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**The effectiveness of the Industrial Security  
Training Program for preventing workplace  
accidents: A field study at the national company  
Sonatrach, Regional Directorate of Eastern  
Transportation, Transport Activity via Pipeline,  
RTE Skikda branch**

فعالية برنامج التكوين للأمن الصناعي للوقاية من حوادث العمل دراسة  
ميدانية بالشركة الوطنية سوناطراك المديرية الجهوية لناحية النقل  
الشرقية نشاط النقل عبر الأنابيب فرع الاستغلال RTE سكيكدة

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**Abstract:**

The study aimed to determine the impact of training and identify obstacles in the training process. A questionnaire was administered to 50 workers from the Tanks and Pipelines Maintenance Department in 2022, using a descriptive approach for participant selection. Statistical analysis was performed on the collected data. The study found significant differences in workplace accidents between workers who received security and prevention training and those who did not. Workers without

training were more susceptible to workplace accidents within the institution. Furthermore, the study revealed that increasing training in occupational health and safety led to a reduction in workplace accidents. This research emphasizes the importance of training programs and highlights the need to address the content of training, awareness sessions, and the workers' capacity to absorb the information. By enhancing training in industrial security, companies can contribute to a safer work environment and prevent accidents among their employees.

**Keywords:** Training; Industrial Security; Workplace Accidents.

#### المخلص:

تهدف الدراسة الحالية الى معرفة دور التكوين في مجال الامن الصناعي للوقاية من حوادث العمل لدى عمال الشركة الوطنية سوناطراك - المديرية الجهوية لناحية النقل الشرقية نشاط النقل عبر الأنايبب فرع الاستغلال RTE سكيكدة، وكذا الكشف عن العراقيل التي تواجه العملية التكوينية من حيث مضمون البرامج التكوينية، الحصص التوعوية ونسبة استيعاب العاملها، ولتحقيق هذا الهدف تم تطبيق استبيان حول التكوين في مجال الامن والسلامة المهنية للحد من حوادث العمل على عينة مكونة من 50 عامل من مصلحة صيانة الخزانات والأنايبب لسنة 2022 والتي تم اختيارهم بطريقة قصدية حسب المنهج الوصفي، وبعد المعالجة الإحصائية توصلت نتائج الدراسة إلى وجود فروق في حوادث العمل بين العمال الذين تلقوا تكوين في مجال الامن والوقاية والعمال غير المكونين، الذين هم الأكثر عرضة لحوادث العمل داخل المؤسسة، كما بينت انه كلما زاد تكوين العمال في مجال الصحة والسلامة المهنية، أدى إلى تخفيض من حوادث العمل.

الكلمات المفتاحية: التدريب; الامن الصناعي; حوادث العمل.

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## **1. INTRODUCTION**

The technological development witnessed by the world and the resulting industrial development has led to many risks that humans must be aware of and take precautions to avoid. Therefore, it was necessary to confront this huge industrial development by providing protection and security for the human element, which we always consider to be the most valuable element of production. The industry has been considered the most dangerous activity for humans, and its losses in terms of lives and injuries far exceed the losses caused by wars. Work accidents, which reflect the level of safety in the industrial institution, have been interpreted differently by researchers. Some attributed them to genetic reasons, while others attributed them to the environmental climate and social and economic conditions of the worker. However, the majority agreed that human factors are the main cause of accidents. Work accidents are a phenomenon that requires investigation, analysis, recording, and measurement in the industrial institution to understand their true causes.

In light of this rapid increase in this dangerous phenomenon that various industrial and economic institutions suffer from, it is important to think and search for suitable conditions and possible methods to reduce work accidents. One of the most important methods is training in the field of occupational safety and prevention, which involves preparing the worker for his profession, developing his abilities, and acquiring skills and techniques related to his work and controlling the various devices and machines he uses and deals with.

Due to the importance of training, most studies indicate that it is necessary to train and educate workers about the professional hazards associated with it. Through the above, it can be said that training in the field of occupational health and safety is of great importance. It can help the worker to perform

his work properly, reduce and prevent work accidents on the one hand, and maintain his health and safety on the other hand.

