Behavioral Based Safety Management in Electric Power Industry – Complementary Safety of Workers

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Abstract: - The safety of employees from the electric power industry is of primary importance because the risks they are exposed to in this field are mainly causing fatalities more than minor injuries. In order to reduce accidents and improve safe performance it is required that the companies implement a behavioral based safety management, that keeps under control the risks also from the point of view of the behavior of the employees, increasing the standards of safety.

Key-Words: - occupational health and safety, behavioral safety, management, electric, power, industry.

1 Introduction

Electrical accidents of the workers in the electric power industry can be fatal and costly. Although electrical professionals’ electrical safety is in Romania treated at a high level, accidents do happen. Also, electrical accidents are not as rare as statistics imply as many minor accidents remain unreported. Underreporting causes lack of information about existing electrical safety problems, and prevents the corresponding preventive actions.

As long as accidents happen, implies that current measures to increase electrical safety are not effective enough. In order to decrease the number of electrical accidents, there is a need for more information about electrical accident risks at the operative level.

In most investigation it is found that electrical accidents occur because certain safety procedures are not carried out prior to work or during work, arising through human error. Some are simply errors, and some are 'violations' as a result of a poor attitude to safety. Still, there is little information as to the reasons why these safety procedures are omitted, and what other significant electrical accident risks electrical professionals currently face. Accidents are rarely caused by one single event or action. Instead they are the consequence of a multitude of events that may have occurred during a long period of time. Still, the acts and thoughts of the victim whose actions immediately preceded the accident should be of great interest for that person is the culmination point of the chain of events and the last person who could have prevented the accident if all the facts had been known.

More than half a century ago, Heinrich (1959) stated that the identification of accidents’ underlying causes (“sub causes”) is an important part of accident prevention [1]. He divided the immediate causes of preventable accidents (98% of all accidents) into unsafe acts (88%) and mechanical or physical hazards (10%). As mechanical and physical hazards are also due to some kind of human input, he argued that all underlying causes behind immediate causes are related to “faults of persons”[1]. According to Heinrich, the underlying causes of unsafe acts can be grouped as the headings of improper attitude, lack of knowledge or skill, physical unsuitability and improper mechanical or physical environment. Besides industrial hygiene and ergonomics -related elements, Heinrich included under the environment-heading those elements, which today are grouped under organizational factors, e.g. company policy, procedures and safety rules.

Therefore human factor is a systematic approach that enables the understanding and considering human capabilities and limitations within the workplace in relation to health and safety.

In the most of cases the knowledge and understanding of the role of human factors only comes to light after systems failures and major accidents. A behavioural based safety process will reduce 'unsafe' behaviours that can otherwise lead to accidents or incidents.
2. Safety of the Workers in Electric Power Industry

Safe working of individuals on electrical equipment is provided by today's safeguards and recommended work practices.

There are three ways to perform electrical work: offline working, live working, and working in the vicinity of live parts. All these have different working methods, safety procedures that must be followed, or safeguards. Most electrical works are supposed to be done offline, but almost all occupational electrical accidents occur during offline working or work that was supposed to have been performed offline.

The safeguards are mainly implying earthing, grounding of the equipments, or using ground fault circuit interrupters. The workers should wear the personal protective equipment (PPE) according to the risks that they are exposed to.

The workers should follow procedures that they are trained with, verified and authorised to.

One of the important procedures used in the electrical industry for providing safety of the workers in is the Lock Out / Tag Out (LOTO) procedure. According to it the electrical power must be removed when electrical equipment is inspected, serviced, or repaired. To ensure the safety of personnel working with the equipment, power is removed and the equipment must be locked out and tagged out. The equipment should be locked out and tagged out before any preventive maintenance or servicing is performed. Lockout is the process of removing the source of electrical power and installing a lock which prevents the power from being turned ON. Tagout is the process of placing a danger tag on the source of electrical power which indicates that the equipment may not be operated until the danger tag is removed.

A danger tag has the same importance and purpose as a lock and is used alone only when a lock does not fit the disconnect device. The danger tag shall be attached at the disconnect device with a tag tie or equivalent and shall have space for the worker's name, craft, and other required information. A danger tag must withstand the elements and expected atmosphere for as long as the tag remains in place.

Lockouts and tagouts do not by themselves remove power from a circuit. They are attached only after the equipment is turned OFF and tested to ensure that power is OFF. The lockout/tagout procedure is required for the safety of workers due to modern equipment hazards. Lockouts are performed using lockout devices that are lightweight enclosures that allow the lockout of standard control devices, such as plugs, disconnects, etc.

These lockout devices must resist chemicals, cracking, abrasion, and temperature changes and are available in various shapes and sizes that allow for the lockout of the electrical equipment.

