikawa diagram oriented to the organization
Source: Own elaboration, licensed by the minitab software (2021)

As can be seen, the preponderant factor is the human, so it is important to apply efforts to that niche, the second cause is the environment, which is outside the full scope of the organization, however, controls can be implemented administrative, engineering or PPE.

6.7. Analysis of compliance with Mexican legislation and internal work safety procedures of the organization

To determine if the company complies with the minimum requirements of the Official Mexican Standards, and the internal procedures in occupational safety, an inspection was carried out in the company, reviewing the points of the standards involving both technical and administrative aspects, these are:

- NOM-002 Prevention and protection against fires,
- NOM-009 Work at height,
- NOM-022 Static electricity,
- NOM-029 Maintenance of electrical installations,
- NOM-017 Personal protective equipment,
- NOM-006 Material handling and storage,
- Internal procedures established by the company case study.

Once this inspection has been carried out, it is concluded that the company complies with all that is established in Mexican regulations and in the procedures established by the organization.

7. General conclusions

An organization is responsible for the occupational safety and health, of its workers and other people who may be affected by its activities, and in general, in the case of the company, case study, once verified and after analyzing the key performance indices, compliance with applicable Mexican regulations and the consultation of the personnel, it is concluded that the conditions of labor safety in said company are favorable for the worker and the assets of the same, however, it is recommended to continue with the implementation of new and better procedures, always following continuous improvement.

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