### **Study problem:**

The major manufacturing movement in the world has had a great impact and a distinctive strategic approach. With the advent of the industrial revolution and the emergence of modern technological developments that keep pace with it, modern societies have adopted modern technological methods in the field of manufacturing to meet the growing needs of society for goods and services at the expense of human energies and resources.

Undoubtedly, the process of planning to confront such situations remains limited to identifying the basic needs of the industrial institution and understanding the training pattern adopted in the organization based on the application of modern industrial standards, measures, and legislation aimed at establishing an industrial safety system. This latter is available in a set of elements that are considered a training plan followed by the institution to protect its workers from the various hazards they are exposed to in the industrial environment.

This plan includes a set of security measures and mandatory laws characterized by integration and effectiveness, starting from the top of the organizational pyramid represented by the senior management of the institution, which must be the first to promote security and maintain high levels of it through a thorough study of work engineering and through the formation of prevention and awareness departments of work accidents and injuries, and the formation of committees that activate internal communication and interaction among workers within the institution, creating an atmosphere of cohesion, cooperation, and exchange of knowledge and experience among workers, especially during training courses and awareness campaigns.

These committees are primarily concerned with ensuring the implementation of the conditions and agreements that must be available in the workplace, applying the laws and regulations related to that, and working to provide the most suitable conditions that help workers to work without stress or boredom, taking into account that this represents the minimum requirement that must be available in the work environment. Secondly, they specialize in training the worker on the safe method of work and creating the motivation or incentive for him to follow this method, and raising his awareness of the correct way to interact between him and the machine to increase specialized knowledge and the necessary skills to accomplish the work, leading to preventive awareness.

Therefore, industrial safety and its training and awareness programs are the scientific approach to achieving these goals and reaching a reduction in the cost of these hazards, which may be the starting point for developing good and new security training programs that help measure efficiency and performance, as well as being the goal and motivation for many institutions to focus on preventing work accidents.

Based on the above, and given the attention paid to this problem, we can ask the following question:

**To what extent does the industrial safety training program contribute to preventing work accidents?**

**Study Hypothesis:**

This study proceeds from the following main hypotheses:

**The more workers are trained in the field of occupational safety and health, the more it leads to a reduction in work accidents.**

**Study importance and objectives:**

The research topic is of great importance, especially in light of the significant attention that the field of human resources has received as one of the most important foundations on which the present and future of the institution is built. The importance of the study lies in its focus on the phenomenon of work accidents, which are considered one of the most dangerous problems and obstacles facing economic and industrial institutions and endangering the health of workers. The objectives of the study are to determine the effectiveness of the industrial safety training program in preventing work accidents, especially since the human element has become one of the most important institutional resources. The study also aims to identify the relationship between the industrial safety training program as a method of preserving the worker and the machine and its contribution to reducing work accidents and occupational hazards in the sample of the national company Sonatrach - the regional directorate for transportation in the eastern region, the pipeline transportation activity, exploitation branch RTE Skikda. Additionally, the study aims to identify the type and pattern of training programs applied in Sonatrach and their impact on consolidating preventive awareness and culture among workers, as well as to identify the type of security training and the content of its programs followed by the national company Sonatrach and its effectiveness in developing the skills and competencies of workers and acquiring qualifications that prevent them from falling into work accidents while performing their tasks.

## **2. Concepts**

### **2.1 Formation**

Formation can be defined according to researchers' perspectives as follows:

- Ahmed Mustafa Khattar and others: It is "raising the level of worker productivity and equipping them with new experiences in work or directing them to new work or a new position"(Khattar & Mustafa, 2001, p. 233).

