Occupational Health and Safety - Program 62

Program Overview

Program Description

Workplace injuries affect employee health, productivity, and job satisfaction and increase the cost of doing business. Efforts to reduce injuries and illnesses, medical costs, and losses in productivity and to improve overall morale are a critical part of electric power company operations. Within the electric power industry, typical risks result from poor ergonomic design in equipment and misguided procedures and long-term or repetitive exposure to various physical agents continue to be a source of injury or illness. Companies must develop strategies for compliance with worker health and safety requirements for reliable, uninterrupted delivery of electricity to customers, in addition to strategies for meeting exposure standards. Regulatory standard setting and rulemaking by the Occupational Health and Safety Administration (OSHA), as well as sister agencies in Canada and the European Union (EU), influence the amount of exposure monitoring, injury prevention and training programs, and engineering controls or best practice guidelines required within the electric sector.

The Electric Power Research Institute’s (EPRI) Occupational Health and Safety program provides scientific research needed to make informed decisions about control methods geared toward workplace injury and illness prevention. Products, tools, and design recommendations that emerge from this research help electric power companies maintain safer, healthier work environments and control labor-related costs. The research identifies injury and illness trends, develops cost-effective ergonomic interventions and designs, and addresses critical occupational exposure issues. The program serves as the foundation for occupational health and safety–related work within the electric utility industry.

Research Value

This program provides the scientific research needed to make informed decisions about regulatory compliance and control methods geared toward workplace injury and illness prevention. Scientific research provides the basis for informed health and safety practices for both the current and anticipated future electric utility infrastructure. The program provides insight into future regulatory deliberations and an integrated approach for occupational planning in the electricity sector based on the integration of health, exposure and surveillance data. Lost productivity and medical costs of occupational injuries significantly contribute to operational costs within the electric power industry. If effectively integrated within the safety management systems of electric power companies, EPRI products and research results may contribute to the reduction of these operational costs.

Approach

This program delivers research, data, analyses, and expertise that help electric power companies effectively address occupational health and safety issues. The program transfers the knowledge through many avenues:

- The Occupational Health and Safety Database annual report, which compiles information on injury and illness rates and statistical analyses drawn from unique, industry-specific data
- Easy-to-read handbooks and instructive DVDs describing ergonomic interventions and design guidelines
- Presentations on ergonomics to industry, the scientific community, and regulatory agencies
- Representation of the electric utility sector on the advisory council for the National Institute for Occupational Safety and Health's National Occupational Research Agenda
- Reports and peer-reviewed literature on toxic and potentially toxic workplace exposures that provide data for guideline setting by OSHA and for compliance with federal and state regulations
Accomplishments

The program provides timely, reliable, and comprehensive solutions to industry-specific research needs and offers practical implementation guidance. Program accomplishments include:

- Worker health and safety improvements through reduced workplace injuries (ergonomic solutions reduced strain and sprain injuries among power plant and line workers);
- Occupational Health and Safety Database annual report allows companies to benchmark injury rates;
- The first ergonomic power plant design handbook, a key reference for design engineers;
- Detailed process guidelines for vehicle acquisition and maintenance and design specifications for fleet vehicles in the electric power industry;
- Analysis of industrial hygiene databases (chemical and physical exposures) available within the electric utility industry.

Current Year Activities

Program R&D for 2013 will focus on refining the injury surveillance database; assessing ergonomics in new work environments including renewable energy resources; characterizing occupational exposure to temperature extremes, noise and hearing loss; and developing a comprehensive, industry-specific exposure database. Specific efforts include:

- Characterization of electric power industry specific work tasks involving high temperature exposures (outdoor/indoor) and laboratory calorimetry assessment of heat stress to provide the scientific basis for occupational guidelines;
- Characterization of ergonomic issues associated with the future power grid and generation infrastructure for development of recommendations on tools, design and training;
- Integration of existing industrial hygiene exposure data from across the electric industry and expansion of the job exposure matrix to include physical, biological and chemical exposures;
- Sector specific characterization and risk evaluation of shift work;
- Industry-specific studies to inform future occupational risk guidelines for sulfur hexafluoride decomposition by-product exposures, for potential integration into substation safety programs;
- Addressing emerging and long-term chronic health effects among electric power industry workers by expanding the EPRI Occupational Safety and Health Database;
- Better quantification and integration of task and occupation specific exposures to inform OSHA rulemaking and sector specific occupational guidelines on noise, heat, trace metals and other emerging exposures.

