Electrical Safety

Elements of an effective program

By John J. Kolak

THE DEVASTATING EFFECTS of electrical shocks and burns have long been of concern to employers. National Safety Council (NSC) estimates that electrical shock accounts for more than 30,000 nonfatal accidents and more than 1,000 fatalities each year (NFPA, 2004). Similarly, approximately 2,000 people are admitted to burn centers with severe arc-flash burns. Clearly, electrical hazards present a serious risk to employees and substantive measures must be implemented to protect employees.

Significant improvements have been made in engineering designs and safe work practices during the last 30 years. However, accident investigations often reveal electrical accidents occur because key protective systems were either missing or dysfunctional. In response, OSHA and the National Fire Protection Association (NFPA) require employers to develop and implement comprehensive and effective electrical safety programs (ESPs) (NFPA, 2004). This article provides reviews key elements of an effective ESP.

Compliant vs. Effective Programs

There is an important distinction between compliant and effective ESPs. Here, a compliant ESP is one that meets OSHA minimum electrical safe work practices outlined in either Subpart S (29 CFR 1910.331-1910.335) or Subpart R (29 CFR 1910.269).

An effective ESP is a program that has been analyzed using appropriate hazard analysis techniques and will protect employees against electrical shock. Although OSHA regulations provide excellent guidance in many respects, difficulties in revising the regulations have left standards outdated in many important areas of electrical safety. Also, the use of performance-based language in the Code of Federal Regulations (CFR) have left many employers unable to determine whether their firm's ESP meets OSHA minimum standards.

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The need for up-to-date information on electrical safety has caused many employers (and even OSHA) to turn to consensus standards to provide the current best thinking in electrical safety. Two consensus standards must be consulted when developing effective ESPs; they are included in the National Electrical Code (NFPA 70) and the Standard for Electrical Safety in the Workplace (NFPA 70E). NFPA 70E is a subset of NFPA 70. The National Electrical Code (NEC) is a design and installation standard that relates to the "how to build it" part of electrical work; NFPA 70E is the "how to work on it" part of electrical safety. In concert, these standards are the best sources of information on electrical safety to date.

Although OSHA has no specific guidelines for developing ESPs, NFPA 70E-2004 provides a general outline in Annex E. A statement at the beginning of the annex clearly indicates that the ESP outline is for informational purposes only and is not formally part of the NFPA 70E document itself.

This article describes what elements should be included when building an effective ESP, some of which include using well-established safety practices such as the management oversight and risk tree (MORT) chart and system safety principles.

MORT Chart

System safety was developed in the 1960s when the use of nuclear energy created an obvious need to anticipate and control hazards without first having a negative event to investigate (Stephenson, 1991). In the late 1960s, a retired National Safety Council manager named Bill Johnson was hired by the Atomic Energy Commission to develop its system safety program. In 1973, Johnson produced the first version of the MORT chart to be used as a safety system evaluation tool (Stephenson, 1991).

The MORT chart is actually a fault tree. It is most useful because it includes "logic gates" that allow the analyst to connect base level events to the accident. For the first time, it was possible to track the flow of events to correlate how causal factors contributed to an accident. This logic also contributed to breaking down the overly simplistic linear thinking which indicated that accident causation followed Heinrich's domino theory (Petersen, 1988) and that accidents can be prevented by merely "breaking any element in the accident chain." The MORT chart illustrates the idea of multiple causation of accidents; this concept is now generally accepted as the correct model for accident investigation and prevention.

In the author's opinion, the MORT chart offers the best representation of the safety system. Furthermore, many safety engineers have recognized its value as a planning tool for developing safety systems. In fact, it can be changed from a negative tree (accident causation) to a positive tree (accident prevention) simply by reversing the logic gates on the chart.

It is important to understand that the recommendations in this article for developing effective ESPs are taken from systems safety concepts and the MORT chart itself; the recommendations in this article are based on sound safety practices.

ESP Overview

This article breaks ESPs into tiers, following a format of the Partnership Protection Process (Williams, 2004). This format was selected because it offers simple yet powerful organization and presentation of program attributes. Seven elements are presented, and each divided into several factors, each of which represents a program-level process. Although not discussed, each factor must be defined to a lower level to represent the task-specific level of development.