- Safi Aqeeli Omar: Formation is defined as a planned process that uses methods and tools to create, improve, and refine skills and capabilities in individuals, expand their knowledge for efficient performance through learning to raise their competencies, and consequently the competencies of the organization in which they work as a work group(Omar, 1991, p. 220).
- Mohammed Abdelghani Sharif: He defines it as a process of teaching and learning that enables the individual to master his profession and adapt to his work conditions in the shortest time and with the least possible effort(Sharif, 2003, p. 273).
- Mohamed Gamal El-Din El-Morsi: It is an organized procedure through which individuals are equipped with knowledge and skills to perform and execute a specific task(Morsi, 2003, p. 27).
- Mohammed Qasim Al-Qarawuti: It is the increase of skills and knowledge in specific fields and an attempt to increase the awareness of trainees about the goals and message of the organization they work for(Al-Qarawuti, 2010, p. 166).
- Mohamed El-Fatih Mahmoud Bashir El-Maghrebi: It is an activity carried out by management with the aim of developing and improving individuals in several aspects, including knowledge, abilities, skills, attitudes, behavior, and job performance(El-Fatih & El-Maghrebi, 2016, p. 46).

Procedural Definition: Formation is defined as an organized process of teaching and developing the individual's capabilities in the shortest time to perform their work appropriately and adapt to work conditions.

## **2.2 Industrial Security**

If we go back to the origin of the word "security" in the Arabic language, we will find that "amn" means making something safe and secure, and it also means tranquility and peace of mind. From this perspective, we find that the word "security" for companies and establishments is the tranquility and serenity of these establishments while performing their tasks, creating safe working conditions, and promoting a sense of security in the work environment. Therefore, the function of security is to protect establishments or sites, i.e., the place where work is carried out, and to provide security within it for all production elements, including human resources, financial resources, machinery, and equipment in their various forms, whether raw or manufactured (Gharbi, 2004, p. 96).

Zidane Abdelbaqi defines it as the process through which workers are protected from work accidents (Abdelbaqi, 1978, p. 171).

Habib El-Sahaf defines it as providing workplaces with protective or therapeutic equipment that enables them to perform their work, protecting them from hazards that threaten their lives or health (El-Sahaf, 1998, p. 48).

Meanwhile, Saad Naif Brinouti defines it as the protection of workers from injuries resulting from work-related accidents, meaning protecting them from injuries within the workplace (Brinouti, 2004, p. 467).

**Procedural Definition:** Industrial security is the set of preventive programs and methods adopted by the organization towards its employees in order to provide a suitable working environment, which includes tranquility, mental health, and physical health.

### **2.3 Work Accidents**

Occupational accidents can be defined from several angles, depending on the specialization of each party involved in



the accident. Based on this perspective, SEKIOU defines it from the perspective of those directly involved as "an incident that results in injuries that can be deep or severe burns, and in extreme cases, can lead to death. The latter must be proven and officially recorded".

From the employer's point of view, it means "economic loss, as it is accompanied by the loss of productive work time and wastage of raw materials, as well as machine breakdowns, etc." From the perspective of a safety officer, an industrial accident is "a statistical factor and a subject of study that allows us to find ways to reduce and avoid them if possible." However, from the perspective of the injured party (the worker), it means "physical and psychological suffering, and the compensations provided are not enough to alleviate these pains and losses" (sekiou., blodien, & fabi, 2001, p. 581).

Multiple definitions of work accidents have been presented according to the researchers' perspectives on their causes and resulting consequences. Among these definitions are the following:

- Badee' Mahmoud Al-Qasim defines work accidents as "unexpected events that either affect someone, cause damage to machines and materials, or result in work disruptions and production stoppage" (Al-Qasim, 2001, p. 56).
- Mohammed Al-Shukrji defines work accidents as "everything that happens unexpectedly and causes harm to individuals primarily, and to materials, devices, and properties secondarily. If the accident results in someone's injury, it is called an injury. An injury is defined as an incident that causes the injured person to be absent from work for one day or more" (Al-Shukrji, 1968, p. 481).
- Farah Abdul Qadir Taha defines work accidents as "any

event that happens to an individual or involves them without prior knowledge, and it causes harm to the individual, others, equipment, or property" (Taha, 2001, p. 75).

Based on these definitions, we can conclude the following:

- The concept of work accidents is broader than the meaning of worker injuries. Injuries refer to any physical and psychological harm that befalls a worker as a result of work accidents.
- Work accidents occur as a result of interconnected and interacting factors, including material factors related to work conditions or the technical aspect of machinery, as well as insecure human factors primarily related to the human element.