Estimated 2013 Program Funding

$1.5M

Program Manager

Gabor Mezei, 650-855-8908, gmezei@epri.com
Summary of Projects

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<thead>
<tr>
<th>Project Number</th>
<th>Project Title</th>
<th>Description</th>
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<tbody>
<tr>
<td>P62.001</td>
<td>Occupational Health and Safety Database</td>
<td>This project produces the Occupational Health and Safety Database, a unique source of detailed, comprehensive, standardized injury and illness rates and statistical analyses specifically for the electricity industry. The database is updated with new information from multiple electric companies on an annual basis. An annual report on major injury trends and costs is prepared from information drawn from the database. Reporting, collecting and analysis of near-miss incident could be a useful tool in identifying unsafe work conditions and practices. Piloting of a near-miss incident database will also be explored.</td>
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<td>P62.002</td>
<td>Ergonomics Research</td>
<td>This research determines the role of ergonomic factors in current work tasks and suggests design remedies. Results are expected to control costs due to burden of musculoskeletal injuries. In 2013, this project will address ergonomics issues related to new occupational environments related to renewable energy generation (e.g., wind turbines, solar farms, and biomass plants).</td>
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<td>P62.003</td>
<td>Occupational Exposure and Health Studies</td>
<td>This research investigates relationships among injury and illness occurrence rates, lifestyle factors, and workplace exposures (e.g., heat stress, sulfur hexafluoride decomposition by-products and noise). Current issues include exposure to beryllium, heat stress, and noise. Development of a comprehensive exposure database will also contribute to significant cost savings in exposure monitoring by pooling available industrial hygiene data from participating companies. Exposure characterization and epidemiologic research to address occupational and lifestyle factors potentially associated with injuries and illnesses, and statistical analyses of existing occupational exposure and health information provide further insight.</td>
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P62.001 Occupational Health and Safety Database (101907)

Key Research Question

To maintain a healthy workforce, improve productivity, and control health care costs, electric power companies need access to accurate illness and injury incidence rates and cost impacts. For comprehensive databases, the National Academy of Sciences recommends coding of injury/illness data using standardized procedures and precise, consistent descriptions. Only a comprehensive, industry-specific database containing populated standardized fields from multiple companies provides a robust foundation needed for informed preventive measures.

Approach

Updated annually, the Occupational Health and Safety Database (OHSD) is a unique source for detailed, comprehensive, standardized injury and illness rates across the electricity industry. The OHSD also enables monitoring and evaluation of workforce injury and illness trends and provides a basis for identifying high-risk occupations, quantifying costs and lost time, and setting research priorities. In addition, the database is a powerful tool for benchmarking and safety program evaluation for participating companies. The database is the source of information for tailored analyses for individual electric companies, selective descriptive analyses by injury type or cause in OHSD highlights, and for the Occupational Health and Safety Database Annual Report, providing statistical analyses for the electricity industry. Systematic collection and analysis of near-miss incident reports via non-punitive, confidential and secure reporting system could be a useful tool in identifying unsafe work practices and work conditions. Piloting of a near-miss reporting database will be explored. The...
feasibility work will initially focus the near-miss project on a specific topic e.g. motor vehicle or transmission distribution work.

Impact

- Enables medical cost control by identifying injury trends and tracking related costs
- Contributes to reduction of injury and illness rates
- Supports benchmarking and continual injury monitoring
- Provides information for establishing health and safety program priorities and for estimating the impact of prevention programs
- Directs health and safety research
- Aids in assessment of the effectiveness of injury and illness prevention programs

How to Apply Results

Occupational health and safety staff at participating electric companies will use project information and analyses to monitor and control health care costs, improve health and safety programs, and reduce occupational illness and injury rates. Information from this project can also be used to identify health and safety research gaps

2013 Products

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<thead>
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<tr>
<td>OHSD 2012 Annual Report – Data Years: 1999-2011: This technical report continues a series of reports which provide quantitative, detailed injury and illness incidence rates and strategic economic impacts from trends analyses based on information from the EPRI Occupational Health and Safety Database (OHSD).</td>
<td>04/30/13</td>
<td>Technical Report</td>
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<tr>
<td>OHSD Highlights: This 2013 deliverable will feature some key descriptive data, preliminary incidence rates from the EPRI OHSD in a short communication.</td>
<td>12/31/13</td>
<td>Technical Update</td>
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Future Year Products

