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The Effectiveness of Occupational Health and Safety Procedures at the General Electricity Company of Libya: A Critical Analytical Study in Light of International Standards

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فعالية إجراءات الصحة والسلامة المهنية في الشركة العامة للكهرباء بليبيا: دراسة تحليلية نقدية في ضوء المعايير الدولية

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Abstract:
Occupational Health and Safety (OHS) is a major concern in vital sectors such as the energy sector, especially in countries where law enforcement and safety practices are still developing. This study aims to evaluate the effectiveness of the Occupational Health and Safety Management System (OHSMS) implemented at the General Electricity Company of Libya (GECOL), in light of international standards and global best practices. The research adopted a quantitative and qualitative analytical methodology by analyzing secondary data related to injuries and accidents during the period (2012-2014), in addition to analyzing a field questionnaire that included a sample of workers. The results showed a significant weakness in the application of occupational health and safety management systems, as the percentage of injuries resulting from safety instruction violations reached 36% in 2012, 20% in 2013, and 27% in 2014. The study also revealed the absence of effective supervision, lack of training, and insufficient personal protective equipment. The study concludes with the necessity of adopting an Integrated Occupational Health and Safety Strategy that includes planning, implementation, review, and continuous improvement, emphasizing the importance of training, awareness, and the presence of effective supervisory systems such as ISO 45001. It is important for the company to implement a specific occupational health and safety system, which may be designed by the company or based on international systems.

Keywords: Occupational Health and Safety (OHS), General Electricity Company of Libya, Work Injuries, Integrated Safety Management.

الملخص
تُعد الصحة والسلامة المهنية *(OHS)* مصدر قلق رئيسي في القطاعات الحيوية مثل قطاع الطاقة، لاسيما في الدول التي لا تزال فيها ممارسات السلامة وإنفاذ القانون في طور النمو. تهدف هذه الدراسة إلى تقييم فعالية نظام إدارة الصحة والسلامة المهنية *(OHSMS)* المطبق في الشركة العامة للكهرباء بليبيا *(GECOL)*، وذلك في ضوء المعايير الدولية وأفضل الممارسات العالمية. اعتمد البحث منهجية تحليلية

كمية ونوعية من خلال تحليل البيانات الثانوية المتعلقة بالإصابات والحوادث خلال الفترة (2012-2014)، بالإضافة إلى تحليل استبيان ميداني شمل عينة من العاملين. أظهرت النتائج ضعفاً كبيراً في تطبيق نظم إدارة الصحة والسلامة المهنية؛ حيث بلغت نسبة الإصابات الناتجة عن مخالفة تعليمات السلامة *36%* في عام 2012، و *20%* في عام 2013، و *27%* في عام 2014. كما كشفت الدراسة عن غياب الإشراف الفعال، ونقص التدريب، وعدم كفاية معدات الحماية الشخصية. تخلص الدراسة إلى ضرورة تبني إستراتيجية متكاملة للصحة والسلامة المهنية تتضمن التخطيط، والتنفيذ، والمراجعة، والتحسين المستمر، مع التأكيد على أهمية التدريب والتوعية ووجود أنظمة رقابية فعالة مثل معيار *ISO 45001*. ومن الأهمية بمكان أن تقوم الشركة بتنفيذ نظام محدد للصحة والسلامة المهنية، سواء كان مصمماً من قبل الشركة نفسها أو مستنداً إلى الأنظمة الدولية.

الكلمات المفتاحية: الصحة والسلامة المهنية (*OHS*)، الشركة العامة للكهرباء بليبيا، إصابات العمل، الإدارة المتكاملة للسلامة.

1.Introduction

Occupational health and safety form a fundamental pillar for the sustainability of industrial facilities, especially in the high-risk energy sector (Khenfri & Benidir, 2023). In Libya, the General Electricity Company faces significant challenges in this area as internal data and the company's official reports show a noticeable increase in injury and accident rates, which negatively impacts production efficiency and job stability for workers (Source: Company Annual Reports, 2012-2014).