Procedural definition: It is defined as an unexpected incident that occurs by chance during work due to material, organizational, or human factors, resulting in a halt in the production process, affecting work safety, and causing damage and loss to machinery, equipment, and products.

## **2.4 Work Accidents**

Ali Al-Sharif defines it as "doing the right things at the right time and in the right way" (Al-Sharif, 1994, p. 23).

## **2.5 Efficiency**

It is the provision of necessary conditions, technical specifications, and regulatory procedures in the work environment to make it safe and healthy, meaning that no accidents occur and no occupational injuries arise from it. This is done to enhance the efficiency of the material and human production elements (Hanafi, 1977, p. 400).

## **3. Research Field**

The present study was conducted in SONATRACH, an Algerian state-owned company formed to exploit petroleum resources in Algeria. Its full name is the National Company for Research, Production, Transport, Transformation, and Marketing of Hydrocarbons. It is the sole company responsible for the exploitation and sale of the country's vast oil and gas resources.

Due to the difficulty of conducting research in all branches of SONATRACH due to its extensive presence across the national territory, a branch in the Skikda region, specifically the Regional Directorate of Eastern Transportation (RTE Skikda), was selected. It is considered one of the most important fuel hubs at the national level, specializing in pipeline transportation activities.

The Regional Directorate of Fuel Transportation in Skikda was established in 1971 and is one of the main branches of SONATRACH. It is located in the industrial area in the eastern part of Skikda city and is administratively and geographically affiliated with the municipality of Hamadi Krouma. Its activity mainly focuses on the transportation of liquid and gaseous fuels through pipelines, originating from production fields located in Hassi R'Mel and Hassi Messaoud, to exploitation and financing centers in the eastern part of the country. It also includes the transportation and distribution of gas to the Tunisian and Italian markets, as well as the transportation of petroleum and gas to Europe through the two petroleum ports. Additionally, the Directorate is responsible for the maintenance of transportation facilities and operates a network of fuel transportation. It employs approximately 450 workers, including executives, technicians, and control and implementation assistants.

#### **4. Research Methodology**

Regarding the subject of our study, we utilized the descriptive methodology as it is the most suitable for the topic. This was done to understand the relationship between the industrial security training program and workplace accidents

within the Regional Directorate of Eastern Transportation (RTE Skikda) branch of SONATRACH - Maintenance Department for Tanks and Pipelines. The methodology involved gathering accurate data and studying the phenomenon as it exists in reality, providing a detailed description of it.

## **5. Sample and its selection method**

A research sample was selected from the maintenance department of tanks and pipelines in a non-random purposive manner, meaning it was a deliberate sample, because it was the most suitable for this study. The workers in this department are the most exposed to work accidents compared to other departments within the institution. The number of individuals in the sample was estimated to be 50 workers, including technicians and control and implementation assistants.

## **6. Data collection techniques**

The use of a specific methodology in any research requires the researcher to use appropriate tools that enable him to access the necessary information. In this study, we used the following methodological tools:

- **Observation technique:** The subject of the study relied on direct observation aimed at surveying and exploring the socio-professional environment within the regional directorate of the Eastern Transport District, the pipeline transport activity of the RTE exploitation branch in Skikda (Sonatrach) - the maintenance department of tanks and pipelines. Observation helped describe and analyze work accidents and how to prevent them by relying on an effective awareness and safety training program through field monitoring of various documents and places where accidents can occur. Observation was used in our study from the beginning of the study until the data collection stage, where we benefited from it through the reactions and statements of the workers

while filling out the questionnaires and observing some behaviors, especially the prevailing atmosphere and relationships between team members. They understood the nature and type of the prevailing awareness and training program, their work methods, and the conditions surrounding the work environment.

