Participative Ergonomics

Train the work teams facilitator's guide

A learning program for the NSW mining and extractives industry

NSW GOVERNMENT Trade & Investment Mine Safety

NSW MINE SAFETY ADVISORY COUNCIL

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Table of contents

Overview

Musculoskeletal disorders were an issue highlighted at the NSW Workplace Health and Safety Summit in 2005. The Mine Safety Advisory Council (MSAC) published an action plan in response to the summit, which committed the NSW mining and extractives industry to steps to achieve the summit goals and performance measures. As a result the MSD project steering group was formed as a focus point for industry efforts to improve musculoskeletal disorder management. It includes members from government agencies, employer and union representatives and an independent musculoskeletal disorder expert.

The *Train the work teams* workshop and facilitator's guide teaches stakeholders to confidently facilitate their own participative ergonomics workshops throughout the industry. They also support the department's *Managing Musculoskeletal Disorders: A practical guide to preventing musculoskeletal disorders in the NSW mining and extractives industry.*

Don't Make Yourself Bloody Useless is a holistic participatory ergonomics (PE) program encompassing key ergonomics principles and a strong communication strategy to assist in the reduction of musculoskeletal injuries. The aim of the program is to use the workers as task experts and equip them with knowledge and tools to identify hazardous manual tasks and provide solutions to reduce the hazards.

The *Don't Make Yourself Bloody Useless* program is MSAC initiative that has been developed and implemented by the department's Mining Industry Assistance Unit.

MSAC is the peak tripartite Work Health and Safety (WHS) body for the NSW mining and extractives industry and provides advice to the Minister for Resources and Energy. It has become an authoritative and credible body on WHS.

The Mining Industry Assistance Unit develops and delivers education programs, site assistance, information and advice.

Email: minesafety.assistance@trade.nsw.gov.au

Program delivery

The delivery of this program is flexible. It can be delivered as a whole package or broken down and delivered on a module by module basis. Facilitators can select modules that are most relevant for their operation or combine modules according to the needs of different operational groups. Ideally the program would be held over six sessions with two to three hours allocated to each session (see recommended running times).

The workshop uses various tools as exercises and these tools are available to participants to use in their operations, or if needed the tool can be modified. The decision to present all or some of these exercises is at the discretion of the facilitator. To assist with the delivery of the exercises, the facilitators may like to use video files, diagrams, drawings, photos or on site video footage of hazardous manual tasks.

It is recommended that a trained facilitator deliver this workshop, but it is not essential. It may also benefit to have the skills and experience of a health or medical professional such as an ergonomist, physiotherapist, occupational therapist or WHS nurse to assist in the delivery of the program.

It is also recommended that workshop participants are not assessed, as the intention of this workshop is to use the workers as the task experts. It is important that before the start of the workshops, participants have some knowledge of risk factors associated with hazardous manual tasks as demonstrated in the *Managing Musculoskeletal Disorders: A practical guide preventing musculoskeletal disorders in the NSW mining and extractives industry*

The guide can be downloaded from the department's website at:
www.resources.nsw.gov.au/safety/world-leading-ohs/musculoskeletal-disorders

The *Don't Make Yourself Bloody Useless* participatory ergonomics program provides an opportunity to consultatively manage hazardous manual tasks and has tools the whole business can use to assess and rate their systems.

Program participants

The maximum number of participants that the program can accommodate is ten. The participants should come from a cross section of work areas within the operation and should be well respected among their colleagues.

Management commitment to the program

For the program to succeed, it is important that site management is committed. If the site is 'program weary' or lacks management support or understanding with regards to health and safety issues, then this program is not recommended.

To obtain management support and to determine if the site is ready to tackle hazardous manual tasks, a meeting between the facilitator and site management should be held before the program begins.

The aim of the of this meeting is to:

- provide information and expected outcomes of the program
- determine if the site has the commitment needed from management to ensure success
- confirm if the work team can be released from duties to attend training and undertake risk identification and assessment activities
- determine if management is able to provide the resources needed to develop and implement the controls.

How to run the initial meeting

It is important an agenda is established before this meeting, an example agenda is listed in Table 1 as a guide (it can be changed depending upon circumstances).

Table 1: Example of program management meeting agenda

No.	Item	Points for discussion
1	Welcome and introduction	• Introductions • Give a brief overview of the program including discussion topics, the risk assessment tool and prioritising controls.
2	Expected outcomes	• Provide an overview of what is hoped to be achieved • Show some examples of what other organisations have achieved through the program. If there are no examples some useful guides can be found at: www.deir.qld.gov.au/workplace/resources/pdfs/perform-case-study-sun-metals-belt-conveyors.pdf www.deir.qld.gov.au/workplace/resources/pdfs/perform-case-study-oxy-cutting-torch.pdf as well as: http://vimeo.com/65216270 (This is Centennial Coal's example of participative ergonomics in developing a tool to reduce a hazardous manual task.)
3	Communication resources and strategy	• Discuss the videos and posters that will be used. • Show the videos and the posters to the management team. • Discuss the participant activity of Developing a communication strategy (module 1) that requires the workers to determine the best way to engage colleagues with the communication resources as well as talk about hazardous manual tasks.

4	Commitment to the program including financial	• Identify how many people will participate in the program. Participants also need to be well respected and proactive when it comes to work, health and safety. • When workers are asked to participate in the program, it is expected that they will be available to attend each session. • There are six sessions in total with a minimum two-week period between sessions. The first two sessions are three hours with the remaining four sessions being two hours. • Indicate it is important that management can commit to attending a number of the sessions, particularly sessions three to six. Ask for a roster of managers and place their names against the sessions. If unable to commit on the day follow this up with an email. If there is still no response it is suggested that the program is delayed until a commitment is gained. • Highlight that some of the solutions will require financial commitment. But also point out that some of the solutions are not expensive. It is important at this meeting to understand this commitment. This will provide guidance on how to influence participants to find solutions within budget capacity.
5	Brainstorm current hazardous manual tasks with management team	• Have the management team identify the hazardous manual tasks within their operation. • This can be on a white board or written on paper. • Make sure you keep a copy of the tasks as this will enable you to compare this to the participants' list in session one.
6	Data gathering requirements	• It is expected that all sites undertake a data-gathering exercise. • Data needs to be collected before the program begins, during and at the end of the program. • Data collection provides a cost benefit analysis of the program. The data that should be collected includes: – the number of musculoskeletal injuries. – the time lost as a result of musculoskeletal injuries compared to the total time lost for all injuries. – gross incurred cost of claims as a result of musculoskeletal injuries. – the number of accidents and incidents reported in the past 12 months related to hazardous manual tasks and/or musculoskeletal injuries. – workforce participation in a MSD survey.
7	Conclusion and questions	• An opportunity for management to ask questions.

MSD survey

To assist with the evaluation of the program, sites should participate in a musculoskeletal disorder (MSD) survey. All workers are to complete the survey twice, at the start of the program and again six months after the end of the program. The aim of the survey is to:

1. provide the department with an opportunity to scientifically evaluate the success of the program and communication resources.
2. provide the site with information about changes in knowledge and attitude to MSD, through evaluating how successfully the whole site engaged in the program.

For copies of the survey please call the Industry Assistance Unit on 02 4931 6406.

