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Electrical Safety Improvement Project - A Complex-Wide Teaming Initiative

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

Project Hanford Management Contractor for the
U.S. Department of Energy under Contract DE-AC06-96RL13200

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ABSTRACT

This paper describes the results of a year-long project, sponsored by the Energy Facility Contractors Group (EFCOG) and designed to improve overall electrical safety performance throughout Department of Energy (DOE)-owned sites and laboratories. As evidenced by focused metrics, the Project was successful primarily due to the joint commitment of contractor and DOE electrical safety experts, as well as significant support from DOE and contractor senior management. The effort was managed by an assigned project manager, using classical project-management principles that included execution of key deliverables and regular status reports to the Project sponsor. At the conclusion of the Project, the DOE not only realized measurable improvement in the safety of their workers, but also had access to valuable resources that will enable them to do the following: evaluate and improve electrical safety programs; analyze and trend electrical safety events; increase electrical safety awareness for both electrical and non-electrical workers; and participate in ongoing processes dedicated to continued improvement.

INTRODUCTION

In the past two decades, the Department of Energy (DOE) has demonstrated concern for the safety of the employees working within their facilities through numerous campaigns dedicated to preventing electrical safety events and injuries. Each initiative resulted in varying degrees of success, but none was able to sustain the continuing improvement expected by the DOE. The most recent effort contains unique elements that promise to achieve and maintain the performance that each Secretary of Energy in the past 20 years has challenged their staff to meet. What follows is a history of events leading up to the Electrical Safety Improvement Project, and substantiation as to why successful execution of this Project is a significant contributor to worker health and safety—now, and for years to come.

BACKGROUND

Work within the DOE Complex provides fascinating and rewarding opportunities, as well as challenges and hazards that those outside the industry often don't appreciate. The challenges with electrical safety are excellent examples of where, regardless of the circumstances – from electrical workers in the research and development laboratories, working with unimaginable high levels of energy; to the facility maintenance electricians dealing with 50-year-old systems that were installed without consideration of current codes and standards and have been subject to abusive radiological exposures –DOE workers have been expected to be a cut above the average worker to ensure they go home safely each day.

Following two electrical fatalities in the late 1980s, Secretary of Energy O'Leary chartered a team of DOE and contractor personnel, led by Oliver D.T. Lynch, Jr., to perform assessments at selected DOE sites to determine the overall health of the Complex electrical safety program and ensure that conditions similar to those contributing to the fatalities were identified and corrected. The product of that initial team established the foundation for those that followed to build on. At the conclusion of their designated assessments, the team published three documents: a report presenting their observations at each site visited, along with a summary of crosscutting issues; an Electrical

Safety Handbook [1] that contained a wealth of resource information, with data from the most up-to-date nationally accepted standards addressing all areas of electrical safety experienced in DOE workplaces; and a Model Electrical Safety Program [2] that the Secretary directed all sites to use as a template for individual programs.

The assessment team evolved into what came to be known as the DOE Electrical Safety Committee (ESC). To increase knowledge and maintain awareness of electrical safety principles, the ESC conducted annual electrical safety workshops across the country. Thousands of contractor and DOE personnel attended the workshops that focused on instructing the audience in the requirements from the electrical safety sections of 29CFR1910 and 29CFR1926 and new technology. This approach addressed one of the common weaknesses noted, a lack of knowledge of the Occupational Safety & Health Administration's (OSHA's) requirements regarding electrical safety in the workplace. The ESC and the products from the assessment team provided valuable resources and networking opportunities for individual sites as they attempted to nurture new electrical safety programs and change a well-established culture. During the period when the ESC was active, the Complex realized substantial improvement in electrical safety performance.

During the mid- to late-1990s, changes in DOE's mission and financial restrictions reduced support for Complex-wide initiatives and individual sites retreated to deal with their electrical safety challenges independently. It was during this period that the DOE Electrical Safety Handbook [1] began to become neglected. No one had the time or resources to keep it updated and its use began to wane. It was also during this time that a near-fatal electrical accident occurred at one of the DOE laboratories when a worker drilled into an energized electrical conductor [3]. One other event occurred during this period that, looking back, was a significant milestone in the history of DOE's electrical safety program. The National Fire Protection Association (NFPA) published the 5th edition of NFPA 70E, *Standard for Electrical Safety Requirements for Employee Workplaces®* in 1995. This was the first time that the concept of quantifying approach distances for protection from shock and arc flash hazards was published in a consensus standard. Many DOE sites adopted NFPA 70E as part of their electrical safety program, but without a unified implementation plan, each site interpreted and enforced the requirements individually. Also, the DOE workforce was represented on the NFPA 70E Technical Committee by two principal members participating in the development of the 2000 edition of NFPA 70E.