Applying occupational health and safety management system will help the company to reduce the accident and injury rate and will also give good image intern and extern.

This study comes in the context of the urgent need to assess the reality of occupational health and safety procedures in this company, which is one of the largest companies in Libya with over 53,000 workers. The study relied on official data and statistics from company reports, in addition to the results of a field questionnaire specifically designed for this purpose.

The study aims to answer the main question: How effective are the occupational health and safety measures used at the General Electricity Company of Libya? It also seeks to achieve the following objectives:

- Assess the current state of health and safety in the company.
- Analyze the causes of accidents and injuries.
- Provide practical and developable recommendations.

This study holds significant scientific and practical importance, as it fills a research gap in the local literature concerning occupational safety in the energy sector and provides applicable insights for decision-makers in Libya and countries with similar conditions.

2.Theoretical Framework and Previous Studies

A study by Saudi & Sinaga (2019), titled "The Influence of Occupational Health and Safety Management on the Performance of Employees in the Electrical Power Distribution Sector," found a positive relationship between the quality of safety procedure training and reduced accident rates, highlighting the need for intensive and comprehensive training programs.

2.1 Explaining Theories and Models

The study relies on the Deming (PDCA) model for continuous improvement, Heinrich's theory of accident causes, in addition to the "Integrated Safety System" model that combines human, technical, and organizational factors (Gallagher & Underhill, 2001). It is also based on the Safety Culture Theory, which emphasizes the importance of shared values, attitudes, and practices in determining safety performance levels (Al-Mekhlafi et al., 2022).

2.2 Previous Studies

Previous studies have shown weakness in the application of safety standards in Arab industrial environments, especially amid administrative instability and weak infrastructure. In Algeria, a study by (Bourahla & Benslimane, 2022) indicated a positive agreement among workers that the occupational health and safety level in an electricity company is relatively high and significantly affects worker safety from occupational accidents, while a study by (Lamri & Nacereddine, 2025) confirmed significant negative repercussions of non-compliance with health and safety standards on the effectiveness of the organization and the work environment. The following table summarizes the most prominent relevant studies:

Table 1: Summary of Previous Studies

Author(s)	Year	Methodology	Sample/Scope	Key Findings
Gallagher et al.	2001	Management Systems Analysis	Several Industrial Facilities	Effectiveness of integrated systems in reducing accidents
Bourahla & Benslimane	2022	Field Survey Study	Electricity Company Workers (Algeria)	A relatively high OHS level impacts accident reduction
Omidi & Palassi	2021	Dynamic Analysis	Electrical accident data	Human factors are the main cause in 70% of accidents
Zgheb et al.	2020	Qualitative Study	Employees in the Libyan oil sector	Shared organizational and administrative challenges across sectors
Al-Mekhlafi et al.	2022	Quantitative Study	Energy sector workers	Organizational culture indirectly affects safety performance
Lamri & Nacereddine	2025	Field Study	Electricity Distribution Co. Employees (Algeria)	Non-compliance with safety standards negatively impacts organizational effectiveness

Recent studies show that the challenges of applying safety standards in Libya and Algeria are not limited to the electricity sector only but extend to other vital sectors such as oil and gas (Zgheb et al., 2020). International and local studies also confirm the importance of human factors, organizational culture, and compliance with standards in determining the effectiveness of safety systems (Al-Mekhlafi et al., 2022; Omidi & Palassi, 2021; Bourahla & Benslimane, 2022; Lamri & Nacereddine, 2025).

3. Methodology

The research adopted a mixed-methods approach combining quantitative analysis of official statistics and qualitative analysis of questionnaire results (Saudi & Sinaga, 2019). A quantitative model was built to analyze the relationship between the application of safety procedures (independent variable) and the injury rate (dependent variable).