Completed surveys should be sent to:
Industry Assistance Unit - Mine Safety
NSW Trade & Investment
Po Box 344
Hunter Region MC,
NSW 2310

Communication resources

The aim of the communication resources is to change attitudes and receive and build on commitment from the workers to reduce hazardous manual tasks. The communication resources deliver an effective message and should be used in unison with the PE program to ensure its success.

The *Don't Make Yourself Bloody Useless* communication strategy was developed after extensive research that included discussions with workers. As part of the research, a number of NSW site visits were undertaken, in order to understand what motivates mine workers. The research found the most powerful motivation for workers was the fear of letting others down, adding to other pressures to be productive, resourceful and hard working.

The communication resources include videos and posters of miners and their wives encouraging fellow workers to become involved in the program. There are versions targeted to the coal and metalliferous / extractives industries.

It is important that the facilitator does not to tell the participants how to use the resources. In Module 1 the participants need to develop a communication strategy and determine how they will use the resources to engage with their colleagues. For copies of the resources, please contact the Industry Assistance Unit on 02 4931 6406.

Fig 1. One of the Don't Make Yourself Bloody Useless posters featuring a worker.

Program delivery terminology

Narration

This is the presentation of information. It can be done verbally or provided in a separate document and given to participants. If the facilitator is presenting the information verbally, the text does not necessarily need to be verbatim but this is a starting point for facilitators and can be personalised or additional information added.

Information

This is added content. The facilitator can use this extra information to either field more specific questions or to provide more depth to the topic area.

Read

Have participants read through the information provided.

Display

Display the graphic provided, through a data projector or handout.

Discussion

These are set questions posed by the facilitator to the participants in order to draw out participants' experiences and ideas.

Action

This is a prompt for facilitators to prepare a scheduled activity or exercise.

Activity

This is a semi-directed learning action that involves the participants but is guided by the facilitator to reach an outcome, but there is no right or wrong answer.

Exercise

This is a structured learning activity that involves participants and is guided by the facilitator to reach a desired outcome.

The training environment

The program should be held in a training room or meeting room, which is comfortable and large enough to hold all participants. The room should have the facilities to run PowerPoint and if possible have a whiteboard.

The number and lengths of sessions

As a guide the program consists of six sessions that will be held fortnightly. If the program is gaining momentum and a number of outcomes are being achieved the program can extend beyond six weeks. Typically the sessions are:

- Session 1 - 3 hours
- Session 2 - 3 hours
- Subsequent sessions- 2 hours

Proposed session plan

The following session plan can be used as a guide for program delivery. It can be extended or shortened at the discretion of the facilitator.

Session	Proposed session content	Proposed time frame
1	Module 1	3 hours
2	Module 2	3 hours
3	Module 3	2 hours
4	Work through hazardous manual task action list and discuss as a group proposed controls and actions completed	2 hours
5	Work through hazardous manual task action list and discuss as a group proposed controls and actions completed	2 hours
6	Work through hazardous manual task action list and discuss as a group proposed controls and actions completed. Summarise outcomes achieved from program and set future agreed action plan for outstanding tasks with participants	2 hours

Introduction

Participatory ergonomics is a site-based program that uses the concept of workers as the task experts. With the assistance of several site champions the aim of the program is to identify 'gut busting' activities in the workplace, then use the hierarchy of controls to implement changes and reduce the hazardous manual component of the task. Module 1, 2 and 3 are delivered over the first three sessions, the remaining three sessions will enable the participants to work through their hazardous manual tasks and research, discuss, consult and implement controls.

Modules

Module 1 will consider:

- manual and hazardous manual tasks
- musculoskeletal disorder and injury mechanism
- direct and contributing factors
- the participative ergonomics process
- the development of a communication strategy.

Module 2 will address:

- the risk management process
- the identification of hazardous manual tasks and risk factors
- hazardous task risk assessment principles
- using and applying the risk assessment approach.

Module 3 will:

- prioritise hazardous manual task treatment
- apply control hierarchy towards the hazardous manual task
- implement participatory ergonomic controls.

Why are musculoskeletal disorders such an issue?

Musculoskeletal disorders are the most common cause of workers compensation claims with almost half an organisation's workplace injuries related to MSD.

What is expected of the participants?

All workers who are asked to take part in the program, must want to participate. As such participants are to:

- contribute to the program's activities and discussions
- engage with other workers to identify gut busting activities and contribute solutions
- be available when sessions are held
- champion the program within the workplace
- be respectful to the facilitator and other participants.

Who is involved in the program?

MSDs need to be managed as an integral part of each organisation's WHS management strategy and system.

Participative ergonomics uses the expertise of:

Workers: More often than not, workers know the problems and what can be done to fix them. Involving workers provides the opportunity to identify the problems and find solutions. The participatory ergonomics process promotes team work, consultation and cooperation and can have a positive impact on culture.

Management: They are required to provide support in the process and the implementation of the controls. They should not only provide the initial engagement to the process but provide ongoing support through providing resources, allowing time for workers to attend training, providing input into solutions and making decisions.

Facilitators: Either internal or external facilitators are required to drive the process and provide expert support.

Module 1 MSD's in the workplace

Image: A mining workplace

1.1 Introduction to the musculoskeletal system

Overview of module

Musculoskeletal disorders resulting from performing manual tasks account for a significant proportion of injuries in the NSW mining industry. Musculoskeletal disorders is an umbrella term for several injuries and disorders and can occur suddenly, develop over time or a combination of both. Exposure to risk factors can lead to the development of permanent and disabling injuries that may prevent workers from returning to their jobs and performing simple tasks that are part of their everyday routine. Reducing and eliminating risk factors will lead to healthier employees.

Musculoskeletal system

The musculoskeletal system consists of the bones, muscles, ligaments. The function of the musculoskeletal system is to:

- provide support and movement
- protect the internal structures and organs of the body
- give shape to the body
- produce blood cells.

The skeletal system is joints and 206 bones. The bones provide strength and rigidity.

Muscles

There are 624 muscles in the human body, but there are three types of muscle in the body: cardiac, skeletal and smooth muscles. The skeletal muscles make up the bulk of muscles in the body and account for 40% of total body weight. They are responsible for positioning and moving the skeleton and are assisted by tendons that attach muscle to bone. Ligaments attach bone to bone. (Silverthorn, 2001)

Note to facilitator: The following link may be a useful resource showing the skeleton: http://lrrpublic.cli.det.nsw.edu.au/lrrSecure/Sites/LRRView/7700/documents/5657/5657/applets/001_03_01_1sa_ap01.htm (Department of Education of Training, 2008 & Silverthorn, 2001)

Musculoskeletal structures within the body

The spine, pelvis and discs

The spine and pelvis supports the weight of the body parts and are also involved in movement. The spine consists of vertebrae, intervertebral discs and ligaments that together make up the spinal column, which provides support and protection for the spinal cord. The vertebrae and their related structures increase in size from the bottom to the top of the spine in accordance with the increased load that they must bear. Stature changes occur after about 30 years of age as the discs start to degenerate due to micro tears and scar tissue and fluid is lost more readily as the disc spaces narrow permanently. (Bridger, 2009)

Discs are spongy cushions that separate the block-like bones (vertebrae) of the spine. The discs have important functions including shock absorption, keeping the vertebral column stable and giving the vertebrae “pivot points” to allow movement. The discs can handle a lot of pressure without damage, but certain types of pressure can damage the shell and push its contents out. (Better Health Vic, 2013)