In May 2004, after several electrical incidents and near-miss events across the Complex, Undersecretary Clay Sell held a video conference, during which he expressed the Secretary of Energy's concern about the apparent decline in attention to electrical hazards. He directed each DOE Field Office to develop an improvement plan and hold contractors accountable for improving electrical-safety performance. While each site focused on developing and executing their individual improvement plan, overall Complex performance continued to decline. Then on October 11, 2004, a subcontract employee at a DOE site was seriously injured when the electrical panel he was working on produced an arc flash and subsequent arc blast Among the Judgment of Needs resulting from the Type A Accident Investigation Board [4], was the observation that the site had failed to adequately implement the safe electrical work principles required by OSHA and NFPA 70E. The lack of continued focus on OSHA requirements established by the ESC, combined with an ineffective effort to individually incorporate NFPA 70E, resulted in a failure to protect the worker from the electrical hazards.

The following year, DOE took a slightly different approach in addressing the continuing decline in performance. They initiated a campaign to raise the awareness of all workers to the hazards of electricity. May was dedicated to electrical safety and sites were encouraged to promote the theme throughout the month. In addition, DOE management approached EFCOG's Board of Directors with a proposal that EFCOG consider addressing the apparent systemic failure of individual electrical-safety programs. EFCOG accepted the challenge and at its Integrated Safety Management Working Group (ISM-WG) Meeting in Albuquerque, New Mexico (Fall 2005), they convened a group of electrical experts from across the Complex. The group discussed probable causes, identified barriers likely to impede success, and finally arrived at a list of seven initiatives that, if executed effectively, would produce both near- and long-term results. EFCOG's Board of Directors assigned a project manager, who assembled a project team of both Federal and contractor employees. The team developed a project-management plan that turned the initiatives into milestones. Champions were assigned for each of the milestones, and in January 2006, the EFCOG Electrical Safety Improvement Project (ESIP) began executing the project-management plan.

PROBABLE CAUSES OF ELECTRICAL EVENTS

The *ad hoc* EFCOG committee at the Albuquerque meeting represented a broad range of experience and expertise within DOE. The Chair of the ISM-WG facilitated discussion that included input from DOE Headquarters Senior Management and representatives from the Institute of Nuclear Power Operations (INPO). After two days of discussion, the group concluded that most reported events could be grouped into one or more of the following general categories:

- Weaknesses within individual electrical safety programs
- Lack of qualified subject-matter experts
- Inadequate technical resources
- Inaccurate tracking and trending methods
- Insufficient electrical safety awareness training for non-electrical workers
- Inconsistent guidance for controlling electrical hazards
- Failure to integrate and coordinate electrical-safety initiatives from all DOE sites.

Weaknesses within Individual Electrical Safety Programs

The DOE Model Electrical Safety Program produced by the DOE ESC contains all the essential elements for ensuring an effective electrical-safety program. Sites that emulated this model and implemented a companion program of periodic assessments and adjustments saw substantial reductions in the number and severity of electrical events. As DOE's ESC began to disintegrate, however, some sites lost focus of DOE's Model, along with the lines-of-inquiry necessary to determine the strength of the structure supporting the electrical safety program. In addition, sites moved away from the site-to-site assessments. A few sites even dissolved their electrical safety committee. Some reduced their committee to single individuals, leaving little or no worker involvement. Without a clear set of performance criteria, and inadequate feedback from the field, sites have little or no way of determining weakness in their programs until they are made obvious through events or injuries.

Lack of Qualified Subject Matter Experts

Historically, DOE's nuclear program has been successful in protecting the public, environment, and workers – in part, because of the extensive qualification programs for the nuclear workers, the qualifications of technical-support professionals, and the knowledge of oversight personnel. Nuclear operating plants successfully implemented a strong military-style conduct-of-operations philosophy to compensate for potential human error. DOE laboratories have been populated with the brightest scientists, providing immeasurable technical contributions to the country and the world. There have been several changes during the past several years that may have driven DOE to evaluate whether or not previous methods of protection are still effective. Here are a few of the changes that may have affected DOE's electrical-safety programs and warrant a review of the technical qualifications of DOE's working, support, and oversight personnel:

- The mission at many DOE sites transitioned from operations to deactivation, decommissioning, and demolition (D&D). This work does not fall into either classical maintenance or construction; therefore, the associated electrical hazards may not have been well characterized or documented.
- Many electrical systems aged to well past their design life. Other factors further complicated this condition. Budget restrictions and a run-to-failure approach to maintenance in anticipation of D&D may have added to an already degrading system. In addition, before the mid-1990s when an emphasis was placed on installing electrical systems to national consensus standards (e.g., NFPA 70 [*National Electrical Code®*] and ANSI C2 [*National Electrical Safety Code®*]) electrical workers were not mandated to know the generally accepted industry standards. Consequently, current electrical workers are discovering unexpected wiring scenarios that are non-compliant. Previous generations of electrical workers relied heavily on tribal knowledge to identify potential traps. Workforce restructuring across the Complex has reduced, and in some cases, that knowledge.
- Direct oversight by both DOE and contractor safety professionals increased significantly. As a result, more apparent electrical problems are reported than before. To avoid a false indication of potential problems; and conversely, overlook indicators of serious problems, oversight personnel must be able to evaluate electrical hazards as effectively as they can other industrial and radiological hazards. The use of electricity and maintenance of electrical systems inherently comes with a level of risk. Generally, the acceptable risk

of other forms of energy (e.g., steam, mechanical, and nuclear) is well known and documented. Even chemical, radiological, and noise hazards have acceptable thresholds of exposure that are recognized without debate. No such clear criterion exists for electrical energy. Consequently, implementers and enforcers of electrical safety principles must rely on a thorough task-based hazard analysis and technical judgment to establish an acceptable safety equivalency.

- Technical knowledge in our R&D community increased exponentially. It isn't apparent that DOE armed its R&D electrical workers with corresponding knowledge of potential electrical hazards and necessary controls that may have resulted from the technical advances. As energy levels increased in the laboratories, problems masked previously became more apparent. Historically, electrical safety has focused on the facility power systems. Research and resulting guiding documents for electrical safety practices have neglected to include the unique hazards faced by the R&D electrical workers.
- Integrated Safety Management (ISM) and Voluntary Protection Program (VPP) became the foundation for worker protection throughout DOE. Both philosophies, which have been successful in protecting workers well beyond industry norms, rely heavily on worker involvement. Benefits of worker empowerment include ownership of self and co-worker safety, as well as a positive culture change that embraces safety performance improvement. A risk of moving from a military-style disciplined approach to performing a task is the possibility that workers may focus so intently on the task that potential error precursors may be overlooked. To offset this risk, safety professionals and supervision must be technically knowledgeable in electrical safety requirements and work practices to contribute a higher level perspective to the hazard analysis. Further, the workers themselves must stay current on information regarding electrical work, which may require interfacing beyond DOE boundaries.

Inadequate Technical Resources

When first published, DOE's Electrical Safety Handbook was one of the most comprehensive accumulations of information anywhere regarding electrical work within the DOE scope. Addressing all known types of electrical work from instrumentation to explosives, the document covered mechanics of electrical devices, applicable requirements, and best practices where requirements were inadequate to address unique circumstances. For a period, the Handbook was updated by a small group of technical experts, implementing comments from the DOE public. Budget restrictions eliminated funding to update the Handbook. Gradually, DOE sites reduced the use and reliance on the Handbook as the basis for establishing safe electrical work practices. Instead, most sites migrated to the NFPA electrical codes and standards as their primary resources for electrical safety.

Most governing agencies adopting consensus standards such as NFPA 70 and NFPA 70E augment or amend the code through legislative actions, such as state laws or municipal administrative codes. The laws will address how the rules in the consensus codes will be interpreted, applied, and enforced. The laws will also define the lines of authority for interpretation and the resolution of disputes. DOE work presents unique challenges that standards designed for normal industry may not adequately address. For example, energized electrical work within Airborne Radiation Areas is a condition that authors of NFPA 70E are not likely to consider. Also, models for predicting the consequences of an arc flash are based on research using 60-Hertz systems, so controls established in NFPA 70E may not be appropriate in an R&D environment. Beyond the DOE Electrical Safety Handbook, there is no known repository that singly collects all necessary information to address the electrical hazards that may be encountered while working on a DOE project or collects interpretations for how DOE expects particular rules in consensus standards will be applied.

Inaccurate Tracking and Trending Methods

Reporting and determining causes of undesirable events is critical to any safety program, especially electrical safety. The successful electrical safety program relies heavily on ISM, particularly the feedback principle, to ensure potential weaknesses are discovered before they result in catastrophic events. The Heinrich Safety Triangle (Figure 1) predicts the ratio that continued unsafe behaviors will result eventually in serious injuries and is well known among safety professionals. The triangle predicts that for every 300 recordable injuries, the workforce will experience a fatality. What may not be well known is that when the subset of electrical unsafe behaviors is analyzed separately, the ratio of recordable injuries to a fatality is reduced to 10. Clearly, electricity is not very forgiving.

