

Ergonomics Essentials

TEACHING GUIDES

M506 –ERGONOMICS ESSENTIALS- SUGGESTED TIMETABLE

Day 1

0830 – 0930	Introductions & Course Overview
0930 – 1030	Overview of Ergonomics – General Principles
1030 – 1045	Coffee Break
1045 – 1245	Overview of Ergonomics – Biological Ergonomics
1245 – 1330	Lunch Break
1330 – 1500	Overview of Ergonomics – Psychology at Work
1500 – 1515	Coffee Break
1515 – 1700	Developing an Ergonomics Strategy at Work

Day 2

0830 – 0900	Review of Overnight Questions
0900 – 1030	Ergonomics Methods & Techniques – Work Design
1030 – 1045	Coffee Break
1045 – 1245	Ergonomics Methods & Techniques – Risk Management
1245 – 1330	Lunch Break
1330 – 1415	Ergonomics Methods & Techniques – Measurements & Information Collection
1415 – 1500	Standards & Social Aspects
1500 – 1515	Coffee Break
1515 – 1700	Musculoskeletal Disorders – Manual Handling

Day 3

0830 – 0900	Review of Overnight Questions
0900 – 1030	Musculoskeletal Disorders – Manual Handling (cont.)
1030 – 1045	Coffee Break
1045 – 1245	Musculoskeletal Disorders – WRULD
1245 – 1330	Lunch Break
1330 – 1500	Musculoskeletal Disorders – Practical
1500 – 1515	Coffee Break
1515 – 1700	Workplace, Job & Product Design – Work Environment

Day 4

0830 – 0900	Review of Overnight Questions
0900 – 1030	Workplace, Job & Product Design – Work Environment (cont.)
1030 – 1045	Coffee Break
1045 – 1245	Workplace, Job & Product Design – Information, Displays & Controls
1245 – 1330	Lunch Break
1330 – 1500	Physical Factors of the Work Environment
1500 – 1515	Coffee Break
1515 – 1700	Physical Factors of the Work Environment (cont.)

Day 5

0830 – 0900	Review of Overnight Questions
0900 – 1000	Revision
1000 – 1045	Coffee Break
1045 – 1245	Mock Examination
1245 – 1330	Lunch Break
1330 – 1430	Examination Review
1430	Close of Course

The above timetable is provided as a suggestion only and can be altered to meet the customs and requirements of the students and lecturers.

The sequencing of the lectures is such that it follows the sequence of chapters in the Student Manual/BOHS Syllabus, with the exception of Day 2, Standards & Social Aspects, which has been moved forward from the manual for timing and relevance of content.

A number of additional case studies have been developed to supplement the teaching content if the trainer has time to include them. These are found at the end of this document.

TEACHING GUIDE – DAY 1

OVERVIEW OF ERGONOMICS

STUDENT LEARNING OUTCOME:

1. To appreciate the scope of ergonomics and its application to work:
 - (a) Discuss principles of anatomy, physiology and psychology
 - (b) Apply these principles in describing ergonomics building blocks of anthropometry, biomechanics, physiological and cognitive capacity

Notes for Trainer:

- 2 exercises are included in the day:
 - a. Human Error Case Study (below)
 - b. Anthropometry exercise. You will need Tape Measures and Anthropometric Tables.

*This section is an overview of the discipline of ergonomics and orientation to the physical, cognitive and organisational components of the study of ergonomics. The training course is designed to be interactive and provides opportunity to tailor the content to the participant. This approach will promote the principles of adult learning. Assessment strategies are to be determined by the Trainer.

Case Study

Human Error

While based on real events, facts have been altered to facilitate learning. The case study should not therefore be taken as an accurate reflection of what actually happened.

INCIDENT AT E1 JETTY, 1 AUGUST 2005

Synopsis

At about 0540hrs on Friday 1 August 2005 Mr. X, the night shift worker at E1 jetty handed over responsibility for unloading the ship “Talava” which was then berthed at the jetty. Mr. Y assumed responsibility for unloading operations until about 0620hrs when he handed over responsibility to Mr. Z.

At around 0620hrs the E1 fuel oil Jetty-head valves on booms 4 and 5 were open, and the F80 main line valve was also open to allow F80 line cleaning.

As Mr. Y walked back to the mess room he closed the F80 main line valve and opened the F35 main line valve, thus allowing fuel oil to flow up the F35 main line to clear the line. It appears that Mr. Z was fully aware of these actions and understood their implications.

Mr. Z was left alone on E1 jetty, and closed the boom 4 jetty-head fuel oil valve as line cleaning on the F80 main line was now completed. He then continued to check the valve line-up and noticed that a boom 5 valve, which he presumed was the fuel oil valve, was shut. He opened it and continued with his duties.

However, instead of opening the boom 5 jetty-head fuel oil valve, Mr. Z had opened the boom 5 jetty-head ballast valve, thus allowing fuel oil to enter the ballast system. At interview, Mr. Z said that he had no intention of opening the ballast valve; he intended to open the fuel valve.

Line clearing continued with this erroneous valve line-up until about 0800hrs, when Mr. Z handed over responsibility for unloading to Mr. Y. Mr. Y checked the valve line-up and discovered Mr. Z’s error. The boom 5 jetty-head ballast valve was closed and corrective action commenced.

2003 incidents at E1 and E2 Jetties

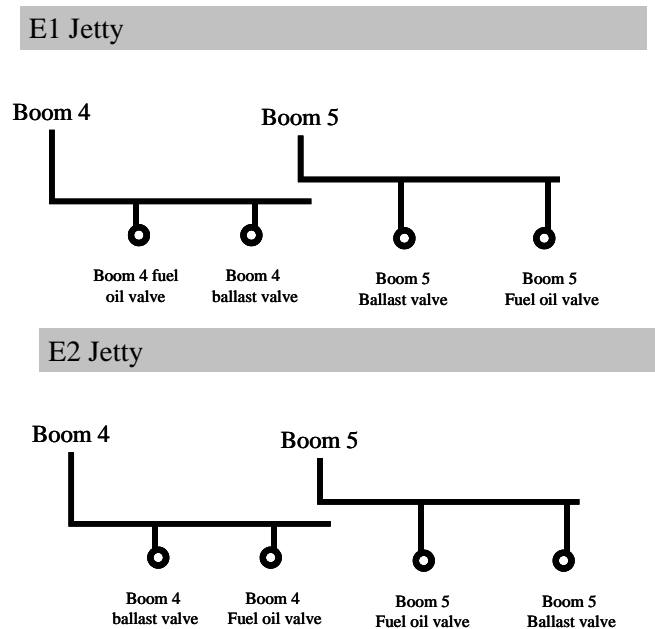
3 June 2003 incident at E1 Jetty

In this incident an operator was distracted whilst opening two jetty-head fuel oil valves. Having correctly opened the first valve, he then applied the right action (opening the second valve) to the wrong object (the jetty-head ballast valve). This had the same consequence as the 1 August 2005 incident, allowing fuel oil into the ballast system. It is understood that this incident also involved the same jetty-head booms, namely numbers 4 and 5.

14 February 2003 incident at E2 Jetty

In this incident it was determined that during loading of a vessel a jetty-head ballast valve had been left open, allowing DERV to enter the ballast system. At some time after the initial error, an unknown person had closed the ballast valve.

BOOM AND VALVE CONFIGURATION



The fuel and ballast valves are identical and have no labels or colour-coding to indicate which is which, so it was not possible to visually distinguish between them. There was no written procedure for valve line-up for loading and un-loading vessels, or line-cleaning.