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<tr>
<td>OHSD 2013 Annual Report – Data Years: 1999-2012: This technical report continues a series of reports which provide quantitative, detailed injury and illness incidence rates and strategic economic impacts from trends analyses based on information from the EPRI Occupational Health and Safety Database (OHSD).</td>
<td>04/30/14</td>
<td>Technical Report</td>
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<tr>
<td>Feasibility Assessment of a Near-Miss Incident Reporting System: This technical report summarizes findings from a feasibility assessment study to explore the potential ways of how a centralized, confidential and secure near-miss incident reporting system may be developed for the electric power industry.</td>
<td>12/31/14</td>
<td>Technical Report</td>
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<td>OHSD Highlights: This 2014 deliverable will feature some key descriptive data, preliminary incidence rates from the EPRI OHSD in a short communication.</td>
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P62.002 Ergonomics Research (102993)

Key Research Question

Musculoskeletal (strain and sprain) injuries currently account for more than 40% of total medical costs for electric power companies. EPRI statistical analyses found that in just four companies, there was a loss of more than 70 full-time-equivalent employees for one full year owing to these injuries. Reduction of injury rates and associated costs depends on prevention of chronic injuries resulting from inefficient design of tasks, tools, and equipment. Occupational health and safety resources are scarce, benefits of implementing recommended interventions need to be evaluated. Evaluation of existing designs and development of ergonomic interventions are critical for accounting for uncertainty and duration of benefits associated with such programs.

Approach

The aim of this project is to develop specific interventions to prevent chronic injuries resulting from inefficient design of tasks, tools, and equipment. Effective ergonomic interventions can reduce injury rates and associated costs as presented by business cases. The research project will investigate other methods both epidemiologic and economic for evaluation of ergonomics. Research results also provide objective information relevant to inform implementation of ergonomic interventions. In 2013, research will explore industry-wide ergonomics issues in new occupational environments related to renewable energy generation (e.g., wind turbines, solar, biomass).

Impact

- Provides ergonomic evaluation and intervention that can help companies reduce injury rates and associated costs through prevention
- Helps improve worker job satisfaction and productivity
- Helps ensure compliance with ergonomics guidelines and regulations
- Aids in understanding industry-wide ergonomic-related issues relevant to renewables

How to Apply Results

Application of EPRI ergonomics research results can help prevent chronic injuries among electric industry workers through improved work practices and ergonomically designed tools and equipment. These interventions can also help ensure workforce compliance with ergonomics guidelines and regulations. Results from the fleet vehicles project can help electric companies prevent vehicle-related injuries associated with ergonomically poor entry and exit design, seating, and access to parts, tools, and equipment. Implementation of ergonomic interventions requires an investment of time and money; however, many recommended interventions are low in cost.

2013 Products

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<tr>
<td>Ergonomic Interventions Evaluation: This 2013 technical update will summarize methods used for an assessment of measured results in overhead linemen/women ergonomic work.</td>
<td>12/31/13</td>
<td>Technical Update</td>
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<td>Wind Turbine Ergonomics: This wind turbine ergonomics report summarizes findings from several turbine site visits across the electric power industry. The report will describe the industry-wide ergonomic issues facing workers who operate and maintain wind turbines.</td>
<td>12/31/13</td>
<td>Technical Report</td>
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P62.003 Occupational Exposure and Health Studies (055833)

Key Research Question
Adverse health effects can result from occupational exposure to physical and chemical agents (e.g., heat, noise, beryllium, sulfur hexafluoride decomposition by-products). An initial examination of the exposure database may identify future areas of exposure assessment needed within the electric power industry. In anticipation of potentially worker exposures, current occupational exposures to non-welding beryllium sources will be assessed. As temperature extremes (e.g., heat stress in power plants and in areas with hot climate) continue to result in potential health hazards and loss of productivity, EPRI Occupational Exposure and Health Studies project set will quantify heat stress for select worker tasks. Overall, the project set will address several research questions related to physical and chemical agent exposures within the electric power industry.

Approach
Scientific research in this project provides relevant data for protection of worker health, setting standards and guidelines and for developing appropriate strategies to comply with anticipated regulations for exposure to metals (such as beryllium and other toxic substances). Having explored beryllium in welding fumes, we will initiate work on exploring other sources involving potential exposure to beryllium. Work to develop an industry-wide exposure database that captures a wide range of industrial hygiene sampling data is also planned and will form the basis of a job-exposure matrix. Specific focus will be placed on the characterization of physical stressors, including heat stress in various work environments, and noise exposure and hearing loss prevention. Future EPRI program work will characterize shift work within electric utilities, assess the degree of maladaptation, and design possible interventions for these workers.