Elements

Elements are the corporate-level components that make up a site's ESP. Each element is divided into several factors. Every site must have all these elements in order to have a complete ESP.

Factors

Factors are specific components of each element; they provide more-specific guidance regarding what processes must be in place to have an effective ESP. The factors can be organized in any manner that suits an organization. An organization may already address portions of an ESP in other programs. For example, safety training is often addressed under the corporate training program. In these cases, the corporate ESP need only reference the key elements of the training program rather than reiterate it in the ESP.

Element 1: Proactive Measures

The most cost-effective way to manage safety is to prevent accidents rather than to correct system deficiencies following a loss. To optimize return on investment (ROI) for safety activities, an organization should ensure that this element is implemented in the early stages of ESP development.

Factor 1-1: Design

The best way to protect employees is to design a system in which safety is inherent, such as preventing electrical hazards via engineering controls rather than relying on procedures or PPE. Other important components are electrical equipment and procurement standards.

Factor 1-2: Hazard Analysis

Organizations that excel at safety share a common theme: the ability to anticipate and control hazards before they result in injury, illness or system loss. This factor is designed to measure the site's process for identifying and analyzing electrical hazards. Many hazard analysis techniques exist. The ESP must identify the methods used to identify and rank order electrical hazards in the workplace. Two types of hazard analysis considered required are formal arc-flash hazard analysis and shock hazard analysis.

Factor 1-3: Hazard Controls

An effective electrical safety process will manage existing and potential hazards to minimize and eliminate the effect on employees. As noted, priority is given to the elimination of hazards and the development of engineering controls. Administrative, work practice and PPE controls are alternatives when eliminating hazards is not possible. Interim controls should be instituted, as needed, when hazards are identified.

Factor 1-4: Planning

Effective ESPs are driven by formal plans that provide clear direction regarding how the organization intends to manage electrical safety. Some risk factors will be identified through hazard analysis (see Factor 1-2) while others are managed via good management practices such as generally accepted engineering standards. Typical planning components include emergency response and training plans and the use of an ESP.

Element 2: Training & Evaluation

OSHA mandates that only qualified electrical workers be allowed to work on or near exposed electrical equipment energized to 50 V or more. Furthermore, employers are re-

Organizing an Effective ESP

Element 1: Proactive Measures
Factors
1-1: Design
1-2: Hazard analysis
1-3: Hazard controls
1-4: Planning

Element 2: Training & Evaluation
Factors
2-1: Technical training
2-2: Safety training
2-3: Proficiency training
2-4: Testing and evaluation
2-5: Safety meetings
2-6: Emergency response training
2-7: Awareness/orientation training

Element 3: Documentation & Procedures
Factors
3-1: Safety rules
3-2: EOPs
3-3: Emergency planning
3-4: Equipment-specific procedures
3-5: Auditing procedures

Element 4: Equipment Maintenance
Factors
4-1: General maintenance
4-2: Electrical maintenance
4-3: PPE
4-4: Tool maintenance

Element 5: Operational Safety
Factors
5-1: Awareness and self-discipline
5-2: Tracking corrective measures
5-3: Contractor safety
5-4: Inspections
5-5: Hazard reporting

Element 6: Leadership, Participation & Commitment
Factors
6-1: Management leadership and commitment
6-2: Employee involvement
6-3: Roles and responsibilities
6-4: Performance planning

Element 7: Reactive Measures
Factors
7-1: Accident investigation
7-2: Emergency response

quired to ensure that employees demonstrate proficiency with regard to performing hazardous tasks (OSHA, 1996). Developing qualified electrical workers entails providing both classroom and on-the-job training. The effectiveness of the training must then be verified via both cognitive (written) and demonstrated proficiency (hands-on) testing. In addition, employers must provide ongoing training for experienced workers to maintain awareness of safety.