Instruction

Use the Human Error information in your manual to analyse the following unintentional behaviour by

1. Determining the error type
2. Identifying the contributing factors
3. Making recommendations to prevent further incidents.

“Mr Z opened the boom 5 jetty-head ballast valve, allowing fuel oil into the ballast system for approximately one hour and forty minutes.”

Model Answer

1. Human Error Type:

a. Skill-based error; slip of action

Mr Z was clear which valve was the fuel oil valve. Both valves were identical. Mr Z did not forget anything and therefore he did not have a lapse of memory. His plan was good but execution poor – he did not make a mistake.

2. Contributing Factors:

a. Design of equipment.

No information available to indicate which valve was which (e.g. colour, shape coding). There is some information available in terms of the position of the two valves in relation to each other, but this is unclear due to the different layout on the adjacent boom and on the other jetty. All the problems associated with inconsistent layout and lack of coding indicates poor ergonomic input during design.

3. Recommendations:

a. Distinguish valves by

- i. Colour
- ii. Shape
- iii. Consistent layout in all locations
- iv. Other suggestions to distinguish valves

b. Determine other control strategies to use short term:

- i. Briefing personnel re confusing design
- ii. Use of second operator to check line-ups
- iii. Development of a procedure

c. Preventative actions:

- i. Human factors audits of other jetties
- ii. 'forward feeding' of lessons learned
- iii. Participative ergonomics review of practices.

d. Other suggestions from delegates

Day & Timing	Topic	Contents	Learning processes	Resources	Resources - exercises	Learning outcomes
Day 1 0830-0930	1. COURSE OVERVIEW	Welcome	Welcome participants to course	O/H 1		
	1.1 Introduction					
		Emergency Procedures	Indicate the Site Emergency Procedures to participants	O/H 2	Familiarisation with Emergency Procedures	
		Introductions	Introduce the lecturers and ask participants to introduce each other	O/H 3 (plus extra overheads if more than one lecturer)		
			Icebreaker/Introduction	O/H 4		
	1.2 Aim of Course	Course Aims	Indicate the course aims	O/H 5		
	1.3 Learning Outcomes	Overall Learning Outcomes	Indicate what participants can expect to learn	O/H 6		
		BOHS Syllabus				
	1.4 Format of Manual	Topics to be Discussed	Discuss the topics to be covered in the course Brief familiarisation with manual	Manual		
	1.5 Participation	Student Participation requirement		O/H 7		

Day & Timing	Topic	Contents	Learning processes	Resources	Resources - exercises	Learning outcomes
0930-1030	2. OVERVIEW OF ERGONOMICS		Go to Section 2 PowerPoint presentation			
	2.1 General Principles	2.1.1 Definition 2.1.2 History of Ergonomics	Outline definition and history of ergonomics	O/H 1-4	Ask for their ideas and common misconceptions (e.g. ergo = chairs & desks)	1a
		2.1.3 Scope of Ergonomics and Systems of Work	Describe scope of ergonomics.	O/H 5-8	Exercise: Ask for features of a well designed piece of domestic or work equipment. Discuss this design in terms of enhancing productivity	
		2.1.4 Aims, Objectives and Benefits of Ergonomics	Discuss, with simple examples. Stress that ergo solutions are very specific to the task, work team, region etc and must be designed and agreed in situ. (i.e. tailored for the relevant population)	Whiteboard	Ask re ideas about 'costs' and 'benefits' of ergonomics. Industries often think it will cost them \$, with little understanding of benefits, esp. over time.	
		2.1.5 Fitting the Job to the Person and Person to the Job, Occupational Ergonomics 2.1.6 Systems of Work: Seeing the Whole Picture	Discuss each of the 5 key elements when analysing work, and their inter-relationships (the whole picture)	O/H 9-15	Ask for ideas under each element	

Day & Timing	Topic	Contents	Learning processes	Resources	Resources - exercises	Learning outcomes
		2.1.7 Human Characteristics, Capabilities and Limitations	Introduce topic	O/H 16	Ask what impacts on these characteristics	
		2.1.8 Human Error	Outline topic, clarify the different definitions of human error. Stress that human error is generally related to poor design / poor ergonomics. Work through flow diagram	O/H 17-22	Ask for ideas re possible organisational factors contributing to errors. Ask re individual factors contributing to errors.	
		Exercise	Group Activity	Human Error Case Study	Break group into threes. Work through the case study and analyse the case study using the 'Types of Human Failure' Model. Make recommendations to prevent 'accident' recurring.	1b
		2.1.9 Teamwork	Describe types of teams	O/H 23-25	Ask re advantages of teams Ask re disadvantages of teams	1a
		2.1.10 Ageing	Outline issue of ageing workforce (in developed and developing countries, e.g. Australia's profile)	O/H 26-27	Ask re population demographics of their countries. QUIZ – true & false Ask to recall the equipment example. What features are especially important for ageing users? Consider physical, cognitive, social / organisational.	

Day & Timing	Topic	Contents	Learning processes	Resources	Resources - exercises	Learning outcomes
		2.1.11 The Role of the Ergonomist	Summarise key issues, and role of ergonomist. Emphasise the course will assist members to apply ergonomics principles at work, and to know when to call in an ergonomist.	O/H 28		
1030-1045	Break	Conclude session	Summary of morning	O/H 29		
1100-1245	2.2 Biological Ergonomics	2.2.1 Body Systems	Use animation to explain links	O/H 29,30	Ask what the human body part or system is that provides this function.	1a
		2.2.2 The Musculoskeletal System	Describe musculoskeletal system – inc ms, ligaments, muscle movements and muscle work	O/H 31-34		
		2.2.3 Posture and Movement	Show the different joint movements – OH and on self. Describe mid-range / neutral concept and importance for work design.	O/H 35-38	Ask group to all demonstrate postures and movements with you. Ask group to demonstrate mid range for elbow and for wrists	
			Describe difference bwn static & dynamic muscle work. Use images of tasks to describe which muscles are working statically.	O/H 39,40	Show pics. Ask where workers are likely to be feeling most tired. This is often where the muscle is working statically.	

Day & Timing	Topic	Contents	Learning processes	Resources	Resources - exercises	Learning outcomes
		2.2.4 Biomechanics	Outline concept and 1 st , 2 nd and 3 rd order levers Provide brief advice about what a well designed job may look like re postures, muscles etc	O/H 41-45		1b
		2.2.5 Anthropometry	Define term, and describe static and dynamic measures and the differences.	O/H 46-51	Ask for factors that might affect body dimensions and shapes	
		Exercise	Group Activity	Anthropometric tables Tape measures	Divide group into pairs Pairs measure each other's standing height & popliteal height. Determine which percentile of the population distribution they are in. Is the percentile different for the two criteria? Use this exercise to reinforce the anthropometric differences between people and within people.	1b
		2.2.6 Applying Work Physiology: Body Metabolism, Work Capacity and Fatigue	Provide overview of work physiology. Describe issues of: Strength Work capacity Endurance	O/H 52-57	Occasionally ask if they know the answers to the OH issue (all are customised to make data appear 2 nd)	