Impact
- Provides knowledge necessary for developing preventive measures to minimize the health impact of occupational exposures
- Helps ensure compliance with exposure standards
- Offers the opportunity to improve worker health, morale, and productivity
- Reduces health-related costs
- Provides information about health risks associated with power plant occupational exposures that can be used to address proposed regulatory limits and to effectively protect and communicate with workers
- Provides a comprehensive exposure database that will contribute to significant cost saving in exposure monitoring by pooling available industrial hygiene data from participating companies

How to Apply Results
Results from this work can be used to assess potential health risks associated with occupational exposures and to develop preventive measures, including appropriate work practices that electric companies can implement. Electric company occupational health and safety staff also will use results to determine compliance with exposure standards. In addition, results may provide input to exposure standard formulation.

2013 Products

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<td><strong>Exposure Database Pilot Project:</strong> This 2013 product deliverable builds upon previous survey work on the types on industrial hygiene data electric utilities gather. Based upon recommendations made in 2012, this technical update will describe ongoing efforts to combine industrial hygiene data from several electric power utilities.</td>
<td>12/31/13</td>
<td>Technical Update</td>
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<tr>
<td><strong>Evaluation of Heat Stress Risk for Worker Tasks in the Electric Power Industry:</strong> This 2013 product builds upon previous work summarizing literature and identifying highest risk tasks/jobs. The technical update will preview the quantitative aspects of heat stress among electric power workers.</td>
<td>12/31/13</td>
<td>Technical Update</td>
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</table>
Assessment of Potential Beryllium Exposures in the Electric Power Industry: Initiating identification of potential non-welding beryllium sources in anticipation of regulatory changes, this technical update will provide an overview of potential sources of beryllium exposure in the electric power industry.  

12/31/13 Technical Update

Summary of Future Research Needs on Occupational Hygiene Aspects of Sulfur Hexafluoride Decomposition By-products: The technical update will provide a summary proceedings of an expert workshop on future research needs on occupational hygiene aspects of sulfur hexafluoride decomposition by-products in the electric power industry.  

12/31/13 Technical Update

Future Year Products

Shift Work Among Electric Utility Workers: This technical report summarizes findings from a pilot study that monitors human rest and activity cycles and hormone levels to identify workers who appear maladapted to their shift-work schedule. If maladaptation is present among electric utility workers, future work should identify possible factors in daily life to target intervention methods.  

12/31/15 Technical Report

Laboratory Studies on Sulfur Hexafluoride Decomposition By-Products: Based on data gaps identified in the 2013 workshop, further laboratory studies will be developed and conducted.  

12/31/15 Technical Report

Supplemental Projects

Interest Group for Worker Safety Research Trends across Electric Power Generation and Delivery (073470)

Background, Objectives, and New Learnings

As the electric power sector works to continuously improve safety performance, individual companies must manage proactive and responsive safety management systems. However, as inherent safety concerns across the electric power industry require workers to confront a range of challenges, individual companies must promote and manage programs, to maintain and improve procedures and processes doing the same job better and safely. Although existing industry forums exchange current best practices and methods, rarely do such discussions focus on safety-related research, particularly tasks, exposures and environments unique to electric utilities. With the lack of commercially available ('off the shelf') power sector specific safety programs and resources, individual companies are challenged to translate commercial programs and generic safety research to their business.

Driven by factors such as compliance, regulation, reliability and cost considerations, and the expectation of a safe work environment, companies need to create effective methods to establish and maintain safety programs. The programs, imbedded in an organizational culture, benefit both the worker and the company. Ultimately, the public benefits by avoiding indirect costs associated with safety failures and high injury rates.
Project Approach and Summary
Interest group members will guide discussion topics with organizing meetings, conference calls, webcasts, and other means of communication. EPRI will identify external safety experts and industry professionals to present on relevant topics. Potential general areas of interest to be discussed over an initial series of monthly webinars and a scoping forum include the following:

Collaboratively Advance Industry Worker Safety
- Maintain an industry forum including facilitated discussions, presentations, and engagement with industry experts to exchange new ideas identify potential research topics.
- Identify emerging safety issues and discuss common safety challenges with an eye toward solutions.

Understand Safety Priorities and Indicators
- Evaluate industry safety priorities and performance indicators through representative business cases and case studies (including successes and failures).
- Evaluate the utility of risk analysis or cost-benefit methodologies to sector-specific safety management.

Describe Available Methods for Immediate Safety Improvements
- Organize and develop programs based on research outcomes and best practices, focused on improving worker safety performance on key indicators.
- Share or design specific methods to improve and measure worker practices and behavior-based safety failures.

Identify Knowledge Gaps Requiring Safety Research, Technical Developments or New Management Tools
- Discussion will focus on research needs and best practices with potential to be developed into specific safety programs.

