



بسم الله الرحمن الرحيم

Sudan University of Science and Technology



College of Graduate Studies

Application of Standards for Occupational Health and Safety management systems (OHSAS 18001:2007) in construction segments

(Case study Faisal Real Estate Company)

تطبيق المواصفة القياسية (أوساس ٢٠٠٧:١٨٠٠١) لنظام إدارة السلامة و الصحة المهنية في قطاعات

البناء والتشيد – (دراسة حالة شركة الفيصل العقارية)

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Dedication

To my mother and father and my family a decent appreciation and recognition.

Acknowledgement

Praise is to Allah, the Lord of the worlds in which good and blessed praise, prayer and peace is upon the best.

Senders of Prophet Muhammad and his family and companions and after:-

Thank God first and foremost on the bounty of the completion of this study, and thanks to my Supervisor, Professor Osman Saad who supervised this research, advice and guidance to me and Parts of God are better.

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Abstract

This study was conducted at the request of Faisal Real Estate Company for the application of occupational health and safety system to recognize the reality of the building and construction of the company.

The international standard OHSAS 18001:2007 was applied in this study, which includes a list of verification and inspection of office, store, projects and report of injuries and accidents, rates of event frequency and injury severity rate forms.

Results of the study showed that by used excel computer program, the percentage of matching the inspection and verification of the offices were 80%, 72%, 80%, 88% for housekeeping, electrical wiring, fire-fighting and general requirements, respectively, and the percentage of matching the inspection and verification of the store were 40%, 85%, 50%, 75% for housekeeping, electrical wiring, fire-fighting and general requirements, respectively, and the percentage of matching the inspection and verification of the projects were 17%, 37%, 23%, 20%, 48%, housekeeping, electrical wiring, fire-fighting, scaffolding and general requirements, respectively, and the frequency rate of incidents was 17.66 /lost days and the severity rate was 227.75 injuries / time.

The results showed a lack of commitment to occupational health and safety and increase accidents and injuries in the projects compared to offices and store standards in the company.

The study recommended the need to use OHSAS 18001:2007 system as a global system used in the Occupational Safety and Health for Faisal real estate Company to protect its staff and reduce economic loss ratios. Also the study recommended that relevant regulatory institutions in Sudan

must control construction companies on a regular basis using OHSAS 2007 system for Occupational Safety and Health.

ملخص الدراسة

تمت هذه الدراسة بناءً على طلب شركة الفيصل العقارية بتطبيق نظام السلامة والصحة المهنية في الشركة.

استخدمت معايير المواصفة العالمية ٢٠٠٧:١٨٠٠١ OHSAS والتي تتضمن استمارات قائمة التحقق والتفتيش للمكاتب والمخزن والمشاريع وتقرير الاصابات والحوادث ومعدلات تكرار الحدث ومعدل شدة الإصابة.

وضحت نتائج الدراسة أن نسبة مطابقة التفتيش والتحقق للمكاتب: 88%, 80%, 72%, 80% للنظافة العامة والترتيب، التوصيلات الكهربائية، مكافحة الحريق والمتطلبات العامة علي التوالي، ونسبة مطابقة التفتيش والتحقق للمخزن: 75%, 50%, 85%, 40% للنظافة العامة والترتيب، التوصيلات الكهربائية، مكافحة الحريق والمتطلبات العامة علي التوالي، ونسبة مطابقة التفتيش والتحقق للمشاريع: 48%, 20%, 23%, 37%, 17% للنظافة العامة والترتيب، التوصيلات الكهربائية، مكافحة الحريق، السقالات والمتطلبات العامة علي التوالي، وأن معدل تكرار الحوادث 17.66/أيام مفقودة، وشدة الاصابات 227.75/اصابة/الزمن.

وضحت النتائج قلة الإلتزام بمعايير السلامة والصحة المهنية وزيادة الحوادث والإصابات في المشاريع مقارنة بالمكاتب والمخزن.

أوصت الدراسة بضرورة استخدام نظام ٢٠٠٧:١٨٠٠١ OHSAS كنظام عالمي يستخدم في السلامة والصحة المهنية بشركة الفيصل العقارية لحماية العاملين بها وتقليل نسب الخسائر الاقتصادية. كما توصي الدراسة بضرورة قيام المؤسسات الرقابية ذات الصلة في السودان بالرقابة على شركات البناء والتشييد بصفة دورية مستخدمة نظام ٢٠٠٧:١٨٠٠١ OHSAS للسلامة والصحة المهنية.

Chapter One

Introduction

The provision of a safe working environment from the risks of various industries and raise the level of efficiency and means of prevention will undoubtedly lead to the reduction of occupational injuries and diseases and protect workers from accidents and then reduce the number of lost working hours as a result of absences due to illness or injury, as well as the reduction of rehabilitation and compensation for disease treatment costs and occupational injuries, which will have to improve and increase the level of production and the lifting of economic power of the state.

This study was conducted at the request of Faisal Real Estate Company for the application of occupational health and safety system to recognize the reality of the building and construction of the company.

The international standard OHSAS 18001:2007 was applied in this study, which includes a list of verification and inspection of office, store, projects and report of injuries and accidents, rates of event frequency and injury severity rate forms.

Purpose of this study to evaluate the Occupation Health and Safety measures described by (OHSAS- 18000) in Al-Faysal Real Estate, by to Access to production without accidents and injuries and this by:

- To Protection of individuals.
- To Risk protection.
- To remove the danger of the work area.
- To minimize the risk if they are not removed.
- To provide personal protective equipment.
- To Protection of company.

- Including machinery and materials of the possible risk of occurrence and impact of fire.

Safety in the construction segments has always been a critical issue and one of the most unprotected segments of the unorganized labour in Sudan. A large number of workers in this sector are susceptible to the various workplace accidents and occupational health problems. Safety and health protection has become a major positive factor in favour of economic growth and productivity.

Hypothesis of the study:

- 1- Comply of the application of methods of occupational health and safety in the **Al-Faysal Real Estate** Company.
- 2- Failure of the application of OHSAS measurement non-compliance with the conditions of safety increased the exposure of workers to risks and injuries.

Objective of the study:

The objective of the present study is to evaluate the Occupation Health and Safety measures described by (OHSAS- 18000) in Al-Faysal Real Estate.

Problem of the study:

1. Deficiencies in determining the responsibilities.
2. The lack of clarity responsibilities.
3. Deficiencies in the coordination between the various departments.
4. Inadequate training and resources.
5. Not identify the person alternative.
6. The belief that every individual there is another bear responsibility.

The study within:

- The time to study for 10 months.
- Field of study the state of Khartoum, Al-Faysal Real Estate.

Methodology of the study:

- The use of descriptive methods.
- The use of check list of inspection.
- Incident investigation report.

- Monitor and analyze information and data entry for a computer program excel.

The study resources:

- Includes references to scientific papers and the Internet.
- Check list of inspection and Incident investigation report include.

The study restructuring:

- Chapter one: Introduction.
- Chapter two: Literature review.
- Chapter three: Material and Methods.
- Chapter four: Results and data analysis.
- Chapter five: Discussion, Conclusion and Recommendation.