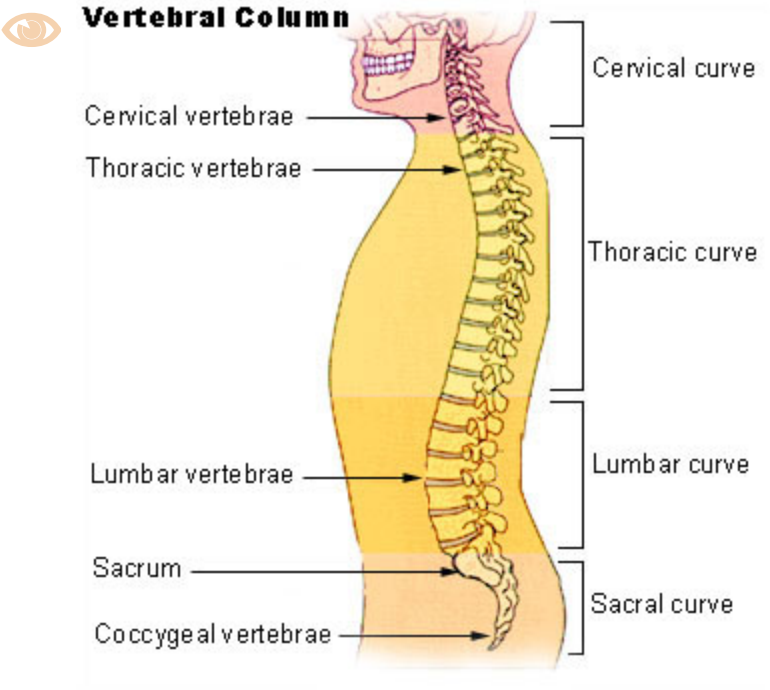

Figure 2: An outline of the segments of the spine
Public domain image from www.training.seer.cancer.gov

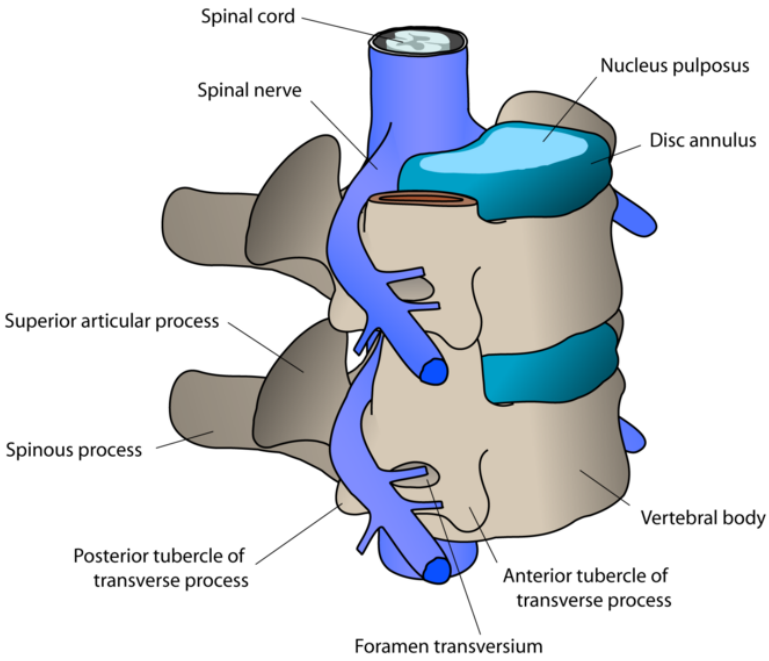

Figure 3: Cervical vertebrae from an oblique viewpoint.
CC BY-SA 3.0 debivort from www.commons.wikimedia.org

The shoulder

The shoulder joint is the most mobile joint in the body and together with the soft tissues this makes it very prone to injury particularly when the arms are held above shoulder height. The shoulder joint is a ball and socket joint, and has a complex muscle structure that includes the rotator cuff muscles. Shoulder instability problems are common in the workplace, especially when workers are required to work with their upper limbs above their heads. (Bridger, 2009)

The knee

The knee joint is a hinge joint and is one of the largest joints in the body. It is comprised of three bones, the femur and tibia and fibula and they are connected by four strong ligaments. These ligaments serve to stabilise and control the motion of the knee joint. The bones are cushioned by a gelatinous cartilage called meniscus that lies between them.

At the front of the knee joint, the patella (kneecap) sits in a groove at the lower end of the femur. The entire joint is enclosed inside a tough capsule lined with a membrane and filled with a lubricating synovial fluid. Extra capsule of fluid known as the bursa offer extra cushioning (Better health Vic, 2013)

1.2 Manual tasks

Manual tasks

Manual handling has been referred to as those " activities requiring a person to use their body (musculoskeletal system), including work involving lifting, lowering, pushing, pulling, carrying, moving, holding or restraining a person, animal or item. Manual tasks also include tasks with repetitive actions, sustained postures and may involve concurrent exposure to vibration." (*Guide to the Management of Musculoskeletal Disorders in the Mining and Extractives Industry*) www.resources.nsw.gov.au/safety/world-leading-ohs/musculoskeletal-disorders

The term manual tasks and hazardous manual tasks has replaced the term manual handling as it also captures other risk factors such as posture and exposure to vibration. Manual tasks can be expensive and inefficient. In addition manual tasks that are light, heavy, repetitive or intermittent pose a significant risk to health to those who do it. This is especially true when the manual task activity takes people to the limit of their work capacity (McPhee, 2005).

It is important that workplaces ensure everyone can undertake a manual task safely and subsequently tasks should be designed so that they can accommodate everyone.

For more information on the legislative requirement please refer to Safe Work Australia Hazardous Manual Task Code of Practice. This can be provided as a resource to the participants.
www.safeworkaustralia.gov.au/sites/SWA/about/Publications/Documents/640/COP_Hazardous_Manual_Tasks.pdf

Why training in lifting techniques is not an effective measure of MSD management

General human handling of materials and people is expensive and inefficient as well as posing significant risks to health to those who do it. Teaching people specific lifting techniques to overcome lifting problems has mixed success in reducing the risks of injury. Sometimes techniques can be helpful in specific situations but some techniques place extra demands on the muscles and joints, which is slower and physiologically more demanding (McPhee, 2005).

There are numerous academic articles that support this statement, these include:

A controlled trial of an educational program to prevent low back injuries. The New England Journal of Medicine, Vol. 337, Number 5, 322-328.) As outlined by Daltroy et al, a very large controlled trial of more than 4000 US postal workers participated in manual handling training and exercises program. The postal workers continued to receive follow up over a 5.5 year period that included three to four reinforcement training sessions. The outcome of the trial found no long term benefits with training and lifting techniques.

Daltroy, L.H., Iversen, M.D., Larson, M.G., Lew, R., Wright, E., Ryan, J., Zwerling, C., Fossel, A.H., Liang, M.H. (1997).

A review of nine investigations showed strong evidence that training is not effective in prevention. Only one showed a positive impact on initial sick leave and duration of symptoms.

Linton, S.J. & van Tulder, M.W. (2001). Preventive interventions for back and neck pain problems. Spine, Volume 26, Number 7, 778-787.

