A Constructive Ergonomic Guide for Risk Management

Presented by
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A CONSTRUCTIVE ERGONOMIC GUIDE FOR RISK MANAGEMENT
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10/16/2014

Topics
• Basic Ergonomics
• What is Ergonomics?
• Risk Factors
• CTDs
• Ergo Cost Model
• Design principles and Basic Ergonomic Program
• Job Rotation
• What is Correct
• Why it is Beneficial
• OCRA analysis
• Summary

What is Ergonomics?
“Ergonomics (or human factors) is the scientific discipline concerned with the understanding of the interactions among humans and other elements of a system, and the profession that applies theoretical principles, data and methods to design in order to optimize human well being and overall system performance.” IEA 2000

Ergos = Work
Nomos = Law or Norm

Ergonomic Risk Factors

Repetition
Force
Posture

Ergonomic Force Guidelines:
- Forces are exerted with both hands (lifting, pushing, pulling, or carrying):
  \[ \leq 10 \text{ lbf (44.5 N)} \]
- Forces are exerted with one hand (lifting, pushing, pulling, or carrying):
  \[ \leq 6 \text{ lbf (26.7 N)} \]
- Forces are exerted with one thumb (lifting, pushing, pulling, or carrying):
  \[ \leq 5 \text{ lbf (22.2 N)} \]
- Pinch/grip force exerted to assemble, grasp, pull, push, or hold:
  \[ \leq 6 \text{ lbf (26.7 N)} \]
Risk Factors

Repetition
- Number of times, or amount of time, a muscle group is active during a task
- Performing the same acts or motions over and over again
- Operation cycle time less than 60 seconds

Repetitive Movements
Repetitive Cycle
Repetitive Work

Force
- Amount of physical effort required to perform an action or movement

Posture
- Refers to the position of the body, limb, or body segment when performing an action
- One or more joints that have a different angle than what is considered neutral

Normal range of population variation (± 1SD)
(CHAFFIN AND ANDERSSON, 1991)
Other Risk Factors

- Contact Stress (pounding on parts, resting on sharp edges, etc.)
- Static Load/Posture (staying in one position for long periods of time)
- Vibration
- Noise
- Cold Temperatures

Personal Factors

- Rheumatoid Arthritis
- Endocrinological Disorders (diabetes, etc.)
- Acute Trauma (bruises, laceration, etc.)
- Gender
- Pregnancy
- Surgery

Why is Ergonomics Important

<table>
<thead>
<tr>
<th>Resources</th>
<th>Engineering Changes</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design</td>
<td>Strategy</td>
<td></td>
</tr>
<tr>
<td>Technical Information</td>
<td>Team Work</td>
<td>Lower Cost</td>
</tr>
<tr>
<td>New Idea Design Phase Starts</td>
<td>Idea Brought To Life</td>
<td>Workstation with out any injury or illnesses</td>
</tr>
<tr>
<td>Proactive Product Design</td>
<td>Design for Manufacturing</td>
<td>Reactive Production Assembly</td>
</tr>
<tr>
<td>Cost</td>
<td>Influence Level</td>
<td></td>
</tr>
<tr>
<td>Direct</td>
<td>Indirect</td>
<td></td>
</tr>
</tbody>
</table>

Ergonomic Risk Factors: Hierarchy of Controls

- Repetition
- Force
- Posture

Repetition

Design/Engineering Controls:
- Task analysis
- Task composition
- Task design

Administrative Controls:
- Work hardening
- Programmed breaks

Force

Design/Engineering Controls:
- Product design
- Workstation and equipment design

Administrative Controls:
- Work hardening
- Programmed breaks

Posture

Design/Engineering Controls:
- Workstation design
- Environment design

Administrative Controls:
- Work hardening
- Programmed breaks

Why is Ergonomics Important

CTD’s or WMSD’s
MSD's (Musculoeskeletal Disorders)

WMSDs are work-related injuries and disorders of the musculoskeletal system, which includes the muscles, tendons, tendon sheaths, nerves, bursa, blood vessels, joints and ligaments. WMSDs have been related to various ergonomic risk factors, including, but not limited to:

- repetitive, forceful, or prolonged exertions
- frequent or heavy lifting, pushing, pulling, carrying of objects
- fixed or awkward work postures
- local or whole-body vibration
- cold temperatures
- work organization (e.g. task variability, work rate)

Also referred to as:
- Repetitive Strain Injuries
- Cumulative Trauma Disorders
- Repetitive Motion Disorders
- Etc.

KEY POINT = develop gradually over weeks, months, and years from exposure to repetitive, awkward, and/or forceful tasks.

Also referred to as:
- Repetitive Strain Injuries
- Cumulative Trauma Disorders
- Repetitive Motion Disorders
- Etc.

Development of a MSD

Phase 1:
- Symptoms are present when performing certain activities, and disappear when the body part is not in use.
- Does not affect productivity, movement, or force of the person.
- It can be present for weeks, months, or even years.

Phase 2:
- Symptoms are present even when the body part is not in use.
- Productivity and force are reduced.
- It can be present for weeks, months, or even years; but may not be reversible.

Phase 3:
- Symptoms increase and are present 24/7.
- Productivity, movement, and force are decreased.
- Not reversible, usually requires surgery to get relief.

MSD’s (Musculoeskeletal Disorders)

- Tendonitis
- Carpal Tunnel
- DeQuervain’s
- Rotator Cuff
- Back Disorders
COST OF ERGONOMICS

Indirect Costs related to Poor Ergonomics

- Productivity loss
- Overtime
- Time for incident investigation
- Maintenance and update of the case
- Worker replacement
- Scrap
- Low self-esteem and work environment impact

For every incident cost, there is a higher indirect cost:

- From $1 to $5 indirect cost for every $1 of direct cost (*Liberty Mutual, 1998)

Cost of CTDs

CTD (WMSD's) injuries can get very expensive:

<table>
<thead>
<tr>
<th>Direct Cost ($)</th>
<th>Indirect Cost ($)</th>
<th>Total Cost ($)</th>
<th>Profit Margin of Program (%)</th>
<th>Maximum Potential Impact on Revenue ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,000</td>
<td>4,500</td>
<td>5,500</td>
<td>5</td>
<td>110,000</td>
</tr>
<tr>
<td>4,000</td>
<td>6,400</td>
<td>10,400</td>
<td>5</td>
<td>308,000</td>
</tr>
<tr>
<td>7,000</td>
<td>8,400</td>
<td>15,400</td>
<td>5</td>
<td>308,000</td>
</tr>
<tr>
<td>10,000</td>
<td>11,000</td>
<td>21,000</td>
<td>5</td>
<td>420,000</td>
</tr>
</tbody>
</table>

According to the ‘Safety Pays’ program for US:

<table>
<thead>
<tr>
<th>Direct Cost Range</th>
<th>Indirect Cost Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>$0 - $2,999</td>
<td>4.5</td>
</tr>
<tr>
<td>$3,000 - $4,999</td>
<td>1.6</td>
</tr>
<tr>
<td>$5,000 - $9,999</td>
<td>1.2</td>
</tr>
<tr>
<td>$10,000 or more</td>
<td>1.1</td>
</tr>
</tbody>
</table>
Ergonomic Assessment:

**Costs**

Costs Related Incidents:

Actual Shoulder Injury (End of line workstation, related to bad design, height, reach, and force exceeded design guidelines)

<table>
<thead>
<tr>
<th>Incident</th>
<th>Direct Cost</th>
<th>Indirect Cost</th>
<th>Total Cost</th>
<th>Profit %</th>
<th>Revenue Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shoulder Injury</td>
<td>$17,785.00</td>
<td>$19,563.50</td>
<td>$37,348.50</td>
<td>5.0%</td>
<td>$746,970.00</td>
</tr>
</tbody>
</table>

The direct costs in the calculation are only the ones reported in WC.
Ergonomic Design Criteria

Factors:
- Heights
- Reach
- Force Exertion
- Torque
- Level
- Frequency of movements
- Body part
- Duration of task
- Flexion

Ergonomic Analysis Tools

Basic Ergonomics Program Structure

Production (Reactive Ergonomics)
- Ergonomic Team
- Ergonomic Investigation
- Tools:
  - Vعلا
  - WCOH Lifting Equation
  - Energy Expenditure
  - HAL
  - Strain Index
  - REBA
  - OCRA
  - OQSSPP
  - Job Rotation (Rotation Paths)
  - Stretching Exercises
  - Buyoffs

Training
- Specific Ergonomics Training to different functional groups
- Management
- Engineers
- Supervisors
- Team Members

Office Ergonomics
- Training
- Analysis for cases with illnesses or complaints

Rotation

They rotate every 30 minutes
Rotation

• Rotation should vary the different level of risk on different body parts

• Good Job Rotation Path Requirements
  • Absolute minimum of 4 jobs in a rotation cell (8 or less hours shifts)
  • Recommendation is to have 8 – 12 jobs in a rotation cell
  • If jobs need to be removed from a rotation path due to RTW, restrictions, etc.
    • As long as # Healthy Workers - # Injured Workers ≥ 4 (for jobs in the rotation path), then the injured operator can be accommodated
  • If it comes out less than that, the injured operator cannot be accommodated

Good Rotation Path

Deficient Rotation Path

Job Rotation

• Maximum job rotation frequency/cumulative time spent at one station/job should be 2 hours per day
• Job ratings for specific body parts/muscle groups associated with the task should be identified by applicable and validated risk assessment tool to help create the job rotation schedule
• Each job rotation cell should consist of a minimum of 4 jobs (a higher target of 8 jobs is recommended for optimal performance)

Exceptions

• There are some cases where it is not possible to implement a job rotation schedule:
  • Jobs where pay grades or union agreements prevent adequate rotation paths
  • Areas where there is no variation (or not enough variation for adequate rotation paths) on body parts and their level of risk.
  • For specialized/skilled operations (skilled trade, welding, etc.).
• A break schedule can be implemented instead:
  • At least 5 minutes of stretching at the beginning of the shift
  • 2 - 4 minute breaks for every hour of work with stretching focused on the body parts being used at the specific station
  • At least 5 minutes of stretching at the end of the shift
Risk Reduction by Break vs. Rotation

<table>
<thead>
<tr>
<th>Hours of shift, no programmed breaks except 30 minutes for breaks</th>
<th>Level of risk exposure at station</th>
<th>Summary of risk exposure for work duration of 10 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 hours shift, 30 minutes for breaks</td>
<td>30.3</td>
<td>4.4</td>
</tr>
<tr>
<td>8 hours shift, with natural breaks (break every 2 hours for breakfast and 30 minutes for lunch)</td>
<td>8.8</td>
<td>7.5</td>
</tr>
<tr>
<td>8 hours shift with the program breaks of 20 minutes for breakfast and 20 minutes for lunch, plus a programmed break (1.5 minutes) for stretches every hour</td>
<td>6.2</td>
<td>5.1</td>
</tr>
<tr>
<td>Hours of exposure throughout the day with no breaks</td>
<td>5.4</td>
<td>4.4</td>
</tr>
<tr>
<td>Hours of exposure throughout the day with programmed breaks (1.5 minutes every hour)</td>
<td>1.8</td>
<td>1.7</td>
</tr>
<tr>
<td>Mean exposure, based on Ergonomic Rotation (cumulative)</td>
<td>2.8</td>
<td>2.1</td>
</tr>
</tbody>
</table>

Job Rotation Worksheet

Let’s analyze a rotation path!

Summary

Incident with an Injury/illness

- Ergonomic: Muscle strain, Papelitis, Carpal Tunnel, Tendonitis
- Pre-existing Personal (Arthritis, Rheumatoid Arthritis, Sprain, Strain, etc.)
- Non-Ergonomic: Muscle strain, Papelitis, Carpal Tunnel, Tendonitis

Ergonomic Investigation

- With validated risk assessment tools: RULA, OCRA, Sue Rodgers, NIOSH Lifting Equation, etc.

Follow-up: NIOSH or equivalent process to solve the case.

Risk corresponding to Injury/illness

- No risk corresponding to injury/illness
- Risk level corresponding to injury/illness

Job requires intervention

Thank you all from the Ergo Team

Monica Maria Parag
Thanks!!!

Comments or Questions?!?

"It’s an ergoaccess keyboard. Once you learn how to use it, it will increase your speed by six times!"

If you would like to discuss an issue, please don’t hesitate to contact us!