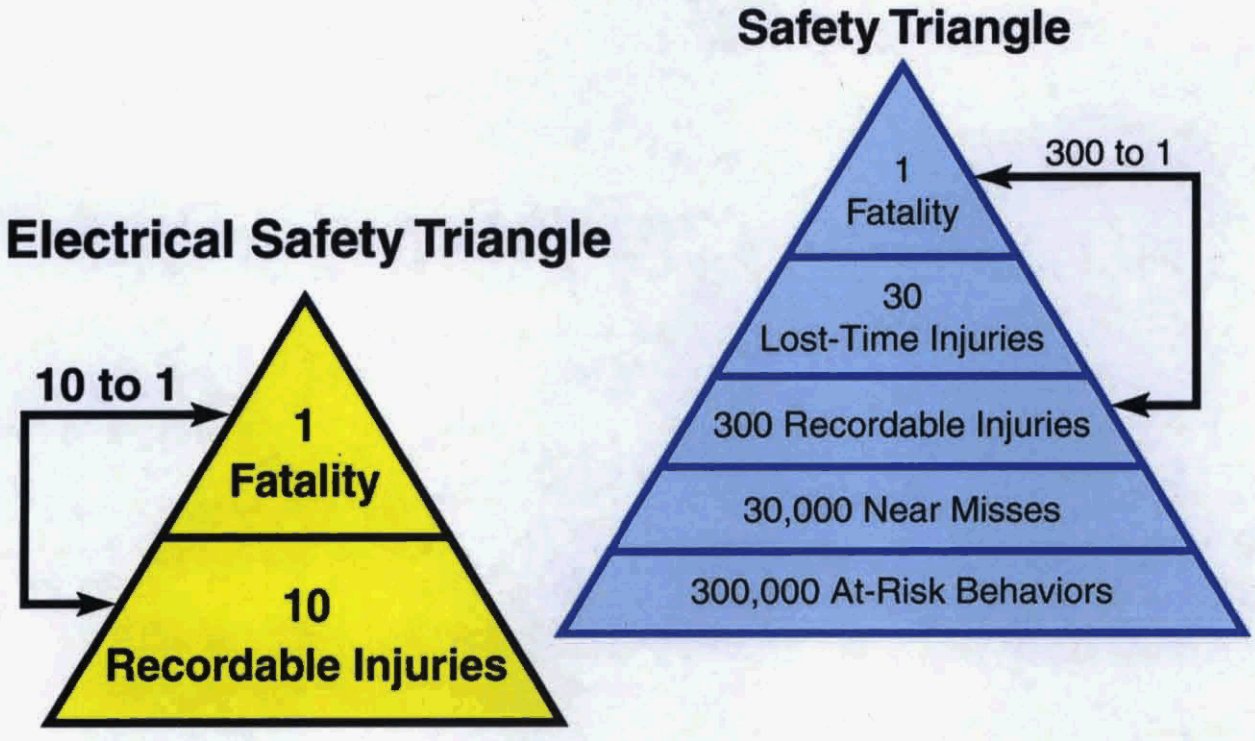

Fig. 1. The Heinrich Safety Triangle is used in predicting the ratio of unsafe actions to consequences for total workplace injuries and the subset for electrical injuries.

The challenge with using reported electrical incidents, as well as electrical close-call events to drive preemptive measures, is ensuring the information accurately reflects context and causes. In addition, similar events across the Complex must be submitted consistently to ensure the metrics accurately reflect Complex performance. A dry-hand shock from a 51-volt voice modulated communication system and contact with a 277-volt bare conductor in a wet environment are both electrical shocks, but clearly warrant different levels of attention. Unless the events are screened and categorized, they each become a single, equally weighted data point on a performance chart. Further, non-electrical events that affect electrical equipment tend to dilute electrical-safety metrics or reporting criteria. For example, if a vehicle contacts an electrical light pole causing enough damage that the electrical conductors are no longer enclosed, so long as appropriate measures are taken to prevent personnel from approaching nearer than a safe distance, the event should not be included in the electrical safety database. Likewise, inadvertent operation of a circuit breaker that results in a reportable event should be outside the scope of the electrical safety database. Unless the data is pure and accurate, programs are at risk of ignoring preventive opportunities or establishing ineffective corrective actions.

Insufficient Electrical Safety Awareness Training for Non-Electrical Workers

Non-electrical workers experience the majority of electrical shocks within DOE facilities.. Great progress has been made in recent years in protecting our electrical workers from the hazard of making contact with energized electrical parts with un-insulated parts of the body. From the "no energized work" philosophy to extensive personal protective equipment, our electrical professionals are well informed and well armed to avoid electrical shock. The same effort has not been expended to non-electrical workers. What electrical safety awareness training that has been provided has been generic.