Day & Timing	Topic	Contents	Learning processes	Resources	Resources - exercises	Learning outcomes
			Physical fatigue			
			Provide summary about what a well designed job might look like re postures, movements, ms work, metabolism etc			
1245-1330	Lunch	Conclude session	Summary of morning	Whiteboard to list topics	Any questions?	
1330-1500	2.3 Psychology at Work	2.3.1 Perception and Cognition	Provide session outline Explain Perception, using diagram	O/H 58-60		1a
		2.3.2 Memory	Explain memory, using diagram	O/H 61		
		2.3.3 Decision-making	Explain decision-making and impact of : Uncertainty, familiarity, time	O/H 62		1b
		2.3.4 Perception of Risk	Describe risk perception	O/H 63-65	Ask for experiences of risk perception	
			Report factors that reduce risk perception		Check if risk experiences are consistent with the reported factors	
		2.3.5 Signal Detection Theory	Describe theory	O/H 66-68	Ask for examples	
		2.3.6 Vigilance	Describe concept of vigilance with work applications List methods to enhance performance	O/H 69-71	Ask for examples from Participant workplaces	

Day & Timing	Topic	Contents	Learning processes	Resources	Resources - exercises	Learning outcomes
		2.3.7 Motivation & behaviour	Describe motivation at work and types of rewards. Discuss goals and rewards	O/H 72,73	Ask what motivates members of the group. Ask for examples of when rewards have NOT worked (why not?)	
		2.3.8 Work 'Stress' – Causes, Preventative and Protective Measures	Define work stress. List factors that contribute. Discuss signs of stress (after asking them for suggestions) Describe underload v overload	O/H 74-77	Ask what factors can contribute to work stress. Ask to list signs of stress under the headings on OH 75 Ask why stress is important in ergonomics	
		2.3.9 Work Organisation – Shift Work and Overtime	Describe concept of work org. List types of work hours Describe pros and cons of shiftwork with all contributing ideas	O/H 78-80	EXERCISE: work in small groups and list advs and disadvs of shiftwork, inc own experiences	
		2.3.10 Rest and Work Breaks	Define breaks. Discuss work breaks and timing. Show sleeping guide	O/H 81-83	Ask for experiences re breaks and timing. Ask for comments on sleep guide. Does it look logical or surprising?	
		Conclude session	Summary of session	Whiteboard to list topics	Any questions?	
1500-1515	Break					

Day & Timing	Topic	Contents	Learning processes	Resources	Resources - exercises	Learning outcomes
1515-1700	2.4 Developing an Ergonomics Strategy at Work	2.4.1 Culture of an Organisation – Commitment and Decision-making	Outline workplace culture Describe concept of 'change management' Describe importance of consultation in ergonomics and emphasise it must be 2 way	O/H 84-88	Ask for experiences in change management. What worked well and why? Ask what consultation at work means. Ask how it's done (e.g. who, what, why, when etc)	1a
		2.4.2 Macro-ergonomics and Participatory Ergonomic Teams	Describe macro-ergonomics and participatory ergonomics	O/H 89,90	Ask for examples of teams from Participant workplaces; discuss consideration of ergonomics issues in team environments at their workplace	1b
		2.4.3 Ergonomics at the Design Stage	Explore user and potential user population concepts	O/H 91,92	Discuss changing workforces – ask for examples from Participant workplaces where new worker populations have struggled with design of equipment (e.g. different ethnic groups anthropometry, ageing, disabled, etc)	
		2.4.4 Developing Ergonomics, Professional Ergonomists and Competence	Inform re IEA and technical committees. Describe re competencies for ergonomists	O/H 93-95		
		2.4.5 Seeing the Whole Picture	Revisit the ergonomics diagramme and discuss in light of day's topics. Use this as revision of session.	O/H 96 Whiteboard	Facilitated revision of day 1.	

TEACHING GUIDE – DAY 2

REVIEW OF OVERNIGHT QUESTIONS

Receive guidance in understanding the reasons for any incorrect answers to the overnight questions from Day 1.

ERGONOMICS METHODS & TECHNIQUES

STUDENT LEARNING OUTCOMES:

1. Identify ergonomics investigation methods which can be used in a risk management approach to plan optimum job/tasks, equipment and systems of work

MUSCULOSKELETAL DISORDERS (INTRODUCTION)

STUDENT LEARNING OUTCOMES:

2. Define manual handling
3. Describe characteristics of manual handling work which pose a risk of developing a musculoskeletal disorder

Notes for Trainer:

- A Hierarchical Task Analysis class exercise is scheduled for this morning. The trainer will need to prepare a Hierarchical Task Analysis exercise relevant to the group and the Trainer's experience. This exercise should take approx. 30-40 minutes.
- Section 7 of the manual has been moved forward to this training day, as it links with the risk management section. Students will need to follow the presentation by turning to Section 7.
- A short exercise is included in the last session on manual handling.

Day & Timing	Topic	Contents	Learning processes	Resources	Resources - exercises	Learning outcomes
Day 2 0830-0900	REVIEW OVERNIGHT QUESTIONS					
0900-1030	3 Ergonomics Methods and Techniques	Introduction	Discuss general concepts to be covered in this section	O/H 1-3		
	3.1 Work Design	3.1.1 Allocation of Function	Explain the concept. Use the ISO info to elaborate on the principles in design of work systems. Show categories for evaluation	O/H 4-6		1
		3.1.2 Task Analysis	Explain HTA and differentiate this system analysis with a task analysis of job	O/H 7 HTA exercise Flipchart Paper & pens	Ask people to suggest evaluation techniques for each category Ask for examples Break into groups of 3 and Conduct a relevant HTA Feedback to large group Identify ways in which the usefulness of the HTA could be maximised	
		3.1.3 Work Organisation Factors	Explain Taylorism Discuss the 3 ways of achieving task variation and the benefits from this Explain ideal workload, and issues with over/underload	O/H 8 O/H 9 O/H10	Ask people to list potential ads and disads from this work fragmentation	

Day & Timing	Topic	Contents	Learning processes	Resources	Resources - exercises	Learning outcomes
		3.1.3 Work Organisation Factors (cont.)	Discuss issues of job satisfaction	O/H 11	Ask for experiences	
			Explain theory re Demand, Control and Support – give e.g.s	O/H 12	Ask for e.g.s from their work	
		3.1.4 Problems Arising From Poor Work Design	Explore issues with computer, sedentary and rep work	O/H 13	Ask why Participants think these may be an issue – consider yesterday's session content	
		3.1.5 User Trials	Discuss the role of User trials in ergonomics	O/H 14		
			Go through steps involved in conducting user trial	whiteboard		
		3.1.6 Problem Solving – Scientific Method	Explore the scientific approach to problem solving for Ergonomics. Link User Trial with concepts of ergonomics intervention	O/H 15	Discuss each step with Participants. Link with Risk Management – monitoring interventions...	
		Conclude session	Summary of session	Whiteboard to list topics	Any questions?	
1030-1045	Break					
1045-1245	3.2 Ergonomics Risk Management		Provide overview of risk management approach	O/H 16,17		
		3.2.1 Definitions of Hazards and Risk	Discuss concepts	O/H 18		
		3.2.2 Ergonomics Risk Identification	Outline the 3 main methods of identifying problems	O/H 19	Ask for examples of each method from their work	

