EPRI’s Occupational Health & Safety Research Program

Sharan Campleman, PhD MPH DABT
Sr. Project Manager
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October 9, 2012
EPRI Occupational Health and Safety Research Base Program

Mission
Provide tools that enable our members to maintain a healthy workforce and safe work environment

Occupational Health and Safety

- Occupational Health and Safety Database
- Ergonomics Research
- Occupational Exposure and Health Studies

Employees are the most important asset to any company
EPRI Occupational Health and Safety Research: Base Program 2012

• Occupational Injury Surveillance Database (OHSD)
  – Descriptive detailed injury & cost
• Ergonomic Evaluation & Interventions
  – Fleet vehicles, T&D, Generation
  – Substation & Generation Plant Design
  – Vegetation Management
  – Renewable Energy (Wind turbines)
• Occupational Health & Exposure Studies
  – Industry-wide Job Exposure Database
  – Physical Exposures: Heat Stress, Noise
  – Economic Analysis Programs & Interventions
EPRI Occupational Health and Safety Research: Key 2013 Changes

• Pilot an industry-specific occupational exposure database
  – Integrate welding fume data
• Conduct sulfur hexafluoride workshop
• Evaluate impacts of occupational heat stress
• Develop an economic evaluation plan for hearing protection
• Expand ergonomics to renewables
• Identify safety specific research topics
Planned Research Direction for Program 62

2012 Focus
- OHSD
- Fleet ergonomics
- Heat stress
- Exposure database

2013 Focus
- OHSD
- Exposure database
- Heat stress – field studies, laboratory
- SF₆ workshop
- Economic evaluation of ergonomics interventions
- Ergonomics of renewables

3-5 Year Focus
- OHSD
- Exposure database
- Heat stress - guidelines
- Economic evaluation of interventions
- Workplace near-miss database for electric utility
- Shift work
Summary of 2012 Program Projects

Occupational Health & Safety Database (OHSD)
Occupational Health & Safety Database (OHSD)

- **Monitor injury rates & trends**
  - Standardize data
  - Quantify lost time & cost
  - Identify predictors
  - Strong analytical capability
  - Long-term & industry-wide

- **Data from 18 utilities**
  - >1,700,000 person-years
  - >52,000 recordable & lost-time injuries
  - Time period: 1995-Current

- **Inform Research Agenda**
  - Identify projects
  - Evaluate interventions
  - Trends

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EPRI OHSD Surveillance Program

OHSD Detailed Injury Items:

• Nature of injury (e.g. Sprain/strains, cuts/punctures, burn – flash, burn – chemical, burn – heat/thermal, CTD/RSI, etc)
• Source of injury (e.g. Overexertion, Caught – in, under between, Fall – same level, Fall – between levels, Contact w/ current, etc)
• Body region (e.g. Back/trunk, Neck/shoulders, Knees, etc)

OHSD Detailed Administrative Items:

• Administrative / work time lost
• Injury costs (medical, rehab, etc)
• Occupation, Primary work location
• Base worker population (w/ same detail)
EPRI OHSD Surveillance Program

Benefits

• Assess magnitude of problem on industry level
• Monitor implementation of health programs
• Understand local epidemiology of the problem
• Assess changes in injury trends by age, occupation and location
• Identify specific worker groups at risk
• Assess impacts of intervention programs
• Administrative/cost data for economics & financial metrics
EPRI OHSD Surveillance Program

Reporting Issues

• Additional participant companies
• Logistical constraints (slows analyses)
  – Compiling base population data
  – Changing company contacts
  – Substantial amount data handling, recode, QA required
• Limited time to analyze & report by end of calendar year
Basic descriptive data: Trend analysis over time
EPRI OHSD 1995-2010: Age Specific FTE Loss Rate and Number FTEs Lost by Age Group

<table>
<thead>
<tr>
<th>Age Category</th>
<th>Number of FTEs Lost</th>
<th>FTE Loss Rate per 10,000 Employee-Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 or Less</td>
<td>318.6</td>
<td>12.1</td>
</tr>
<tr>
<td>21-30</td>
<td>606.9</td>
<td>18.0</td>
</tr>
<tr>
<td>31-40</td>
<td>796.0</td>
<td>17.5</td>
</tr>
<tr>
<td>41-50</td>
<td>855.6</td>
<td>15.5</td>
</tr>
<tr>
<td>51-60</td>
<td>12.1</td>
<td>18.0</td>
</tr>
<tr>
<td>61-65</td>
<td>10.9</td>
<td>10.9</td>
</tr>
<tr>
<td>65+</td>
<td>49.8</td>
<td>8.4</td>
</tr>
</tbody>
</table>

Basic descriptive data: Age-specific FTE loss – Absolute vs. Rate
EPRI OHSD 1995-2010: Employees by Location with Available Data