Factor 2-1: Technical Training

Employee safety and ensuring system functionality require that only qualified electrical workers are allowed to work on the electrical system. Becoming a qualified electrical worker is the result of a multifaceted process that includes classroom instruction, on-the-job training under close supervision of a qualified electrical worker and rigorous testing of the employee to ensure s/he fully understands proper procedures/techniques needed to perform the job. The information communicated is typically the training elements included in an electrical apprenticeship. For cross-trained employees, the curriculum must include those elements needed to perform any required task with the same skill that a journeyman electrical worker could perform the same task. In other words, cross-trained workers cannot be allowed to be at greater risk of injury than would a journeyman performing the same task.

Factor 2-2: Safety Training

Part of qualified electrical worker training includes formal safety training to ensure that the worker can properly identify hazardous conditions, then effectively protect against those hazards. Although OSHA has minimum training standards for electrical workers, achieving adequate employee protection requires considerably more breadth and depth than OSHA's minimum standards. Typical components of this factor include Subpart S or Subpart R training, lockout/tagout and energized work procedures.

Factor 2-3: Proficiency Training

An electrical worker must demonstrate proficiency before s/he can be considered fully qualified in performing the tasks included in Factors 2-1 and 2-2. Furthermore, the worker must be evaluated by a properly qualified individual. Proper documentation of the evaluation must be maintained as well.

Factor 2-4: Testing & Evaluation

Employers must test and evaluate employees to ensure that they possess the skills required to safely and efficiently perform their tasks. This requirement necessitates some form of both cognitive and demonstrated proficiency testing. The depth and intensity of the testing program must be commensurate with the complexity of the job classification and the level of hazards to which an employee is exposed on the job.

Factor 2-5: Safety Meetings

Safety meetings help to maintain awareness of important information needed for workers to safely perform their jobs. NFPA 70E, Section 110.7(B), is devoted to awareness and self-discipline because of the importance of maintaining awareness as a part of safety. Although most safety meetings are used to review material disseminated in previous training, in some cases, new information that has developed since the last formal safety training can be shared.

Factor 2-6: Emergency Response Training

OSHA's 1994 Electrical Power Generation, Transmission and Distribution standard requires that electrical workers be trained to provide both CPR and first aid to shock or burn victims. In addition, workers (or professional medical services) must be able to safely rescue a fallen worker from any location and begin emergency first aid/CPR within 4 minutes.

For example, those who work aloft on catwalks must be trained to properly rig and lower an accident victim. Similarly, those who work in manlifts or aerial baskets must be trained to use the emergency controls to lower a victim to the ground. Given that it is virtually impossible for an on-site emergency rescue team to reach each location in a plant within 4 minutes, it is recommended that all electrical workers be trained to effect a rescue and begin CPR until medical personnel can take over emergency treatment of the victim.

Factor 2-7: Awareness/Orientation Training

Electrical safety is not limited to qualified electrical workers. The company must provide lower-level (awareness) training to any employee who can be exposed to electrical hazards as part of the job (NFPA, 2004). This training must occur before the employee is allowed to work unsupervised (orientation training) and periodically thereafter as needed to maintain safety awareness.

Element 3: Documentation & Procedures

In effective ESPs, safe work procedures are used to ensure that hazardous tasks are performed safely and efficiently. Referencing these procedures in training helps to standardize training and prevents bad habits from being passed from one group of workers to the next. Proper documentation of procedures is also critical—both to satisfy regulatory requirements and to provide a source document for management to reference when implementing the ESP.

Factor 3-1: Safety Rules

Safety rules are the cornerstone of safety programs. These rules define all safety-related procedures, so care must be taken to ensure that the definitions accurately reflect management requirements. The rules establish high-level guidance, and are suitable for reference both during the actual work and at safety meetings. In addition, those rules that pertain to a new employee's job must be formally covered during new-hire orientation.

Factor 3-2: Electrical Operating Practices

Electrical operating practices (EOPs) are written procedures that describe how to perform important electrical tasks. Used both as a training aid for new hires and for refresher training, EOPs are typically developed based on input from electrical workers, engineering staff, safety staff and outside experts.

Factor 3-3: Emergency Planning

Effective ESPs include an emergency response system that minimizes losses and prevents secondary accidents. Formal plans, preparations and practices are made for all reasonably predictable emergencies such as shock/burn injuries and significant system loss. This section should include requirements for medical intervention for minor shock events as well.

Factor 3-4: Equipment-Specific Procedures

Along with safety rules and EOPs, equipment-specific procedures are needed. These should address proper use, servicing and safe work procedures (e.g., lockout/tagout) associated with equipment.

Factor 3-5: Auditing Procedures

Effective ESPs include a process to verify that the system is working as designed. The difference between this factor and Factor 5-4 is that the auditing process is conducted by objective third-party professionals (i.e., outside consultants), while inspections are conducted by line supervisors and managers.

Element 4: Equipment Maintenance

There is an obvious need to properly maintain electrical equipment to ensure that inherent safety features (e.g., interlocks) are properly functioning and will protect all employees. The need for proper maintenance is critical for electrical protective devices such as circuit breakers and fuses. In the event of a system fault, even partial failure of a protective device can result in death or catastrophic loss.

Factor 4-1: General Maintenance

Proper maintenance of electrical equipment is necessary to ensure functionality and to prevent the development of unsafe conditions (such as explosive dust accumulations). Typical components of this factor include periodic maintenance procedures, inspection/testing of protective systems (i.e., interlocks), and grounding system inspection and testing. The NEC is an excellent reference for system grounding and hazardous classified location (explosive environments) requirements.

Factor 4-2: Electrical Maintenance

Special maintenance procedures are needed to ensure that electrical equipment will perform as expected both in normal operation and during faulted (short-circuit) conditions. Typical components within this factor include insulation testing, thermoscanning and trip-testing main circuit breakers.

Factor 4-3: PPE

PPE must also be maintained so that it will function as expected. Typical components include rubber glove testing by approved laboratories and testing of personal protective grounds used to protect high-voltage workers from electrical shock.

Factor 4-4: Tool Maintenance

Maintaining specialized tools used in electrical work is critical. Specialized tools include voltage testing devices, Fiberglass-reinforced plastic tools (switch sticks) and low-voltage insulated tools.

Element 5: Operational Safety

Many safety elements must be in place to ensure that safety happens in real time (in the operations phase) on the shop floor. Some items relate to increasing awareness, such as the requirement to conduct job briefings. Some items relate to managerial responsibilities, such as performing crew visits (Factor 5-4) and ensuring that corrective measures for identified job hazards have been implemented.

Factor 5-1: Awareness & Self-Discipline

The terms *awareness* and *self-discipline* mean that supervision has created a situation where qualified workers are focused on the job at hand (awareness) and that those workers will consistently perform in the safest manner possible (self-discipline). Job briefings are one way management can improve the level of safety awareness among employees while also making sure that all members of a workgroup recognize their role when performing a hazardous task.

Factor 5-2: Tracking Corrective Measures

Corrective measures must be tracked to ensure that they are implemented in a timely manner. In this context, the term *corrective measure* refers to the actions taken to remedy a known defect in the safety system, such as damaged equipment or ineffective training. Not all reported job hazards will receive a corrective measure. For example, in some cases, management may determine that the identified hazard is either an acceptable risk or that the risk can be temporarily managed via an interim intervention until a permanent remedy can be funded and implemented. The key is to ensure that management is made aware promptly of job hazards and that a decision regarding a response to the hazards is made in a timely manner.

Factor 5-3: Contractor Safety

Ensuring that both contractors and employees are protected on the job is a significant consideration for many organizations. Critically important components of this section include a formal contractor safety program, established procedures for screening contactors and clear direction regarding how company employees should relate to contractors on the job. Corporate legal counsel is a primary resource of information in this factor.

Factor 5-4: Inspections

Line supervision must conduct regular site safety and health inspections to evaluate hazard exposures and the effectiveness of controls. An important element of inspections is that they afford an opportunity for supervisors to correct unsafe behaviors and to deliver positive reinforcement for safe work practices. OSHA requires "regular supervision" of employees by management; this is normally interpreted to mean at least daily oversight by supervisors.

Factor 5-5: Hazard Reporting

An important part of proactively managing safety is for management to receive timely feedback regarding hazardous situations before they result in an accident. Often, accident investigations reveal that

Effective ESPs use safe work procedures as a means to ensure that hazardous tasks are performed safely and efficiently.

employees were aware of a hazard that injured another employee but were unwilling to report it to management. A reliable hazard reporting system enables employees to notify management, without fear of reprisal, of conditions that appear hazardous and to receive timely and appropriate responses in return.

Element 6: Leadership, Participation & Commitment

Management commitment and employee participation are complementary and form the core of any safety and health program. Management must clearly understand its role in the safety process and must recognize that leadership, participation and commitment are demonstrated attributes which are observable by lower-level supervisors and employees. In organizations that excel at safety, employees can articulate specific examples of how they know they work for a safe organization (Williams, 2004). The factors within this element need not appear in an ESP if they exist elsewhere within the organizational safety system.

Factor 6-1: Management Leadership & Commitment

Management demonstrates its commitment to safety in virtually everything it does. Tangible evidence must show that supervisors and managers actively manage the electrical safety process in the same manner as they manage any other process. Key components include evidence of proactive interventions by management; demonstrating urgency regarding safety; and "walking the talk" regarding safety. For example, a senior manager who returns a weak accident investigation to the investigation team for additional analysis rather than simply "rubber stamping" it demonstrates commitment to safety.

Factor 6-2: Employee Involvement

OSHA requires that employees and their representatives be afforded the opportunity to participate in all phases of the safety and health process (OSHA, 1971). Through participation, employees help to identify hazards, recommend and monitor abatement, and participate in their own protection. Successful processes enable employee participation in the structure and operation of the program and in decisions that affect safety and health. Effective communication between employees and management is an essential element.

Factor 6-3: Roles & Responsibilities

Effective performance planning relies on having clearly defined roles and responsibilities for all employees. Further, standards of performance must exist such that performance can be measured in both quantitative and qualitative terms. Key components of this factor include written documentation outlining safety responsibilities for all levels of management, the existence of degreed safety professionals on staff (for larger organizations) and the existence of written standards of performance for all employees.

Factor 6-4: Performance Planning

Safety performance can be measured and determinations can be made as to how well a given manager/supervisor has fulfilled his/her responsibilities for safety management. Most organizations already have some form of process to measure management effectiveness. This factor merely applies this process to safety. Key components include formal performance plans for all levels of supervision, and measurable goals and evidence that electrical safety is weighted as heavily as production-related objectives.

Element 7: Reactive Measures

Making improvements to safety following an accident or loss is the least-efficient way to manage hazards. Accidents are system failures; failure to identify root-causes of accidents and failure to correct system deficiencies almost guarantee a similar accident will recur. Therefore, an effective program must include a comprehensive process to analyze accidents and identify appropriate corrective measures necessary to prevent recurrence. Many corporate safety programs already include excellent accident investigation and emergency response programs. In these cases, the ESP need not include anything except specific additions needed to address electrical hazards.

Factor 7-1: Accident Investigation

Effective safety programs should already have in place a flexible accident investigation process that is capable of analyzing accidents ranging from minor injuries through fatalities or complete system loss. However, the extremely technical nature of electrical systems may require adapting a high-quality accident investigation process to become capable of investigating electrical accidents. Key components of this factor include the existence of a written accident investigation protocol, maintaining highly skilled investigators and evidence of capabilities to perform electrical accident investigations.

Factor 7-2: Emergency Response

Factor 2-6 addresses the need to prepare employees to safely respond to accidents/incidents via training and drills. This factor addresses the need for post-event review and implementation of corrective measures for identified emergency response deficiencies. This includes tracking how well the existing planning (Factor 1-4), emergency training (Factor 2-6) and emergency plans (Factor 3-3) met the needs of the situation. Evidence must also exist that corrective measures identified in this analysis have been implemented.

Scoring & Evaluation

Given the volume of information included in an ESP, an evaluation process is needed to identify areas of strengths and deficiencies. Successful evaluation systems strive for the greatest degree of objectivity possible, so different analysts would arrive at similar conclusions when evaluating the ESP. The following strategy can help achieve that outcome.

1) Break each factor into task-specific activities.

2) Write each activity so that it can be measured quantitatively.

