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Contribution to the occupational risk assessment for sustainable management in health and safety at work: case study

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Abstract. This article describes the progress of continuous improvement of management practices based on feedback from adverse events revealed and recorded during a period of activity within a national company. This rapidly expanding tool is intended to provide the means for reflecting on the experience acquired during accidents and / or incidents that have occurred in a normal or disorganized situation, in order to draw the consequences, memorize it and reuse it. It is a process in which the manager observes with his own eyes the mapping of working conditions for a well-defined period and thus makes decisions based on real information. Thus, the assessment of occupational risks is at the heart of a search for continuous improvement in occupational health and safety. This assessment consists of a thorough inspection of the workplace to identifying the different situations and processes that may cause harm, in particular to people. It is very difficult to do prevention when we have a little knowledge of the factors that cause accidents or only part of them. To overcome these weaknesses and have an effective prevention in the company, a structured approach of action is proposed. The latter makes it possible to propose measures to improve performance in terms of health and safety and working conditions in companies. As a field of study, we try to constitute a memory of the risks based on the experience feedback of the adverse events manifested in the national company "SOFARE".

1. Introduction

To different proportions, human society is all exposed to a multitude of risks, the result of complex interactions between the activity, its performance and the environment. In addition, work can influence the physical and mental health of the employee, for better but also for worse. Therefore, the prevention of occupational risks must be at the heart of everyone's concerns and is revealed in the context of human resources management, which is of primary importance. Thus, poor working conditions can have adverse effects on workers, their families, residents and the environment. Otherwise, occupational health and safety programs must aim to prevent work-related accidents and illnesses rather than to solve problems after the fact [1]. Among the objectives of health and safety at work, is to promote and maintain the highest possible degree of physical, mental and social well-being of workers in all trades on the one hand and to prevent harmful effects on the health of workers due to their working conditions on the other hand [2, 3]. This is why occupational health and safety efforts aim to prevent work accidents and occupational diseases while engaging in a process of continuous improvement of working conditions [4, 5]. Henceforth, to implement an approach for the prevention of occupational risks, it is essential to know the general principles of prevention and good practices [6]. This prevention is represented by all the measures implemented to preserve health and safety, while improving working conditions and promoting well-being at work [7]. This work is part of a study to assess working conditions within a national company, the aim of which is to discern the different causes of work accidents, or even to come up with measures and methods of management

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contributing to the improvement of working conditions. Importantly, this minimizes the rate of work-related accidents and at the same time improves business performance [8]. As a field of application, we have chosen the SOFARE Company located in Ain Smara, Constantine. The assessment is made for a five-year fiscal period of 2014-2018.

2. DESCRIPTION OF THE STUDY SITE

The SOFARE (retro chargers manufacturing company) is a subsidiary of ENMTP (National Company for Public Works equipment) located in the industrial zone of Ain Smara (Southwest Constantine), Figure 1. It is connected by National Highway No. 5 (NR5) and 13Km distant from the town of Constantine. The SOFARE spreads over an area of 221,545 m2. The SOFARE CCA (complex compactors Ain Smara compressors) A subsidiary of ENMTP Specializes in making retro-loaders, compressors, concrete pumps and compactors. The subsidiary has a total of 143 people in all socio professional categories combined working in normal hours is from 7:30 to 3:30 p.m.

Figure 1: Company Overview sockets SOFARE

3. WORKING METHODOLOGY

Among the objectives of health and safety at work, we find promoting and maintaining the highest possible degree of physical, mental and social well-being of workers in all trades on the one hand and preventing adverse effects on the health of workers due to their working conditions on the other hand. For this purpose, several approaches have been proposed in the literature and the tools implemented mainly depend on the nature of the data and knowledge available to build a behavior model of the real system including the behavior phenomenon. In this work, we have chosen to orient our work on a data-driven approach. The envisaged working method is based on experience feedback, a posteriori approach, from adverse events manifested in the company [9, 10]. This approach is primarily a learning tool for organizations, which allows them to build up a risks memory.