Basic descriptive data: Injury & population occupational data
## EPRI OHSD 1995-2010: Injury and FTE Loss Rate by Select Primary Work Locations

<table>
<thead>
<tr>
<th>Primary Work Location</th>
<th>Injury Rate per 100 Employee Yrs</th>
<th>FTE Loss Rate per 10,000 Employee Yrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Field</td>
<td>4.0</td>
<td>17.3</td>
</tr>
<tr>
<td>Garage</td>
<td>3.2</td>
<td>20.0</td>
</tr>
<tr>
<td>Generation Stations</td>
<td>3.9</td>
<td>13.6</td>
</tr>
<tr>
<td>Other Facilities</td>
<td>6.6</td>
<td>41.9</td>
</tr>
<tr>
<td>Shop</td>
<td>8.1</td>
<td>40.3</td>
</tr>
<tr>
<td>Substation</td>
<td>3.9</td>
<td>26.4</td>
</tr>
<tr>
<td>Transmission and Distribution</td>
<td><strong>10.0</strong></td>
<td><strong>59.4</strong></td>
</tr>
</tbody>
</table>

**Highest injury & FTE rates by work location among T&D workers**
Highest injury rate among welders, meter readers & line workers
## EPRI OHSD 1995-2010: Example Occupation Specific Rates – Line Workers

<table>
<thead>
<tr>
<th>Line Workers</th>
<th>Primary Work Location</th>
<th>Injury Rate by Location per 100 EmpYrs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Other Facilities</td>
<td>40.4</td>
</tr>
<tr>
<td></td>
<td>Transmission &amp; Distribution*</td>
<td>25.8</td>
</tr>
<tr>
<td></td>
<td>Substation</td>
<td>10.8</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Source of Injury</th>
<th>Injury Rate per 10,000 EmpYrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overexertion, Body Motion</td>
<td>346.6</td>
</tr>
<tr>
<td>Fall on same level</td>
<td>105.8</td>
</tr>
<tr>
<td>Struck by</td>
<td>105.2</td>
</tr>
<tr>
<td>Fall to different level / elevation</td>
<td>67.5</td>
</tr>
<tr>
<td>Animal or Insect Bite</td>
<td>52.1</td>
</tr>
<tr>
<td>Striking against</td>
<td>33.3</td>
</tr>
<tr>
<td>Caught in, under, or between</td>
<td>32.8</td>
</tr>
<tr>
<td>Contact with electric current</td>
<td>31.4</td>
</tr>
</tbody>
</table>
Majority OHSD fatalities occur among line workers
Summary of 2012 Program Projects

Ergonomic Design of Fleet Vehicles
Ergonomics & Worker Safety for Renewable Energy Generation

• Ergonomic Research
  – Assesses the risk of musculoskeletal disorders (MSDs) by specific task, tools, materials and equipment
  – Generates possible interventions (training, engineering or administrative)
  – Evaluates the proposed interventions

• Goal
  – Minimize the incidence and severity of injuries
  – Improving productivity and work quality
  – Work force retention

MSDs remain a major cause of worker injury and lost time
EPRI Ergonomics: Past Deliverables

PID 1021128
October 2010

PID 1019014
December 2009
Ergonomic Design of Fleet Vehicles

Background

- $10-$100M annual cost per company
  - Purchase & upfit
- Motor vehicles are major contributors to occupational injuries
- Problems
  - Users not involved at purchase/retrofit
  - Insufficient process for selection and purchase
  - Lack of ergonomics guidelines for fleet vehicle designs

Poor ergonomics → Strains & Overexertion → Injury & Costs
Objective:
Determine design features and worker characteristics for ergonomics design of vehicles in the electric power industry to decrease the risk of acute (fall) or cumulative (MSD) injury to electric utility workers.

Results:
- Sector-specific anthropometry study
- Cab design features
- Aerial bucket truck features
- Variety safety designs (signaling, controls, tool specific storage systems)
2012 Fleet Design Ergonomics Handbook

**Recommendations:** Example for aerial buckets

- Relative utility and ergonomic stress of various step designs
- Relative utility and ergonomic stress various handlebar designs with lab and field studies
2012 Fleet Design Ergonomics Handbooks

Target Audience:
- Fleet manager & personnel
- Operational supervisors & managers
- Health & safety committees

Content includes:
- Design specifications to inform vendor/manufacturer
- Specific design/measures aid development of vehicle request-for-bids (RFB)
- Illustrations and descriptions of solutions
- Best practices for company specific process comparison and prioritization of fleet ergonomic requirements
Summary of 2012 Program Projects

Occupational Exposure and Health Studies
Occupational Exposure and Health Studies

Overview

• Exposure assessment is the process of estimating the magnitude, frequency and duration of exposure to an agent, along with the number and characteristics of the worker population, which can be used in future health studies.
Industry-wide Exposure Database Defined