Inconsistent Guidance for Controlling Electrical Hazards

As with other potential causes, the Albuquerque group concluded that degradation of the network linking the DOE electrical safety experts, as well as the absence a common forum, may have resulted in some sites taking a less-conservative approach to electrical safety. Informal surveys indicated that sites were using the Energized Electrical Work Permit, mandated by NFPA 70E 130.1(A)(1), differently. The authorization level for justifying energized work was not consistent throughout the Complex.

Failure to Integrate and Coordinate Electrical Safety Initiatives from all DOE Sites

Although not likely a direct cause of electrical events, the committee agreed that individual attempts by site electrical safety programs to improve performance was not the most effective approach to the problem. Failure to take advantage of the wealth of knowledge and resources residing within the DOE community could certainly contribute to a less-than-optimum electrical safety program—both individually and collectively. In addition, the lack of a central focused effort increases the probability of future failure.

POTENTIAL BARRIERS TO SUCCESS

The team also considered possible barriers to achieving the desired goals. One potential problem that was foreseen was the probability of strongly opinionated team of professionals would develop an adversarial attitude. Early on, team members agreed that individual titles and roles would be disregarded and each member would be respected as a valuable asset. The result was a highly effective team: federal employee, contractor, doctorate, and electrician, all worked collectively to achieve outstanding results.

Another potential issue was the lack of support from the sponsor, EFCOG, and the client, DOE Headquarters. The project team developed a communication plan that ensured both organizations received status reports on project progress. The Project Manager interfaced regularly with the EFCOG Board of Directors and Headquarters sponsors. In reality, the support to the project team exceeded expectations. Clearly, the effort was important to the DOE and EFCOG members.

The team also addressed individual contractor's willingness to support the initiatives and workers' desire and ability to implement in the field the changes necessary to effect improvement. To make the workers' job easier, management must send a clear message that change is not only needed, but also supported. Second, the workers must have confidence in the force initiating change and that the proposed direction is appropriate. By including workers on the project team and soliciting feedback from other workers, the project team was successful in establishing credibility with field workers. Obtaining management support was somewhat easier. Coincidental with the Electrical Safety Improvement Project, was the impending implementation of 10CFR851, carrying potential penalties to contractors failing to comply with particular electrical codes and standards. Contractors welcomed the advice of the Project Team regarding electrical safety improvement actions.

PROJECT EXECUTION

To maximize impact during the discrete schedule of the Project, the team chose milestones that would focus on awareness for immediate results and support individual programs to establish a basis for longer-term results. Realizing the time limitations, they chose a multi-phased approach. The actions taken by the project would include a transition plan to use programmatic changes to drive improvements to the field and task levels in following years. Seven project areas were chosen to address each of the probable causes, with both a DOE and a contractor champion assigned to each area. The sub-teams supporting each project area selected tasks deliverables and commitment dates designed to accomplish the action.

Project Area #1 – Baseline Assessment/Criteria

Action: Develop a standardized criteria and review approach document (CRAD) for electrical safety to support the execution of baseline assessments within DOE and contractor operations. The assessment areas will include Operations, Construction, R&D, and NFPA 70E Implementation.

Result: The CRAD was completed, presented to DOE for use in conducting assessments, and posted on EFCOG's Electrical Safety Web Site [5], for individual sites to use in evaluating electrical-safety programs.

Project Area #2 – Technical Authorities and Qualifications

Action: Establish electrical safety authorities at federal and contractor levels. Develop a standardized set of qualification requirements for consistency throughout the DOE Complex. This project area was divided into two parts. Part I addressed federal personnel with responsibilities for overseeing electrical safety; Part II provided qualifications for contractor electrical subject matter experts.

Result: An electrical functional qualification standard (FAQ) was presented to the DOE Federal Technical Capabilities Panel (FTCP). After an extensive review and comment-resolution phase, the ESIP work was issued in DOE Standard DOE-STD-1170-2006.

After Part I was completed, the ESIP, using the DOE FAQ as a benchmark, developed a qualification document and posted it on EFCOG's Best Practices Web Site.

Project Area #3 – DOE Electrical Safety Policy and Handbook

Action: Update the DOE Electrical Safety Handbook [1] to include seven different areas: R&D, NFPA 70E implementation, personnel protective equipment, locator methodologies, use of non-UL listed equipment, and subcontractor management and reporting criteria.