Secondary data was collected from company reports for the period 2012-2014, in addition to the results of a questionnaire that included 36 workers in the Western Distribution Division. The study relied on the following key performance indicators:

- Injury frequency rate
- Percentage of injuries resulting from safety violations
- Level of compliance with international safety standards

Table 2: Time Series of Study Variables (2012-2014) Source: Annual Reports of the General Electricity Company (2012-2014)

Year	Percentage of Workers Trained	Percentage of Injuries Due to Safety Violations	Number of Injuries
2012	28%	36%	11
2013	32%	20%	56
2014	35%	27%	36

4. Data Analysis

Statistical analysis of the data showed concerning results regarding the effectiveness of occupational health and safety procedures in the company:

1. **Weak application of safety procedures:** Results showed that 61.1% of workers believe that protective equipment is insufficient, while 47.2% confirmed they did not receive adequate training on safety procedures according to the questionnaire data.
2. **High injury rates**: The average injury rate was 34.3 injuries annually during the study period, with a significant peak in 2013 recording 56 injuries, as shown in the annual reports.
3. **Low safety awareness**: The study revealed that 47.2% of workers had not heard of occupational diseases, indicating weak awareness and education programs in this area.
4. **Psychological pressures**: 91.6% of workers indicated suffering from fatigue and psychological stress due to work conditions, which may negatively affect their concentration and increase the likelihood of accidents.

4.1 Analysis of the Evolution of Injury Rates

Table 3: Evolution of Injury Rates During the Study Period

Indicator	2012	2013	2014	Average
Number of Injuries	11	56	36	34.3
Injury Rate per 100 workers	0.021	0.106	0.068	0.065
Percentage of Injuries Due to Violations	36%	20%	27%	27.7%

Table 4: Distribution of Injuries by Main Cause (2012-2014)

Main Cause of Injury	2012	2013	2014	Total	Percentage
Violation of Safety Instructions	4	11	10	25	24.3%
Lack of Knowledge	2	12	7	21	20.4%
Negligence	2	10	6	18	17.5%
Stress/Fatigue	1	8	5	14	13.6%
Equipment Defect	1	7	4	12	11.7%
Physical Unfitness	1	4	3	8	7.8%
Unsafe Methods	0	2	1	3	2.9%
Other Causes	0	2	0	2	1.9%
Total	**11**	**56**	**36**	**103**	**100%**

Observations on the Table:

Overall Trend: The data shows a noticeable increase in the number of injuries in 2013 compared to both the previous and following years.

Main Cause: "Violation of safety instructions" was the leading cause of injuries over the three-year period, accounting for 24.3% of the total cases.

Cause Development: Factors such as "lack of knowledge" and "negligence" together make up nearly 38% of all injuries, highlighting the urgent need for training and awareness programs.
Least Common Causes: "Unsafe practices" and "other causes" were the least frequent.