- **Questionnaire technique:** The questionnaire is the main tool used in our current study, where it included 25 questions, some of which were closed and others were open, distributed on two main axes: . The first axis revolves around personal data and consists of 07 questions. . The second axis: training in the field of occupational safety and reducing work accidents, consisting of 18 questions.
- **Document and record technique:** In this study, documents and records were a complementary tool for data collection tools and are considered important means that we relied on and used in collecting data. The records and documents that were handed over to us helped to save a lot of effort and time, especially those related to the nature of the activity practiced by each type. Some of the most important documents we obtained were:
  - Data related to the historical aspect of the institution.
  - The organizational structure design of the institution.
  - The internal system of the institution.
  - Documents and reports related to accidents that workers suffered, such as statements, issued by the Social Affairs Department.

## 7. Study results

The field study was conducted to verify the validity of the hypothesis stated in our current study, entitled "The

effectiveness of the industrial safety training program in preventing work accidents." The procedural hypothesis: "The more workers are trained in the field of occupational safety, the more it leads to a reduction in work accidents." We note from the statistical results that the majority of the sample individuals are males, aged between [27-45] years, married, with a secondary level of education. They are control and implementation assistants, and their professional experience ranges from [5-20] years with an unspecified work contract.

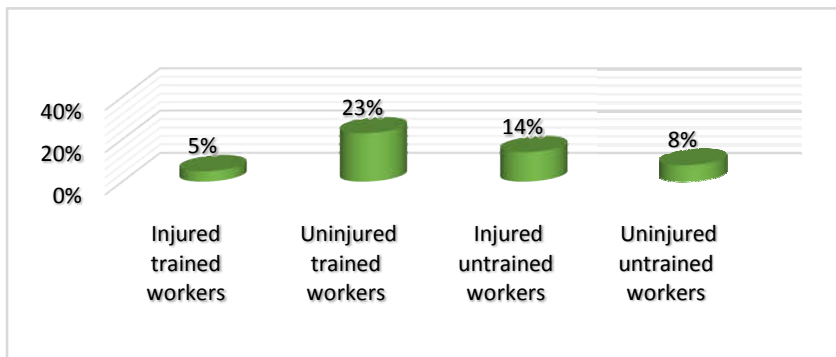
**Table 1.** Represents the differences in work accidents between trained and untrained workers in the field of safety and prevention for Sonatrach RTE Skikda

	trained workers		untrained workers		Ka2	freedom degrees	Sig Level	Statistical function
	R	%	R	%				
injured in work accidents	5	17.86	14	63.64	10.94	1	0.05	Sig
Workers not injured	23	82.14	8	36.36				
Total	28	100	22	100				

R = Repetition

**Source:** Prepared by the researcher

**Fig.1.** Represents the rates of work accidents among trained and



untrained workers of Sonatrach RTE Skikda Company

**Source:**Prepared by the researcher

Through the table and the figure, it is evident that the category of workers who received training recorded the highest percentage of 82.14% without work accidents and a low percentage of work accidents at 17.86%, compared to the rest of the workers who did not receive training, who recorded the highest percentage of exposure to accidents at 63.64%. Meanwhile, 36.36% of the same sample stated that they did not experience any injury or work accident in the institution. It is also evident from the table that there are statistically significant differences between workers trained in the field of safety and prevention and those who are not trained regarding work accidents. This means that the calculated and estimated value of the significance level (p-value) is 10.94 at a significance level of 0.05 and a degree of freedom (DF) of 1. In general, it can be said that the hypothesis has been achieved, as workers who received training did not experience work accidents significantly. Workers who have sufficient knowledge about their work environment, such as operating machines and devices and adopting safe behavior, are less prone to accidents. Therefore, the training process is of great importance in developing individuals' abilities, increasing their skills and qualifications, and thus playing an effective role in avoiding accidents and achieving safe and efficient performance. Most workers in this company acknowledge that the institution cares about training, and they confirmed receiving training on criteria and mechanisms for occupational safety and prevention. The short-term training received within the institution is conducted once during their professional career, making this training average and insufficient to be aware of all safety signals at work sites. Despite the content of the training programs being related to the problem of work accidents, training for workers is an opportunity to discover new knowledge, which develops their skills and knowledge to qualify them to perform their jobs efficiently and safely. Therefore, training is considered one of

the factors that reduce work accidents by realizing most of the hazards associated with work. However, trained workers still experience work accidents, some of which are fatal, due to a lack of communication during training courses, which leads to the worker's failure to absorb the training. This does not deny that many workers do not consider the content of the training and neglect to apply it practically, making it impossible to perceive all hazards, as many hazards remain ambiguous. Based on the nature of the results we obtained, the hypothesis stating that the more workers are trained in the field of occupational safety, the more it leads to a reduction in work accidents has been achieved.