"The results of the systematic review indicate that there is little evidence supporting the effectiveness of technique and educational based manual handling training. There was considerable evidence that principles learnt during training are not applied in the working environment, i.e. there is little transfer of training from the learning environment to the working environment."

Haslam et al. (2007). Manual handling training. Investigation of current practices and development of guidelines. http://www.hse.gov.uk/research/rrhtm/rr583.htm

"…there was no significant difference in reports of back pain, back-related disability or absence from work between groups who received training on proper lifting techniques and assistive devices and those who received exercise training, back belts or no training. Similarly, there was no difference, on average, between those who received intensive training and those who received shorter instruction. These findings were consistent when measured in the short-term or long-term and when examined in randomised trials or cohort studies.

Martimo et al. (2007) Manual material handling advice and assistive devices for preventing and treating back pain in workers. Cochrane Database of Systematic Reviews 2006, Issue 2. http://www.cochrane.org/reviews/en/ab005958.html

1.3 Hazardous manual tasks

Hazardous manual tasks

Not all manual tasks are hazardous. Those manual tasks that have the potential to cause MSD are referred to as *hazardous manual tasks*. As outlined in the *NSW Industry Investment Managing Musculoskeletal Disorders Guidelines,* a hazardous manual task has any of the following characteristics:

- repetitive or sustained application of force
- repetitive or sustained awkward posture
- repetitive or sustained movement
- application of high force
- exposure to sustained vibration
- manual tasks involving the handling of unstable loads or loads that are difficult to grasp or hold.

Start a discussion with all participants and have them identify the hazardous manual tasks commonly performed in the work area. Record the participant's responses.

Hazardous manual task parameters

Factors that can help to identify if the task is hazardous include:

- an injury (musculoskeletal disorder) has been recorded that was associated with the task
- any employee is physically incapable of performing the task, or the task can only be done for a short time
- reporting of discomfort from any employee associated with the manual task;
- employees have improvised controls for the task
- employees doing this task have a higher turnover, or increased absenteeism;
- the mass of any object, person, or animal being handled exceeds 16 kg
- the force exerted on any object, person or animal exceeds 200 N
- the postures adopted to perform the task involve substantial deviations from neutral
- the task involves static postures held for longer than 30 seconds and the task is performed for more than 30 minutes without a break, or for more than two hours per shift.

After you have discussed with the group hazardous manual task parameters, have the group re-examine their hazardous manual task list and have the group see if they can identify further tasks that may have been missed on the first occasion. Make sure that the additional tasks are added to the list.

For further information to assist with the hazardous manual tasks parameters please refer to NIOSH Information Circular 9509, *Ergonomics Processes: Implementation Guide and Tools for the Mining Industry* and *Procedure for Managing Injury Risks Associated with Manual Tasks* Burgess-Limerick (2008*).* www.cdc.gov/niosh/mining/UserFiles/works/pdfs/2009-107.pdf

The parameters identified in this research describe the potentially hazardous manual tasks based on research. These are guidelines only and are not prescribed limits.

Hazardous manual task risk factors

For a task to be considered as hazardous there needs to be specific risk factors present. The risk factors for MSD are often not obvious to the observer, but based on research conducted in Australia and overseas, the key risk factors in the mining and extractives environments are:

- awkward postures
- bending and twisting
- manual handling/load
- forceful exertions
- weight of the load
- repetitive actions
- duration of task
- heavy lifting
- vibration – hand arm and whole body (including jolting and jarring);
- access
- slips, trips and falls
- working long hours without opportunity for rest and recovery
- exerting force in a static position for extended periods
- problems with the work environment (e.g. working in hot or cold weather, rain and unpredictable conditions)
- high job demands and time pressure
- fatigue
- lack of job rotation and equipment change.

(Guide to the Management of Musculoskeletal Disorders in the Mining and Extractives Industry , 2009)

Another issue to be mindful of is that the same task and same environment may affect workers in different ways, e.g. a shorter worker may be required to overreach, while a taller worker may be cramped and restricted while operating machinery.

Direct risk factors

Research has shown significant links between exposure to specific risk factors and the onset of MSD.

Evidence exists for the relationship between MSDs and:

- forceful exertions
- awkward and sustained postures (working postures)
- repetition of movement
- duration of task
- vibration.

Note: It is important for participants to have a general understanding of the risk factors and an understanding that many tasks expose workers to a combination of risk factors. In these cases, it is important for participants to be able to identify all present risk factors and the magnitude of the exposure to risk factors and be able to systematically prioritise them for developing controls.

Exertion/force

Applying force is mostly about the mass/weight of the object being handled but force also depends on the position of the body from the distance of the load. Similarly the force involved also depends on the frictional properties of the load and the surface. Even if forces involved are not close to maximum, the task may pose a high risk of an MSD if the body part is also exposed to other risk factors. (NIOSH, 2009)

Examples of sustained force include:

- pushing and pulling objects
- holding down a trigger to hold operate a power tool
- lifting and stacking goods onto a pallet
- throwing or catching objects
- striking objects
- cutting reinforced steel with large bolt cutters.

After you have discussed with the group force/exertion, have the group identify tasks that involve force and exertion. Make sure all tasks are recorded. If one task stands out in the discussion, organise for someone in the group to take photos or video footage and bring this to the next session.

Awkward or sustained postures

The risk factor ‘awkward postures’ refers to any working postures where the body parts are deviated from a neutral position, and where any part of the body is in an uncomfortable or unnatural position such as postures that are unbalanced or asymmetrical and postures that require extreme joint angles or bending and twisting.

Examples of an awkward posture include:

- squatting while servicing plant or a vehicle
- working with arms overhead
- squatting, twisting and reaching
- kneeling while troweling concrete.

Sustained postures require the body to maintain the same posture with little or no movement. Your body will require movement to assist with moving the blood supply around the body. If the body does not move, the blood cannot circulate effectively, which will fatigue muscles that then increases the risk of injury.

Examples of sustained postures include:

- supporting materials above your head whilst you wait until it is secured
- continually standing with weight mainly on one leg while operating a power press with four pedal controls (Safe Work Australia, 2011).

After you have discussed sustained and awkward postures, have the group identify tasks that involve sustained and awkward postures. Make sure all tasks are recorded. If one task stands out in discussion, organise for someone in the group to take photos or video footage and bring this to the next session.

Repetitive movement patterns

Exposure to repetition occurs when similar movements are required to be performed for one hour or longer. Repetitive work also refers to work where even though the task itself may change, the worker performs similar actions across a number of tasks during their shift. As a result, the same muscles and other soft tissues are being used continuously, contributing to their fatigue and risk of injury.

Examples of repetitive work include:

- the use of hand tools in maintenance
- handling bolting equipment in bolting operations
- painting
- using a socket and ratchet or spanner to unscrew long bolts
- shovelling
- static posture without changing position such as driving or operating plant
- continuous standing without walking (this can cause pooling of blood in the lower legs that can create long term circulatory issues including, chronic venous disorders).

Work is considered repetitive when:

- the work cycle is less than 30 seconds
- a fundamental activity in the work cycle is repeated for more than 50% of the work cycle time
- the work must be performed for a minimum of 60 minutes
- the risk is increased as a combination of other factors.

