# **Ergonomics Design for Engineers**

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- a Bureau Veritas Company



- Objectives and DFx training overview
- Logistics structure
- Background and reasoning
- Content and applications
- Flexibility and dynamics



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. <u>Select</u> a process or product for evaluation and improvement
- 2. <u>Evaluate</u> the process or product using the ergonomics assessment tools and checklists
- 3. Develop <u>improvement options</u>
- 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



## 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**



## **Design Related Issues**

- 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





## **Risk Factor Thresholds**

BODY PART	POSTURE	FORCE	FREQUENCY	DURATION
NECK	Bent forwards>30°; backwards: sidewaws: twisted	> 21b	≥2/min	≥10 secs
	>20°			
SHOULDERS	Behind the back;	≥101b lift; push or pull	≥ 2 /min	≥10 secs
	≥45° forward or to the side;			
	shoulders shrugged			
ARMS/ELBOWS	Rotated forearm;	≥ 101b lift	≥ 2 /min	≥10 secs
	full extension			
WRISTS / HANDS	>45° flexion/extension; radial	≥ 21b pinch grip or finger	≥ 30 /min	≥10 secs
/ FINGERS	or ulnar deviation	press; ≥ 101b power grip		
BACK	Twisted; bent forward >20°;	≥ 251b	≥ 2 /min	≥10 secs
	bent sideways or extended			
LEGS/KNEES/	Squat, kneel, 1 foot	>101b foot pedal	≥ 2 /min	≥30% of day
FEET				-

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: Location: Product:

#### **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.

#### 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	Source of Risk	Improvement	Ideas
Posture:			Raise/Lower Work surface
			Improve Line of Sight
Frequency:			Postural breaks
Force:			
Duration:			
SHOULDERS	Source of Risk	Improvement	Ideas
Posture:			Power Tool
			Different Tool
Force:			Counter Balance
			Mechanical Assist
Frequency:			Layout Changes
			Tilted Work Surface
Duration:			Improve Heights
ARMS/ELBOWS	Source of Risk	Improvement	Ideas
Posture:			Power Tool
			Different Tool
Force:			Improved Tool
			Arm Rests
Frequency:			Layout Changes
			Eliminate Task
Duration:			Angled Tool Grip



#### ERGONOMICS STRATEGIES EVALUATION MATRIX

Department:		
Job:		
Analyst:		

Date: Location: Product:

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

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

Clayton Group Ergonomics Ergonomics Strategies Evaluations Matrix

## Case Study - Task Observation

### **Genentech Packaging Video Analysis**



## Case Study– Shipper/loader



Isometric profile: provided by AnybodyCAD





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







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