Chapter Two

2.1 Scientific background:

The occupational safety and health system deals with the prevention of injuries and illnesses related to work. As well as to protect and promote the health of workers. It aims to improve the working conditions and the environment. And involving health Professional to promote and maintain the highest degree of physical, mental and social well-being of workers in all occupations. In this context, the basic principles of the process of risk assessment and management professional to anticipate and the recognition, evaluation and control of hazards arising in /or from the workplace which affect the health and well-being of workers. It should also take the potential impact on the surrounding communities and the general environment in mind. And derive the basic process of learning about the reduction of hazards and risks from the roots of the principles of more complex safety control and occupational health today. The need to master the growing industrialization in the present day, and the demand for sources of energy of serious nature, such as the use of nuclear energy, transportation systems and technologies to develop complex methods of risk assessment and management is greater .We must achieve a balance in all areas of human framework between the benefits and costs of risk. But, in the case of Occupational Safety and Health, this balance is affected by many complex factors such as the speed of scientific progress and technology, and the world of work and the diverse and ever-changing economy. The fact that the application of the principles of safety and occupational health and involving the mobilization of all social and scientific disciplines constitute a clear measure of the complexity of this area, (ILO Report, 2011).

Is the Occupational Safety and Health is a visor for all members of society against the dangers. The incidents inside and outside of work, and it must be aware of all individuals, and the entire conviction The value of the concepts and foundations of occupational health and safety in order to avoid injuries and accidents within homes and public places, shops, businesses and industrial enterprises. The risk of human exposure increased dramatically where the complexity of life that We live , and the places where condense these risks such the increase in the industrial plants where different circumstances in which the pattern of normal life fundamentally different in terms of temperature , humidity and air purity or contamination of oceans , and the nature of the processes that take place daily in sharp cutter machines. In addition to having a piston compressors and conveyors moving , as well as to a lot of trading materials with unusual properties mismatch . Burning these materials caused by caustic makes poisoning and choking and many of occupational diseases. In addition to what caused by the use of electric current in the process of running machinery and equipment of electric shocks to individuals and fires inside the plants , and the effects of these risks caused harmful different hazard in shape , size and duration of impact include the worker and his family and the entire community. (Sabawi, 1998).

As a result of these multiple risks faced by the manpower had to be interested to take the necessary measures to ensure that the care and maintenance of those powers in terms of Planning , implementation and evaluation of programs of occupational safety and health , and the need to focus on the provision of Personal protective equipments, clothing and protection of the body, helmet , gloves, safety shoes , equipment eye protection , face and hearing as well as providing first aid kit , alarms and extinguishers, and the fire so as to facing emergency situations (Jaber

,2001).

The actions related to the organizations of occupational safety and health, dealing with policy development and issuance of regulations and laws on safety and occupational health and attention to keep pace with developed scientific advances to reach the highest levels, in this area (Alakaalh ,2003).

2.2 Origins and evolution of safety systems

The Origins and evolution of safety systems should be in the business to survive the accident, as the basis in the economics of the business, not in the Profit maximization, but in avoiding losses as said by Peter Drucker, (Osman, 2009).

2.3 Historical Perspective:

Interest in the Management's responsibility for safety since the start of the era of civilization. Like the start of attention to quality, safety features due to the interest in the year 3000 BC and was in Babylonia. In ancient Babylon there was *Hammurabi* (King of Babylon in the 18th century BC), who famously set of laws attributed to him: One of the laws and committed against him to punish supervisors who caused the damage inflicted if their work did not perform a proper manner , though the worker lost his arm as a result of mistake or negligence of the supervisor of the work , *Hammurabi* cut arm supervisor likewise. Another law of the laws of *Hammurabi* : Provides for the execution of the supervisor of the construction of any house did not take into account the proper technique, which led to its collapse and the death of its owner, (Osman, 2009). In England , during the eighteenth century , the back of the Law (1802) , which contains requirements for safe work , as well as hours of work , and it was at that time intended to stop run of poor children who are used in the textile industry .

Increasing the issuance of laws in England dealing with explosives since 1875, where many losses were employed till the establishment of the Occupational Safety and Health laws in 1974. (Osman, 2009) the European Union issue guidance on the control of the safety which is committed to its implementation in the Member States of the European Union :

It is the most recent directives (Directive 82/501/EC) , which is also known as the (Seveso 11 Directive): , and specialized in a manner to control the risk of serious accidents that produce hazardous substances and reduce their impact on people and the environment , and that was a result of a serious disaster occurred in Italy in the July 10, 1976 , which led to the leak of tetrachloro di petro para dioxin into the air in a factories producing microbicides , this article of the most dangerous substances highly toxic. As a result of the delay in responding to emergencies , the neighbors have not been evacuated , but after several days , and appeared on the 2,500 individual symptoms of injured and blood diseases. (Osman, 2009).

In North America, there was interest in activities that exposed employment risk, and that was a result of the study in 1909 on the industries that offer employment risk, which reported that during one year just happened 30,000 cases of health damage with fatal result due to industry in the United States .There were laws, including the law, which was issued in 1915 (Ontario Workmen's Compensation Act) in order to protect workers and compensation for damages. (Shafi, 2011).

2.4 The new trend of safety management:

The ways in which lead only to deal with accidents and their causes instantaneous and after they occur, become sterile way for many of the constructors who also failed in findings about the accident such as the

pollution of the environment. And until not long ago was thinking about safety on it either or/ both:

- The problem of natural solutions that require technical or engineering.
- The responsibility of individuals to safety specialists only.
- Concerns with the lack of incidents (i.e., that the facilities are safe, which does not happen by accident).

Since World War II, began to progress in safety management as a result of knowing the following:

- The safety is the responsibility of management.
- The safety management requires the active participation of all.
- The safety management and control of all the risks and potential accidents, which can result in damage or destruction.
- Preventive actions to accidents.
- That accidents impending Near Misses, and accidents, often have the same basic reasons. (Osman, 2009).

In this Modern outlook, governments began in some countries in the load management responsibility, and have enacted laws that require systems and safety management programs.

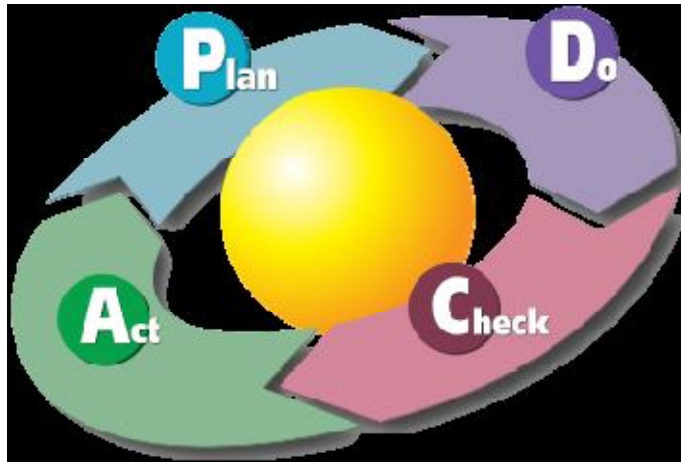
And the direction of risk management systems, found great resonance in the past years, and this has helped to progress that has occurred in total quality management systems. As a result of the methods used now to assess the risks and potential accidents, possible allocation of resources, which is now able to achieve the greatest economic benefit of the facility by reducing risk management. Constructors cannot be in isolation from the world. There is nothing permanent, but that everything is going to change sooner or later. (Osman, 2009)

The activities of the facility and the associated risks are subject to change, and even at times does not happen where changes to the system must be exposed to continuous improvement (OHSAS 18001:2007).