Day & Timing	Topic	Contents	Learning processes	Resources	Resources - exercises	Learning outcomes
		3.2.3 Ergonomics Risk Assessment	Describe risk assessment Explore each point in depth	O/H 20	Ask when this would be undertaken – experience from Participant workplace?	
		3.2.4 Controlling Ergonomics Risks	Hierarchy of Controls	O/H 21		
		3.2.5 Priorities	Matching controls with level of risk Discuss examples of each	O/H 22		
		3.2.6 Evaluating Controls	Link with risk management cycle Discuss evaluation in terms of effectiveness – does it actually control the problem , does control create more problems (unanticipated); Availability of controls ongoing Cost benefit.	O/H 23	General Discussion Discuss cost benefit in general terms – what would Participants consider when measuring cost benefits of interventions (NB further detail on this later in day).	
		Conclude session	Summary of session	Whiteboard to list topics	Any questions?	
1245-1330	Lunch					
1330-1415	3.3 Measurements and Information Gathering	3.3.1 Ergonomics Standards	Inform re the main sources of information: Standards, guidelines (e.g. from ILO and country OHS bodies) Explain role of ILO and	O/H 24-28	Ask about the guidance Participants currently	

Day & Timing	Topic	Contents	Learning processes	Resources	Resources - exercises	Learning outcomes
			guidance data			
			Provide more detail on ISO & explain the aim of ISO and the standards with ergo input.		use– inc country / state/organisation specific – and its value.	
		3.3.2 Methods of Information Gathering/Measurement	Use these standards as benchmarks for ergonomics (or as minimum standards). Ergonomists need to measure what is happening in the workplace to compare to these standards, and need to choose an appropriate measuring method	O/H 29		
		3.3.3 Rating Scales, Questionnaires and Check Lists	Explore these types of assessment methods	O/H 30	Discussion regarding Participant experience with each type of assessment method	
		Conclude Section 3	Summary of Section 3 Link now to Section 7 of manual – explain that manual laid out as per BOHS syllabus, and course designers felt Section 7 followed on from Section 3 more logically for the presentation	whiteboard		
1415-1500	7. STANDARDS & SOCIAL ASPECTS		Go to Section 7 PowerPoint presentation Introduction Link with previous section	O/H 1,2		
	7.1 Standards		Outline ISO standards and how derived Discuss the TC 159 for ergonomics	O/H 3,4		

Day & Timing	Topic	Contents	Learning processes	Resources	Resources - exercises	Learning outcomes
	7.2 Training, Experience and Skill Development	7.2.1 Acquisition of Physical Skills 7.2.2 Skill Development and Individual Differences 7.2.3 Training Needs Analysis 7.2.4 Types of Training 7.2.5 Education and Training in Ergonomics	Discuss role of training in ergonomics and general workplace training Discuss principles of training Describe Use examples Describe Use examples	O/H 5 O/H 6 O/H 7	Explore Participant experiences with workplace training – when it was good, when it could be improved and why Discuss re training in Participant workplaces	
	7.3 Health Information	7.3.1 Health Information, Legal Duty of Care 7.3.2 Supervision and Records 7.3.3 Measuring Health and Illness	Outline these principles Link with Occ Hygiene	O/H 8-10		
	7.4 Measuring the Impact of Ergonomics	7.4.1 Positive Performance Indicators (PPIs) 7.4.2 Negative Performance Indicators (NPIs) 7.4.3 Injury/illness Rates 7.4.4 Program Evaluation 7.4.5 Strategic Planning 7.4.6 Key Performance Indicators 7.4.7 Program Audits 7.4.8 Accident and Incident Investigation	Discuss measuring impact of ergonomics – differences between PPIs and NPIs. Explore overhead topics, gain input from Participants	O/H 11,12		

Day & Timing	Topic	Contents	Learning processes	Resources	Resources - exercises	Learning outcomes
		7.4.9 Cost-Benefit Models				
		7.4.10 Risk Assessment Techniques				
		7.4.11 Evaluating Solutions Directly				
		7.4.12 Gathering Evidence				
		Summary of Section 7	Review Section 7	O/H 13		
		Conclude session	Summary of session		Any questions?	
1500-1515	Break					
1515-1700	4. MUSCULOSKELETAL DISORDERS		Go to Section 4 PowerPoint presentation, Day 2 Introduction			
	4.1 Manual Handling	4.1.1 Introduction and Definition	Outline of Section	O/H 1, 2		2
			Discussion of definition	O/H 3		
			Discussion of body parts at risk; link back with anatomy section; discuss types of joints & structures	O/H 4		
			Discussion of figures/statistics	O/H 5		
			- Surprised?			
			- Their workplace experience?			
			Discussion re types of tasks, and characteristics of tasks.	O/H 6,7		3
			Examples from own workplace.			

Day & Timing	Topic	Contents	Learning processes	Resources	Resources - exercises	Learning outcomes
		4.1.2 The Nature and Causes of Manual Handling Disorders (Musculoskeletal Disorders) Exercise	Outline risk factors Group Activity	O/H 8 Whiteboard		
1655-1700	Brief Review & Close				Break into pairs and discuss work tasks that fit into these physical risk factors. Feedback to large group.	

TEACHING GUIDE – DAY 3

REVIEW OF OVERNIGHT QUESTIONS

Receive guidance in understanding the reasons for any incorrect answers to the overnight questions from Day 2.

MUSCULOSKELETAL DISORDERS (CONTINUED)

STUDENT LEARNING OUTCOMES:

1. Outline the causes of musculoskeletal disorders
2. Describe assessment and control strategies and techniques for musculoskeletal disorders
3. Outline the causes of work-related upper limb disorders
4. Describe assessment and control strategies and techniques for work-related upper limb disorders

WORKPLACE, JOB & PRODUCT DESIGN (INTRODUCTION)

STUDENT LEARNING OUTCOMES:

5. Outline key ergonomics characteristics in optimum workplace design
6. Outline key ergonomics characteristics in optimum product design

Notes for Trainer:

Resources are required for this day of training.

- Due to copyright restrictions, participants will need to print off forms to use in the in class activities; the trainer to decide which forms to use:

MAC <http://www.hse.gov.uk/pubns/indg383.pdf>

UL Filter <http://www.hse.gov.uk/msd/pdfs/riskfilter.pdf>

UL Risk Assessment <http://www.hse.gov.uk/msd/pdfs/worksheets.pdf>

Australian Standard & COP

<http://www.ascc.gov.au/ascc/HealthSafety/HazardsSafetyIssues/ManualTasks/>

- Trainer to supply video footage and job demands description of 2 tasks, one general manual handling, and one upper limb for in class activity. Alternatively, utilise the MAC training tasks on the HSE website.