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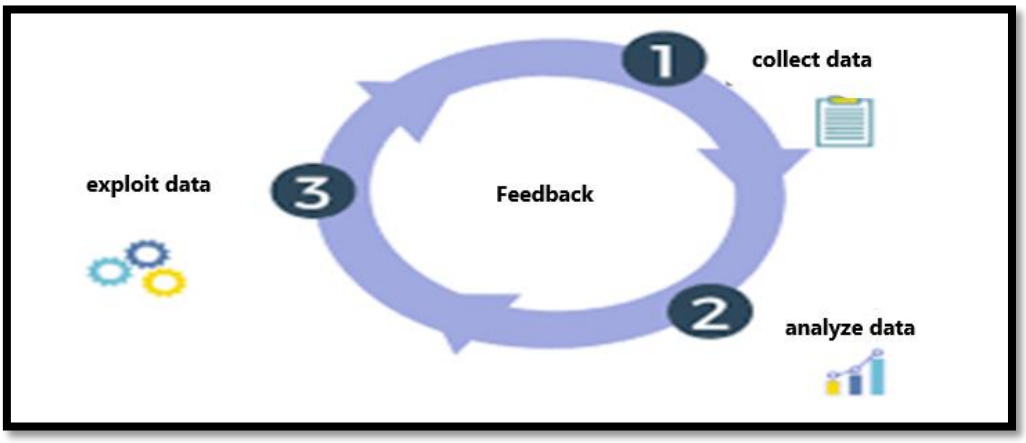

Figure 2. Envisaged approach

Experience feedback (REX) has become a method of managing the security of complex systems to improve quality, safety and reliability from a technical and/ or human point of view. Figure 2 illustrates the various steps to be followed within the framework of this rapidly expanding tool which aims to provide the means for reflecting on the experience acquired from accidents and / or incidents occurred in a normal or disorganized situation, in order to extract the consequences, memorize it and reuse it. It is based on feedback, identification and capitalization of lessons. It is a process in which the manager observes with his own eyes the mapping of working conditions for a well-defined period and thus makes decisions based on real information.

Must be a source of progress and continuous improvement in the face of concrete realities. The quality of this analysis is fundamentally based on the information that security will be able to collect in the field, thereby preventing the recurrence of accidents and incidents that have occurred in the entity and proposing solutions to the deficiencies observed. Consequently, a risk assessment consists of a thorough inspection of the workplace with It a view to identifying, among other things, the elements ,situations and processes which may cause harm ,in particular to people.

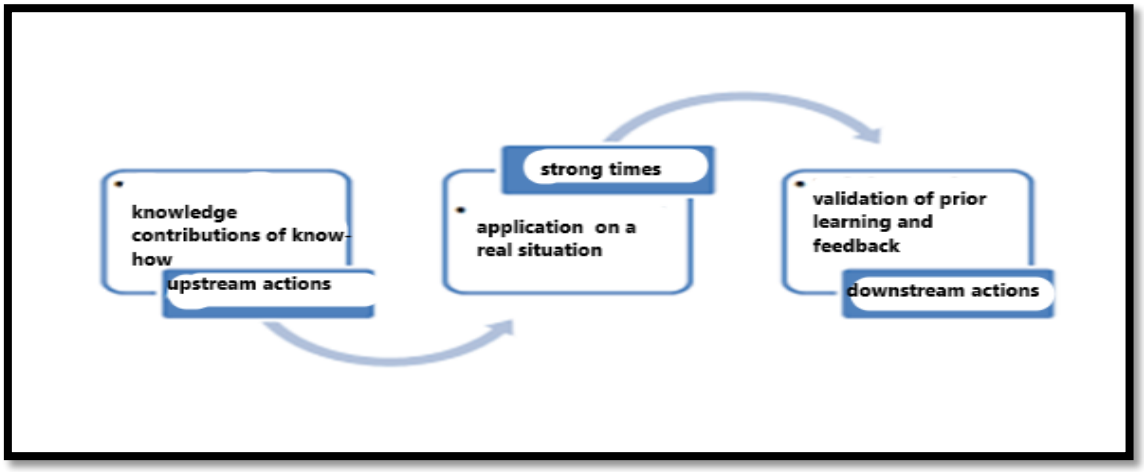

Figure3. Concept of continuous improvement

The term risk assessment is used to describe the entire process or method that allows:

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- Identify hazards and risk factors that could cause harm(hazard identification);
- Analyze and examine the risk associated with the hazard (risk analysis and risk review);
- Determine appropriate means to eliminate the hazard or to control the risk when the hazard cannot be eliminated (risk control).