After you have discussed repetition, have the group identify tasks that are repetitious. Make sure all tasks are recorded. If one task stands out in discussion, organise for someone in the group to take photos or video footage and bring this to the next session.

Duration

Duration is a risk factor that considers how long a worker might be performing the task. The longer the task is performed the higher the risk. Extended shifts should be taken into account for duration. Operating mining vehicles in open cut mining is one of the most obvious tasks where duration is a factor.

If a task is performed continuously without a break and for a long time, the muscles do not have the opportunity to recover, and subsequently the cumulative micro injury may occur. A way to manage this situation is performing several tasks during a shift to assist with recovery especially if tasks involve the use of different muscles and movements (NIOSH, 2009)

After you have discussed duration, have the group identify tasks that are long in duration. Make sure all tasks are recorded. If one task stands out in discussion, organise for someone in the group to take photos or video footage and bring this to the next session.

Vibration

Exposure to vibration can consist of either whole body vibration or hand/arm vibration. In both cases, the vibration exposure impacts MSD risk both directly and indirectly.

Vibration arises from contact with mechanical sources. Vibration energy can be passed on to operators from vehicles on rough roads, vibrating tools, vibrating machinery or work platforms. Vibration can be transmitted through the feet and legs, hands and arms but most commonly through the buttocks. The magnitude of vibration depends on the severity and length of exposures. (McPhee, 2009)

Whole Body Vibration (WBV)

Mine workers are exposed to the WBV through a number of transport and other mining equipment. WBV can be transmitted to the operator from a vehicles or machine through the seat and into the driver's body via the legs, buttock and back.

There are three main sources of harmful vibration in vehicles and machines:

1. Rough road and poor work surface conditions
2. Vehicle activity – e.g. ripping versus pushing material in a dozer
3. Engine vibration, but to a lesser extent.

There are many factors that can either increase or decrease the exposure of the operator these include:

- road construction and maintenance
- vehicle type and design
- age and condition of the vehicle
- maintenance of vehicle suspension systems
- seat design, suspension and maintenance
- cab layout design and orientation
- vehicle or machine speed, driver skills and awareness
- lighting and visibility (McPhee, 2009).

Hand arm vibration (HAV)

Hand-arm vibration (HAV) is transmitted as a result of work processes or tasks, to workers' hands and arms. Vibrating tools such a chainsaws and jack hammers can produce hand arm vibration. It can cause circulatory disorders of the hands known as vibration white finger (Raynaud's disease) particularly in colder climates. Common sources of HAV in mining and extractives are from:

1. hand-held power tools (used in maintenance for process plants, fixed plant, some mobile equipment)
2. hand-guided powered equipment (mainly hand-held drills, air leg drills, drill rigs)
3. powered machines where vibration is transmitted via body to hands (operating jumbos without vibration dampening).

After you have discussed vibration, have the group identify tasks that exposes them to vibration. Make sure all tasks are recorded. If one task stands out in discussion, organise for someone in the group to take photos or video footage and bring this to the next session.

1.4 Musculoskeletal disorders and injury mechanism

What is a musculoskeletal disorder?

Musculoskeletal disorder or MSD is a term used to describe injuries specifically related to the muscle system or the skeletal system. These injuries include but limited to:

- sprains and strains of muscles, ligaments and tendons (e.g. shoulder muscle strain leading to rotator cuff tear)
- back injuries, including damage to the muscles, tendons, ligaments, spinal discs (e.g. ruptured discs), nerves (e.g. sciatica), joints and bones
- joint injuries or degeneration, including injuries to the shoulder, elbow, wrist, hip, knee, ankle, hands and feet
- bone injuries (e.g. fractures)
- nerve injuries (e.g. carpal tunnel syndrome of the wrist)
- soft tissue hernias (e.g. abdominal hernias)
- muscular and vascular disorders as a result of hand- arm vibration (HAV).

MSDs are quite common and most people at some point in time, either at work or at home, have experienced a musculoskeletal related injury.

Discuss with participants - What injuries have they experienced? How did it occur? What did it feel like? Did the injury prevent them from doing normal activities?

How do musculoskeletal injuries occur?

Injury mechanism refers to how the injury occurs. It is an opportunity to fully understand how the injury occurs and assists to guide how to prevent that injury reoccurring (Bahr & Kroohaug, 2005).

MSD injuries can occur when the load on the body tissue is greater than the tissue's capacity. An MSD injury can occur either:

- suddenly as a result of a single forceful action like pulling or lifting a moving object, actions through excessive exertion or force or through a slip, trip or fall.
- develop over a longer period as symptoms associated with minor tissue injuries (including nerve and vascular tissues) are ignored, eventually resulting in a more serious injury. Injuries suffered by workers (e.g. transport drivers, mechanics) doing repetitive work and/or work of a similar nature could also fall into this category.
- be a combination of both, where tissues that are weakened by cumulative injury may become more vulnerable to an acute injury, even at much lower forces.

Fatigue, pain and muscles

Active muscles require a regular blood supply to replenish fuel and remove waste. If the muscles are placed in situations of sustained activities, rapid movements and large forces then the muscles will reach a maximum workload and fatigue. The loss of muscle function that occurs with fatigue implies the risk of musculoskeletal injury. This indicates why consideration needs to be given to work-rest cycles, work durations and forces and needs to be contemplated in the risk assessment process. (Silvertorn, 2001 & Bridger, 2009)

1.5 Direct and contributory risk factors

Direct risk factors

The risk factors for MSDs are often not obvious to the observer. To assess a hazardous manual task, the observer must be able to identify the presence of specific risk factors. These risk factors may not be apparent unless the observer is aware of the risk factors and the worker is observed performing the actual task including interaction with the environment and tools.

Another issue to be mindful of is that the same task and same environment may affect different workers in different ways. For example a shorter worker may be required to overreach, while a taller worker may be cramped and restricted while operating machinery.
Research has shown significant links between exposure to specific risk factors and the onset of MSD.

Evidence exists for the relationship between MSDs and:

- forceful exertions
- awkward and sustained postures (working postures)
- repetition of movement
- duration of task
- vibration.

Contributory risk factors

There are also a number of inherent risks that might contribute to MSDs:

- Workplace design and layout, equipment and vehicle design.
- Working environment- thermal environment, floor surfaces, steps, ramps, housekeeping, vibration, the mine working environment factors, including the road surface and haul roads, uneven, muddy and wet ground, limited access underground and around equipment, poor visibility etc.
- Characteristics and location of equipment - weight, balance, handle design or orientation, shock loading or impact forces, failure to select for purposes.
- Work organisation, planning and systems of work, job design for “average” workers including rosters, shutdown deadlines and overtime.

SHEL model

The Software Hardware Environment Liveware (SHEL) model (see Figure 5) is also another simple way to explain contributory risk factors. The SHEL model considers a variety of contextual and task-related factors that interact with the human operator and influence operator performance (Weigmann & Shappell, 2003).