<http://www.hse.gov.uk/msd/mac/liftintro.htm>

<http://www.hse.gov.uk/msd/mac/carryintro.htm>

<http://www.hse.gov.uk/msd/mac/teamintro.htm>

Day & Timing	Topic	Contents	Learning processes	Resources	Resources - exercises	Learning outcomes
Day 3 0830-0900	REVIEW OVERNIGHT QUESTIONS					
0900-1030	4. MUSCULOSKELETAL DISORDERS	Link with previous day	Review outline of MSD section	O/H 1-3		
	4.1 Manual Handling	4.1.3 Low Back Disorders	Discuss functions of spine	O/H 5		1
			Discuss structures of the spine - discuss with model - draw and discuss discs and outline function	O/H 6 Whiteboard Plastic spine model	Pass spine model around class	
			Discuss injury mechanisms in relation to spinal structures	O/H 7 Whiteboard Plastic spine model		
			Risk Identification principles Discuss in relation to process of risk management	O/H 8 whiteboard		
		4.1.4 Risk Assessment	Discuss assessing risk of manual handling tasks	O/H 9	Ask what assessment techniques are used in participant workplaces	2
			Outline ergonomics approaches to risk assessment and discuss	O/H 10-16		
		4.1.5 Job Design and Training	Discuss Risk Control with regard to manual handling (designing job to eliminate risk) Discuss control options in O/H 22,23	O/H 17-19	Ask if other solutions from participant workplaces	

Day & Timing	Topic	Contents	Learning processes	Resources	Resources - exercises	Learning outcomes
		4.1.6 Principles of Handling and Preventative and Protective Measures	Outline Risk Management model with training as last option, but also required for each level of control	Whiteboard		
			Outline principles of manual handling & discuss HSE guidelines	O/H 20-22	Ask what risk management strategies are used in participant workplaces	
1030-1045	Break					
1045-1245	4.2 Work-Related Upper Limb Disorders (WRULD)	4.2.1 The Nature and Causes of WRULD/Repetitive Strain Injuries/Cumulative Trauma Disorders	Discuss increasing incidence of WRULDs	O/H 23, 24		3
			Explain terms		Ask about risk factors, ask Participants for examples	
			Discuss the upper limb	O/H 25 Model of upper limb, or use whiteboard	Ask to recall anatomy from day 1 – types of joints?	
			Discuss the function of the upper limb: shoulder stabilisation for arm and hand function	O/H 26	Ask implication of small muscles of hand	
			Discuss functional position of hand and different grips	O/H 27 Demonstration	Ask for examples of grips in Participant workplaces	
			Discuss UL injury mechanisms	O/H 28,29 Whiteboard	Ask for examples of functional work tasks	
		4.2.2 Risk Assessment	Discuss risk management cycle	Whiteboard		4

Day & Timing	Topic	Contents	Learning processes	Resources	Resources - exercises	Learning outcomes
			Discuss risk ID	O/H 30		
			Discuss risk Assessment	O/H 31		
		4.2.3 Principles of Control, Preventive and Protective Measures	Discuss risk control strategies	O/H 32-34	Ask for examples of control strategies in Participant workplaces	
1245-1330	Lunch					
1330-1500	Case Studies	a. Manual Handling	Provide Manual Handling case study	HSE material or ASCC risk assessment form (downloaded by Participant for copyright reasons)	Break into groups of 3 HSE material: MAC ASCC COP: Risk Assessment	
		b. WRULD	Provide UL case study	HSE material (downloaded by Participant for copyright reasons)	Break into groups of 3 HSE material: UL Filter UL Risk Assessment	
			Summary of Section 4	Review Section 4 whiteboard		
1500-1515	Break					
1515-1700	5. WORKPLACE, JOB & PRODUCT DESIGN		Go to Section 5 PowerPoint presentation, Day 3	O/H 1,2		
			Outline of Section			
	5.1 Work Environment	5.1.1 Principles of Workplace and Work Systems Design	ISO Definition	O/H 3		
			3 Domains of Ergonomics			
			Discuss principles of work system design	O/H 4	Ask if any Participants have been involved in 'green field' site & gone through the process. Ask them to outline for group	5
			Discuss layout of workspaces and workstations.	O/H 5		

Day & Timing	Topic	Contents	Learning processes	Resources	Resources - exercises	Learning outcomes
			Discuss general considerations	O/H 6 whiteboard	Explore each dot point on slide and ask for examples	
		5.1.2 Workstation & Equipment Design	ISO Definition	O/H 7		
			Discuss principles of workstation design	O/H 8		
			Link with anthropometry section			
			Describe task in slide and ask re dot points		Discussion of case study on slide	
			Demonstrate horizontal work area in terms of Primary, Secondary and Tertiary work areas	O/H 9		
			Discuss work position principles: sitting/standing; sit/stand stations	O/H 10,11		
			Discuss viewing distances & angles	O/H 12	Ask Participants for examples from their workplaces	
			Emphasise anthropometric requirements of reach & clearance. Use examples	O/H 13		
		5.1.3 Tools	Discuss tool design principles Use examples	O/H 14 Examples of good and bad tool designs: e.g. handles, forces, controls.	Divide into 3 groups, 1 tool per group and ask to identify the problem with the design and suggested controls	
1655-1700	Brief Review & Close		Summarise Day	Whiteboard		

TEACHING GUIDE – DAY 4

REVIEW OF OVERNIGHT QUESTIONS

Receive guidance in understanding the reasons for any incorrect answers to the overnight questions from Day 3.

WORKPLACE, JOB & PRODUCT DESIGN (CONTINUED)

STUDENT LEARNING OUTCOMES:

1. Outline key ergonomics characteristics in optimum workplace design
(Learning outcome (5) from previous day)
2. Outline key ergonomics characteristics in optimum product design
(Learning outcome (6) from previous day)
3. Describe sources of data that can be used for ergonomics design of workplaces, jobs and products

PHYSICAL FACTORS OF THE WORK ENVIRONMENT

STUDENT LEARNING OUTCOMES:

4. Outline the physical factors of the work environment which can impact on human performance
5. Describe the ergonomics principles for the physical factors of the work environment

Notes for Trainer:

Resources are required for this day of training.

- Office/work chairs are needed to use as examples
- VDU Assessment forms are required for a class activity. Due to copyright restrictions, participants will need to download the forms:
HSE <http://www.hse.gov.uk/msd/campaigns/vduchecklist.pdf>
WorkSafe Victoria Office Wise
<http://www.workcover.vic.gov.au/wps/wcm/resources/file/ebcb9c435c881f7/officewise.pdf>
- An office or workspace is required for the VDU activity; if this is impractical, the trainer will need to provide a detailed case study with photographs, and/or video clip
- Handout of the Characteristics of Signals (Table 5.2 of manual) is required for the late morning session
- Model of human ear
- Lighting Exercise: Case Study below

Case Study

Lighting at Work

Issue: A company moved into an old building, and the office staff started to complain about a number of issues, including the lighting.

Task Analysis

After consulting with the manager and the office staff to find out more about their duties and their concerns with the lighting, the general office layout, equipment and tasks were assessed.

Findings:

- illumination levels at most work areas were well below Australian Standards for the tasks being performed;
- lighting was variable and resulted in an unsatisfactory affect from patchiness and areas of distinct shadow;
- lights were spaced far apart on a high ceiling, and lacked any diffuser system;
- natural light was coming from the eastern windows, and these lacked any window coverings;
- staff having a variety of desks including those with glossy black or white tops - when the white tops had the sunshine directly on them it created reflected glare, and white papers on the black desks also generated an extreme visual contrast;
- most desks being positioned in line with the eastern windows, with the staff sitting with their backs to the windows, or facing the windows. Staff with their backs to the light were working in their own shadow, and often had their computer screens flooded with light and reflecting the sun (facing the windows also made the screen viewing difficult);
- many staff working from documents with a very small font (8 and 9 point) on large spreadsheets, as well as reading handwritten letters and cheques; and
- many data entry staff having the papers and cheques positioned flat on the desks to one side, thus tending to lean and twist when reading the data for entry.

Model Recommendations

1. Review existing maintenance and renewal program for the lights and considering the installation of additional lighting where lighting levels were still too low;
2. Install diffusers to reduce the glare and to create a more even light throughout the office;
3. Install window coverings on the eastern windows so that the lighting can be better controlled;
4. Re-orientate desks and/or the monitors, so the main light sources are perpendicular to the desk rather than directly behind or in front;
5. Provide document holders to support work (eg. papers and cheques) off the desks and closer to the monitors and the workers' eyes, encouraging more upright and symmetrical postures;
6. Ensure the monitors and papers are positioned so that the items most often viewed are closest to the middle of the desk, with lesser used items to the sides;
7. Provide large monitors for staff who currently have to look at large spreadsheets or other data in very small font size, so font size can be increased; and
8. Monitor the changes to check if any other modifications or adjustments are required.