The main importance of a lockout device is that it is individually keyed. Practically the key is on the person that performs the work on the locked system. The main causes of accidents, ending with casualties, in the electric power industry are due to failures to de-energize, test, earth, or secure against accidental energize. These are determined mainly by the failure of following the safety procedures due to the unsafe behaviours of the workers performing the job.

At the level of the organization, its workers safety is provided by implementing and maintaining a good health and safety management system. Such health and safety management systems are based on elaborating policies, procedures, training of personnel, establishment of comities and councils for health and safety, and compliance with the legal regulations or standard requirements. Looking at the causes of accidents that are mainly consisting of human errors and violations it doesn't mean that if the workers are trained with these procedures, or know them, will also follow them.

Electrical safety training that merely covers the work practices spelled out in the legal requirements is lacking in that simply knowing the rules doesn't equal following the rules. Practically is needed a training that not only outlines the safe work practices but also why they must be followed.

It is needed to change at-risk behaviors by urging workers to adopt new electrical safe work practices. In order that the health and safety management system is implemented to make a difference, training time must be spent on the health and safety culture of the workers in order to alter their risky behavior [6].

3. Behavioural Based Safety Approach

The human behavior is anything that is an observable action about an individual. Because behavior is both observable and measurable, so therefore the behavior can be managed.

Behavioral Based Safety is an excellent tool for collecting data on the quality of a company’s safety management system. It represents a scientific way to understand why people behave the way they do when it comes to their or their fellow workers safety.
The BBS approach is founded on behavioral science as conceptualized by B. F. Skinner [5]. Experimental behavior analysis, and later applied behavior analysis, emerged from Skinner’s research and teaching and laid the foundation for numerous therapies and interventions to improve quality of life.

Properly applied, Behavioral Based Safety is an effective next step towards creating a truly proactive safety culture where loss prevention is a core value.

Most experts believe that human behavior is primarily controlled by the “ABC model” of Activator—Behavior—Consequence [2].

Activators refer to the fact that people behave the way they do because they are activated to do so. Activators can be someone’s voice, a phone ringing, a “Do and Don’ts List”, safety sign or pictogram, training, procedure, etc. Activators can be either conscious or subconscious.

Behavior is a reflection of our knowledge, training and competence and can be intentional or unintentional.

Individuals are most often motivated to repeat a behavior, by the consequences or enforcements experienced from previous behaviors. Consequences are the most powerful force, therefore the consequences of a person’s actions determine whether he or she will continue or increase the desired behavior or discontinue or decrease it.

Behaviors are also affected by people’s attitudes about risk. This knowledge helps us to minimize unsafe behavior by making workers aware of why they behave the way they do, what is a safe and unsafe behavior, and what can be done to minimize unsafe and encourage safe behaviors.

Consequences influence behavior based upon three factors: timing, consistency, and significance. Significance is dependent on magnitude and impact. The different combinations of these factors will determine the likelihood of behavior increasing or decreasing in the future.

Timing refers to the cases if the consequence is immediate or if it may happen in the future.

Consistency refers whether the consequence is certain to happen or is there uncertainty.

Significance refers to whether the consequence is viewed as positive or negative by the person who receives the consequence. Significance means is the consequence of large or small magnitude and what impact does it have on the person receiving it.

The critical point in Behavioral Based Safety is that activators or signals preceding behavior are only as powerful as the consequences supporting them. That is, activators tell people what to do to receive a consequence, from the ringing of an alarm, telephone to the instructions from a health and safety training seminar or one-on-one coaching session. People follow through with the particular behavior activated to the extent they expect doing so will provide them a pleasant consequence or enable them to avoid an unpleasant consequence.

The BBS approach applies this ABC principle to design interventions for improving behavior at individual, group, and organizational levels. More than 40 years of research in the behavioral sciences has demonstrated the efficacy of this general approach to directing and motivating behavior change.

The principle of focusing on positive consequences to motivate behavior provides more specific direction for designing an intervention.

The use of punishment (or negative consequences) to motivate behavior is not always the solution because, according to Skinner “The problem is to free men, not from control, but from certain kinds of control” [4].

Therefore control by negative consequences must be reduced to increase perceptions of personal freedom. Unfortunately, the common metric used to evaluate and rank companies on their safety performance is the total recordable injury rate (or an analogous count of losses) that puts people in a reactive mindset of avoiding failure rather than achieving success. I the BBS approach there are provided proactive measures that employees set goals to achieve to reduce occupational risks and prevent unintentional accidents.

Behaviors can be objectively observed and measured before and after an intervention process is initiated. This application of the scientific method provides feedback for cultivating improvement. The acronym DO IT - standing for define, observe, intervene, and test - can be used to teach this principle of BBS to employees who are empowered to intervene on behalf of their coworkers’ safety and want to continuously improve their intervention skills. The DO IT process begins by defining certain target behaviors. These can be at-risk behaviors that need to occur less often or safe behaviors that need to occur more often. Decreasing the occurrence of at-risk behaviors often requires the occurrence of certain safe behaviors. Therefore, safe behaviors might be targeted to substitute for particular at-risk behaviors. On the other hand, a safe target behavior can be defined independently of an associated at-risk behavior.