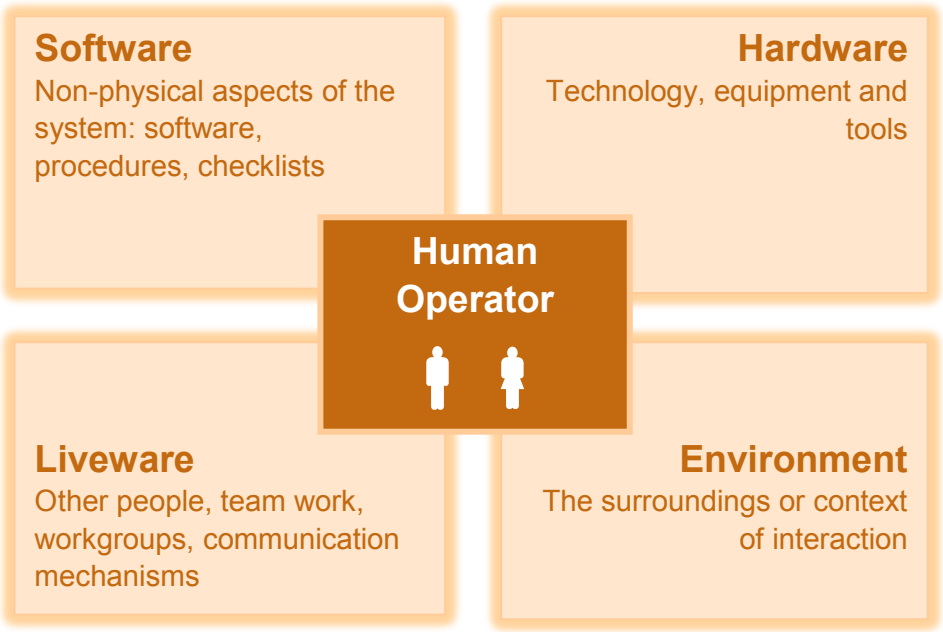

Figure 5: SHEL model

Other risk factors

Mining and extractive sectors now have a more diverse workforce with more women, older workers and less experienced workers. Jobs and tasks need to accommodate the physical characteristics, skills and experience of individual workers rather than a notional average worker. For example: individuals will vary in the amount of force they can apply:

- Some tasks promote awkward postures due to workers' physical size differences.
- Less experienced workers may perform repetitive tasks more frequently due to errors or if they are unfamiliar with the task
- Lack of rotation and equipment change.
- Systemic organisation problems limiting rest periods at work, rest periods outside of work and appropriate intervals of rest periods at work.

Place the organisation injuries statistics on PowerPoint, or if this is not available obtain a copy of the incident register and identify any hazardous manual tasks.

Prompt discussion among the participants and ask open ended questions such as:

- What do you think about the statistics/results?
- What are the key trends or tasks that can be identified as causing injury?

- Does the presented information surprise you?

1.5 Preventing and managing MSD

Musculoskeletal disorder management

There are several ways to manage musculoskeletal disorders including policy, risk management, stretching and exercise programs and lifting technique training. A participative ergonomics approach is internationally recognised as the most effective way to conduct manual task risk management and reduce MSD injuries. The participative ergonomics approach differs from other methods because it engages with the people who perform the tasks daily. As part of the approach, work teams are provided with training about manual tasks risks and participate in facilitated workshops to generate control ideas.

The advantages to this approach include:

- development of effective controls that target the key risk factors and are designed for the work requirements/environment
- providing workers with a greater sense of ownership and commitment to use the controls.

The cost benefit of MSD management

Musculoskeletal disorders are a massive drain on resources, including workers' compensation, sick pay, lost productivity, retraining, and legal expenses. They also represent an opportunity for savings because they are manageable and preventable.

"In terms of cost benefits the cost of solutions and the time needed to identify and quantify the problems need to be considered against the cost of making mistakes and having injuries. Unfortunately reduction of work-related MSD is often hard to prove statistically and there is likely to be a long delay before information is available to justify changes. Sometimes it is easier to justify the cost of ergonomic changes because they will make the job faster, easier and probably safer. Therefore the benefits of changes need to be assessed in different ways in the short and long term." (Mcphee 2005)

Controlling the risk of MSD

The way of controlling the MSD risk is by ranking them in accordance with the hierarchy of control. WHS regulations require duty holders to work through the hierarchy of control that most effectively eliminates or minimises the risk of injury.

The most effective control measure is to eliminate the hazard. Eliminating hazards and risks are usually cheaper to achieve in the planning or design stage. It is not always reasonably practicable to eliminate the risk therefore as such to control the hazard consideration should be given to substituting, isolating or implementing engineering controls.

More information will be provided in module 2 and 3 of this program.

1.6 Developing a communication strategy

Communication resources

How will the participants get the rest of the work place involved in the program? Facilitate discussion with the group. Make sure answers are recorded for all participants to view.

Questions to ask the group:

- What do you hope to achieve from the PE program?
- How do you think we achieve this?
- How we will receive engagement from their fellow workers?

Communication resources have been developed to work in conjunction with this participatory ergonomics training package (see page 8). It is important that facilitators do not tell the participants how to use the resources but provide participants with an opportunity to develop their own communication strategy.

Show the *Bloody Useless* videos , posters and stickers.

Ask the following questions of the participants. Make sure all answers are recorded:

- What do you think of the posters and videos?
- Do you think you would like to use these resources within the work place?
- How do you think you would like to introduce your colleagues to the work you are undertaking in the participatory ergonomics program?
- What is the best way of showing or rolling out the resources within the organisation?
- Is there any other ways you can engage your colleagues?
- Indicate that the group has the opportunity to also add a slogan to one of the posters and advise that they will be given time at the next session to come up with some ideas.
- Also ask the group what they need from you as the facilitator to assist with the process.

Once all answer are recorded, write an action plan that includes:

- the aim of the communication strategy
- dates and times for the communication resources to be rolled out
- who is responsible to ensure the action plan is implemented
- a list of people who will assist in roll out
- any additional resources or aids needed to ensure a successful and smooth roll out.

Team identification: - Challenge – who are we?

In addition to the communication resources it is important for the work teams to form their own identify as a selling tool to engage the other work groups they are representing.

Set the challenge with your work teams. Before the next session they are required to have discussions with other team members on a name for their participatory ergonomics team. Encourage the work teams to be creative and provide examples of what others have done.

Fig 6: Examples of other team names

Participants will be required to undertake homework before the start of session two. Ensure that the participants fully understand what needs to be completed before session two. Include the following activity on a hand-out sheet.

Homework activity 1

The learning outcomes of homework activity one are:

- to be able to identify the five risk factors of a hazardous manual task
- to identify the hazardous manual tasks in their work environment
- to champion a communication strategy to increase awareness of musculoskeletal disorders and hazardous manual tasks.

Description of homework activity

At session two, participants are required to provide the following:

- The undertaking of a tool box session with colleagues and how the facilitator coached them to understand the five risk factors that contribute to a hazardous manual task.
- Provide written material (dot points will be sufficient) on the hazardous manual tasks that were discussed at the tool box session.
- A verbal report on how they championed a communication strategy that is a part of the participatory ergonomics program. This includes showing the videos, posters and handing out the stickers.

Note: Participants should be given two weeks (minimum) to complete the tasks.