All the information collected in the field is presented through simple tables and cross tables, which purpose is to have an overview of the distribution of these dysfunctions within the SOFARE study company on the one hand. Then, analyze these results to help put together an action plan that meets the expectations of the business on the other hand. To then determine what measures to adopt to prevent the prejudices from materializing, or even to suggest improvements to the approach applied.

4. Analysis of data and interpretation of results

The results of the information gathered in the field of adverse events manifested during the period spanning from 2014 to 2018 are presented in the following figures:

✓ Distribution of accidents following the age group, Figure 4.

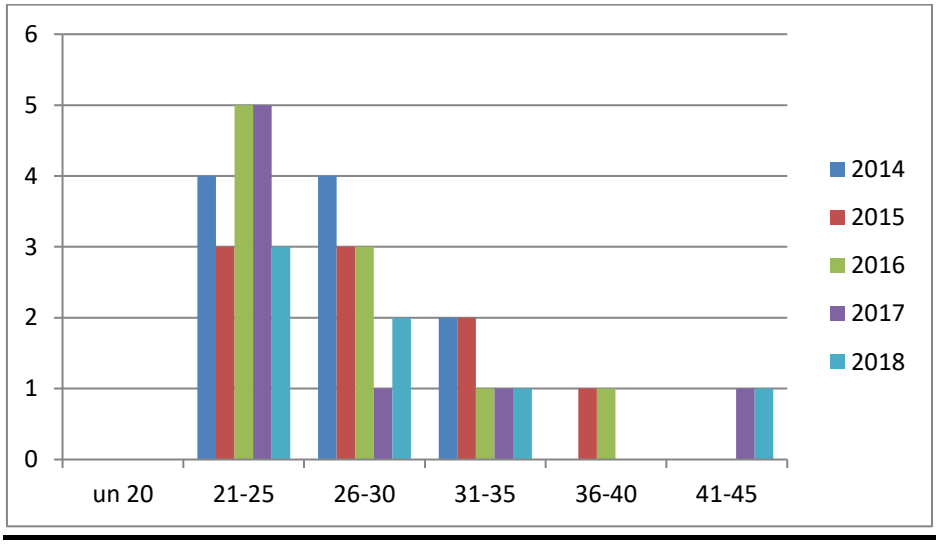

Figure 4: Distribution of industrial accidents according to age groups

Comment: According to the obtained results, we can see that the most affected are the slices of youth 21 to 25 years and those older than 51 to 55 years. In our view, we can say that the first tranche inexperience and low training and information through against the second tranche despite having the experience but low reaction (aging problem and fatigue).

✓ Distribution of accidents according to the professional qualification Figure 5:

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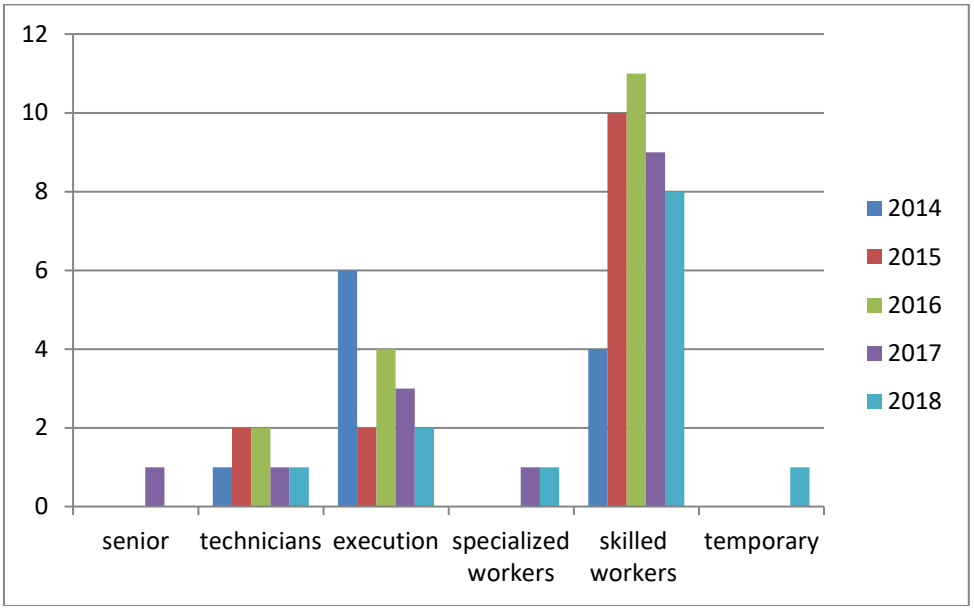

