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Study And Recommendations In Electrical Safety In An Agri Machinery Industry

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ABSTRACT

According to the Bureau of Labor Statistics Census of Fatal Occupational Injuries Research File, Electrocution is the cause of 7% of all workplace deaths among young workers aged 16–19, causing an average of 10 deaths per year. Therefore electrical safety has to be strictly followed. This paper is a summary of the different hazards and risks associated with electricity in an automobile industry and audit conducted to make proper observations and recommendations to prevent the occurrence of potential accidents. The primary goal of the EHS (Environment, Health And Safety) management system is to minimize the risks associated with electricity and hence prevent accidents. Audit is one of the best ways to observe and identify the risks involved to prevent accidents by making a check if the operational activities comply with the statutory standards. This process involves study, observation, identification of the risks and possible hazards associated in the industry in the form of a risk matrix and make recommendations in accordance to different standards and safe engineering practices. Further these recommendations can be implemented to obtain a safe work place. Safety audit is normally carried out at different levels in the factory to check if the standards are being properly followed and to prevent potential accidents from happening.

1. Introduction

The voltage of the electricity and the available electrical current in regular business and homes has enough power to cause death by electrocution. Even changing a light bulb without unplugging can be hazardous because coming in contact with the hot, energize or live part of the socket could kill a person. 50percent of electrical fires and failures can be prevented by improvement of the design and maintenance of minor components such as connectors, fuses etc. Failures create problems for the owners by way of losses in production or revenue.

Whenever there is an electrical fire, it is assumed that the fire was caused by a short circuit. This is misleading and dangerous. Short circuit is only the proximate cause. We must aim at Zero Failures. Safety Audit is an important tool for identifying deterioration of standards, areas of risks or vulnerability, hazards and potential accidents in plants for determining necessary action to minimize hazards and for ensuring that the whole safety effort is effective and meaningful.

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2. Electrical Hazards

Electrocution:

An electrical shock is received when electrical current passes through the body. Current will pass through the body in a variety of situations.

Burns Caused by Electricity:

Electrical burns can result when a person touches electrical wiring or equipment that is used or maintained improperly.

Arc Blasts:

Arc-blasts occur when powerful, high-amperage currents arc through the air

Electrical Fires:

Electricity is one of the most common causes of fires and thermal burns in homes and workplaces.

Inadequate wiring hazards:

Connections with aluminium wire can become loose and oxidize if not made properly, creating heat or arcing. Special care needs to be taken with aluminium wire.

Exposed electrical parts hazards:

Electrical hazards exist when wires or other electrical parts are exposed. Wires and parts can be exposed if a cover is removed from a wiring or breaker box.

Overhead power line hazards:

More than half of all electrocutions are caused by direct worker contact with energized power lines. Most electrocutions involving overhead power lines are caused by failure to maintain proper work distances.

"OSHA Regulation, the NEC (National Electricity Code), NFPA 70E (National Fire Protection Act), standard of electrical safety in work place, National Electrical Safety code (NESC)" provide a wide range of safety information.

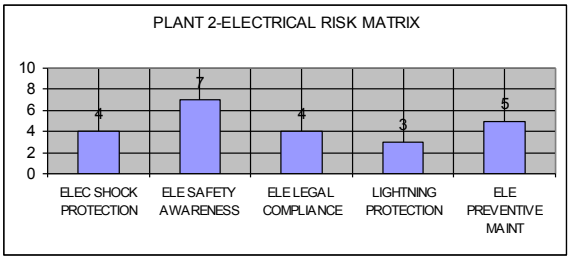
3. Electrical Risk Analysis

An audit was conducted in an Agri Machinery Industry, which the gap analysis was studied, so that the company may work on the recommendations to minimize hazards and make the safety effort effective and meaningful.

Sl no	Practices followed in the Plant	Practices that should be followed according to standards	Standards followed during supervision
1	Tr-4 incoming & outgoing cable sizes are not marked on the transformer terminal boxes.	Incoming and outgoing cables sizes to be marked with paint on the end boxes	IE Rule 1956 Section 29
2	Transformer end boxes are not sealed and large gaps exist	End boxes should be sealed tight so that, moisture/vermin cannot enter inside. Cable gland should be used, so that, cables are supported properly and the cable weight stress is not transferred to the transformer terminal	IE Rule 1956 Section 29
3	Silica gel breather used here is enclosed metal type. Silica gel is pink in color	It is recommended to go for transparent type breather, so that change in color of silica gel can be observed clearly.	(IS 10028,Part 3)
4	Oil temperature set point is 80deg C for alarm and 90 deg C for trip	It is recommended to arrive at a common settings for all the transformers and in no case, trip set should not exceed 90 deg C. **(**	**Standard Engineering Practice**
5	In TR-1 silica gel breather, oil cup is missing.	Oil cup is provided so that, oil acts as a filter medium for the air breathed by the transformer. Otherwise, dust laden air will enter inside the transformer internals and cause failure of	IE Rule 1956 Section 65(7)