Result: Updating the Handbook is a multi-year task. As a Project deliverable, the EISP chose to collect input from the Complex, assign a team to revise the document, and submit recommended changes to the revision team for the complete update in Calendar Year 2007. The actions were completed and the revision team met in a working session at the DOE Electrical Safety Workshop sponsored by Sandia National Laboratory in Albuquerque, New Mexico, July 2007.

Project Area #4 – Reporting Criteria/Performance Measurement

Action: Establish a standardized approach for tracking and trending electrical safety incidents across the Complex.
Result: The Severity Index Tool was posted on EFCOG's Electrical Safety Web Site. The task team identified three key areas for standard reporting and performance measurement improvements with electrical safety metrics for 2006:

- Formulated and implemented a "significance/ severity-" based approach for trending electrical-safety incidents. Two tools were developed and implemented as a pilot program: electrical severity and electrical severity index. These methods were tested at multiple DOE sites.
- Reviewed the current criteria for DOE's occurrence reporting system for accuracy in identifying electrical-safety incidents (to include significance categorization). The team presented the results, including a comparison of test cases using the electrical severity tool during EFCOG's April 25, 2006 meeting.
- Provided recommendations to DOE and contractors for implementing the tool as part of the reporting criteria and performance-measurement process.

Project Area #5 – Awareness and Continuation Training
Action: Provide a standardized approach for initial electrical safety awareness and continuation training for non-electrical workers.

Result: The ESIP developed seven training modules and posted them on EFCOG's Electrical Safety Web Site . Some modules focused on particular areas of electrical safety common to all workers and others were designed to increase awareness of electrical hazards for particular work groups.
Module 1 – Basic Electrical Safety for Non-Electrical Personnel
Module 2 – Electrical Cord Safety
Module 3 – Electrical Safety During Arc Welding/Plasma Cutting
Module 4 – Electrical Safety Working Near Overhead Power Lines
Module 5 – Electrical Safety During Excavations and Trenching

Module 6 – Electrical Safety for Skilled Non-Electrical Worker
Module 7 – Electrical Safety Hazard Awareness Study Guide for Instructors and Students.

Project Area #6 - Controlling Energized Work Hazards

Action: Minimize or eliminate energized electrical work (to the extent practical) to prevent injury and ensure worker safety. Submit recommended best practice to EFCOG ISM WG for posting on Best Practices Web Site.

Result: Developed a conceptual document entitled "Best Practices" for analyzing potential energized work situations to minimize energized electrical work. Included with this approach was a review of the associated permit process for energized work. The permit process contained the following: a compelling reason, system and specific work activity, strict authorization process, and training; as well as NFPA 70E Annex J, *Permitting Process*, and NFPA 70E Annex F, *Hazard/Risk Evaluation Procedure*. Recommendations were submitted to DOE for implementation of improvements to enhance worker protection and posted on EFCOG's Web Site.

Project Area #7 – Consolidation of Ongoing Electrical Safety Activities

Action: Integrate current DOE and contractor electrical safety activities under a single EFCOG umbrella in order to foster consistency in achieving continuous improvement in electrical safety. Included are all current DOE "Sponsored" and "*Ad Hoc*" electrical safety groups involving the participation of DOE and/or contractor employees.

Result: A permanent EFCOG Electrical Safety Task Group was formed. The group held its first meeting in October 2006 at EFCOG's ISM WG meeting in Las Vegas, Nevada. The Project Area #7 team, composed a formal charter, which included transitioning responsibility from the Electrical Safety Improvement Project to the Task Group for on-going efforts, and posted it on the EFCOG's Electrical Safety Web Site.

PROJECT IMPACTS ON DOE ELECTRICAL SAFETY PERFORMANCE

In addition to the efforts made by the project area task teams, a campaign was waged to inform as many stakeholders in the Complex as possible, of the efforts that were taking place. Several briefings to both contractor and DOE representatives were made throughout the project year. A presentation by one of the EISP team members was made to the 2006 Annual DOE Facility Representative Conference, which solicited the support of the Facility Representatives to increase the awareness of electrical safety hazards and proper controls. Results of the direct Project actions and ancillary activities were a measured improvement in all metrics addressing electrical safety. Figure 2 shows that during the course of the Project, total electrical events across the DOE decreased by an average of 33% per month.

The greatest improvement was in the Environmental Management (EM) Program Office. Figure 3 shows an improvement of nearly 50% in the total number of reported electrical events at all EM sites. Especially noteworthy is the reduction in electrical shocks during this period. Figure 4 illustrates this improvement including a particularly outstanding period in which no electrical shocks were reported for seven consecutive months.