- Systematic electronic entry of occupational exposure measurements including full documentation of sampling conditions and methods
  - Excel spreadsheet
  - Relational database
Industry-wide Exposure Database:
2012 Phase 1 Project Objectives

- Define current practices in terms of qualitative and quantitative exposure assessment, management of exposure, job description & work process information
- Review best methods for IH data collection and coding
- Define needs of the electric utility industry
- Develop data dictionary
- Evaluate existing exposure databases
- Recommend a path forward

Initial phase and report complete
Final Report
Prepared by:
Mike Van Dyke
National Jewish Health

Product ID: 1023805
August 2012
Industry-wide Exposure Database: 2012-13 Phase 2 Utility Industry

• Follow-up and input on added value and sector requirements
• Develop an exposure database for the utility industry based on specifications
• Provide complete documentation
• Pilot test database attributes
• Provide instructions for importing data from other databases currently in use in the utility industry
• Input existing welding exposure data from a previous EPRI project
Heat Stress and Strain: Relevance to the Electric Power Industry

• No evidence-base to substantiate whether electric power workers experience increases in workplace heat strain

• Increased risk of workplace injury?

• Decreased work productivity or time lost?
Heat Stress and Strain: Research Recommendations

- Research recommendations (University of Ottawa, Dr. G. Kenny, EPRI Report #1023806)
- Continuing laboratory research studies
  - 2013-15
- Potential 2013 Supplemental –
  - Company-Specific Field Studies

Source: University of Ottawa Human and Environmental Physiology Research Unit
Potential New Projects: 2013 and beyond

• Beryllium exposure

• Application and value of research – case reports

• Near-miss surveillance
  – Pilot study
  – EPRI-based reporting system

• Heat stress field visit – supplemental
Addressing Research to Practice

- Highlight the value of individual case reports and lessons learned

- Develop a survey to understand member training needs and barriers to implementation of research results

- Work with experts in development of training materials
Application of Research Findings Case Study: Ergonomics Handbooks

- Examine how companies use the EPRI ergonomics handbooks
- Identify types of workers training methods currently being employed
- Identify alternative methods for increased accessibility of research results
Ergonomics Handbooks Case Study: Project Progression

- Issue final report
  - In September 2013
- Conduct followup interviews
- Analyze data
- Launch survey campaign
  - First reminder
  - Second reminder
- Develop survey questionnaire
  - Design online tool survey
  - Identify respondents

Survey will begin in December 2012
E-mail sent from or on behalf of Gabor Mezei

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Supplemental Projects
Evidence other industries

- Hearing loss / impairment occurring below current OSHA standard
- Damage and loss being observed among workers not enrolled in hearing conservation programs
- Apply newer exposure and dose assessment technology to identify workers, tasks, and/or locations at higher risk
Occupational Exposure to Physical Stressors: Intervention and Prevention - Noise

EPRI OHSD Surveillance: Reported Hearing Loss

– 1995 - 2010: 1,577 reported cases of hearing loss
  • 2.7% total injuries
  • Injury rate: 0.09 per 100 employee-years
  • Company specific range: 0 - 9.9% total reported Injuries
  • Highest rate by occupation (per 10K employee-yrs)
    – Welders 119.6 - Other 48.3
    – Machinists 52.4 - Plant Operators 32.4
    – Maintenance 35.7

– Injuries due to noise exposure higher proportion injuries generation (9.7%) vs. overall (3.9%)

Hearing loss in the electric industry – Current programs effective?
Occupational Exposure to Physical Stressors: Intervention and Prevention

Objectives and Scope

• Evaluate use of novel in-ear dosimeter with built-in feedback system
• Develop intervention strategies for hearing loss prevention
• Examine relationship between in-ear/ambient noise levels and injury

Value

• Reduce hearing loss and worker compensation costs
• Assess leading indicator of noise-induced hearing loss and workplace injuries
• Incorporates in-ear dosimeter as part of PPE training

Details and Contact

• $50,000 per site visit
• Qualifies for TC/SDF

Gabor Mezei
• gmezei@epri.com (650)855-8908

SPN Number: 1023338

Reduction of noise-induced hearing loss and injuries
EPRI OH&S Program Ergonomics Portfolio

- Long-term Project
- Experienced Team
  - Marquette University
    - Methods development
    - Laboratory/engineering
  - Ergonomics Solutions LLC
- Description
  - Field observation/measures
- Analysis
  - Laboratory reconstruction
  - Intervention analysis
- Recommendations/Evaluation
  - Task specific tools & training
  - Design changes
EPRI OH&S Program Ergonomics Portfolio

Long-Term Ergonomics Research
- Overhead distribution workers
- Underground manhole/vault workers
- Underground direct-buried cable workers
- Generating station electricians
- Generating station operators & mechanics
- Fleet vehicles