Sl no	Practices followed in the Plant	Practices that should be followed according to standards	Standards followed during supervision
		transformers	
6	The transformers are installed in ground level	Any water logging due to heavy rain, will affect the transformers operation. Hence it is recommended to construct a bund wall around transformer yard with water pumping arrangements	Standard Engineering Practice
7	For Neutral earthing, PVC insulated cable is used. For some transformers, ALUMINIUM bus bars are used	It is suggested to use, only bus bars as they can withstand heavy short circuit currents in transformers secondary level. Cables cannot withstand the short circuit current.	(Standard Engineering Practice)
8	The total oil quantity exceeds 8000 litres in the transformer yard and oil soak pit is not available.	When the oil quantity exceeds 2000 litres, oil soak pit is necessary. Escorts to construct oil soak pit and interlink it with all the transformers so that, in the event of fire in any one of the transformers, the valves can be opened and oil can be drained	IE Rule 1956 Section 65(7)
9	There is no fire separation wall for the transformers installed	Clearance between the transformers ranges from 1.67 mtrs to 3.24 mtrs. Hence it is a mandatory requirement to construct fire separation wall of brick /concrete with a height of atleast 600mm taller than the tallest point of the transformer. When the oil quantity exceeds 2000 ltrs, fire separation wall is a must.	IS 10028,Part 1&2
10	Transformer oil is stored in barrels in open near transformer yard.	Transformer oil should never be stored in open as there is every possibility of moisture entering the transformer oil	Standard Practice
11	Transformer marshalling boxes are not maintained in dustproof & waterproof condition.	This will result in entry of vermin, which may cause short circuit of wires and unnecessary tripping of transformers	IE Rule 1956 65(7)
12	Neutral Bus bars are not Insulated	Neutral bus bars should be insulated to provide a safe working environment to the operating persons	IE Rule 1956 65(7)
13	Transformer yard has 8 numbers outdoor transformers (4*1000 kVA +4*1500 kVA) installed inside in open space.	For catering to the plant need, transformers have been added as and when required. Instead of having large numbers of 1 mva & 1.5 mva transformers, 2/2.5 MVA transformers should have been installed which could have increased the reliability, reduced maintenance requirements and increased floor space for other activities.	Good Engineering Practice

4. Results



Parameters of Electrical Safety	Score
Electric shock protection	4
Electrical safety awareness/training	7
Eletrical statutory compliance	4
Lightning protection	3
Eletrical preventive maintenance	5
Total score/50	**23**
Final score/100	**46 %**

Parameters Considered:

- **Electric Shock Protection:**
  - Use of ELCB
  - Use of correct milli amps ELCB
  - Regular maintenance of ELCB
  - Testing kit for ELCB
- **Electrical Safety Awareness and training**
  - Regular internal training
  - External training
  - Contractor training
  - Screening safety films
  - Celebrating safety day/week
  - Past electrical safety audit
  - LOTO procedure in full
- **Electrical Statutory Compliance**
  - Approved sld with latest loads
  - Person available
  - Inspection done recently
  - Compliance with i.e. rule 1956
  - Elect. contractor valid license
- **Lighting Protection**
  - Lightning protection provided
  - LP drgs available
  - Earth pits maintained as per is 3043
  - Awareness of lightning
- **Electrical Preventive Maintenance**
  - Regular earth pit maintenance
  - Regular transformer maintenance
  - Good oil filtration program
  - HT switchyard/panels maintenance
  - Relays calibration
  - LT/HT motor maintenance
  - History card maintenance
  - Flame proof equipment maintenance
  - All meters availability (LT and HT)
  - Fully insulated/ non sparking tool.

5. Conclusion

Audit was conducted by EHS department of the Agri Machinery Company in the Power House to identify the risk and hazard associated so that accidents or further breakdown can be minimized. A risk matrix was accordingly prepared. After conducting the Audit we can conclude that the company is aware of all the standards (IS, OSHAS, IE Rules 1956), but they are unable to interpret the standards specifically while implementing them in many fields. Although they are implementing they are unable to stick to the specific standards that should be actually followed. Otherwise it is committed to the preservation of Environment and Ecology, Sustainable Development, Enrichment of the quality of life of Employees, Customers and the Community around its operational Area.

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