Analytics of electrical system to improve its efficiency with the help of Safety Audit

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Abstract **An organization's safety systems, policies, and procedures are thoroughly examined during a safety audit to make sure they minimize hazards and adhere to legal requirements. A safety audit is an organized method of enhancing workplace safety by identifying possible risks and evaluating the efficacy of existing safety protocols. To make sure that all safety procedures are being followed and that safety equipment is being maintained appropriately, it entails examining the physical surroundings, operational procedures, and staff practices. In order to find patterns or reoccurring problems, the audit process usually consists of site visits, staff interviews, and a thorough examination of incident records. On the basis of these conclusions, auditors offer suggestions to enhance safety performance, deal with non-compliance problems, and lower the risk of mishaps. By promoting ongoing development and the active participation of all staff members in upholding safe working conditions, routine safety audits also aid in the establishment of a robust safety culture inside the company.**

Key Words safety, audits, procedures, workplace, compliance, insurance.

INTRODUCTION

Organizations are more and more realizing the vital significance of creating a working environment that protects not only employees, but also the immediate community from the effects of rising crises. Such crises include diverse elements, ranging from health to safety, climate, and other relevant issues. There is greater focus on averting even slight injuries as part of this forward-looking strategy. Technological developments have brought in new technologies and frameworks, having a deep impact on human ways of life and beliefs. Therefore, this change has subjected workers to possible threats resulting from profound changes as a result of mechanization and industrialization. The world of science and innovation has enabled the rise of numerous complex and high-risk activities. Hence, there is a recurring incidence of major mechanical breakdowns that cause huge losses to institutions and nations in general. An SMS is an organized way to deal with issues pertaining to safety. Accuracy, precision, and completeness are characteristics of safety hazard management. The executive power approach is intended to be in line with the operational statutory frameworks as well as the establishment, categorization, and evaluation of occupational safety control measures. An SMS's seamless integration into an organization's structure, which becomes ingrained in its culture and influences how employees carry out their responsibilities, is what sets it apart [1]. One way to describe an SMS is as a coordinated framework that establishes and enforces uniform policies and goals throughout a business in order to safeguard the environment and the well-being of its workers [2]. A comprehensive analysis was carried out in [3] to differentiate between SMSs, which are divided into three categories: hybrid, mandated, and voluntary. An established standard or internal policy serves as the foundation for the first tactic. However, following Occupational Health and Safety (OHS) laws, the state legally mandates the second approach. The third approach blends aspects of the first two approaches. According to the 2007 British Standards Occupational Health and Safety Assessment Series (OHSAS), OHS refers to the circumstances and elements that could affect the security and welfare of workers and other individuals in a workplace [4]. An organization's overall management system must include an OHSAS since it serves as a tool for creating and implementing organizational policies and managing OHS-related risks [5]. The standards for managing occupational health and safety in organizational settings are outlined in the OHSAS 18001 standard. To address the need for a unified global standard, key trade associations, international standards agencies, and standardization businesses

collaborated to create the widely recognized international OHS standard. The Plan-Do-Check-Act (PDCA) cycle serves as the foundation for the framework, and all phases of the process are covered by its standards. Creating business rules, identifying workplace hazards, evaluating risks, and developing strategies to meet health and safety goals are all part of the planning step. During the implementation stage, controls and preventive measures put in place during the planning stage are put into practice. Additionally, training is given to guarantee that jobs are completed safely and that everyone is fully aware of how OHSMS applies. During the check stage, controls and OHSMS operation are reviewed, and corrective and preventive action steps are integrated. The acting phase of the PDCA cycle, which follows, requires management to conduct an overall evaluation in order to permit OHSMS [6].

METHODOLOGY

Industry Details- Both primary and secondary data sources were integrated using a mixed-method research approach in order to provide an inclusive picture of the sector. In order to directly observe market trends and concerns, key industry stakeholders, including executives, analysts, and consumers, were interviewed in order to collect primary data. Reputable industry databases were used to extract secondary data.

Data collection- validation, and interpretation were all part of the process-oriented approach used to assess the monthly electricity bill details. Electricity consumption data was gathered directly from the service provider's monthly electricity invoices, ensuring its accuracy and dependability. Major elements like as the total units consumed (kWh), fixed and variable costs, government imposts, and payable taxes were carefully examined in each account. Twelve months' worth of bills were examined chronologically to ascertain use patterns and pricing variation

Total Electrical Load of the Industry- entails the systematic computation of an industrial plant's overall electrical load. A list of every piece of electrical equipment and load in the plant is the first step in the procedure. Based on information from the manufacturer, the rated power—typically expressed in kilowatts (kW)—is determined for each of these.

Industry Wiring Specification and Circuit Breaker Specification- methodical approach used to design electrical wiring systems for industrial facilities that are both safe and efficient. Finding the total electrical load of each piece of equipment and its corresponding branch is the first step in the process. Standard charts are used to determine appropriate wire sizes based on these loads, taking into account allowed voltage drop and current-carrying capability. At the same time, safety margins are added and the maximum expected load current is taken into consideration when calculating circuit breaker ratings. Breakers must be rated for overloads and short circuits as well as for the full load current.