The Definition of a safe behavior might be as basic as using certain personal protective equipment (PPE) or walking within pedestrian walkways.
Alternatively, the safe target could be a work practice requiring a particular sequence of safe behaviors, as when lifting or locking-out(187,894),(950,907) energy sources.

O for observe is when people observe each other for certain safe or at-risk behaviors, they realize everyone performs at-risk behavior, sometimes without even realizing it.

I for intervene - during this stage, interventions are designed and implemented in an attempt to increase the occurrence of safe behavior or decrease the frequency of at-risk behavior.

T for test - this phase of DO IT provides work teams with the information they need to refine or replace a behavior-change intervention.

If observations indicate significant improvement in the target behavior has not occurred, the work team analyzes and discusses the situation, and refines the intervention or chooses another intervention approach.

Each time employees evaluate an intervention approach, they learn more about how to improve safety performance. They have essentially become behavioral scientists, using the DOIT process to diagnose a human factors problem, monitor the impact of a behavior-change intervention, and refine interventions for continuous improvement.

The results from such testing provide motivating consequences to support this learning process and keep the workers involved.

Often there are three types of behaviors corresponding three kinds of intervention approaches:

- Instructional intervention - an instructional intervention and typically it is used an activator or antecedent event to get new behavior started or to move behavior from the automatic (habit) stage to the self-directed stage. This type of intervention consists primarily of activators, as exemplified by education sessions, training exercises, and directive feedback.

- Supportive intervention when a person learns the right way to do something, practice is important so the behavior can become part of a natural routine. Continued practice leads to fluency and in many cases to automatic or habitual behavior. Although instructional intervention consists primarily of activators, supportive intervention focuses on the application of positive consequences.

- Motivational intervention is needed when people know what to do but don’t do it, so they require some external encouragement or pressure to change. Instruction alone is obviously insufficient because they are knowingly doing the wrong thing. In safety, this is referred to as a calculated risk. People take calculated risks when they perceive the positive consequences of the at-risk behavior to be more powerful than the negative consequences. The positive consequences of comfort, convenience, and efficiency are immediate and certain, whereas the negative consequence of at-risk behavior (such as an injury due to an accident) is or seems improbable. In this situation an incentive or reward program is useful. It attempts to motivate a certain target behavior by promising workers a positive consequence if they perform it. The behavioral impact of these enforcement programs are enhanced by increasing the severity of the penalty and punishing more people for taking the calculated risk.


Behavioral safety processes and leadership will reinforce safe behavior and help identify causes of unsafe behavior [3]. There are generally three types of approach:

- Top Down - a management driven process, with supervisors measuring behavior and providing one to one feedback.

- Bottom Up - an employee driven process encouraging front-line participation in safety. Peer-to-peer observations are fed back to a workforce team who make recommendations to management to implement.

- Collective - the ideal scenario with both managers and front line staff observing. The analysis is delivered by a safety team, and recommendations identified and implemented.

Leadership behavior is very influential to the level of risk taking within an organization. How leaders react to safety issues will make an impression on how a workforce observes safety. This attitude will determine an organization’s safety culture. It is proven that safety leadership training may help educate managers on safety culture and leadership. It may help managers acknowledge risks and hazards and understand the impact of their own behavior. The goal of the trainings must be to enable participants to understand why people take risks, and to help them develop effective one-to-one coaching methods and help them analyze behavior. Leaders through their own modeling of desired behaviors provide a positive example. People tend to emulate the behavior of their leader or at least focus on what their leaders focus. This applies especially with leader’s people respect and trust. On the other hand, if leaders ignore people and focus mainly on, for example, technological aspects, most people throughout the organization perceive a lack
of importance of people issues. This has important consequences in management of safety and productivity. For instance, it is becoming increasingly clear that leaders focusing blindly on cost-cutting can consciously or unconsciously drive people to cut costs in ways that are not cost-effective, for example resulting with accidents or in ways that reduce productivity. Any safety training program, regardless of the hazard, needs to influence and change worker behaviors in order to prevent injuries. It must impact trainees to the degree that they buy into the new safe work practices. In other words, it needs to make a difference.

4 Conclusion

Electrical power industry safety has been identified as a domain in need of large scale and long-term behavior change. For this to happen, however, a prominent paradigm shift is required. The standard command-and-control or enforcement approach to electrical power industry safety has limited impact, as witnessed by the safety performance plateaus experienced by numerous organizations. The Behavioral Based Safety approach summarized in this paper provides tools and procedures employees can use to take control of their own safety performance, thereby enabling a bottom-up empowerment approach to reducing occupational risks and preventing workplace accidents.

References: