

Ergonomics Design for Engineers

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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 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

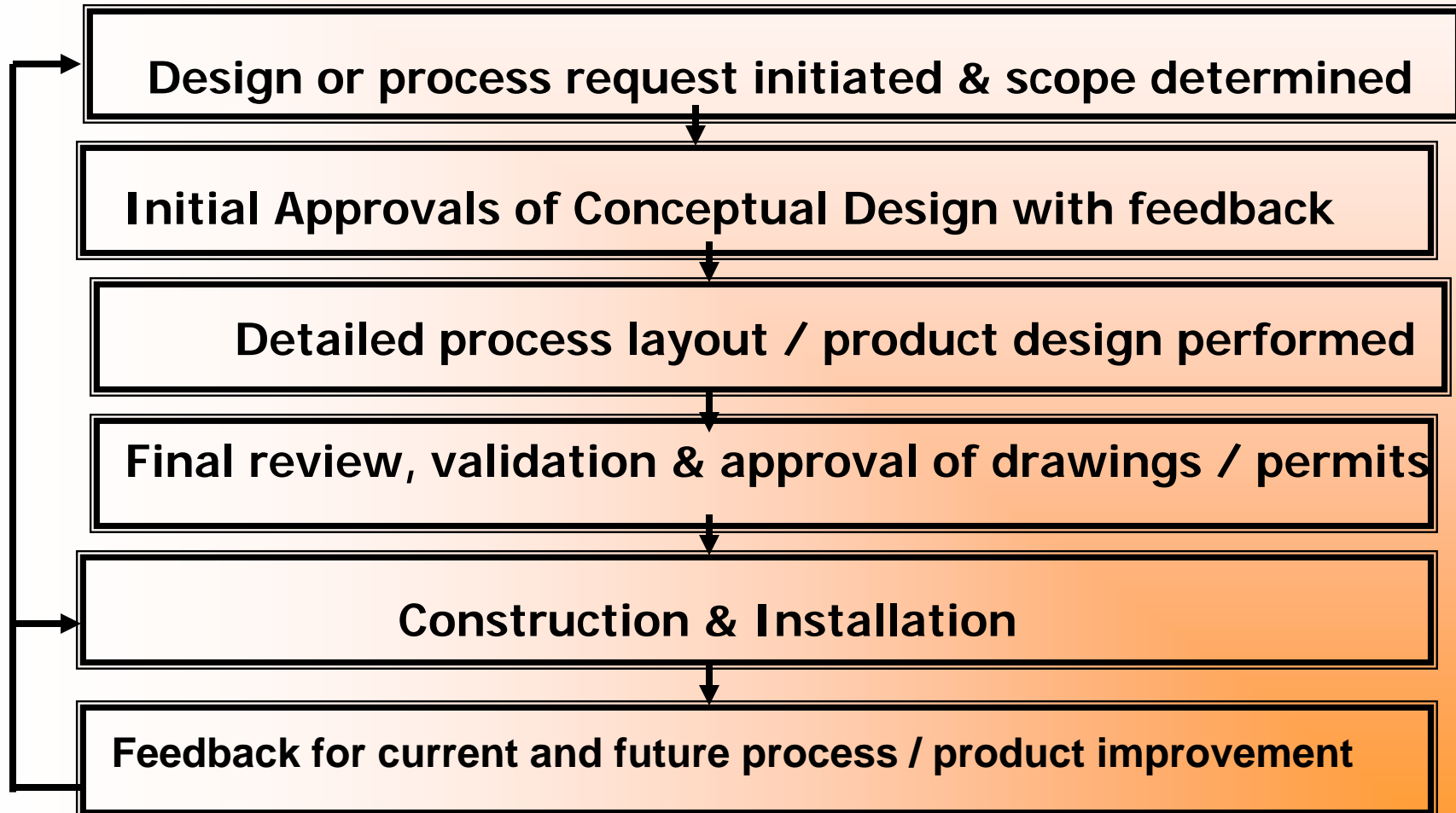


Module 3

***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

PROCESS EVALUATION TOOL (PET)

Form Legend

Sequence #

Score Value

- High= 3
- Medium=2
- Low=1

Process step

Posture

Force

Repetition

Difficulty

Score = P x F x R x D

No Value Added

Process step

Posture

Force

Repetition

Difficulty

Score = P x F x R x D

No Value Added

Risk Factor Thresholds

BODY PART	POSTURE	FORCE	FREQUENCY	DURATION
NECK	Bent forwards $>30^\circ$; backwards; sideways; twisted $>20^\circ$	$> 21\text{b}$	$\geq 2 / \text{min}$	$\geq 10 \text{ secs}$
SHOULDERS	Behind the back; $\geq 45^\circ$ forward or to the side; shoulders shrugged	$\geq 10\text{lb}$ lift; push or pull	$\geq 2 / \text{min}$	$\geq 10 \text{ secs}$
ARMS / ELBOWS	Rotated forearm; full extension	$\geq 10\text{lb}$ lift	$\geq 2 / \text{min}$	$\geq 10 \text{ secs}$
WRISTS / HANDS / FINGERS	$>45^\circ$ flexion/extension; radial or ulnar deviation	$\geq 21\text{b}$ pinch grip or finger press; $\geq 10\text{lb}$ power grip	$\geq 30 / \text{min}$	$\geq 10 \text{ secs}$
BACK	Twisted; bent forward $>20^\circ$; bent sideways or extended	$\geq 25\text{lb}$	$\geq 2 / \text{min}$	$\geq 10 \text{ secs}$
LEGS / KNEES / FEET	Squat, kneel, 1 foot	$>10\text{lb}$ foot pedal	$\geq 2 / \text{min}$	$\geq 30\% \text{ of day}$

- **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.

N E C K	Source of Risk	Improvement Ideas
Posture:		<input type="checkbox"/> Raise/Lower Work surface
Frequency:		<input type="checkbox"/> Improve Line of Sight
Force:		<input type="checkbox"/> Postural breaks
Duration:		
S H O U L D E R S	Source of Risk	Improvement Ideas
Posture:		<input type="checkbox"/> Power Tool
Force:		<input type="checkbox"/> Different Tool
Frequency:		<input type="checkbox"/> Counter Balance
Duration:		<input type="checkbox"/> Mechanical Assist
		<input type="checkbox"/> Layout Changes
		<input type="checkbox"/> Tilted Work Surface
		<input type="checkbox"/> Improve Heights
A R M S / E L B O W S	Source of Risk	Improvement Ideas
Posture:		<input type="checkbox"/> Power Tool
Force:		<input type="checkbox"/> Different Tool
Frequency:		<input type="checkbox"/> Improved Tool
Duration:		<input type="checkbox"/> Arm Rests
		<input type="checkbox"/> Layout Changes
		<input type="checkbox"/> Eliminate Task
		<input type="checkbox"/> Angled Tool Grip

ERGONOMICS STRATEGIES EVALUATION MATRIX

Department:
Job:
Analyst:

Date:
Location:
Product:

Evaluation Criteria	Options Being Considered:		
	1	2	3
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			

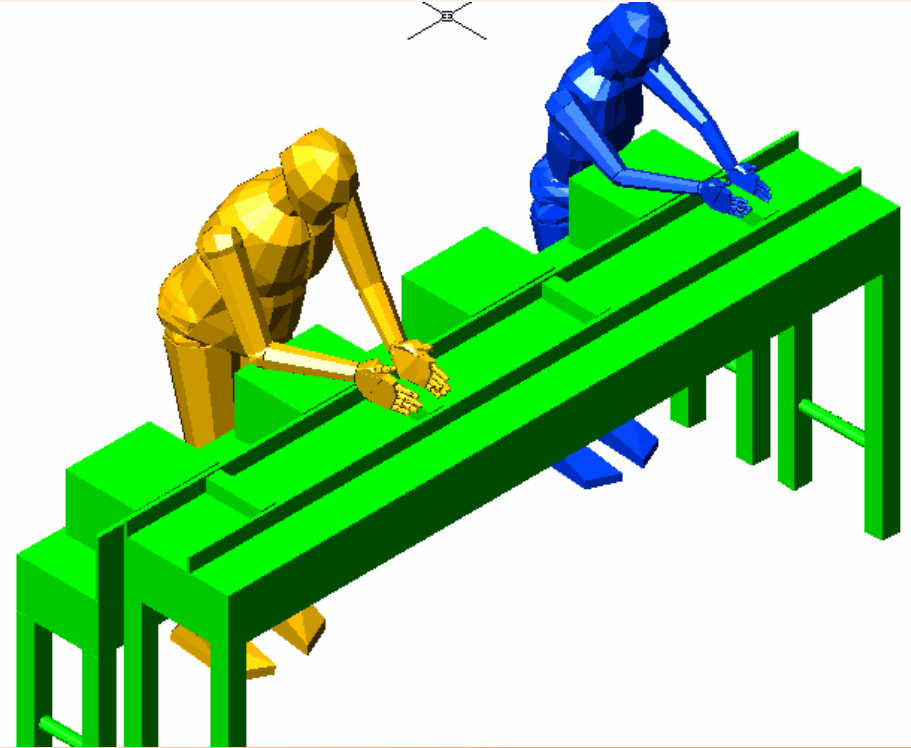
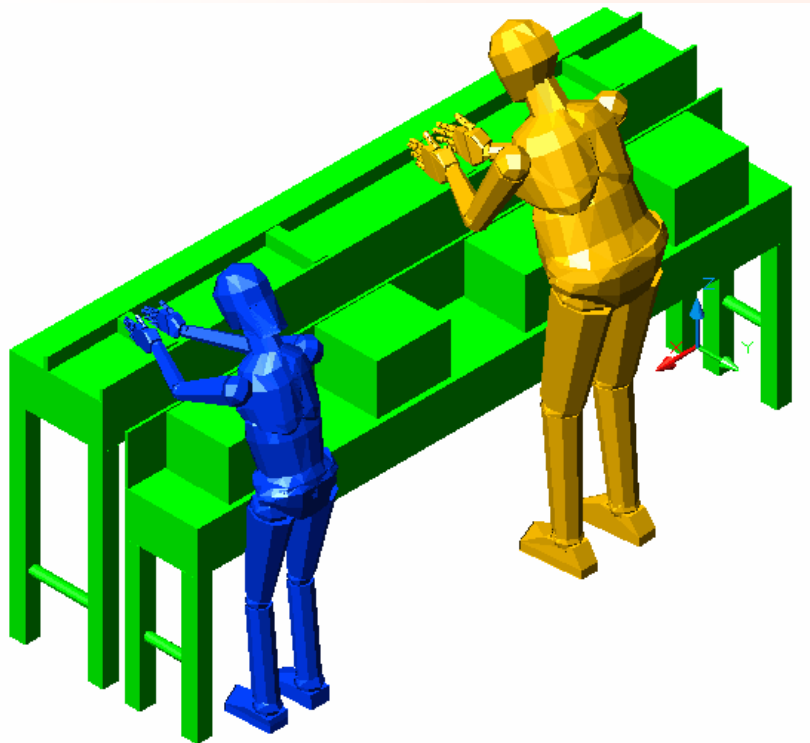
Employers may want to define their definition of each in more detail: **H= High, M=Medium. L= Low**

Case Study - Task Observation

Genentech Packaging Video Analysis

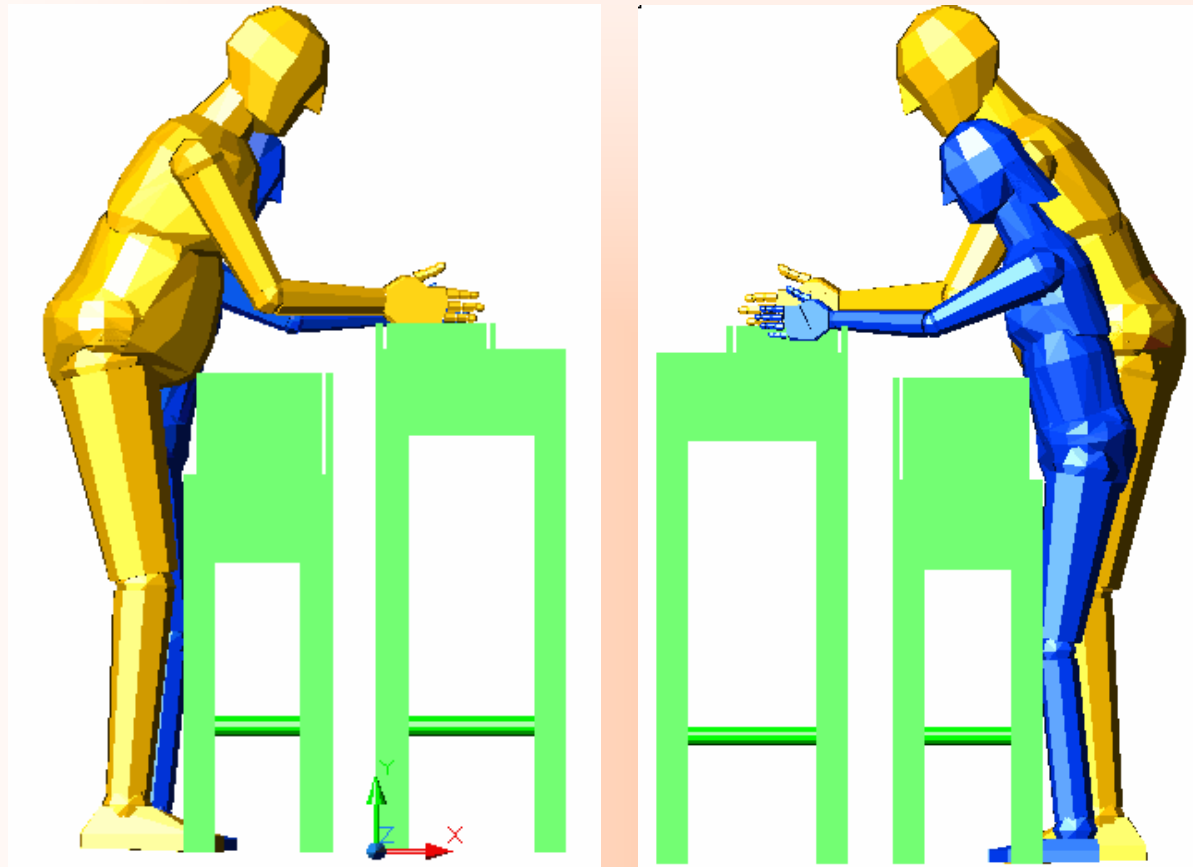


Case Study– Shipper/loader



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

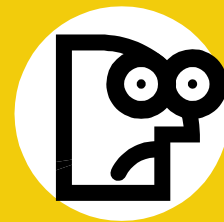
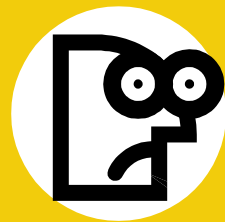
- ***reduced labor***
- ***increased productivity***
- ***reduced injuries***



Flexible and Dynamic

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

Questions



It's QUESTION TIME!!

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