Figure 5: Distribution of industrial accidents according to the professional qualification

Comment: Note that the executive and skilled workers (OQ) are the most affected by workplace accidents. In our opinion it's the slices that are in direct contact with machines and production tools.

✓ Distribution of accidents by family situation, Figure 6.

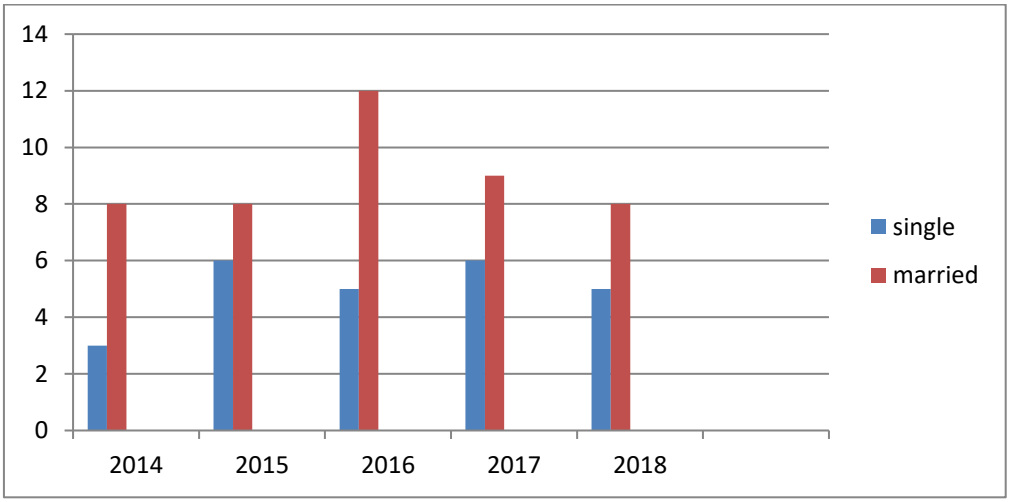

Figure 6: Distribution of industrial accidents according to family situation

Comment: Note that married are most affected by workplace accidents. In our opinion it is not normal in spite of the family commitments. This point really requires a thorough sociological study.

✓ Distribution by educational level, Figure 7.

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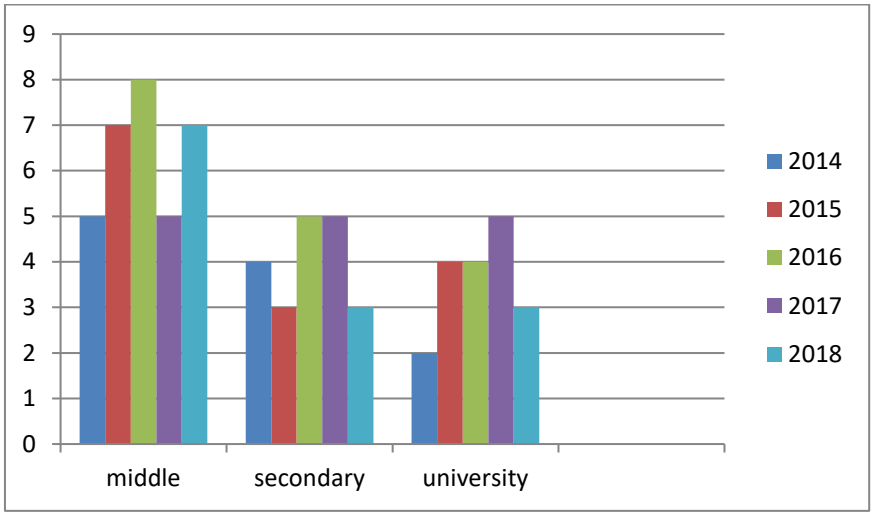

Figure 7: Distribution industrial accidents according level of education

Comment: In this scale, we note that the people most affected by accidents at work are those of the average level. In our opinion,they must be reminded when ever necessary safety precautions and rationalize the training.

