Practical approach to ergonomics risk assessment & selection of controls

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Ergonomics Risk Assessment
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ERGONOMICS RISK
MANAGEMENT PROCESS FLOW

ANTICIPATION AND RECOGNITION
- Gather and review background information and documentation
- Inspections and task observations
- Interview employees
- Review incident history
- Literature review
- Design specifications

ASSESS THE RISK
- Hazard identification
- Estimate the likelihood of exposure / contact
- Identify measures required to eliminate or reduce risk and control exposures
- Keep records

ANY ERGONOMICS HAZARDS PRESENT?

NO

ERGONOMICS ASSESSMENT

YES

ERGONOMICS ASSESSMENT

ERGONOMICS POLICY

MANAGEMENT COMMITMENT AND UNDERTAKING

ERGONOMICS COMMITTEE

ERGONOMICS ASSESSOR / OCC HYGIENIST

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Hazard vs Risk

- **Hazard**: Any agent (biological, chemical, mechanical, environmental or physical) that is likely to cause harm (to humans)

  Used interchangeably with the term “risk factor”

- **Risk**: the likelihood / probability of an adverse event happening

  Interaction between the hazard/risk factor and the exposure (dose)

**Risk assessment**: the first step in the risk management process
Physical Risk Factors

1. Forceful exertions
2. Repetition
3. Awkward postures
4. Static postures
5. Dynamic factors
6. (Localized) Mechanical compression
7. Vibration

Physical Fatigue

Musculoskeletal Disorders

Accidents & Errors
Physical Risk

DURATION (Time constraint)

- Repetitive motion
- Exertion
- Extreme postures

STRESS

RISK

FUNCTIONAL CAPACITY

- Physical fitness
- Aging
- Patient-related factors
- Stress

(Model by Claudon & Cnockaert, 1994, cited in Aptel et al., 2002)
Physical Risk

Load-Tolerance relationship:

Proposed by McGill (1999)

Pictures taken from: Bridger (2009)
Physical Risk

Load-Tolerance relationship:

Changing (usually decreasing) tolerance over time (Marras, 2012)
Cognitive Risk

Cognitive Risk

Cognitive Fatigue

Stress

Accidents & Errors
Cognitive Risk Factors

Phase I: Alarm Response

First reaction to stressor; diminished resistance

Phase II: Stage of Resistance

If the body / individual adapts to the stressor(s), resistance increases and alarm reactions increase

Phase III: Stage of Exhaustion

Long-continued exposure to stressor wears down body’s resistance; adaption energy is exhausted; alarm responses reappear

‘Normal’ level of resistance

[Selye, ≈1939]
Differentiation of Risks

A) Consideration of Consequences: **Humans**

1. Non-recoverable damage or chronic disease (e.g. intervertebral disc rupture, hearing loss, carpal tunnel syndrome)

2. Recoverable injury (e.g. inflammation, chill)

3. Recoverable breakdown (e.g. overload, fatigue)

4. Discomfort or performance decrease (but: discomfort may be an indicator for damages in case of long term exposure)

[Goebel, 2008 – Hons Research Methods]
Differentiation of Risks

A) Consideration of Consequences: Business

1. Destruction of facilities, machines, parts, products etc.

2. Damage to facilities, machines, parts, products → can be repaired, but at a cost

3. Poor production – low quantity & quality → requires overtime work / rework

4. Publicity, goodwill, reputation, environmental impact

Must be avoided

Depends on acceptance
Differentiation of Risks

B) Considerations of the probability and extent of impact

**Estimation of risk** involves:

1. Hazard identification (what risk)
2. Exposure quantification (dose)
3. Dose-Response analysis (probability)

→ These 3 together produce an estimate of risk

→ But: consider that this risk will vary within a population due to varying susceptibilities and exposures
Balancing Task Demands and Human Capabilities

Human Capabilities

Task Demands
The Challenge

- Infinite number of jobs and tasks
- Infinite number of individual workers
- Complex system interactions

The Challenge

How do you EAT an ELEPHANT?
In Preparation....

Ergonomics Assessment

- Purpose & Expectations
- Time available
- Scope of assessment
- Type of data required
- Detail required
- Approach to take

- Budget
- Assessors & Stakeholders
- Equipment

Department of Labour Workshop, 19 February 2016, [18]
How do we do it?

ERGONOMIST

Management

Workers

Occupational Hygienist

Engineers

Industrial psychologist

Co-operative Co-responsibility

Trade Unions

Supervisors

Occupational Health Personnel

Ergonomics Facilitation Team
The Risk Assessment Approach

Identify and intervene for all “red flagged” workstations (reactive)

Identify and intervene for all “orange & yellow” workstations (reactive)

Develop proactive / preventive approach to ergonomics
The Risk Assessment Cycle
The Risk Assessment Cycle

1. Familiarization
2. Problem Identification
3. Problem Assessment → Data Collection, Analysis & Evaluation
4. Intervention Development
5. Intervention Implementation
6. Follow-up / Re-evaluation
1. Familiarization

1. Get to know the nature of the business
2. Identifying system components and understanding their interactions
3. Understanding the process flow
4. Understanding the organizational set-up
5. “Red flag” any glaring mismatches

• Walk-about
• Information from workers, management,
• Records (medical, quality, human resources)
The Risk Assessment Approach

Level 1: General Walk-through

Level 2: Risk Screening (e.g. RULA, JSI)

Level 3: Risk Screening (e.g. OCRA, OWAS)

Level 4: Microanalysis (e.g. LMM, Biodex)
1. Familiarization

Worker Characteristics
- Age, Sex, Morphology, General Health & Fitness

Task Demands
- Physical Demands (loads, repetitions, effort, vibration)
- Cognitive Demands (sensory, memory, decision-making)

Organizational Set-up
- Shift Durations & Times, Structure, Pay scheme,

Physical Environment
- Heat/Cold, Dust, Noise, Lighting, Vibration, (Toxins / Pollutants)
1. Familiarization

Worker Characteristics

Age, Sex, Morphology, General Health & Fitness, Socio-economic & Cultural Background

Task Demands

Physical Demands (loads, repetitions, effort, vibration)
Cognitive Demands (sensory, memory, decision-making)

Organizational Set-up

Shift Durations & Times, Structure, Pay scheme,

Physical Environment

Heat/Cold, Dust, Noise, Lighting, Vibration, (Toxins / Pollutants)
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Task Analysis

• Task objective
• Postures assumed
• Gross motor (whole body) movements
• Fine manipulative movements
• Location of the activity
• Tools, machines and materials manipulated
• Physical environment
• Sequence of events
• Duration (time required)
• Frequency (repetitions)
• ...
The Risk Assessment Approach

Level 1: General Walk-through

Level 2: Risk Screening (e.g. RULA, JSI)

→ **Quantitative confirmation** of problem areas

→ Development of *first level interventions*

→ Identification of areas needing further (Level 3 / CPE) assessment
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“There are no perfect tools; there are just tools in the tool box.”

Risk assessment: “It’s a way of putting things together to evaluate and assess probabilities for adverse effects of different activities or stressors.”

(Dr Peter Chapman, risk analyst for International Environmental Consulting Company Golder Associates)
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Hierarchy of Controls

**Least effective**

**Physically remove the hazard; design it out**

**Substitution**

**Replace the hazard; use something else**

**Engineering Controls**

**Isolate & guard the people from the hazard**

**Administrative Controls**

**Change the way people work; e.g. training and work scheduling**

**PPE**

**Protect the worker with Personal Protective Equipment; Last resort!**

**Most effective**

- Personal
- Administrative
- Engineering
Differentiation of Risks: Why and when to intervene...

C) Considerations of options and effort of implementing countermeasures

where is the optimum?

Workplace costs:
Changes for workstations

Worker costs:
Costs of pain, treatment, absenteeism, etc.

[Taken from HKE Honours - Intervention Strategies notes by Goebel, 2008]
Engineering Controls

- Use of technology, mechanization and design to eliminate / reduce hazards
- Can completely eliminate hazards, but usually expensive
Administrative Controls

- Changes in the way that work in a job is assigned or scheduled that reduce the magnitude, frequency or duration of exposure to ergonomic risk factors

- Examples: job rotation, job enlargement, job enrichment, team work, alteration of work pace

- Administrative controls can fall into the following categories:
  - Socio-political atmosphere and employee morale – policies, education, participatory problem-solving
  - New employee orientation and training – allow for physical and procedural adaptations in job
  - Injury reporting and accident investigations - NB for future injury prevention & cost-saving
  - Early return to work and modified duty
  - Productivity standards and paced work – incentives
Personal Interventions

- Directly affect the employee
- Relatively cheap, but time-consuming and need commitment from workers

Examples:
- Training and education, e.g. ergonomics awareness training, training in job analyses & control measures, training in problem-solving
- Personal protective equipment
- Work hardening programmes
- Stretching programmes
Implementation of Interventions

Find the best strategy to put the new or modified product or system in place. Consider the following:

• Installation & testing → depends on type of project
• Workplace design
• Training and support to users (e.g. manuals)
• Organizational changes
• Acceptance of the new product or system – users need to be convinced of the intervention.
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Questions …?

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