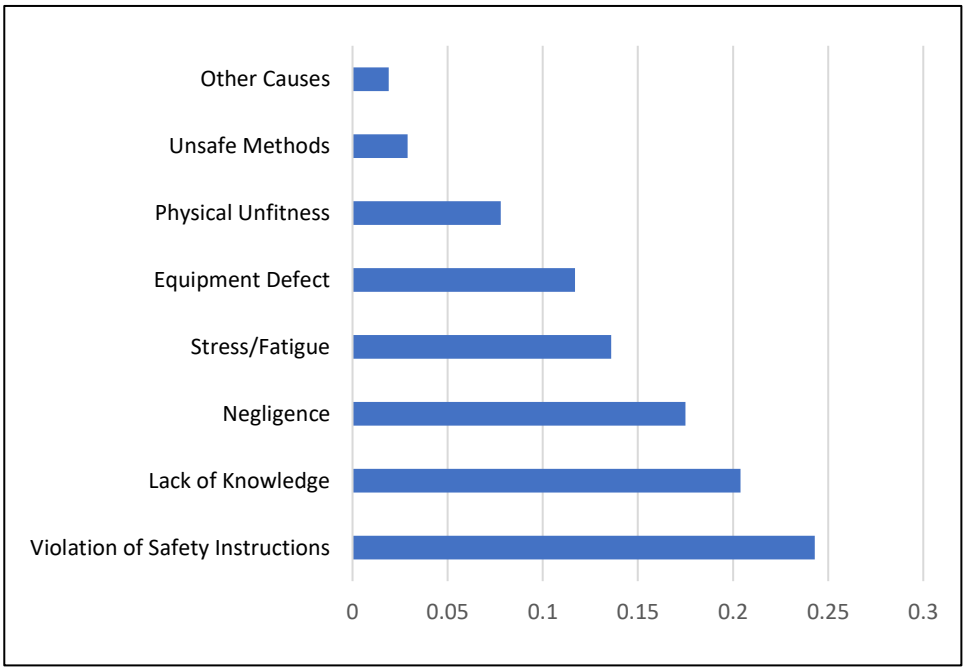

Figure (1): Distribution of Total Injuries by Cause (2012–2014)

The table and analysis clearly demonstrate that human-related factors (violations, lack of knowledge, and negligence) are the dominant contributors to accidents. This calls for urgent interventions to strengthen safety culture and enhance training among workers.

4.2 Analysis of Injury Causes

Table 5: Distribution of Injury Causes by Year (%)

Cause of Injury	2012	2013	2014	Average
Violation of Safety Instructions	36.0	20.0	27.0	27.7
Lack of Knowledge	18.0	22.0	20.0	20.0
Negligence	15.0	18.0	16.0	16.3
Stress/Fatigue	12.0	14.0	13.0	13.0
Other Causes	19.0	26.0	24.0	23.0

4.3 Analysis of Injury Classification

The analysis of injury classifications highlights the nature and patterns of accidents affecting workers at the General Electricity Company, helping to identify priorities for preventive interventions. Table (6) presents the distribution of injuries by type and severity during the study period (2012–2014).

Table 6: Classification of Injuries by Type and Severity

Injury Classification	2012	2013	2014	Total
Impact with moving or stationary object	3	15	10	28
Exposure to temperatures	1	5	3	9
Exposure to chemicals	1	4	2	7
Exposure to electric shock	2	12	8	22
Fall	2	8	6	16
Caught in between parts	1	7	4	12
Other	1	5	3	9

Key Findings from Table (6):
Electrical injuries represent the highest proportion of severe cases and fatalities, with two deaths recorded during the study period. This underlines the extreme hazards associated with electrical work.
Struck-by injuries ranked first in total number of cases (28), highlighting the need to reinforce traffic safety measures and regulate the movement of vehicles and equipment at worksites.