2.5 Deming (PDCA) cycle

The episode (PDCA Cycle) to facilitate continuous improvement. Quality improvement in the performance of occupational health and safety can be implemented through the loop (PDCA Cycle), as well as improvement in the management system. The concept is based on the principle of this process, was designed in the fifties to monitor the performance of the business on an ongoing basis. When applying this principle to Safety and Occupational Health, involves "plan" to develop a policy Occupational Safety and Health and planning, including allocation of resources and the provision of skills and organization of the system and determine the risk and hazard assessment. According to step:

"Do" to the actual implementation of the program and to run the Occupational Safety and Health. For its part, specializes step "check" in the measurement of program performance active and reactive. Finally, close the step "act" episode with a review of the system in the context of continuous improvement and system configuration for the next episode the third-party management system is capable of change and continuous improvement will lose its effectiveness and efficiency.



(Deming) PDCA cycle (Bulsuk, 2009).

OSHA is the acronym for the Department of Occupational Safety and Health, Ministry of Labour of U.S., which aims to encourage employers and employees to reduce the risk of work and the application programs, occupational health and safety, particularly during disasters and crises, to secure the lives of workers in the workplace and their visitors and security teams industrial installations, to avoid a repeat of size the huge losses in the future (Taieb,2009).

2.6 Definition of occupational safety:

Set of actions that lead to:

- 1- The provision of professional protection for workers and reduce the risk of equipment and machines on the workers and established.
- 2- Try to prevent accidents or minimize their occurrence.
- 3- The provision of proper professional atmosphere that helps the workers to work (OHSAS 18001:2007).

2.7 Occupational Health and Safety is based on:

2.7.1 Hazard identification

The process of recognizing that a hazard exists source or situation with the potential to cause harm in terms of human injury or ill-health (OHSAS 18001:2007).

2.7.2 Risk assessment and management

The primary purpose of the Occupational Safety and Health is to manage the occupational hazards. Therefore, it is necessary to assess the danger and risk to determine what can cause harm to workers and property so that they can take appropriate measures for the prevention, protection and implementation. The UK has been developed a unit for Health and Safety Executive using five-step method for assessing the risk in small-sized enterprises (SMEs) which has been approved worldwide. The five steps are:

1. Identify the hazards.
2. Decide who might be harmed and how.
3. Evaluate the risks and decide on precaution.
4. Record your findings and implement them.
5. Review your assessment and update if necessary (OHSAS 18001:2007).

2.7.3 Determination of applicable controls

Determination of applicable controls can be achieved by:

- 1- Measures relevant to eliminate or reduce risk to an acceptable level.
- 2- Measures are based on the hierarchy of control measures.
- 3- Handle with greater significance an effective health and safety system vital for organizations In order to achieve.

The three aspects above provide the ever important foundation for implementing (OHSAS 18001:2007) and without them; the overall system would surely fail.

It can assess the risk, consistent with the size and activity of the institution , as well as available resources and skills. OHSAS requires established high-

risk, such as petrochemical plant risk assessment process which is more complex, and the mobilization of resources and skills at a high level. This willfully many countries to develop guidelines for risk assessment which is often used for regulatory purposes or to develop internationally agreed standards (OHSAS 18001:2007).

2.8 Occupation Health and Diseases:

The process of determining the occupational exposure limits and the process of the development of lists of occupational diseases highlighted the risk assessments aimed at risk management professional . So, dealing with most of the industrialized countries to the question of development and maintenance of lists of limits occupational exposure. These include the chemical and physical hazards (noise, heat and ionizing radiation and non-ionizing and cold), and biological materials. The list of threshold limit values issued by the U.S. Conference Industrial Hygienists leader in terms of coverage and the scientific peer review process and is therefore used as a reference by other states. This is based on the inclusion of occupational diseases in the national lists of the actions of hazard and risk assessment to determine occupational diseases and recognized for the purposes of compensation. They range from respiratory diseases and skin diseases, musculoskeletal disorders and occupational cancer, leading to psychological disorders and behavioral. From here, help the *International Labour Organization* list of occupational diseases (amended in 2010) states the design of national lists of their own, in terms of prevention of diseases caused by exposure to hazards and risks in the workplace, and recorded, and notified, and where appropriate, compensation (ILO report, 2010).

2.9 Approach to Management System Occupational Safety and Health

A report of the Commission of Great Britain on Safety and Health at Work on the status of occupational safety and health submitted in 1972 (Robbins report, United Kingdom) for the transition from industry-specific regulations relating to framework of legislation which covers all industries and workers. This was the beginning of a trend towards more comprehensive occupational safety and health. Paradigm shift has epitomized the law of Occupational Safety and Health for the year 1974 United Kingdom, as well as in the national legislation of other industrialized nations. At the international level, he stressed ILO Convention of 1981 relating to occupational safety and health (No. 155) and accompanying recommendation by (No. 164) on the fundamental importance of participation in the implementation of the tripartite occupational safety and health, both at the national level or at the project level. After a few years, it was felt that the increasing complexity of the world of work and the changing nature quickly called for a new approach to keep working conditions safe and healthy environment. Business management models have been identified and designed to ensure rapid response to fluctuations in the business by evaluating continuous performance as models for the development of a possible approach to systems management Occupational Safety and Health. The quickly approach has been adopted as an effective means to ensure consistent implementation of measures for occupational safety and health with a focus on continuous evaluation and improvement of performance and self-regulation (ILO Report, 2011).

2.10 Safety management system and occupational health and organizations (institutions)

The responsibility for occupational health and safety and compliance with the requirements of all countries in accordance with the laws and regulations

of national rests with the employer. The ensures of application of a systems approach for the management of occupational safety and health in the organization (Enterprise) assess the level of prevention, protection, and continuously maintained through appropriate improvements in a timely manner. Most organizations can take advantage of the concept of system management occupational safety and health if taken into account a number of important principles when deciding to apply a systems approach to management programs Occupational Safety and Health. However, management systems cannot be considered helplessly as global organizations unless analyzed carefully, needs at the level of the means available, and air management system Occupational Safety and Health commensurate with it. Eventually can that is done by expansion or by making it less formal. The administration must ensure that the system design with the aim of improvement and focus on performance measures of prevention and protection. It also must ensure that the contribution of audits accounts in the process of continuous improvement rather than become a mechanism to improve the audit only (ILO Report, 2011).

2.11 Safety Management System and Occupational Health and sectors of the high proportion of hazards

Constitutes a safety management system and occupational health and means "public" which can be designed to manage:

- 1- The specific risks associated with and industry specific process, specifically the proportion of industries with high risk.
- 2- Requirement implementation of prevention measures, protection and a comprehensive assessment of the risks.
- 3 - Regulate and monitor the performance of complex control systems on an ongoing basis.

4- Describes some of the examples below application process safety management system and occupational health in the sectors of economic activity of the main proportion of high risks.