✓ Distribution by qualification, Figure 8.

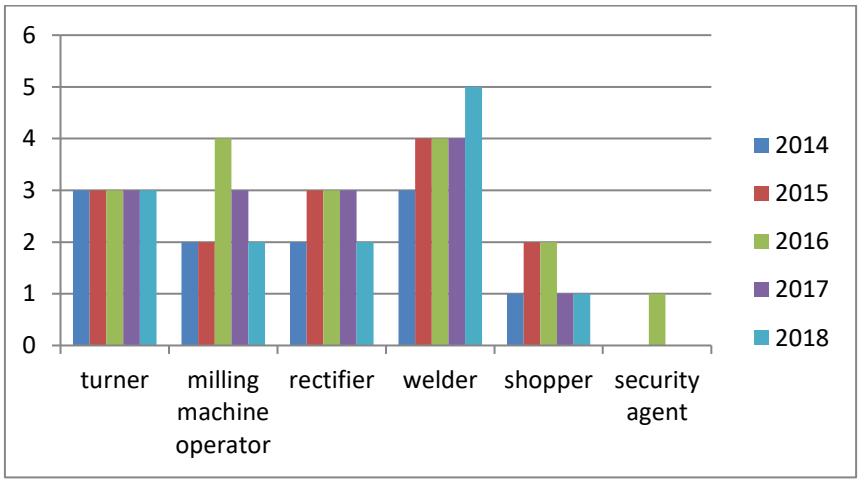

Figure 8: Distribution of industrial accidents according to qualification

Comment: It is seen that jobs and direct contact activities with production tools are the most affected by workplace accidents. In our view, there is a lack of prevention or even non-respect of the safety instructions, lack of training, information and awareness.

✓ Distribution by the location of the injury, Figure 9.

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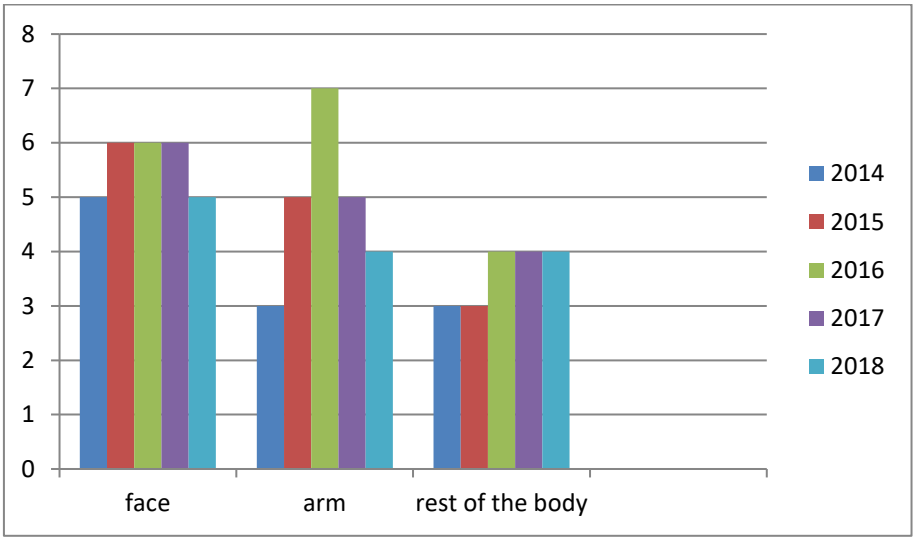

Figure 9: Distribution of industrial accidents according to location of the injury

Comment: Most injuries were to the face and upper limbs. In our opinion there is a lack of protection to report.

✓ Distribution according to workschedules, Figure 10.