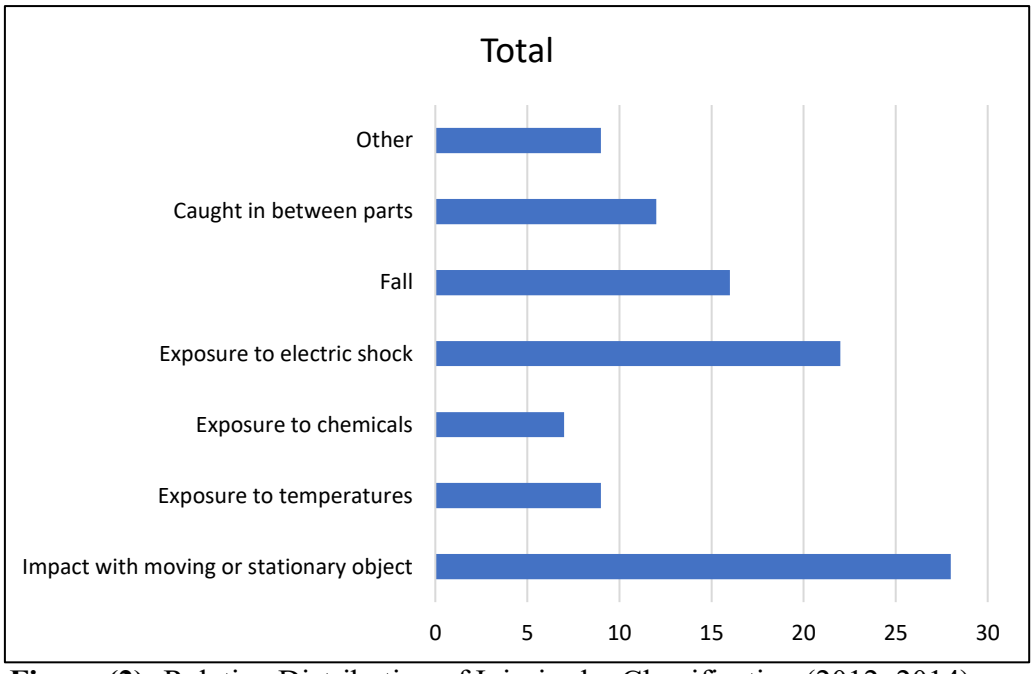

Figure (2): Relative Distribution of Injuries by Classification (2012–2014)

Fall-related injuries accounted for 16 cases, emphasizing the importance of using fall protection equipment, particularly in elevated work areas.

4.4 Questionnaire Data Analysis

Table 7: Results of Worker Questionnaire (n=36)

Statement	Yes	No	Sometimes	I don't know
Adequate protective equipment exists	16.6%	61.1%	0%	22.2%
I received safety training	27.7%	52.7%	19.4%	0%
There is a specialized supervisor in the department	19.4%	61.1%	0%	19.4%
Periodic injury reports exist	41.6%	44.5%	0%	13.9%
I suffer from fatigue and psychological stress	91.6%	8.3%	0%	0%

4.5 Advanced Statistical Analysis

Table 8: Correlation Analysis between Study Variables

Variable	Number of Injuries	Training	Equipment	Supervision
Number of Injuries	1.00	-0.85	-0.78	-0.82
Training	-0.85	1.00	0.92	0.88
Equipment	-0.78	0.92	1.00	0.85
Supervision	-0.82	0.88	0.85	1.00

5. Discussion and Conclusions

The results of this study are consistent with previous literature confirming the weakness of occupational health and safety management systems in unstable industrial environments (Zgheb et al., 2020; Al-Mekhlafi et al., 2022). The absence of supervision, training, and appropriate equipment directly contributes to high injury rates.

The results showed that the causes of accidents are distributed between:

- Unsafe working conditions (58.8%)
- Unsafe acts (23.4%)
- Personal reasons (17.6%)

This aligns with the study by (Omidi & Palassi, 2021), which indicated that human factors are the main cause in 70% of accidents in the electrical sector.

The study concludes that the effectiveness of health and safety measures at the General Electricity Company of Libya is significantly low and requires urgent, comprehensive intervention at the administrative, technical, and human levels. The results also confirm the importance of organizational and cultural factors in determining the effectiveness of safety systems, which is consistent with the findings of (Al-Mekhlafi et al., 2022).

It is important for the company to implement a specific occupational health and safety system, which may be designed by the company or based on international systems.

The company should provide a mental health program in collaboration with experts in the field of mental health and employee well-being.

6. Recommendations

Based on the study's results, the following recommendations can be made:

1. Develop an occupational health and safety management system according to ISO 45001 standards to ensure the effective application of OHS procedures.
2. Appoint specialized supervisors in each department and provide them with training on the latest international safety standards.
3. Activate the role of internal safety committees and external supervision to ensure compliance with preventive measures.
4. Conduct regular medical examinations for workers, especially those in substations and those exposed to electromagnetic fields.
5. Introduce incentives for workers who comply with safety procedures and apply deterrent penalties for violators.
6. Improve training and awareness programs to include all workers, focusing on the practical application of safety procedures.
7. Provide personal protective equipment according to international standards and ensure its periodic maintenance.
8. The company should establish a special department for mental health and employee well-being.

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