5- Increase the percentage of occupational accidents in the construction industry is the issue of the use of subcontractors and contractors at construction sites, multi- core base.

6- A powerful incentive for the use of safety management system Occupational safety and health in this sector.

7- Provides a common format for all parties involved in the site to harmonize between the planning, implementation and monitoring requirements of occupational safety and health , as well as building a base for performance review .

8- Facilitates the integration of the needs of the occupational safety and health in the early stages of design and planning complex, the history and stages of starting construction project.

9- The implementation of integrated management systems in building an effective tool to ensure the integration of quality systems , environment and safety and health professionals in the workplace with many owners interest (Robbins: Safety and Health at Work1996)

2.12 Contractor's role in the safety of the construction site:

The responsibility for the safety of construction (Phase Central between a finished design and the completed building) is largely the responsibility of contractors and other professionals at the site. The success of any project depends on the complexity of the planning and decisions that are made at the site. Most of the construction accidents on the root causes of the core produced result of:

1- The lack of proper training and the application is not sufficient for safety.

2- Roads unsafe or coordination unsafe, and conditions of the site is unsafe.

3- Non-use of safety equipment that was provided and a poor attitude towards safety (Toole, 2002). In most times, it is the role of many of the contractors is unclear. Some contractors may attempt to transfer responsibility to the safety of others. The most common form of construction projects is the existence of a general contractor (Main) / subcontractor. [Under Paragraph 1926.16 of the regulations of the Department of Occupational Safety and Health (OSHA), the main contractor bears full responsibility for the safety of the work site (to comply with the regulations OSHA). Contractors to the public (the principal) the highest level of impact on the safety of the site because they are watching the work of subcontractors and coordinate and run it]. Oftentimes, General contractors provide equipment that is shared by many of the subcontractors. In some cases, there may be a major contractor and one or several major contractors. Subcontractors and provides workers and tools to complete their work. [Under Paragraph 1926.16 of the regulations (OSHA), bears the subcontractors responsible for the safety of their employees in their part of the work. In the case of a subcontractor at any risk, the sub-contractor must protect its own employees as well as others who may be exposed to this risk (Pim, 2005).

Chapter Three

3.1 Study area: Al-Faisal Real Estate Co Ltd

Al-Faisal Real Estate Company, a subsidiary of Faisal Islamic Bank The Company operates in the field of contracting and construction. Headquarter: Khartoum, Ali A. Latif St., Faeiha Commercial.

Al-Faisal Real Estate administration requested officially the assessment of system of Occupational Health and Safety of the company.

3.2 General Methods of Assessment:

There are a number of specifications and international standards the evaluation and application of occupational health and safety system in companies and institutions

1. OHSAS 18001: 2007. (Occupational Health and Safety Assessment Series)
2. OSHA.(Occupational Safety and Health administration – American government)
3. NEBOSH. (The National Examination Board Occupational Safety and Health)

In this study were selected British system OHSAS 18001: 2007 because it is more generally accepted regulations and is applied in Sudan.

3.3 OHSAS 18001: 2007 Methods:

OHSAS methods depended on parameters:

3.3.1 Identify and assess risks:

This procedure determines the rules followed by the real estate company Al-Faisal to identify and assess risks and controls control and goal-setting in-term and finally minimized or overcome the programs implemented.

3.3.2 Team of safety

The official occupational health and safety to comply a team of health and safety professional to evaluate the risks that have been identified. The team

includes representatives from the environmental, health and safety risks, or any other functions suitable and may be formed separate teams to assess certain groups of products, activities and services. The Group may be assisted by other people in the company when need. The team is using a number of checklists (check list of inspection office, store, and projects) these check list were shown in table 1, 2 and 3 (the model performed to investigated the Office and Store inspection consist of 4 parts, each part given 25% will total of 100% for the 4 parts: 1. Housekeeping, 2. electrical connections, 3. fire fighting, 4. General requirements. And the model performed to investigate the projects inspection consist of 5 parts, each part given 20% will total of 100% for the 5 parts:

1. Housekeeping.
2. Electrical connections.
3. Fire fighting.
4. Scaffolding.
5. General requirements. (OHSAS 18001: 2007).

3.3.3 Assessment of potential risk:

Assessment potential risk is a procedure to evaluate all potential risks associated with any of the risks identified during a risk assessment. To identify potential risks, there are three basic steps:

1. Evaluated and the probability of an accident.
2. Calculated or evaluate the expected results.
3. Based on the risk of these two factors gives priority to control the risk by using the hazard classification. (OHSAS 18001: 2007)

3.3.3.1 The first step: probability:

As shown in table (4).

What are the consequences of reality or dangerous situation?

Table 4:- Evaluation of the probability of an accident

Description	A detailed description of an example
Catastrophic	Death or damage to property or the environment
Major	permanent disability or influential damage to property or the environment
Moderate	damage or limited spread to human health or the environment or property
Minor	Low harm to human health or the environment or property.
Negligible	Unlikely to have an adverse effect on human health or the environment or property.

(OHSAS 18001: 2007)

3.3.3.2 The second step: the consequences:

How the probability of an incident or dangerous situation?

Table 5: showed the consequence of the probability of an accident or risk,

Prescriber	Description
Almost certain	Will undoubtedly happen/ recur, possibly frequently
Probably	Will undoubtedly happen/ recur but it is not a persisting issue.
Possible	Might happen or recur occasionally (monthly).
Unlikely	Do not expect it to happen/ recur but it is possible it may do so (six months to a year).
Unexpected/ Rare	This will probably never happen/ recur.

(OHSAS 18001: 2007).

3.3.3.3 Step Three: The anticipated risk (Matrix)

The anticipated risk was shown in table 6. The expected degree of risk from the table of risk expected as follows:

Risk Scoring = Probability (or likelihood) * Severity (Consequence).

Table (6): Matrix of risk,

Severity					Probability
E25	E20	E15	H10	H5	Frequent
E20	E16	H12	H8	M4	likely
E15	E12	H9	M6	L4	Possible
E10	H8	M6	L4	L2	Unlikely
H5	H4	M3	L2	L1	Rare

(OHSAS 18001: 2007).



Extreme risk



High-risk



Moderate risk



low risk

Table 6 and the equation will be translated as follows:

E: extreme risk: asking take action immediately, the most dangerous team leader, responsible health and safety and the environment. And if possible, stop the activity immediately.

H: high-risk: the most dangerous president and administrator of health and safety procedure were implemented immediately to reduce injury to a minimum.

M: Moderate risk: Perform the action immediately to reduce injury to a minimum, for example: safety signs, responsible environmental, health and safety professional, request a corrective action through (...) working days (specify the number of days).

L: low risk: corrective actions within one month (if possible) require the attention of an official safety and health. (OHSAS18001: 2007).

3.3.4 Control of the potential risk:

the control of the potential risk hierarchy was illustrated in table 7.