Module 2 Identification and assessment

Image: A mine worker's hand

2.1 The risk management process

Risk management process

Like all hazards, MSD management requires a risk management approach. It is nothing different or new and can be easily integrated into existing WHS management system. Risk management involves hazard identification, risk assessment and control and the monitoring and evaluation of controls (solutions). Analysis of risk is at the heart of the risk management process. The risk management process can be as complicated but simple methods can achieve reasonable outcomes and reduce risks to ergonomic hazards. (McPhee, 2005)

Step 1: Gather information

The process of finding, recognising and describing a risk is the best way to define risk identification. The best way to identify or gather all the hazardous manual tasks in an organisation is through consultation. It is important that this involves workers, management and other key members within the organisation and provides the opportunity for everyone to identify potentially hazardous manual tasks for further investigation.

There are many sources of information to help identify MSD hazards. The best way to do this is to systematically examine information about the tasks that has the potential to harm the musculoskeletal system. Common sources of information include:

- injury records and trends
- incident and hazard reports
- issues raised by check inspectors, WHS committee members, deputies, employees, permanent and intermittent contractors
- surveys and consultants' reports
- health and safety committee meeting minutes or reports
- industry reports or information on MSD or ergonomics issues
- records of production or services difficulties causing additional manual tasks
- records of maintenance and service requests that mention physical difficulty in using equipment.

Once you have gathered the information the next step is to review that information and in consultation with workers, contractors and health and safety representatives, make a list of:

- all manual tasks where an injury, pain or persistant symptoms have been reported.
- manual tasks reported as difficult to perform such as those that require more than one person to complete.

- manual tasks associated with interruptions or difficulties with work processes, particularly the need to redo work.
- tasks involving equipment or hand tools that are not working properly or are difficult to use.

In addition other task characteristics that need to be considered when gathering information include:

- new manual tasks or those to be altered in some way or which are being undertaken in a changed environment.
- manual tasks that have not previously been examined for the potential as a hazard.
- tasks that have led to reports of slips, trips and falls.

For more information please refer to pages 11 to 22 of the *Guide to the Management of Musculoskeletal Disorders*

www.resources.nsw.gov.au/safety/world-leading-ohs/musculoskeletal-disorders

Step 2: Group tasks by operational area

Once the MSD hazards with in your workplace are identified, the hazard should be related to operational areas. This step enables each operational area to list the tasks with MSD risk factors.

The second step in the process is to review the current risk assessments to determine if the MSD risk factors are clearly documented. Other useful information that can assist in this process includes, areas of the body were previous injuries have occurred and any hazard report or information on the root cause. Information that includes photographs, videos, or other prompts will make it easier for the risk assessment.

At the end of this process you should have a list of jobs, occupations and operational areas most commonly associated with high or potentially high levels of MSD.

Step 3: Review the risk factors

Once the MSD risk factors into operational areas are identified, the next step would be planning the risk assessment. It is important that the risk assessment is broken into operational areas as some areas may have more hazardous manual tasks than others. Planning for the risk assessment includes:

- determining if there are gaps in the information collected
- deciding if assessment of some hazardous tasks or jobs may require additional expertise
- allocating enough resources and representatives to participate in the risk assessments.

It is important that when reviewing the risk factors that the risk factors already identified in Module 1 are considered.

Step 4: Assess the risk associated with the tasks

The risk assessment should explore the root cause of the MSD risk factors, including asking why the manual task is being undertaken . As part of the risk assessment the team will choose the most appropriate tool or checklist incorporating relevant MSD and slip trip and falls risk factors.

There are a number of tools to help assess MSD risk factors. This will be discussed later in the module. The outcomes expected to achieve in the assessing stage is to have a prioritised list of tasks/ jobs to be controlled. This could be in the form of an MSD risk register.

Step 5: Control the MSD risk

Developing controls for MSD risks should be based on the hierarchy of controls. Controlling the risk directly by designing out the hazard is generally more effective than lower order controls. Training in safe lifting techniques on its own is not an

effective control of MSD. Manual task techniques training is therefore not an acceptable control measure on its own.

The first process in controlling a hazardous manual task is to determine if the task can be eliminated. Next consider an engineering or design control to reduce the risks of MSD. The control should deal with all associated risk factors.

When implementing risk controls it is important that the following principles are applied:

- Use the hierarchy of controls
- Trial solutions before making them permanent
- Review controls after the testing period as they may need modification
- Develop work procedures to ensure that the controls are understood and responsibilities are clear
- Communicate the reasons for the change
- Train workers to use the controls
- Supervise the reliable implementation of controls.

Step 6: Monitor and review

The final step in the process is to make sure risk controls are effective. This can be achieved by:

- consulting with workers and supervisors regularly, especially those using the risk control measures.
- observe work activities during walk-through surveys.
- conduct audits and inspections.
- monitor hazard, incident and injury reports.
- conduct surveys of MSD risks.
- check that the risk controls are working successfully and are being used correctly - the task should be easier to perform.
- look at the task in action to see whether the risk factors have been minimised as intended.
- make sure the change introduced to solve one problem has not created difficulties elsewhere.
- make sure changes are properly evaluated by people who do the job.

Please note the above information was obtained from the *Guide to the Management of Musculoskeletal Disorders.* The following flow chart (Figure 6) demonstrates the principles of MSD risk management.

Action	Outcome
1. Gather information	A list of tasks most likely to be hazardous MSD tasks

Action	Outcome
2. Group tasks by operational area	A list of jobs, occupations, operational areas most commonly associated with high potentially high levels of MSD

Action	Outcome
3. Review the risk factors	A list of tasks and/or jobs with identified associated risk factors

Action	Outcome
4. Assess the risk associated with the task	A prioritised list of tasks/jobs to be controlled- this could be in the form of an MSD risk register

Action	Outcome
5. Control the MSD risk	Control solutions and an associated implementation action plan

Action	Outcome
6. Monitor and review	Auditable records showing that MSD risks are being effectively managed

Training

Supervision

Consultation

Fig 6 Principles of MSD risk management:

Managing Musculoskeletal Disorders: A practical guide to preventing musculoskeletal disorders in the NSW mining industry.

2.2 Identify hazardous manual tasks and risk factors

Identifying hazardous manual tasks and risk factors was discussed in module 2.1. Prompt a class discussion on the ways to identify hazardous manual tasks within the workplace. Ensure answers are recorded.

Make sure that as a minimum that the participants identify the following list.

- Injury records and trends
- Incident and hazard reports
- Issues raised by check inspectors, WHS committee members, deputies, employees, permanent and intermittent contractors
- Surveys and consultants reports
- Health and safety committee meeting minutes or reports
- Industry reports or information on MSD or ergonomics issues
- Records of production or services difficulties causing additional manual tasks
- Records of maintenance and service requests that mention physical difficulty in using equipment.

When identifying hazardous manual tasks and associated risk factors it is helpful to define the types of hazards that will be considered during the risk assessment scoping processes. It is important that the right risk assessment method or tool is used. There are different ways to measure and estimate hazardous manual tasks and they all have limitations.

Some examples of the tools that identify the risks associated with hazardous manual tasks include:

- Ovako working posture analysis system (OWAS
- Rapid upper limb assessment (RULA)
- Rapid Entire Body Assessment (REBA)
- NIOSH lifting equation and guidelines
- Borg rating of perceived exertion (RPE)
- Participative ergonomics for manual tasks –PeforM

  (McPhee, 2005), (Bridger, 2009) (NSW Industry & Investment, 2009)

The list is an example of some tools to assist in the risk assessment process, a brief example of these tools will be provided in later modules.