3) Establish a numerical scoring system that defines the degree to which the organization achieves optimal performance (quantitative measurement) relative to the factor being evaluated.

4) Clearly define what must be done to achieve each level of the scoring system.

5) Devise a method to weight the various elements/factors in terms of importance

6) Devise a method to calculate numerical scores and rank order results.

The following example, taken from an evaluation tool developed by the author, illustrates these points.

Example: Factor 2-1: Technical Training

Objective of Factor 2-1: Employee safety and ensuring system functionality require that only qualified electrical workers are allowed to work on the electrical system. Becoming a qualified electrical worker is the result of a multifaceted process that includes classroom instruction, on-the-job training under close supervision of a qualified electrical worker and rigorous testing to ensure the employee fully understands proper procedures/techniques needed to perform his/her job. The principle items within this factor include:

1) A formal curriculum that identifies key training events which must be successfully completed in order to achieve qualified status. The curriculum must identify both key training competencies and standards of performance requirements.

2) Documentation which certifies that the employee has completed all required training events.

3) A process to ensure the safety of employees who are not yet qualified. For example, safety rules should permit trainees to perform hazardous tasks only under the direct supervision of a qualified worker.

4) A formal testing/evaluation process must exist to test both cognitive knowledge and demonstrated proficiency of key technical training topics. Testing should address both initial skills testing for trainees and recurrent testing of experienced employees.

In this case, the technical training factor has been divided into four items that comprise the substance of technical training for a facility. The scoring system developed would be applied to the four items to assign a numerical score for that factor. The power of the scoring system is in the clarity of the operational definitions, not the numerical scale chosen. Typically, a simple numerical scoring system (e.g., 1 to 5) can be used with operational definitions ranging from a score of 1 being nonexistent to a 5 being best in class.

As noted, some elements are more important than others in terms of their effectiveness at protecting electrical workers. For example, any resources devoted to the design (proactive measures) element will have far greater impact than devoting resources to the reactive measures element. Therefore, it is recommended that a weighting system be devised to incent the organization to first work on the most those elements with the greatest impact on worker safety.

Scores should also be aggregated to develop an overall score for the ESP. The most common method is to format a spreadsheet to capture individual factor scores, then calculate individual element and overall ESP scores. Once the spreadsheet has been populated, the sort features can be used to develop a prioritized implementation plan.

Next Steps

Once the ESP has been evaluated and a list of improvement activities has been developed, a final analysis is needed to determine how best to address identified deficiencies. The general approach should leverage organizational strengths and develop a plan to address organizational weaknesses that would create barriers to making the required improvements.

For example, Organization A may already have an excellent process for testing and evaluating employee performance in areas other than electrical safety. This organization then would need only to modify the existing testing model to evaluate electrical safety and technical training for electrical workers. Organization B may have never tested anyone and would need to develop a comprehensive testing and evaluation process. Obviously, the "next steps" plan of action would differ for the two organizations.

The final step would be to integrate the knowledge gained through this analysis into the planning and budgeting processes. Certain activities, such as completing formal arc-flash engineering studies, could cost hundreds of thousands of dollars for larger organizations and a multiyear phased implementation process would likely be developed and funded. Other activities, such as ensuring that proper training records are maintained, may already be in place and virtually no organizational resources would need to be expended. The critical point is to first devote time and resources to the activities with the highest propensity for protecting electrical workers. As the organizational ESP matures, activities of lower importance can be addressed as the organization approaches best in class performance levels.

Once the ESP has been evaluated and improvement activities have been identified, a final analysis is needed to determine how to best address deficiencies.

ESP Implementation

In general, the implementation phase of ESP should follow these steps in order:

1) **Develop metrics (measurement criteria) to assess progress.** In many cases, the activities listed to define what is included in each factor can easily be adapted to meet this requirement.

2) **Identify key implementation milestones.** Assign firm dates to these milestones and manage to these timelines.

3) **Assign responsibility for implementation.** Assign individuals with clearly defined tasks that contribute to the achievement of the implementation plan. Ensure that a senior-level manager has accountability for overall ESP implementation. This person should be a line manager, not the safety manager. Electrical safety is a line management responsibility and the safety manager should serve only in an advisory capacity to management.