Day & Timing	Topic	Contents	Learning processes	Resources	Resources - exercises	Learning outcomes
Day 4 0830-0900	REVIEW OVERNIGHT QUESTIONS					
0900-1030	5.WORKPLACE, JOB & PRODUCT DESIGN	Link with previous day	Review outline of Section 5	O/H 1-3		
		5.1.4 Chairs and Seating	Revisit principle of alternating work postures	O/H 4,5		1,2
			Discuss considerations for work chairs	Examples of chairs	Review chairs in relation to O/H 5	
	5.1Work Environment	5.1.5Vehicle Cabs	Discuss considerations for other common seated workstation: the vehicle cab	O/H 6,7	Ask Participants for examples of vehicle cab seating issues from their workplaces	3
		5.1.6Computers (Visual Display Terminals) & Workstation Design	Discuss VDT (VDU) workstations Explore issues under each heading	O/H 8	Discussion	
			Outline computer equipment requirements (NB very brief, great deal of ergonomic research in these areas)	O/H 9		
		Exercise	Introduce HSE or WorkSafe Victoria checklists for assessing VDT (VDU) workstations	O/H 10 Work area for review; or use video clip	Divide into groups of 3 Review chosen checklist Observe worker Audit workstation with checklist Feedback to large group	
1030-1045	Break					
1045-1245	5.2Information, displays & Controls	5.2.1Design principles For Displays & Controls	Introduction to this section	O/H 11	Ask for examples of each dot point	

Day & Timing	Topic	Contents	Learning processes	Resources	Resources - exercises	Learning outcomes
		5.2.2 Information & Displays	Outline design principles and describe each point	O/H 12		
			Visual Displays	O/H 13	Ask for examples	
			Auditory Displays	O/H 14	Ask for examples	
			Quantitative & Qualitative Displays – discuss	O/H 15	Ask for examples	
		5.2.3 Danger and Information Signals	Discuss Refer to handout	O/H 16 Handout of table: Characteristics of Signals	Discussion	
			Discuss safety signs & labels	O/H 17	Ask for good and poor examples of signs & labels	
		5.2.4 Controls	Discuss controls principles: Layout	O/H 18		
			Discuss controls principles: Shape & size	O/H 19		
			Discuss controls principles: Movement, effort, resistance & feedback	O/H 20		
			Discuss controls principles: Controls & compatibility	O/H 21		
			Group Activity to summarise controls section	Flipchart paper and pens	Divide into groups of 4 Consider the principles of controls just discussed Discuss own experience of controls in workplace – as a group provide one example of an issue with controls in each of the overheads:	

Day & Timing	Topic	Contents	Learning processes	Resources	Resources - exercises	Learning outcomes
					Layout Shape & Size Movement etc Controls & compatibility Feedback to large group.	
		5.2.5 Principles of Software Ergonomics Review morning	Outline ISO 13407 principles Discuss with examples Review topics	O/H 22 O/H 23		
1245-1330	Lunch					
1330-1500	6. PHYSICAL FACTORS OF THE WORK ENVIRONMENT		Go to Section 6 PowerPoint presentation, Day 4 Outline of Section	O/H 1,2		
	6.1 Vision & Lighting	6.1.1 The Eye & Visual Capabilities	Describe structure of eye & visual acuity, Colour vision Vision in low light	O/H 3-6	Ask if anyone has reduced colour vision. How does it impact them at work? How do they manage?	4
		6.1.2 Lighting For Work	Describe contrast, glare (disabling V discomfort) & reflections. Give examples with computer workstations and others as relevant. Explain luminance, illuminance and luminaries. Describe different lighting options, and factors in lighting design	O/H 7-14	Ask about their experience with jobs that require good vision. Are they well designed for it? How?	5

Day & Timing	Topic	Contents	Learning processes	Resources	Resources - exercises	Learning outcomes
		Exercise	Group Activity	Lighting Case Study	Divide group into pairs to discuss and come back to group with recommendations.	
	6.2 Noise	6.2.1 Ears & Hearing	Overview Describe key features of ears & hearing & hearing problems	O/H 15-17	Ear model	4
		6.2.2 Noise	Describe nuisance noises Outline noise measurement & typical levels Give e.gs. of controls	O/H 19-24	Ask for e.g.s of nuisance noises Ask for suggestions too. Why is hearing protection the last option? Examples of different types of hearing protection.	5
	6.3 Thermal Environment	6.3.1 Work in Hot or Cold Environments	Overview of key issues	O/H 25,26		4
		6.3.2 Measuring the Effect of Heat and Cold	Describe 'apparent temperatures' with wind chill & humidity etc & measurements to take Discuss controls for hot and cold climates Describe subjective assessment methods	O/H 27-32	 Ask about their experiences in extreme working conditions	5
1500-1515	Break					
1515-1655	6.4 Vibration		Overview	O/H 33,34		

Day & Timing	Topic	Contents	Learning processes	Resources	Resources - exercises	Learning outcomes
		6.4.1 Hand-Transmitted Vibration	Overview Outline hand-transmitted vibration & causes Describe options to reduce risk	O/H 35-40	Does anyone have experience with hand transmitted vibration? Exposure? Know how to reduce the risk?	4,5
		6.4.2 Whole Body Vibration	Outline WBV & causes Describe options to reduce risk Briefly describe methods for objective and subjective measurements	O/H 41-44	Does anyone have experience with WBV? Exposure? Know how to reduce the risk?	
	6.5 Smell, Taste & Tactile Senses	6.5.1 Olfactory (Smell) Ability & Taste	Brief overview of use of these senses at work. Note that dangerous subs may not have an odour / taste	O/H 45-48		
		6.5.2 Skin & Touch	Note risks to skin Clothing reduces sensation and gloves also reduce dexterity	O/H 49		
	6.6 Clothing & Protective Equipment	6.6.1 Introduction	Issues when selecting PPE Footwear Gloves Eye & head protection Hearing protection	O/H 50-55	Ask about considerations when selecting each type of PPE	
		6.6.2 Risk Perception and PPE Use	Outline the issue	O/H 56	Ask for examples from their work	
		6.6.3 IS EN13921:2007: Personal Protective Equipment - Ergonomic Principles	List principles	O/H 57,58		
1655-1700	Brief Review & Close		Summarise Day	Whiteboard		

TEACHING GUIDE – DAY 5

REVIEW OF OVERNIGHT QUESTIONS

Receive guidance in understanding the reasons for any incorrect answers to the overnight questions from Day 4.