Table 7: Hierarchy to control of risk

	Control	Example
၁	Remove	Completely remove the risk.
၂	Replace	Replacement of the hazardous material or substance less dangerous parts (for example, replacement of material and hazardous chemical substance is dangerous or less dangerous)
၃	Isolation	Restrict entry to the elevator or the control room, closed by under tight control.
၄	Engineering	Prepared the design of a piece of equipment to make them less dangerous, the exclusion of the danger for the person who is at risk, such as the use barrier protection.
၀	Managerial	Take a standard or increase shifts or split

		shifts operating procedures or safe work practices or provide appropriate training, instructions or information.
7	Personal protective equipment	The provision and use of personal protective equipment

(OHSAS 18001: 2007).

3.3.5 Accident investigation:

The accident investigation can be attempt through the application of the incident investigation report (table 8), this report consisted of four steps as follows:

- a. **Step one:** Injured employee.
- b. **Step two:** Describe the incident.
- c. **Step three:** Why did the incident happen?
- d. **Step four:** How can future incidents be prevented?

The criteria of measure of the accident investigation by:

3.3.5.1 Frequency incident

(Standard No. z16.1 according to the specifications of the American National Institute ANSI) specifications and in accordance with what is required from the offices of occupational health and safety. The accident rate is calculated from the crippling work per million working hours as an example:

500 workers * 40 hours per week * 50 weeks per year = 1000000 hour filled.

$$\text{Frequency of the incident} = \frac{\text{The number of injuries} \times 1000000}{\text{The number of workers} \times \text{number of hours worked} \times \text{number of actual working days (during the evaluation period)}}$$

(ANSI – American National Standards Institute, www.ansi.org/default.aspx 2009).

3.3.5.2 Severity rate of injury:

$$\text{Rate the severity of the injury} = \frac{\text{Number of days lost} \times 1000000}{\text{The number of workers} \times \text{number of hours worked} \times \text{number of actual working days (during the evaluation period)}}$$

(ANSI – American National Standards Institute, www.ansi.org/default.aspx, 2009).

To estimate the accident severity and frequency, in our sample projects in a period of 10 months, as:

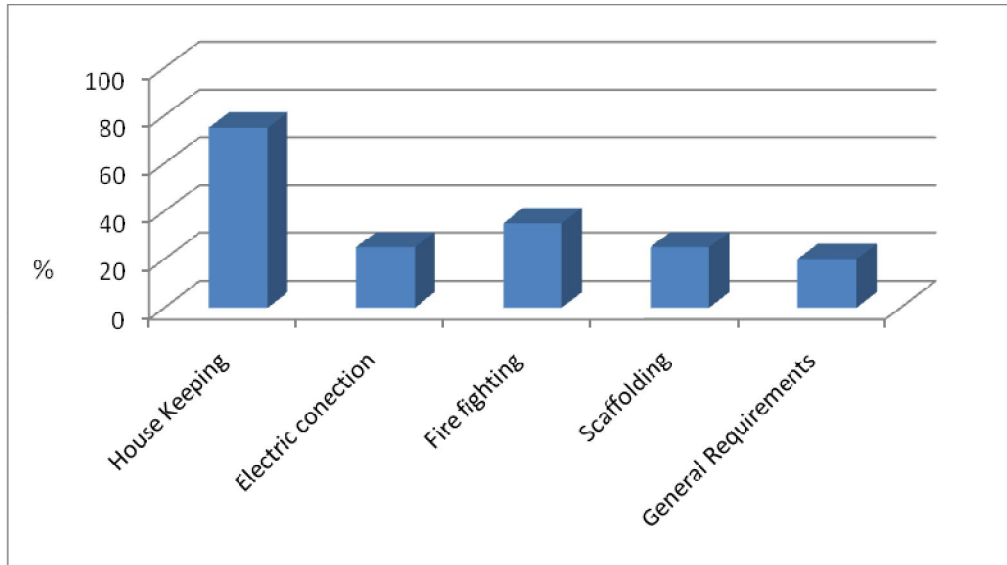
No of injuries (recordable injuries) = 4+6+10 = 20

Total number of workers (in the project) = 203 + 185 + 320 = 708 workers

Total of man-hours (working hours) = (total of workers * working hours in day * working days of the week * number of weeks in month * number of months) = 708*8*5*4*10= 1,132,800 hours

Total of lost days = 258 days.

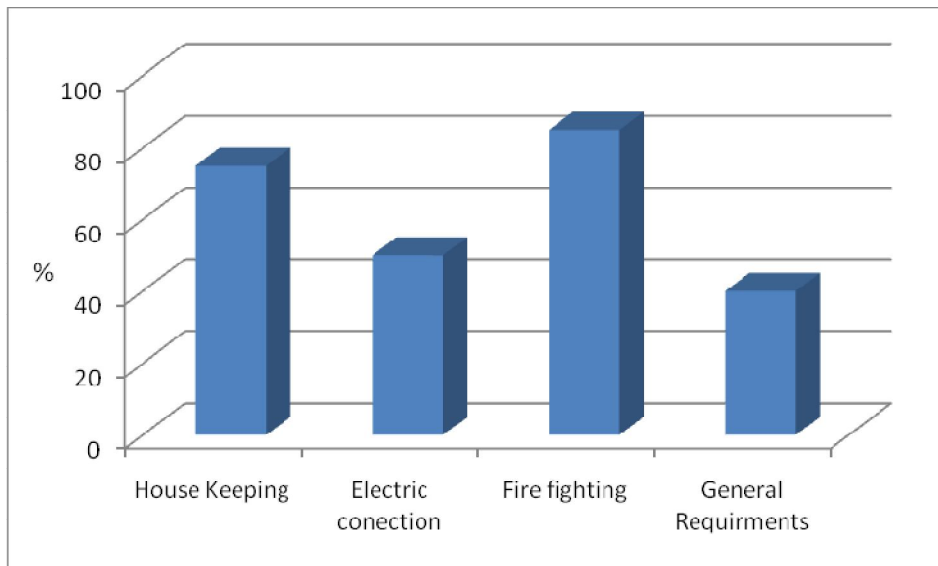
Figure (1) Showed results of the inspection of the offices. Recorded for housekeeping were 88%, electrical connections 80%, firefighting 72%, and general requirements 80%.



(The Researcher).

Figure (1) Results of the inspection of the offices.

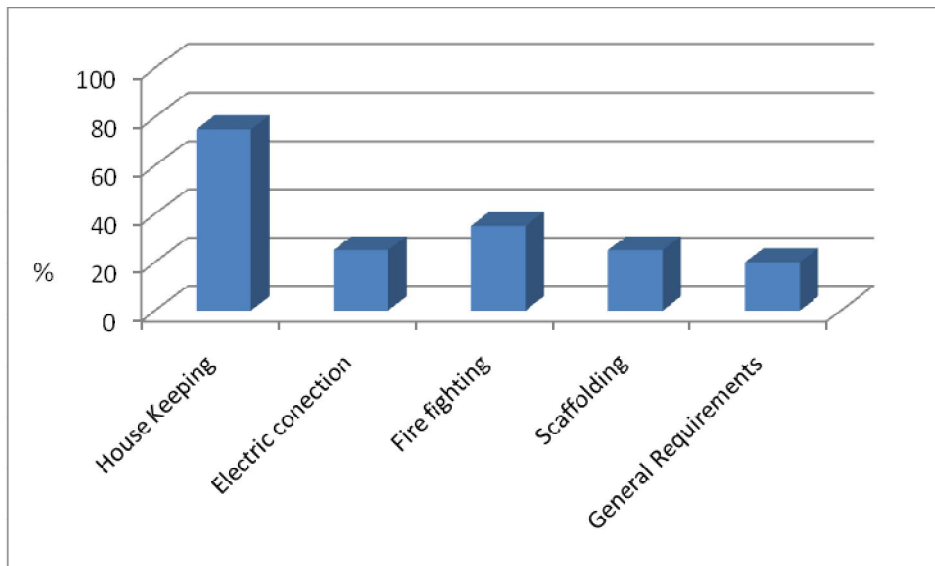
Figure (2) Showed results of the inspection of the store. Recorded for housekeeping were 75%, electrical connections 50%, firefighting 85%, and General requirements 40%.



(The Researcher).

Figure (2) Results of the inspection of the store.

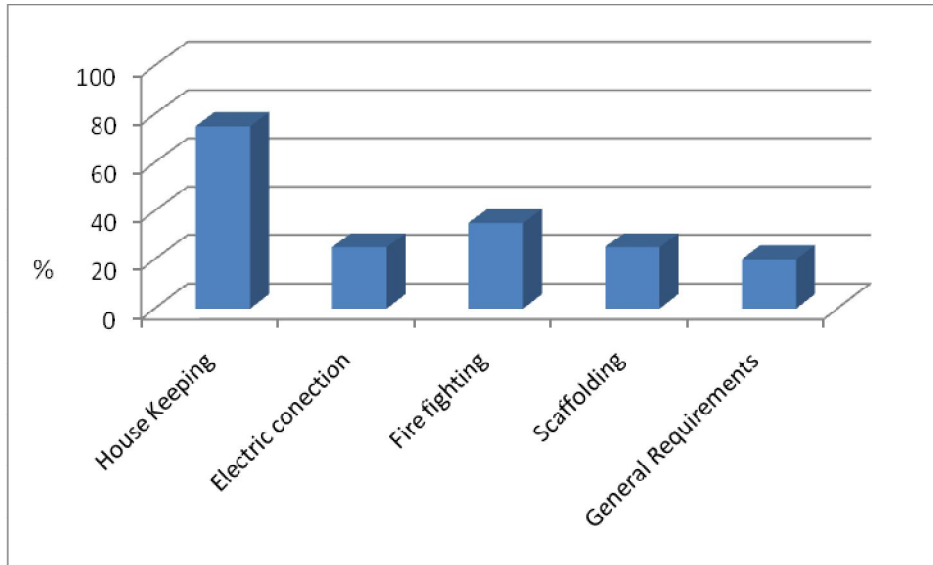
Figure (3) Showed results of the inspection of Fiesal Bank (Saad Gishra). Recorded for housekeeping were 45%, electrical connections 25%, firefighting 25%, scaffolding 35% and General requirements 20 %.



(The Researcher).

Figure (3) Results of the inspection of Fiesal Bank (Saad Gishra).

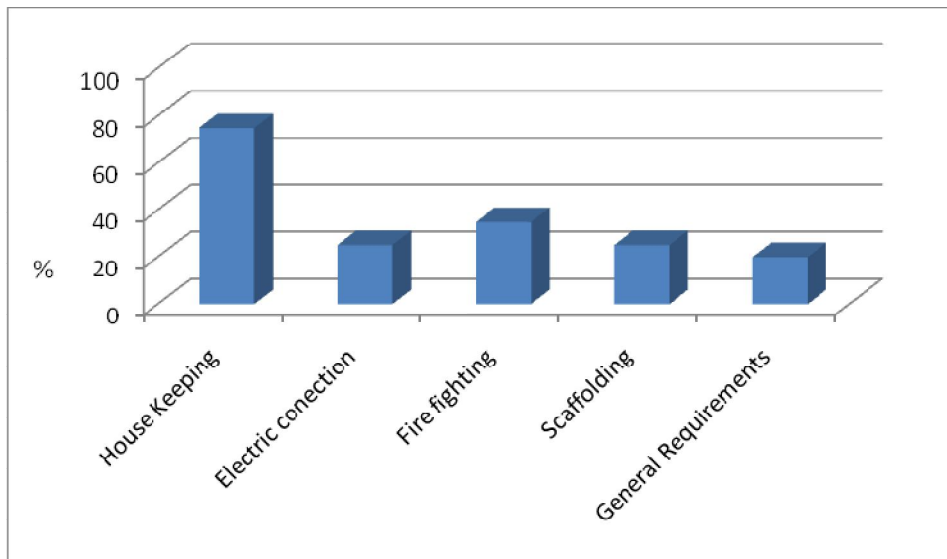
Figure (4) Showed results of the inspection of Al-Mashriq Bank (Al-sajanah). Recorded for housekeeping were 25%, electrical connections 10%, firefighting 10%, scaffolding 50%, and General requirements 10%.



(The Researcher).

Figure (4) Results of the inspection of Al-Mashriq Bank (Al-sajanah).

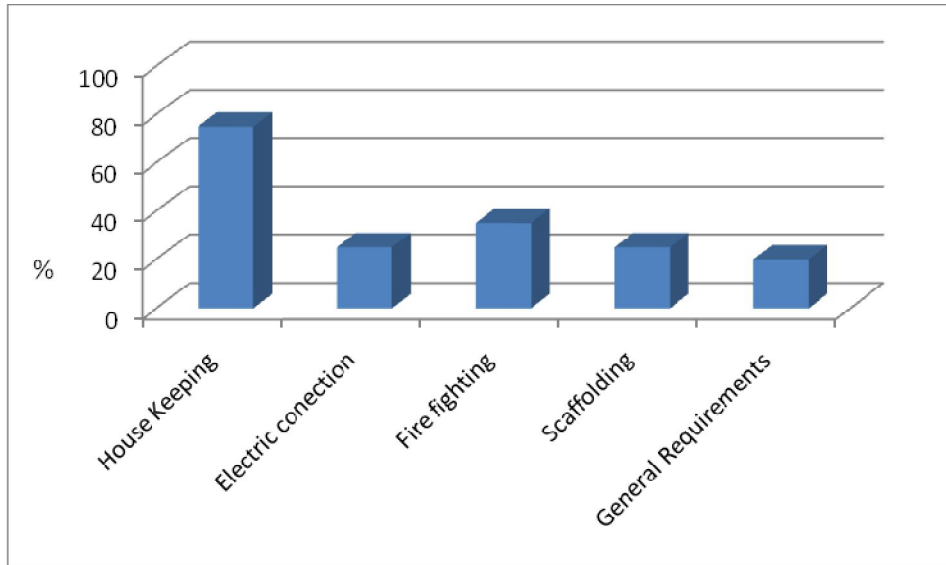
Figure (5) Showed results of the inspection of Fiesal Bank (Al-Jamhouria St.). Recorded for housekeeping were 75%, electrical connections 25%, firefighting 35%, scaffolding 25% and General requirements 20 %.



(The Researcher).

Figure (5) Results of the inspection of Fiesal Bank(Al-Jamhouria St.).

Figure (6) Showed results of the inspection of projects summary inspection. Recorded for housekeeping were 48%, electrical connections 20%, firefighting 23%, scaffolding 37% and General requirements 17%.