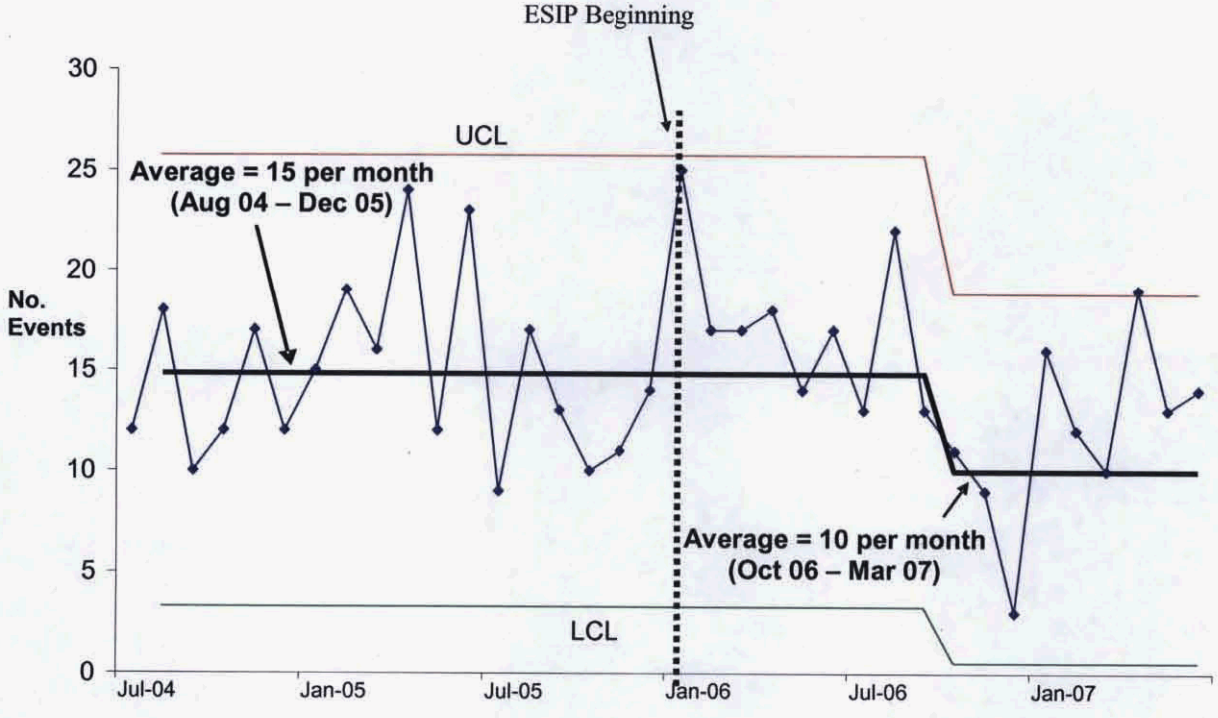

Fig. 2. This chart shows the total number of electrical events the DOE Complex from July 2004 through June 2007. UCL means Upper Confidence Limit and LCL, Lower Confidence Limit.