REVISION

STUDENT LEARNING OUTCOMES:

1. Revise those sections of course that present difficulty.

MOCK EXAMINATION

2. Attempt a mock examination (120 mins) to highlight possible areas of further study.

*** Trainer to determine examination format. This format will inform the running of Day 5 in the afternoon.

Day & Timing	Topic	Contents	Learning Processes	Learning Resources	Assessment & Learning Outcomes
Day 5					
0830-0900	REVIEW OVERNIGHT QUESTIONS				
0900-0930	Today's activities	Outline of the day	Discuss the day – review course content plus examination/case study practice	O/H 1-3	
0930-1030		Review Overview of Ergonomics Ergonomics methods & techniques Standards & social aspects Musculoskeletal disorders Workplace, job & product design Physical factors of the work environment	Discussion	O/Hs Whiteboard Models	
1030-1045	Break				
1045-1245		Mock Examination			Exam LO 1-6
1245-1330	Lunch				
1330-1430		Mock Examination Review			
1430		Course Close			

ADDITIONAL CASE STUDIES

Case Study 1: Manual Handling: Fire Water Pump Station Valves

Case Study 2: Workplace Layout: Control Room

Case Study 3: Manual Handling: Accessing Valves in Restricted Space

Case Study 4: WRULMSD: Computer Operator

Case Study 5: Vibration

Case Study 6: Workplace Layout: Hospitality & Food Serving

Case Study 7: Mine-Site Control Room (detailed)

Case Study 8: Handling Fish Crates (detailed)

Case Study 1

Manual Handling: Fire Water Pump Station Valves

Issue: Difficulty opening valves at Fire Water Pump Station

Task Analysis

The management and staff were consulted and their main issues noted.

Issues and observations included:

- Valves opened weekly
- Well lit environment
- Good valve maintenance programme
- Location of valves requires operator to adopt awkward postures and climb on other equipment to reach



BP



BP

Model Recommendations

The proposed solutions included:

1. Increase length of valve stem to reduce need to stretch
2. Re-orientate valve to avoid reaching across other equipment, e.g. rotate 90 degrees.

Case Study 2

Workplace Layout: Control Room

Issue: Control room operators are required to monitor and respond to data from multiple screens; additionally, they are required to respond to telephone calls (up to 200 calls/day).

Task Analysis

The management and staff were consulted and their main issues noted.

Issues and observations included:

- Training time is 12 months
- 2 shift operation: AM (07.00-19.00) and PM (19.00-07.00); 7 days on, 7 days off
- 4 personnel employed in area
- No telephone headsets
- Operators reporting neck and shoulder discomfort
- Operators reporting general fatigue



BP

Model Recommendations

The proposed solutions included:

1. Undertake detailed risk assessment of job: organisational factors – work loads, working patterns, provision of breaks, training, etc as well as workstation layout, cognitive demands and individual factors (e.g. musculoskeletal screening)
2. Undertake review of processes involved at control desk – detailed task analysis
3. Use task analysis to determine most common tasks, movements, actions, decisions, etc and redesign layout appropriately
4. Outline the key requirements for work desk– work surface should allow comfortable position for arms and wrists; matt finish; storage; etc.
5. Train additional staff
6. Investigate alternate roster arrangements
7. Install telephone headsets (trial variety with users)

Case Study 3

Manual Handling: Accessing Valves in Restricted Space

Issue: Difficulty opening valves in confined areas such as stairwells.

Task Analysis

The management and staff were consulted and their main issues noted.

Issues and observations included:

- Valves can be operated by one hand when 51-102mm in diameter
- Larger valves to be opened by two hands
- Poor postures in restricted environments are used to open valves
- Occasionally operator must reach across hot pipes to access valves



BP



BP

Model Recommendations

The proposed solutions included:

1. Ensure all future valve installation considers operator
2. Install larger valve wheels to reduce operator effort
3. Move valve location to reduce need to stand on adjacent structures
4. Where valves are critical in operation ensure not located below standing surfaces, under grates etc to prevent delays in actuation.

Case Study 4

WRULMSD: Computer Operator

Issue: Frequent user of a personal computer suffers from lower back, neck and right shoulder pain.

Task Analysis

After further consultation it was established that:

- "Frequent" meant up to 8 hours sitting at the computer per day.
- Software package required use of the mouse nearly as often as the keyboard. Mouse was located on right hand side (RHS) of keyboard.
- Telephone was used regularly. Tendency to cradle handset into the neck when checking information with the computer.
- User had a height adjustable chair and a fixed height desk. Chair had been adjusted to provide a comfortable keying posture.
- As User was relatively short, tended to rest feet on the 5 star base of the chair.

Model Recommendations

1. Ensure frequent changes of posture occur e.g. stand up, walk around. Avoid sitting for prolonged periods. Frequent short breaks are better than longer breaks taken less often.
2. Train to use the mouse with both hands on the LHS and RHS of the keyboard. In preference, use the "hot keys" on the keyboard as an alternative to frequent use of the mouse.
3. Obtain a telephone headset from the telephone supplier for use on prolonged calls or when interaction is required with the computer.
4. Obtain a foot-rest or equivalent under the desk to stabilise the feet. They should be supported in front of the knee line to enable the back muscles to relax into the chair backrest.
5. Use the backrest angle lever on the chair frequently during the day to suit the activity. For example, when talking on the phone, angle the backrest into a reclined position. Frequent changes of posture are needed to engage a range of muscle groups.
6. Practice some "passive exercises" i.e. gentle stretches of those muscles that feel tired.
7. Relax! Muscle pain can result from feeling stressed and tense. Identify aspects of the job that may cause muscle tension and discuss strategies to address these issues.

Case Study 5

Vibration: Hitting a pothole in a passenger transport vehicle while travelling at high speeds (McPhee, 2001)

Issue: While travelling in a passenger transport vehicle, one-off jolts occur without warning and all personnel (especially those in the back seat) are unprepared.

Task Analysis

The management and staff were consulted and their main issues noted.

Issues and observations included:

- Speed of travel accentuates impact
- Less skilled or inexperienced drivers may be less able to avoid rough patches
- Vehicles such as troop carriers where passengers are sitting sideways are used, and passengers are unable to brace themselves
- Seats do not have suspension and sitting behind the rear axle can be particularly rough
- Ride is roughest when there are few passengers
- Equipment suspension deteriorates quickly in rough conditions and requires overhaul at around 40,000km.
- Difficult to measure one-off severe jolts as they occur infrequently.

Model Recommendations

The proposed solutions included:

1. Ensure vehicle suspension is effective and appropriate for the type of vehicle and its function
2. Appropriate vehicle and suspension maintenance programme
3. Ensure passenger seats face forward and are properly designed to provide support and shock absorption
4. Provide adequate roadway lighting at night or in bad weather
5. Ensure that vehicle has appropriate tyres and tyre pressure.

Case Study 6

Workplace Layout: Hospitality & Food Serving

Issue: A large city hotel was being re-furnished and updated. It was thought that the dining room and its equipment could be improved to be both more efficient and to reduce injury risk to staff.

Task Analysis

The management and staff were consulted and their main issues noted. The dining room and the staff were observed in busy and quiet times.

Issues and observations included:

- Waiters and waitresses carried large, heavy trays;
- Crockery was thick and heavy;
- Sideboard unit where most of the clean crockery and glassware was kept was located at one end of the dining room, with shelves from waist height to floor level; and
- During busy periods staff carried more plates and were quickly and constantly moving between tables and the kitchen and sideboard

Model Recommendations

The proposed solutions included:

1. Review the use of trays and considering using trolleys for some tasks
2. Change the tray to a lighter and easier to grasp tray
3. Review the crockery designs and weight
4. Move the sideboard to a more central location in the room, and modify or replace to include some higher shelving, and place the most frequently used items between thigh and chest height
5. Rostering staff to cope with peak periods
6. Monitor changes and adjusting as necessary.

Case Study 7

Mine Site Control Room

Background:

The Control Room is the hub of the mine site. The operators work 12 hour shifts and are the central contact point for the movement of personnel and materials underground. Operational information is collected and passed to the next shift. Information is passed to them through written notes and verbally via telephone, radio and face to face communication. Electronic and computer based monitoring of many underground operational aspects report to the Control Room computers. The Control room operators monitor this activity on five computer screens and initiate response to alarms.

The workspace is set up in a “U” shape consisting of five computer monitors, telephone and radio facilities and the paper work required to be completed by the operator. Four screens monitored various aspects of the operation, the fifth belonging to the PC used by the operator for data entry, emails etc. The operator workspace could be described as three distinct but overlapping spaces in the “U” shape. The operator rolls the chair between these three stations, which causes the operator to forward lean and over reach to minimise the amount of rolling around of the chair.

The chair is shared by all operators, and is in use 24 hours a day 7 days a week. The chair is in a dilapidated state. The base or seat of the chair is 7-8cm lower on the right hand side causing the operator to adopt a side ways flexion of the spine to sit upright. The left side arm is also broken and the back reclined at such an angle that the operators were not observed to use the chair back for support but sat leaning forward whilst working. This is most evident when using the radio facility as filing cabinets were stored under the desk in this location eliminating any legroom under the table forcing operator to extend forwards to use the radio.

Four monitors were 17” flat LCD screens. One screen consists of a VDU unit mounted on the wall. This display is a monochrome view of video cameras located on the surface and underground. The display rotated between cameras and shows four camera views simultaneously.

One LCD screen is dedicated to monitoring the underground telephone system and was used only to indicate what phones were in use.

Two screens monitor the status of underground equipment installations.

Each monitoring point has a set alarm level and when in alarm would flash on the screen. There are many factors monitored and each is displayed in alphanumeric text on the main screen. The screen is very busy. Many alarms occur each shift and no distinction is made between 'critical' alarms and general alarms that require no specific action from the control room operator. The alarm log shows pages of alarm history for the shift with only a small number of these alarms actually requiring an action from the operator to correct the situation.

These screens are located against the external windows and operators complain of feeling 'blind' at the end of day shift. Operators have requested sunglasses to work in the control room.



Photo 1 (Source: Aitkin)

The workstation design has the operator sitting in front of a West facing window with monitors to their right and left sides. This can be seen in Photo 1 with the operator position marked by the telephones and paper work. The primary work surface is 2.8m wide with two distinct computer work stations at opposite corners. The operator rolls the chair back and forth between the two.



Photo 2 (Source: Aitkin)

Questions

1. Using this description, identify the key ergonomic hazards, and list any others you may suspect could be an issue
2. Determine which ergonomic assessment strategies/tools/ measurements you would use to determine the risks
3. Make recommendations to improve the ergonomics of this work process

Model Recommendations

The proposed solutions to include:

1. Undertake a detailed task analysis to determine critical and frequent tasks
2. Use data to inform appropriate design of workstation
3. Account for environmental consideration of sunlight, glare and reflection
4. Workplace Layout principles to be identified
5. Recommendations for working heights, positioning of monitors, etc
6. Appropriate chair recommendations
7. Recommendations concerning cognitive demands
8. Recommendations concerning computer screen information, including colour of alphanumeric symbols.

Case Study 8

Handling Large Fish Crates at Fish Markets

Background:

Fish industries around the world are characterised by a large amount of manual work and handling of product and ice. One of the most common tasks is moving and storing large fish crates which are found in all parts of the supply chain including fishing cooperatives, auction centres, transport companies, fish processors, wholesalers and retailers. In NSW, the seafood industry provides more than 400 different species which are carefully sorted and put through different processing and handling methods, depending on the species, its size and market destination (Weigall and Simpson, 2002). One of the critical aspects of the job is to maintain the quality of the product.

Workers in these areas often complain of musculoskeletal aches and pains and injury figures for the wrist and low back are high. In a review of work processes, the following information was found in relation to fish crates:

- Fish crates were commonly stacked 5-6 high and sometimes 7 or more. At 6 high, most workers were lifting above chest height. The upper arms were raised and abducted with neck extended, workers were not balanced, standing on toes, or edge of lower crates to reach top crate
- Fish crates weigh 20-50kg
- Fish crate made of plastic, with drain holes, made to stack together
- Fish crate dimensions (mm) L: 711, W: 438, H: 316
- Task is repetitive

- Hand trucks were used to move stacks of crates (4 at a time); using the trolley was awkward and excessive force required to overcome initial inertia of load to lift up and difficult to control to place crates down
- Crates were 'thrown' on auction floor to sort into species leading to twisting and flexing the back and neck. Loads 16-20kg or more; movements fast – for instance 7 crates in 30 seconds
- Crates are reorientated to show label when sorted on floor – workers twist to swivel crate



Photo 1: Using hand trolley to move fish crates (HSM)

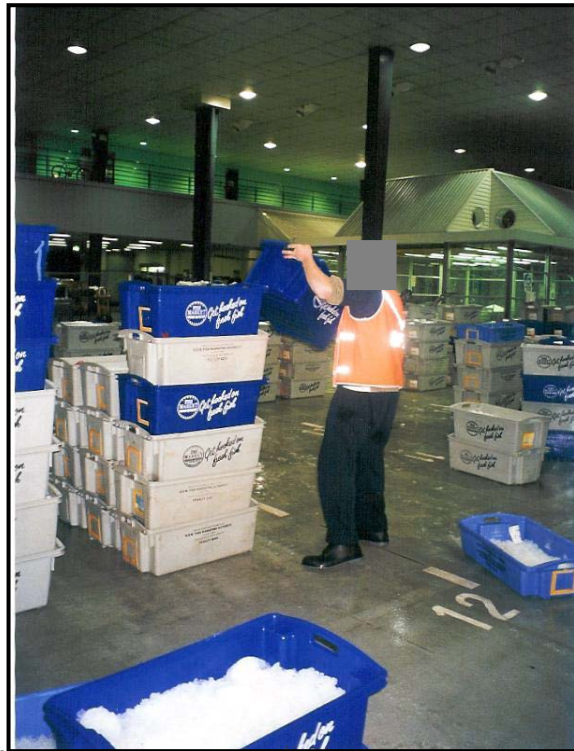


Photo 2: Stacking Crates (HSM)



Photo 3: High Stack of Crates (HSM)

Questions

1. Using this description, identify the key ergonomic hazards, and list any others you may suspect could be an issue
2. Determine which ergonomic assessment strategies/tools/ measurements you would use to determine the risks, and justify your choice
3. Make recommendations to improve the ergonomics of this work process

Model Recommendations

The proposed solutions to include:

1. Undertake detailed process analysis to determine movement of product throughout system
2. Undertake consultation with Management and Workers
3. Measure musculoskeletal load – survey and quantify (choosing appropriate tools such as NIOSH, RULA, Manual Task Checklists, etc)
4. Outline controls for crates: redesign- size, weight, collapsible, etc; use of mechanical aids to move crates (forklifts, mechanised trolleys, conveyors, etc)
5. Discussion of trolley characteristics: curved handles, ‘pram’ handles, diameter of handle to suit population, wheel diameter, tyre characteristics, etc.
6. Streamline product flow
7. Limit stack height
8. Label crates on all sides so no swivel required
9. Develop overall strategy to manage this issues: Safety Management Systems, design requirements for workplace layout, consistency of materials and manual tasks management across industry, training and education for all staff
10. Other recommendations from participants.