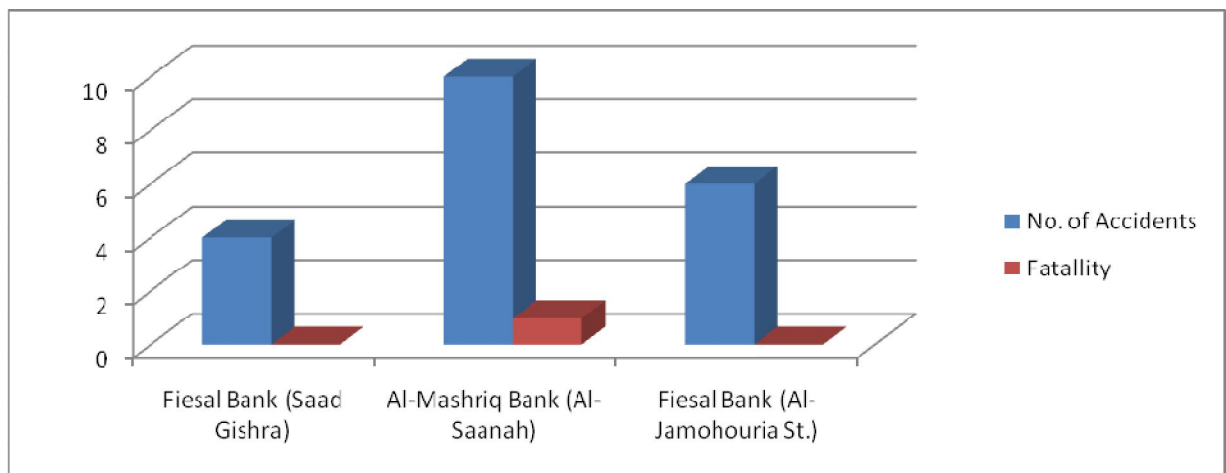
(The Researcher).

Figure (6) Results of the inspection of projects summary inspection.

Project	Fatality	Recordable accidents
Fiesal Bank (Saad Gishra)	0	4
Al-Mashriq Bank (Al-sajanah)	0	6
Fiesal Bank (Al-Jamhouria St.)	1	10

Table (9): Results of Accident investigation
(The Researcher).

Table (1) and figure(7) showed the accident investigation at the three projects: the result were 0,0 and1 fatal case and according to recordable accidents three were 4,6 and 10 for the three projects recorded.



(The Researcher).

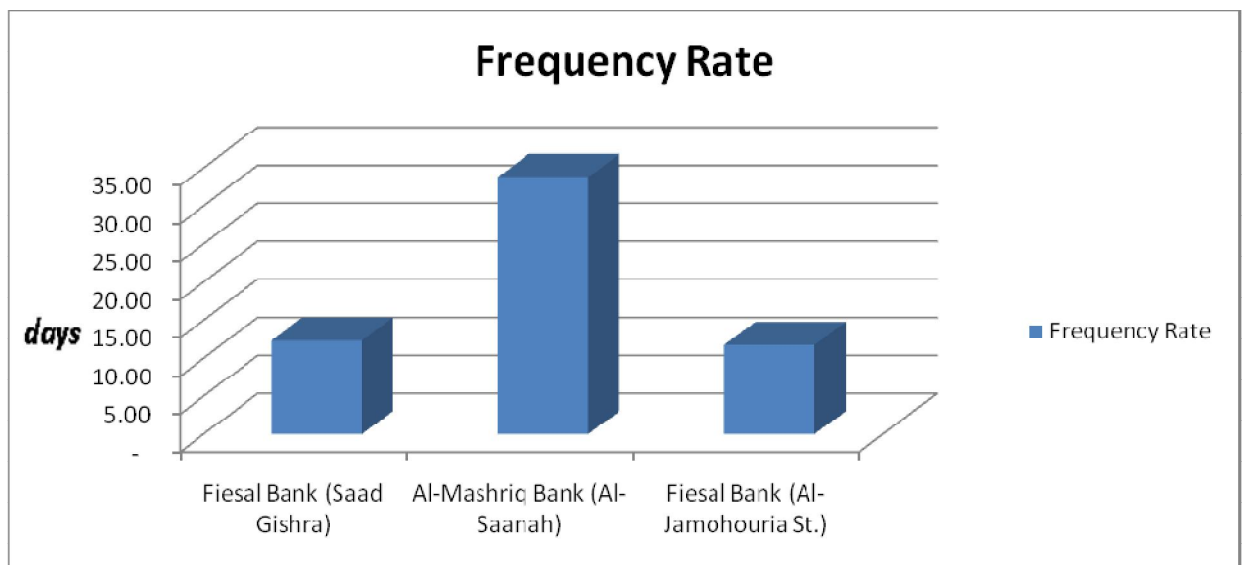
Figure (7): Illustrated the number of registered accidents and death in the three projects for 10 months (from 3 to 12/2014).

Accident frequency = 17.66 lost days.

Accident's severity Rate =227.75 injuries/time.

(Estimated in a period of 10 months)

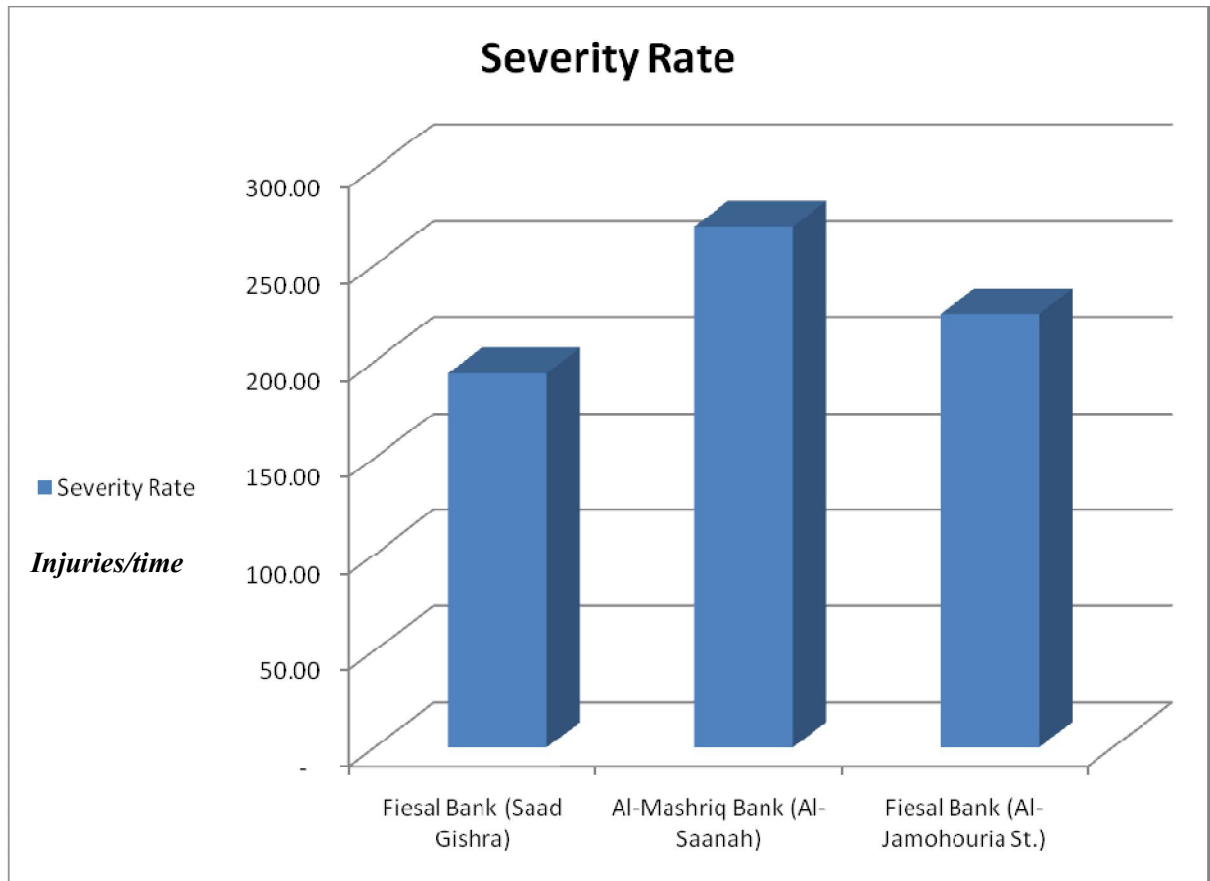
Figure (8) Showed the Frequency of injuries, Accident frequency of Fiesal Bank (Saad Gishra) 12/hour, Accident frequency of Fiesal Bank (Al-Jamhouria St.) 33.7/hour and Accident frequency of Al-Mashriq Bank (Al-sajanah)11.7/hour.