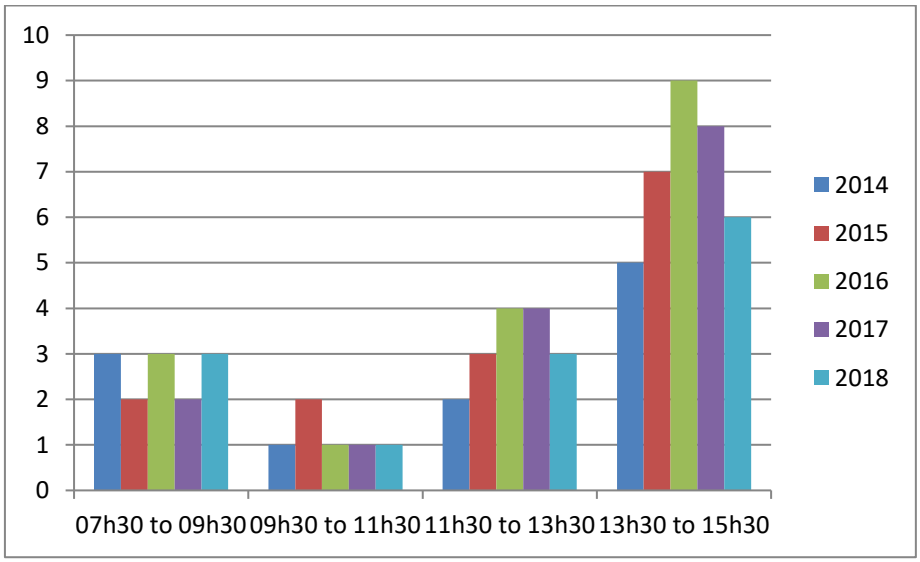

Figure 10: Distribution of industrial accidents according the workschedule

Comment: It is found that the toughest times are the last hours of work, which may be related to fatigue, even the very high workload and / or lack of the work organization.

✓ Research the causes of accidents, Figure 11.

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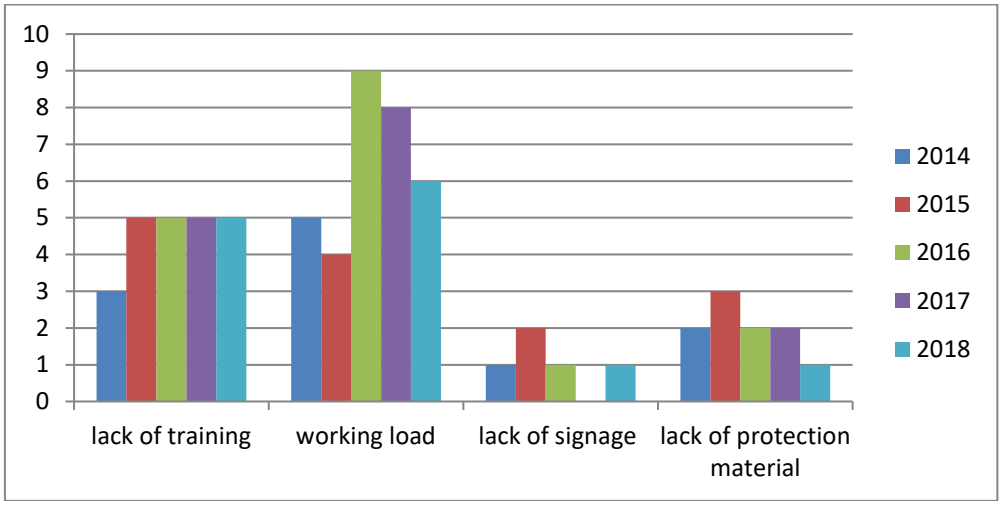

Figure 11: Distribution of industrial accidents according the causes of accidents

Comment: workload and lack of training are the main causes of accidents.

5. Proposed approach

Following this study, we note that the company is failing in occupational health and safety even no improvement in prevention and protection during the five years of study. Otherwise, an emergency action program is required based on the general principles of prevention. Thus, we propose the following approach to improve health and safety within our company study. The approach consists of the following steps, Figure12.