4) **Train affected employees.** Many ESP elements require specific training to ensure that all affected parties understand their roles. Ensure that the effectiveness of training is measured in behavioral terms—that is, make sure the training is translating into performance-based changes on the job.

5) **Integrate ESP implementation into performance planning.** Individuals charged with implementing portions of the ESP (item 3) must have both

the authority and the resources to accomplish this task. It is critically important that management provide enough time to accomplish ESP implementation. This may mean delaying or suspending another initiative. If the organization is unwilling to acknowledge this reality, it is left with the option to insert some form of interim hazard controls (most opt for PPE) and accept the remaining risks. Given the severity of electrical accidents, this approach is strongly discouraged.

By now, the reader may feel overwhelmed by the magnitude of the challenges involved in developing an effective ESP. It may be helpful to note that the process outlined in this article is identical to that needed to address any system change. An adage says, "Give me 6 hours to chop down a tree, and I'd spend the first 4 sharpening the axe." This sentiment is appropriate when discussing ESP implementation. Many organizations feel an urgency to "get something in place" as quickly as possible only to find they expend far more time and money than would have been the case had they taken the time to methodically "sharpen the axe."

Implementation Strategies

These strategies can help any organization with ESP implementation:

- **Divide and conquer.** While implementing an effective ESP may seem a daunting task at first, it is actually quite manageable if it is divided into discreet pieces that are then assigned to subject-matter experts. For example, the manager of engineering would be the logical person to address standardization of engineering designs, while the maintenance manager would be the right person to evaluate the maintenance program and recommend and oversee appropriate changes.
- **Develop a "marathoner" mentality.** Like all essential business processes, ESP implementation is not so much a goal as it is a process. Developing an effective ESP is a multiyear process. Attempting to move too quickly will waste resources and will not achieve effective employee protection. Furthermore, electrical safety is likely only one of several organizational safety initiatives and few organizations have the time to devote all their resources to it. The best approach is to address the big-ticket items first, then thoughtfully and deliberately implement the ESP over time.
- **Sharpen the axe.** Thoughtful planning is essential to achieving an effective ESP in the most cost-effective manner. By far, the most common error committed by organizations trying to implement an ESP is to "do the wrong thing right." While management rightfully should feel a sense of urgency about electrical safety, the marathoner mentality is ultimately the best approach. Using hazard analysis and other evaluative tools will help to ensure that limited resources are devoted to those processes with the greatest ROI.
- **Don't go it alone.** SH&E professionals are among the best at networking because the sheer volume of knowledge required to address both safety and health issues requires the support of other subject matter experts. Implementing an effective ESP requires the same mentality. Assemble an ESP implementation team with an eye to capitalize on each individual's strengths. This approach also prevents any one person from feeling overwhelmed because s/he is only expected to address small segments of the ESP, not to implement the entire program.

Conclusion

Implementing effective ESPs is a lot of work and is most successfully implemented by organizations that appreciate its importance both in human and financial terms. While it may be tempting to take a minimalist approach to ESP implementation, it actually takes almost as much time and effort to do a bad job of program implementation as it does to do it right. Worse, failure to address root-cause risk exposures will amplify corporate losses due to the increased probability of repeat accidents.

Electrical safety must compete with dozens of other worthy programs for scarce corporate resources and this is why it is strongly recommended to use formal hazard analysis to ensure that the organization is focusing on the most hazardous processes. In most cases, using hazard analysis will reveal that electrical safety floats to the top on its own merit as a risk factor to loss of human resources and system function. Conversely, if the analysis reveals that the organization has exposure to other energy sources with greater propensity to injure employees than electrical energy, then the organization should be focusing on those energy sources.

As SH&E professionals, we must be passionate about electrical safety. Passion is perhaps the "X-factor" possessed by all organizations which are known to have excellent safety programs. Anyone who has witnessed the devastating effects of electrical shock and burn injuries has made a silent promise to never let it happen again. The combination of this level of passion, in concert with the elements reviewed in this article, will greatly enhance the probability that electrical workers will return home safely at the end of the day. ■

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