Areas of potential group discussion, to help focus research and program development, may draw from external subject matter experts and include the following:
- Behavior-based Safety Strategies – methods, training, monitoring, and evaluation
- Safety Concerns for Renewable Energy (solar, wind) – expansion of traditional worker safety procedures, standard operating practices, and training
- Injury/Illness Prevention Programs – development, evaluation, and action plans
- Safety Training Program Development– tools, best practices
- Linking outcomes from EPRI research with safety-focused programs

Benefits
The goal of the Interest Group for Worker Safety Research Trends is to provide a collaborative forum representing a cross-section of the electric power and safety industries. The electric power industry will benefit by engaging in discussions and sharing information with other safety professionals to develop common strategies for researching and improving worker safety.

Ultimately, the interest group creates business value by highlighting immediate technical improvements, training strategies, tools, performance measures, management and communication strategies, while also identifying areas for future improvement requiring immediate and longer-term research. The interest group will focus on engaging individuals from the electric power and safety industries to highlight areas of immediate and future concern for maximizing and maintaining worker safety throughout the energy sector, and provide mutual benefits to society.
Ergonomics and Worker Safety for Renewable Energy Generation (073469)

Background, Objectives, and New Learnings

Renewable technologies are a rapidly growing source of electricity generation and a key strategy for diversifying generation portfolios. In combination with advances in Smart Grid technology, workers in the electricity generation sector must increasingly respond to changing environmental conditions and tasks, which may or may not match more traditional work settings. In particular, the growth of wind and solar power industries continue to spur concerns about occupational health and safety, chiefly among workers who construct, operate and maintain wind farms and distributed solar systems. In addition, as other technologies advance into application, including larger utility scale solar projects, geothermal or biomass-combustion, understanding the unique working conditions will be required to minimize injury and maintain a trained workforce. While some renewable and Smart Grid technologies are mature, and others still developing, worker safety in this ‘green job sector’ is not well understood. As companies plan and expand into such new renewables projects, they must develop strategies for worker safety and regulatory compliance to protect and maintain workforce.

In the case of wind energy, a unique workforce has emerged with responsibilities for construction, operation, and maintenance of wind farms, and wind turbine productivity is highly dependent on a safe, skilled team of workers. Wind farm technicians are required to ascend towers over 250 feet to perform essential monitoring of turbine operation or respond to turbine fault events, as well as working in constricted environments in the nacelle. The above work environments and practices may pose risk of ergonomic injuries to wind turbine technicians. Similarly, solar construction and maintenance crews may confront similar conditions, working at exposed heights and working in constrained exposed areas. Although using skills from typical construction trades (carpentry, roofing, electrical work), the unique environments add additional lifting, accessibility and safety requirements leading to additional ergonomic challenges. Ergonomic injuries to this workforce could affect operational costs and reliability through influencing renewable energy productivity, requiring training, retraining and hiring of new employees. EPRI research aims to improve worker health and safety within the growing renewable energy sector translating to gains in productivity and decreases in business costs.

Project Approach and Summary

Project participants will work with an ergonomics research team during a 2–3 day site visit. The research team will meet with workers and managers involved in the company’s renewable energy construction, operation, and maintenance programs to develop plans for individual field assessments. At each site, biomechanical measurements will be made on construction, operations and maintenance workers performing designated tasks specific to the individual renewable or smart grid technology. Specific research areas to be accessed and documented include:

- Interview workers, supervisors, and occupational health and/or safety professionals about the specific occupational task requirements and environments of concern;
- Perform biomechanical measurements of workers during specific tasks on site;
- Record physical dimensions, range of adjustability, and technical features which interface with the workers, areas of interest may include work areas with access or restricted clearance such as the nacelle or gear boxes in wind turbines or area setbacks in large photovoltaic solar installations; and,
- Review and discuss with available personnel any related written work procedure manuals or training materials.

The goal of this work is to improve worker safety and understand the potential injury risk related to the implementation of renewable technologies and smart grid integration. The results of this research may result in new suggested work practices, worker training targets and design recommendations.
Benefits
This project will be useful for utilities investing in renewable energy and smart grid technologies. By providing information on relevant ergonomic requirements and current issues with these projects, this work will:

- Evaluate the degree to which technology-specific project equipment, tasks and signage during construction and normal operations may contribute to risk factors for musculoskeletal injury.
- Identify specific ergonomic-related problems that may arise during project construction and operations; the range of project physical configurations; and, grid integration.
- Generate ideas for ergonomic interventions and potential design strategies for future field evaluation. Develop key recommendations for interim and long-term workplace strategies for interventions.