Recent Field Study 2011
- Wind Turbines - Construction & Maintenance

Expand
- Additional Wind Sites - Construction & Maintenance
- Solar Sites – Installation, Tie-in & Maintenance
Translation of Ergonomic Research Program to Renewable Energy Sources

Opportunities

• Evolve current projects, expertise & tools
• Take advantage of utilities with track history of research involvement
• Target proactive utilities with full participation of management and labor
• Access to utility industry knowledge base to identify innovative technologies

Protect workers & inform developing safety regulation
Translation of Ergonomic Research Program to Renewable Energy Sources

Challenges

• Intersection of traditional & non-traditional work force
• Integrating best practices, training & intervention with contractors & other groups
• Traditional utilities vs. renewable technology companies
• Regulatory agency OH&S cross jurisdiction (OSHA vs. Coast Guard) and relative experience renewables
• Geographic influenced variation manufacturing standards (e.g. EU turbines) vs. safety requirements

Current safety regulation & standards may not be representative
Ergonomics for Wind Turbine Technicians

• Wind Power Maintenance tasks
  – Inspection
  – Oil exchange and filtering
  – Parts removal and replacement
  – Blade cleaning
  – Pylon maintenance

• Wind Turbine Technicians Risks
  – Repeated climbing
  – Tool carrying
  – Limited work space
  – Multiple opportunities for injuries
Field Observation & Measurement of Tasks Posing High MSDs Risk

- Select Examples
  - Climbing fixed ladders
  - Inspecting the gear box
  - Kneeling on grated surfaces
  - Storing and transporting hand tools
  - Transporting oil from the ground to the nacelle

Increases due to high repetition, working at height & limited space
Laboratory Follow Up & Test Intervention Measures

• Select Examples
  – Climbing fixed ladder with climbing tool
  – Testing climbing gear & safety devices under field physical parameters
  – Grip/force requirements for high use tools under field physical parameters
  – Minimal hatch size or clearance areas around components requiring regular maintenance

Experimental analyses to support intervention and design
Wind Turbine Design Features - Problematic or Desirable Based on Ergonomic Risk

- Examples problem areas identified in single field study to date
  - Hatch fasteners
  - Head clearance in nacelle
  - Horizontal clearance in nacelle
  - Entering / exiting the hub
- Issues identified
- Measures and recommendations
- Need additional work scenarios for comprehensive ergonomic best practices and design recommendations

Positive & negative design aspects identified — More work needed
Ergonomics and Worker Safety for Renewable Energy Generation

Objectives and Scope

• Unique workforce health and safety challenges with construction, operation and maintenance of renewable energy

• Target key factors for injuries such as biomechanics, equipment, tasks and signage

• Identify specific ergonomic problems related to specific physical configurations or tasks

Value

• Develop key interim & long-term workplace strategies for prevention of musculoskeletal diseases

• Minimize risk of injuries related to renewable operation and construction

Details and Contact

• $50,000 per site visit

• Qualifies for TC/SDF

Gabor Mezei

• gmezei@epri.com (650)855-8908

SPN Number: 1025607

Target risk factors to prevent worker injuries
Interest Group for Worker Safety Research

Why an Interest Group?
• Identify current safety concerns
• State of the science
• Data needs for the sector

How EPRI programs can help?
• Cross sector work
• Focus future research projects

How companies can help?
• Active participation
  – Webcasts, presentations & program support

Collaborative targeted research for the electricity sector
IGWS Discussion & Topics

Safety in your company
• What are the safety drivers in your company?

Potential IGWS Topics
• Transportation
• Injury & Illness Protection Programs
• Economic analysis for program support
• Behavior-based intervention or training programs
• Specific technology improvements – integration with worker training

Case studies to share
• What have you tried? Successes & failures?
IGWS Activities

• Monthly Webcasts 2012 (Open to All)
  • Initiated June 2012 (2nd Tuesday)

• Monthly Webcasts 2013 (Members Only)
  • 2013 EPRI Portfolio SPN#1025608
  • $15K or Membership in EPRI P62

• Annual Safety Workshop 2013
Interest Group for Worker Safety Research Trends Across Electric Power Generation and Delivery

Objectives and Scope
• Facilitate an industry forum for improving worker safety performance
• Identify common strategies for researching and improving worker safety
• Monthly webinar discussions (member led with external experts) and annual workshop

Value
• Identify worker safety issues requiring additional collaborative research
• Identify topics and exchange data to improve industry specific safety performance

Details and Contact
• Price: Included EPRI Program 62 or $15K per company
• Qualifies for TC/SDF
Sharan Campleman
• scampleman@epri.com 650-855-2331
SPN Number: 1025608

Collaborative safety forum for the electric power industry
Questions?

Sharan Campleman
scampleman@epri.com
650.855.2331