### **8. General result**

This study has revealed a number of important findings regarding the industrial security training program and its contribution to reducing the severity of accidents. These findings were obtained through in-depth analysis of the collected field data. In this context, it can be stated that all the data contributed to a clear confirmation of the study hypothesis, which is that workplace accidents have an impact on workers' performance. Many results related to the hypothesis have shown that the more workers are trained in the field of occupational health and safety, the more it leads to a reduction in workplace accidents. This hypothesis has been empirically validated by workers' increased awareness of work-related hazards, their sources, and their effects on health and safety. This is attributed to raising awareness among workers, fostering a spirit of solidarity, cohesion, and collaboration among them through continuous communication and emphasizing the strict implementation of occupational health and safety procedures. It also involves constant interaction during training sessions, simplifying the content of the programs, informing them about ways to avoid these hazards and accidents through informative signs and publications, and maintaining regular and effective training.



Based on the above, it can be confirmed that this study has provided empirical evidence of the contribution of the industrial security training program to preventing workplace accidents, establishing a relationship supported by quantitative evidence.

#### **4. CONCLUSION**

Through the study conducted at the National Company SONATRACH - Regional Directorate for Eastern Transportation, specifically in the pipeline transportation sector, branch of operation RTE Skikda (Storage and Pipeline Maintenance Department), it becomes evident that the responsibility for implementing the safety and prevention training program in the company is a collective one. This is reflected in the company's health and safety management policy, which is characterized by a reactive approach or what is known as fire management, as most interventions in this field only occur after accidents and injuries have already taken place. However, this does not negate the responsibility of the company's employees. Regardless of the effectiveness of the implemented strategies and the efforts exerted to control hazards and accidents in a sustainable manner, and to ensure safe, secure, and clean working environments for the benefit of the workers, all these efforts and endeavors will remain limited in impact without the presence of sincere and effective political will and the participation of all relevant parties in the development and implementation of training programs in the field of safety and prevention. Furthermore, deterrent and strict measures should be taken towards companies that fail to respond to the rights of workers to perform their duties in a safe and secure work environment, and this can only be achieved through instilling a culture of prevention in them.

In light of the study findings and in order to mitigate this phenomenon and its consequences, we recommend the following:

- Intensify training programs in the field of occupational

health and safety, targeting worker awareness of occupational hazards and improving their level of response to challenging work conditions that pose risks to them, enabling them to avoid occupational accidents.

- Select human resources before implementing training programs to facilitate the assimilation of program content.
- Conduct preliminary medical examinations prior to employment to ensure the suitability of workers for the type of work, as well as periodic examinations.
- Promote a preventive culture, improve workers' awareness, and educate them that occupational safety and accident prevention are everyone's responsibility.
- Involve workers in the development of training programs related to industrial security and inform them of their responsibilities.
- Focus on a policy and strategy of incentivizing and rewarding workers who respect and implement occupational safety procedures they have acquired through training, to foster a competitive spirit and solidify their preventive awareness.
- Investigate the hidden and underlying causes of workplace accidents, particularly among workers trained in the field of safety and prevention, to identify and rectify them.
- Provide financial and administrative support for occupational health and safety training to achieve continuous and effective training.
- Hold meetings and seminars with workers to record their concerns and identify the risks they face in the workplace, taking them into account in training courses.

- Emphasize awareness sessions through printed materials, guidelines, and lectures by specialists in the field of prevention and occupational safety.
- Provide personal protective equipment for workers, ensuring quality when purchasing.
- Focus on workplace supervision and strict adherence to occupational safety procedures during work, while imposing penalties on those who violate these procedures.

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