(The Researcher).

Figure (8) Results of the Frequency Rate.

Figure (9) Showed the Severity of the injury rate. Lost days (Fiesal Bank (Saad Gishra) 194/day, Fiesal Bank (Al-Jamhouria St.) 270/day and Al-Mashriq Bank (Al-sajanah) 225/day.



(The Researcher).

Figure (9) Results of the Severity rate.

Discussion

The present results of the study showed a good safety in inspection and verification standards in the company's offices and store of the order of a housekeeping and electric connections and good combat system well fires of extinguishers and water cannons alarms fire, which complies with Occupational Health and Safety system as stated in OHSAS 18001: 2007 or as stated in the occupational health of Khartoum State Law for the year 2011 in the fourth quarter item 19. The fire-fighting and a plan of evacuation in the company system need more attention and review. Also these results were in accord and complies with that mentioned by (Zidane, Hassan ,1994.). It is noticed that the Sudanese Labor Laws and the Law of Sudanese Engineering Council and the Law of Civil Defense did not focus in details for aspects in such as office space and the number of individuals in each office and the amount of light and the amount of oxygen as stated in the International Standard OHSAS 18001: 2007.

Projects that the company implemented, result showed positive arrangement and hygiene and wiring specially in the project of Fiesal Bank at Al-Jamhouria St. and Fiesal Bank at Saad Gishra but Mashreq Bank project recorded negative results. The scaffolding used in most of the projects according to the review of the values of the results of the inspection and verification showed clear decline precautions which reflect negatively and adversely on the severity of the rate of serious risk assessment, according to the assessment of the risks of scaffolding when the equation of risk assessment was applied. For example, it was clear that the inadequacy precautions, the probability and severity of injury rises to the upper limit in the risk matrix table, and it is clear from the foregoing that the higher the value obtained in the inspection of the risk assessment rate was reduced

inversely with the risk, and this is reflected also in reverse with the severity of the injury and the rate of recurrence. In other words, the risk value of the risk assessment is directly proportional to the severity of the injury and the rates of recurrence in an investigation report injuries and accidents when they occur. The Labour Code provides, in Chapter III Section 12 the following: (for every facility owner must do the registration work and occupational diseases and the dangers of the administration of the accident, according to the determined by the regulations and the employer to take all measures to prevent the recurrence of such cases), (Sudanese Labour Law, 1997). The interest in injuries and occupational accidents and diseases in plants in response was a concern of humane are motivation includes kindness to the injured persons and to contribute to mitigating the damage from the distressed, and then it became the attention issue of occupational health and safety loss which leads to the imperatives of production and improve productivity (Abu Sheikha, 2000).

Accordingly, the non-application of these laws well have negative consequences for accidents and work-related injuries and occupational diseases, as described by OHSAS 18001: 2007 which can be summarized as the following:

Direct consequences:

Different severe injuries (acute / chronic), workers injuries either permanent or temporary disability (total / or partial), and deaths.

Indirect consequences:

These are economic results indicate the material cost due to accidents and work-related injuries, and material costs appear in the following:

1. calculation loss:

The basic character of these losses are the days of work lost due to work-related injuries.

2. cash expenses, which are disbursed because of injury cases straining the company's resources physically, socially and characterized into two types:

a). Expenses incurred by the company:

1. Compensation, salaries and paid vacations.
2. Compensation paid for social security due to lack of safety precautions measures.
3. Direct payments immediately after the incident (ambulance, treatment, subsidies).
4. Repair of machinery, appliances and property loss in material costs.
5. Fines because of the failure to adhere to contracts and delivery dates.
6. Additional incentives for the rest of the workers to ensure continuity at the required level.
7. Others, such as water, electricity, fuel and other services cost.

b). Expenses incurred by social institutions:

1. Factor to grant all rights related to treatment.
2. Monetary compensation for physical damage, estimated by laws and regulations.
3. Sporadic expenses: transportation during the treatment, visit's the expenses of the injured worker, gifts and financial aids are mandatory paid.

3. Other losses:

- The cost of lost work and stop working because of an injury factor, and because of fear and grief and influenced by other workers, and because of supervisors and officials of the ambulance and patient investigation into the incident and the mobilization of the reports and submit them to the responsible parties.

- Low productivity due to low morale.
- Timeout equipments and machines for the duration of the incident.

CONCLUSION:

Faisal Real Estate Company might be considered the first Sudanese company in the field of building and construction ask for the application of a global system of occupational safety and health standards. According to this study hazards and danger were noticed in non-compliance with good application of safety standards in projects especially in the lack of attention to good electrical connections and the use of scaffolding which is not matching with standard specifications and inadequate fire-fighting tools and commitment to wear safety tasks. The company offices and store have the advantage of observing the laws and safety regulations as in OHSAS 18001: 2007.

Recommendations:

- ❖ The present study recommended the application of occupational health and safety system OHSAS 18001: 2007 in order to prevent and reduce accidents and raise the level of preparedness and safety precautions and measure in the company.
- ❖ The need for regulatory institutions to exercise its oversight on the construction companies on a regular basis.
- ❖ The need to educate the employers of the importance of the work particularly in reporting incidents and work-related injuries.
- ❖ The need to provide safe working conditions for employees.
- ❖ The need to focus on the presence of inspectors to monitor Occupational Safety and Health measures.
- ❖ Further studies are needed to improve and develop rules regulations and laws suiting Sudan environment and culture. More details are needed to specify phrases of laws specially laws of Sudan Engineering council for buildings and construction.

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