Ergonomics Design for Engineers

By: Chris Shulenberger, MS Engr., CPE
    Darryl Griffiths, MA OTR, CPE
    Gopal Ramachandran, MSIE, CPE

Clayton Group Services
- a Bureau Veritas Company
Agenda

- Objectives and DFx training overview
- Logistics structure
- Background and reasoning
- Content and applications
- Flexibility and dynamics
• METWA Specifications
• Ergo Design for Engineers Training
• Corporate Engineering Standards
• Safety Improvement Teams
• Job specific training
• Standard Operating Procedures
Business Reasons for Dfx Training

DFx training leads to:
- Improved existing and future workstation design
- Increased workstation efficiency
- Reduced mismatches in man/machine interface
- Learning how to avoid common ergonomics problems
- Improvements in productivity and process reliability
Course Objectives

- Understand common principles of ergonomic job design
- Identify and quantify ergonomics risk factors
- Prioritize jobs for improvement
- Specify ergonomics design guidelines/criteria
- Complete a value-added project
Course Logistics at Genentech

- Departmental request
- Instructor lead training
- Target audience – Engineers and Project Managers
- Site specific slides with department examples
- 2 classes, 4 hours each, separated by 2-4 weeks

Reference Materials Provided:
- Power point presentation
- Participant Training Manual
- Design Guidelines
- Workstation Checklists
Course Structure

- Session 1: (4 hours)
  - Introduction and Goals
  - WMSDs and Ergonomics Risk Factors
  - Overview of Product Life Cycle, DFx Concepts, Problem Solving & Evaluation Tools
  - Review of Basic Anthropometry and Human Physical Capabilities and Limitations
  - Overview of Workstation Design Guidelines
  - Manual Material Handling Analysis
  - Project Initiation and Planning Forms
Course Project

1. Select a process or product for evaluation and improvement

2. Evaluate the process or product using the ergonomics assessment tools and checklists

3. Develop improvement options

4. Describe the implementation plan
Course Structure

Session 2: (4 hours)

- Project Presentations and Discussion
- Discussion of Department Specific Hand Tools (eg, pipettes)
- Cost Justifying Ergonomic Improvements
- Ergonomics Resources: On-website, on internet, within Genentech EHS/Health Services
Module 1 – Example
Optimizing Performance

Optimal Design

Worker Health & Safety
Quality
Productivity

Design Mismatch

Hassle
Discomfort
Pain
Injury
Disability
Module 2

*Work Related Musculoskeletal Disorders & Ergonomics Risk Factors*
Risk Management

- Risk factors
  - Posture, Force, Frequency and Duration
- Control of risk factors
  - Engineering, Administrative and Behavior control
- Implemented by any one of them
  - Employee, Supervisor / Manager, Job Designer
Module 3

Product Life Cycle & Design,
Ergonomics Problem Solving &
Evaluation Tools
Product or Process Life Cycle

1. Design or process request initiated & scope determined
2. Initial Approvals of Conceptual Design with feedback
3. Detailed process layout / product design performed
4. Final review, validation & approval of drawings / permits
5. Construction & Installation
6. Feedback for current and future process / product improvement
Injuries are being reported

Analysis of work area shows Musculoskeletal Disorder (MSD) risk factors

Workers report discomfort, or excessive fatigue in a body part

Parts being damaged

Quality problems exist

Reliability problems exist
Module 4

Industrial Ergonomics
Assessment Tools
Application Tools

- Process Evaluation Tool
- Ergonomics Improvement Process Form
- Strategies Evaluation Matrix
- DFx think list
PROCESS EVALUATION TOOL (PET)

**Form Legend**
- **Sequence #**
- **Score Value**
  - High = 3
  - Medium = 2
  - Low = 1

**Sequence #**

<table>
<thead>
<tr>
<th>Process step</th>
<th>Posture</th>
<th>Force</th>
<th>Repetition</th>
<th>Difficulty</th>
<th>Score = P x F x R x D</th>
<th>No Value Added</th>
</tr>
</thead>
<tbody>
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</table>

Score Value

- High = 3
- Medium = 2
- Low = 1
### Risk Factor Thresholds

<table>
<thead>
<tr>
<th>BODY PART</th>
<th>POSTURE</th>
<th>FORCE</th>
<th>FREQUENCY</th>
<th>DURATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>NECK</td>
<td>Bent forwards $&gt;30^\circ$; backwards; sideways; twisted $&gt;20^\circ$</td>
<td>$&gt;2$lb</td>
<td>$\geq 2$ /min</td>
<td>$\geq 10$ secs</td>
</tr>
<tr>
<td>SHOULDER</td>
<td>Behind the back; $\geq 45^\circ$ forward or to the side; shoulders shrugged</td>
<td>$\geq 10$lb lift; push or pull</td>
<td>$\geq 2$ /min</td>
<td>$\geq 10$ secs</td>
</tr>
<tr>
<td>ARMS / ELBOWS</td>
<td>Rotated forearm; full extension</td>
<td>$\geq 10$lb lift</td>
<td>$\geq 2$ /min</td>
<td>$\geq 10$ secs</td>
</tr>
<tr>
<td>WRISTS / HANDS / FINGERS</td>
<td>$&gt;45^\circ$ flexion/extension; radial or ulnar deviation</td>
<td>$\geq 2$lb pinch grip or finger press; $\geq 10$lb power grip</td>
<td>$\geq 30$ /min</td>
<td>$\geq 10$ secs</td>
</tr>
<tr>
<td>BACK</td>
<td>Twisted; bent forward $&gt;20^\circ$; bent sideways or extended</td>
<td>$\geq 25$lb</td>
<td>$\geq 2$ /min</td>
<td>$\geq 10$ secs</td>
</tr>
<tr>
<td>LEGS / KNEES / FEET</td>
<td>Squat, kneel, 1 foot</td>
<td>$&gt;10$lb foot pedal</td>
<td>$\geq 2$ /min</td>
<td>$\geq 30%$ of day</td>
</tr>
</tbody>
</table>

**Difficulty:** any task that is complex, subject to decision errors, confusing or completed with restricted sensory input (e.g., can’t see hands)
# Ergonomics Improvement Process Form

**Task:**
**Analyst:**

**Risk Factors and the Source:**
Step through each of the risk factors noted for each body part and decide whether the risk factor is present. For each risk factor, note what portion of the job is the source of the risk. In the next column you will develop improvement ideas.

**Location:**
**Product:**

**Improvement Ideas:**
List options for improving the task you are analyzing here. Some generic ideas have been provided on the right side of this column to get you started. You should ask employees, supervisors, mechanics, and other people associated with this job about what can be done to change the source of the risk in order to make the job better.

### Neck

<table>
<thead>
<tr>
<th>Source of Risk</th>
<th>Improvement</th>
<th>Ideas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Posture:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frequency:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Force:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Duration:</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- □ Raise/Lower Work surface
- □ Improve Line of Sight
- □ Postural breaks

### Shoulders

<table>
<thead>
<tr>
<th>Source of Risk</th>
<th>Improvement</th>
<th>Ideas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Posture:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Force:</td>
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<td></td>
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<tr>
<td>Frequency:</td>
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<tr>
<td>Duration:</td>
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</tr>
</tbody>
</table>

- □ Power Tool
- □ Different Tool
- □ Counter Balance
- □ Mechanical Assist
- □ Layout Changes
- □ Tilted Work Surface
- □ Improve Heights

### Arms/Elbows

<table>
<thead>
<tr>
<th>Source of Risk</th>
<th>Improvement</th>
<th>Ideas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Posture:</td>
<td></td>
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<tr>
<td>Force:</td>
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<td>Frequency:</td>
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<tr>
<td>Duration:</td>
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</tbody>
</table>

- □ Power Tool
- □ Different Tool
- □ Improved Tool
- □ Arm Rests
- □ Layout Changes
- □ Eliminate Task
- □ Angled Tool Grip
# Ergonomics Strategies Evaluation Matrix

**Department:**
**Job:**
**Analyst:**
**Date:**
**Location:**
**Product:**

<table>
<thead>
<tr>
<th>Evaluation Criteria</th>
<th>Options Being Considered:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>1. EFFECTIVENESS (H, M, L) (reduction of risk factors)</td>
<td></td>
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<tr>
<td>Short Term</td>
<td></td>
</tr>
<tr>
<td>Long Term</td>
<td></td>
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<tr>
<td>2. COST /ROI (H, M, L)</td>
<td></td>
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<tr>
<td>Initial</td>
<td></td>
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<tr>
<td>Ongoing</td>
<td></td>
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<tr>
<td>3. EASE OF IMPLEMENTATION (H, M, L)</td>
<td></td>
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<tr>
<td>Easy, Medium, Difficult</td>
<td></td>
</tr>
<tr>
<td>4. IMPACT ON OTHERS (H, M, L)</td>
<td></td>
</tr>
<tr>
<td>(e.g., Safety, Maintenance)</td>
<td></td>
</tr>
<tr>
<td>5. IMPACT ON PRODUCTIVITY (H,M,L)</td>
<td></td>
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<tr>
<td>(+, neutral, -)</td>
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<tr>
<td>6. ADDITIONAL COMMENTS</td>
<td></td>
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</tbody>
</table>

Employers may want to define their definition of each in more detail: H= High, M=Medium. L= Low
Case Study - Task Observation

Genentech Packaging Video Analysis

Shipper Loader
Case Study– Shipper/loader

Isometric profile: provided by AnybodyCAD
Task Observation – Shipper/loader

Side profile: provided by AnybodyCAD
Controls Used:

**Short Term (30 days):**
- Body mechanics training and stretching
- Job rotation and adequate staffing
- Encourage early reporting of discomfort
- Provide platforms for shorter workers if lines remain same height

**Medium Term (1-6 months):**
- Reconfigure the shipper loader line to reduce reach (next shutdown)

**Long Term (> 6 months):**
- Design system to minimize manual handling
- Automation
Results

• Body mechanics training implemented
• Moved line 4” closer to reduce reach
• New line will be automated

Payback: ROI to be tracked
- reduced labor
- increased productivity
- reduced injuries
Flexible and Dynamic

- Adaptable to any industry
- Easy to customize
- Highly interactive
- Value-added projects completed
Questions

It's QUESTION TIME!!

Contact:  (925) 426-2691
Chris.Shulenberger @ us.bureauveritas.com