Electrical installation's grounding- (earthing) system resistance can be ascertained using the Earth Resistance Test. Its goal is to confirm that the grounding system can safely transfer fault currents into the earth, lowering the possibility of equipment damage or electric shock.

Insulation Resistance- Test is used to check the electrical insulation integrity of cables, wires, and equipment; it can identify insulation leaks or breakdowns that could cause short circuits, electric shock, or equipment failure.

Illumination Intensity Test- measures the quantity of light (illuminance) in a space to make sure it meets safety, comfort, and visibility requirements. Typically, a lux meter is used to express it in lux.

Recommendation- provide as per CEA 2023 check list

Earth Resistance Test

An earth pit test, also known as an earth resistance or ground resistance test, measures the effectiveness of an electrical grounding system. It ensures that electrical systems have a low-resistance path to the ground, which is essential for safety during fault conditions, such as lightning strikes or short circuits. The test typically uses an instrument called an earth resistance tester, with methods like the fall-of-potential or clamp-on technique to measure the resistance between the earth electrode and the ground. Ideally, the resistance should be below 2 ohm for effective grounding

Result

Test Name	Ideal value	Measured value
Earth resistance test	< 2 ohm	0.36 ohm

Insulation Resistance Test

An insulation resistance test measures the integrity of electrical insulation in wires, cables, and equipment to prevent leakage current or short circuits. The test is typically conducted using an instrument called a insulation resistance tester, which applies a high DC voltage to the insulation and measures the resistance in megaohms (MΩ). A high resistance value indicates good insulation, while a low resistance suggests deterioration, contamination, or damage in the insulation material. This test is crucial for ensuring the safety, efficiency, and reliability of electrical systems, especially in industrial and high-voltage environments

Cable

Sr. No	Connections	Insulation Resistance (megaohm)
1	Between R - Earth	Infinity
2	Between Y - Earth	Infinity
3	Between B - Earth	infinity
4	Between R - Y	100
5	Between Y – B	105
6	Between B - R	75

Motor

Sr. No	Connections	Insulation resistance (megaohm)
1	Between R – Earth	Infinity
2	Between Y – Earth	Infinity
3	Between B - Earth	infinity

Illumination Intensity Test

A lux meter test is used to measure the intensity of light in a particular area, expressed in lux, which quantifies the amount of light hitting a surface per square meter. To conduct the test, position the lux meter's sensor at the desired location where light measurement is needed, such as a workspace, photography studio, or outdoor environment. The meter detects the light and displays the reading on its screen. This test helps assess whether lighting conditions are adequate for various tasks, ensuring proper brightness levels for safety, productivity, or compliance with lighting standards in specific industries or environments

Standard lux

Place	Required light in lux
General workshop areas	500-750 lux
Warehouse loading bays	300-400 lux
Detailed work areas:	750 lux or higher
Corridors and walkways	200 lux or less

Ground Floor

Sr.No	Working Place	Lux
1	Lathe machine	152
2	Milling machine	164
3	Belt grinder	148
4	Double wheeled grinder	128
5	Air compressor	142
6	TIG welding	127
7	Power press cutter	180
8	Hand grinder and drill machine	152
9	Working desk 1	127
10	Working desk 2	138
11	Working desk 3	96
12	Working desk 4	85
13	Natural light	120

First Floor

Sr.No	Working Place	Lux
1	Molding machine 1	184
2	Molding machine 2	159
3	Molding machine 3	162
4	Double Molding machine	187
5	Centrifugal pump	124
6	Inductive oven	142

Voltage Measurement

A multimeter measures voltage in AC or DC circuits. To measure voltage, set the multimeter the component. The reading will display on the digital screen. Ensure the multimeter is rated for the voltage level being measured. Always follow safety precautions to avoid electrical shock.

1	Line To Line	Measured value
	R-Y	413 V
	Y-B	410 V
	R-B	413 V
2	Line To Neutral	Measured value
	R-N	237.1 V
	Y-N	235.5 V
	B-N	237.4
3	Neutral to Ground	0.233 V

Recommendation

Sr. No	Work	Action
1	Temporary installation exist	Major
2	Colour code for electrical supply lines not given	Major
3	MCB connected in opposite polarity	Major
4	Excess cables are tied on switch board	Major
5	Neutral conductor identification not given	Major
6	Danger notice not used	Major
7	Insulation mat or floor not provided	Major
8	Main distribution board is not easy for accessible in emergency situation because of scrap is stored	Major
9	Cable tray or metallic covering for cables is not used	Major
10	Resister is not kept and maintained properly	Major
11	MCB are not equipped with fire encloser	Major
12	Fire buckets filled with dry sand are not present	Major

CONCLUSION

We conducted a safety audit in which we analyzed industry energy bills, calculated total loads, verified cables and circuit breakers, and conducted a number of tests, including tests for illumination intensity, insulation resistance, and earth resistance. We conduct safety audits in accordance with the CEA 2023 check list, and we learn about safety issues in the industry, such as the lack of a neutral conductor color code, a danger notice, a shock treatment chart, or an insulated floor or mat. We have provided recommendations for enhancing electrical safety in the industry.

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