1. Determine the HSE legal and regulatory requirements and HSE main risks concerning the Company's operations
2. Develop action plans for:
   - To gradually comply with the regulations.
   - Master the key risks in HSE matters.
3. Implement action plans
4. Supervise and inspect at workshops compliance with HSE requirements
5. Form as necessary personnel on the requirements of the regulations and HSE
6. Periodically perform and simulations tests
7. Educate staff on the importance of respecting and enforceable HSE requirements
8. Prepare and lead the health and safety committee (CHS)
9. Pilot the implementation of the recommendations of CHS
10. Evaluate and improve HSE performance

Figure 12: SST improvement approach in the company SOFARE

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Following the proposed approach and using the Ichikawa diagram (7M) and rating charts below (table1, annex1, 2), it was determined the actions to take in the imminent, Table 2.

GRAVITY	
CRITERIA	**Notes**
MINOR GRAVITY: Not detectable by the beneficiary and without impact	1
LOW GRAVITY: Detectable by the beneficiary and low incidence	2
AVERAGE GRAVITY: Detectable by the beneficiary and significant impact (significant compliance remediation costs)	3
MAJOR GRAVITY: Detectable by the beneficiary and major impact (very high compliance remediation costs)	4
PROBABILITY	
CRITERIA	Notes
VERY LOW PROBABILITY: Malfunction found at a frequency:<5%	1
LOW PROBABILITY: Malfunction found at a frequency:> 5% and <20%	2
MEDIUM PROBABILITY: Malfunction found at a frequency:> 20% and <40%	3
HIGH PROBABILITY: Malfunction found at a frequency:> 40%	4

Table 1 :Trading Grid / Risk Assessment

6. CONCLUSION AND RECOMMANDATIONS

In conclusion, we note that it is very difficult to do prevention when the factors involved in accidents are not well known, or only a part of it is identified. In addition, for effective management of prevention in the company, it is necessary to encourage the integration of prevention into the various activities of the company and in particular production. Therefore, it is necessary:
- Integrate prevention in Occupational Health and Safety at all levels of the company, by involving managers and staff in the process;

The integration of prevention into production activities must be encouraged. Therefore, you must:

- Integrate prevention in Occupational Health and Safety at all levels of the company, by involving managers and staff in the process;
- Integrate health and safety management at work in all functions of the company;
- Analyze work accidents and occupational diseases by going back to the most upstream causes.

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Annex 1 – Trading Grid / Risk Assessment

PROBABILITY		GRAVITY				
			minor GRAVITY	**Low GRAVITY**	**Average GRAVITY**	**Major GRAVITY**
			1	2	3	4
	VERY LOW PROBABILITY	1	1	2	3	4
	LOW PROBABILITY	2	2	4	6	8
	AVERAGE PROBABILITY	3	3	6	9	12
	HIGH PROBABILITY	4	4	8	12	16

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Annex 2
Grid prioritization of risk actions mastery

PROBABILITY			Minor gravity	Low gravity	Average gravity	Major gravity
			1	2	3	4
	Very low probability	1	C	C	C	B
	Low probability	2	C	C	B	AT
	Average probability	3	C	B	AT	AT
	High probability	4	B	AT	AT	AT

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Risk Analysis of the process operation						
No. step	Nature Of risk	**Risk assessment**			**Risk mastery means**	
		Probability P	**Gravity G**	**Criticity C = P * G**	M	**M1**:Workforce **M2**:Methods **M3**:Midfielder M4 :Machine M5: Material M6: Money M7 :Measurement
1and 2	Insufficient control of HSE regulations	3	2	6	M1	Training for the pilot and copilot of the process
3	Lack of financial resources Insufficient control of HSE risks.	3	2	6	M6 M1	Provide the necessary financial resources; Recruiting qualified staff in HSE particularly in the field of prevention "TS" and / or program of HSE related training for officers post
7	Insufficient responsiveness of staff Unavailability of sensitized staff	4	1	4	M2	Program awareness sessions Increase awareness of workstations.
8 and 9	Frequency of meetings of CHS not respected in a systematic way	4	2	8	M2	Inform the members of the CHS and plan ahead to hold CHS
10	Slowness in the implementation of the recommendations	3	2	6	M2	Develop and follow an action plan outlining the responsibilities for implementing CHS decisions and recommendations with definition of related timeframes.

Table 2: risk analysis results and actions to be under taken
Probability: 1 to 4 Load: 1 to 4 Criticity: 1 to 16
P: Probability G: gravity C = F x G = Criticity