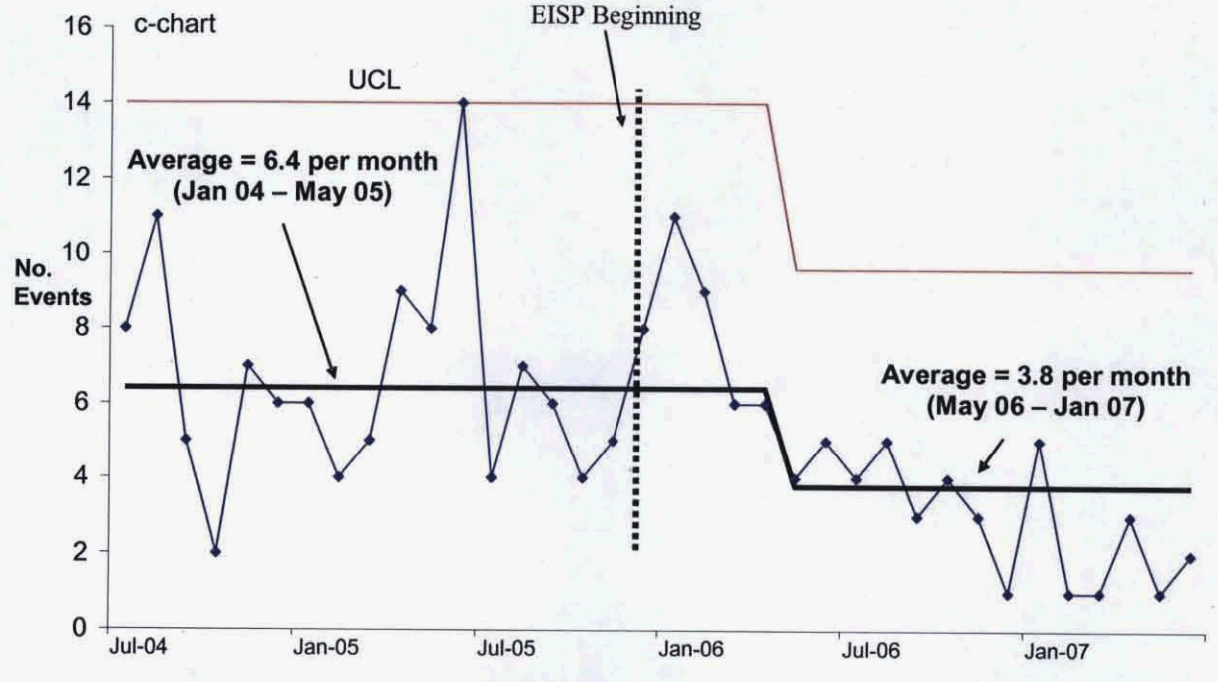

Fig. 3. The total number of electrical events in EM decreased significantly from July 2004 through June 2007.

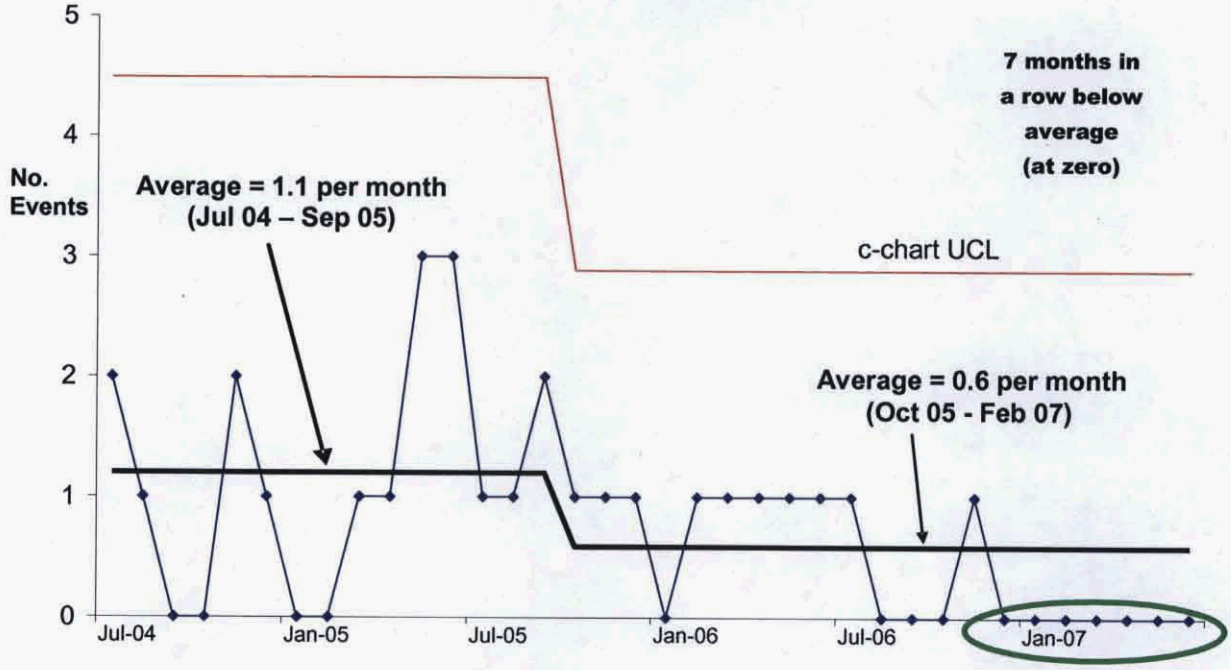

Fig. 4. The number of electrical shocks reported at EM sites from July 2004 through June 2007 also decreased, with no shocks reported for seven consecutive months.

PROJECT SUMMARY

Electrical safety continues to be a top priority for DOE and the contractors working within the DOE scope. The Electrical Safety Improvement Project selected initiatives that addressed a broad range of elements within the electrical safety environment. Tools were provided by the Project team that will educate workers, technical support personnel, and oversight at both the DOE and contractor levels. Other products provided by the Project will ensure electrical events are accurately reported and trended and resources are available to aid in addressing unique electrical challenges within the DOE. Finally, processes were established that will enable continued improvement for the future.

The Project was successful due to the commitment and team spirit of the members involved. Above all, the Project was successful because of the overwhelming support of EFCOG contractor members and DOE Senior Management.

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