Risk assessment traps

Risk assessments are a potentially powerful tool if used correctly, but if they are not used correctly and the workplace does not understand the outcomes then they can lead to unacceptable outcomes.

MDG 1010 *Minerals Industry Safety and Health Risk management Guidelines*, states that some of the pitfalls that need to be considered include:

- carrying out a risk assessment to attempt to justify a decision that has already been made
- using generic risk assessment when a site specific assessment is needed
- carrying out a detailed, quantitative risk assessment without considering whether any relevant good practice was applicable
- carrying out a risk assessment using inappropriate good practice;
- only considering the risk from one activity
- not involving a team of people in the assessment or not including employees with practical knowledge of the process/activity being assessed
- ineffective use of consultants
- failure to consider all possible outcomes
- not doing anything with the result of the assessment
- not linking hazards with risk controls.

A focus on quality in the scoping and execution and using the right risk assessment tool should avoid the majority of these issues.

MDG 1010 Guideline for Minerals Industry Safety and Health Risk Management can be found at: www.resources.nsw.gov.au/safety/publications/mdg

2.3 Hazardous manual tasks risk assessment principles

A person conducting a business or undertaking (PCBU) has the primary duty to ensure so far as is reasonably practicable that workers and other people are not exposed to health and safety risks arising from the business or undertaking. Furthermore a person conducting a business or undertaking must manage risks relating to a musculoskeletal disorders associated with a hazardous manual tasks.

A major part of the risk assessment principles is the hierarchy of controls. The hierarchy of controls provide guidance on what should be considered when controlling the hazardous manual task. WHS regulations require duty holders to work through this hierarchy to choose the control that most effectively eliminates or minimises the risk in the circumstances. This may involve a single control measure or a combination of various control measures.

Eliminate the risk

The most effective control measure involves eliminating the hazardous manual task and its associated risk. Eliminating hazards and risks is usually easier and cheaper to achieve in the planning or design stage.

Minimise the risk

If it is not reasonably practicable to eliminate the risk, then minimise the risks so far as is reasonably practicable by:

- substituting the hazard with something that gives rise to a lesser risk
- implementing engineering controls (Safe Work Australia, 2011)

More information will be provided in module three on the hierarchy of controls.

Using a participatory ergonomics approach to conduct a risk assessment

A participatory ergonomics approach to risk assessment allows a focus group to tackle a hazardous manual task using a systematic approach with a view to identifying solutions to the problem.

The availability of relevant information and expertise is essential to the effectiveness of the participatory process. In addition it provides a forum for constructive consultation, something that can be difficult to achieve in other processes. Fundamentally the participatory ergonomics approach needs to be realistic and provide achievable solutions. A participatory ergonomics risk assessment if done well will:

- provide a sense of ownership of ideas and responsibility for identifying the most appropriate solution
- provide of a framework that workers can use to solve problems
- present the workers the theory and application of ergonomics
- promote effective work place communication (Mcphee, 2005).

The participatory ergonomics process fosters the engagement of all stakeholders, which helps create and maintain a healthy and safe work environment. The following diagram (Figure 7) even though related to risk as a whole, promotes the underlying philosophy of hazardous manual task risk management principles. If any of the principles are absent then the participatory ergonomics process is useless.

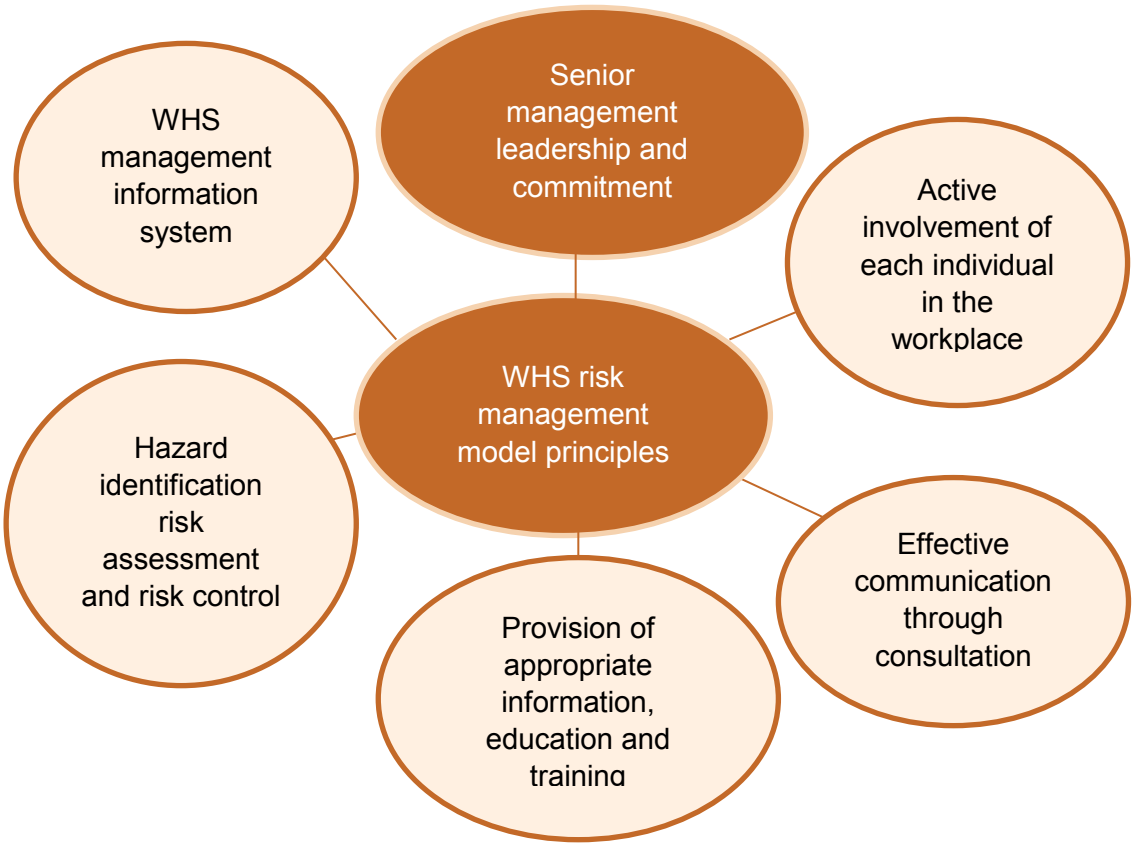

Fig 7: Philosophy of hazardous manual task risk assessments

2.4 Determine appropriate risk assessment tool and apply to hazardous manual tasks

There are tools available to assist in risk assessing hazardous manual task. The following list is a guide and it is the decision of the facilitator which tools to use for this program. The training is flexible enough for the facilitator to focus the discussion on all tools listed, on one tool, or to include other tools not listed in this program.

Hazardous manual task risk assessment tools

Ovaka Working Posture Analysis System
OWAS identifies the most common work practices for the back, arm and legs and the weight of the load handled. In the OWAS method there are about 252 posture combinations, and OWAS videos are made of work tasks for later analysis of postural load. The videos are analysed with a software program. This identifies the least desirable positions or postures and indicates what tasks or activities need to be considered or addressed.
(McPhee, 2005) (Jose , 2005)

Limitations: As with any tool there are limitations with the OVAKA:

- It does not consider repetition or duration of the sequential postures;
- Time consuming
- It does not separate right and left upper extremities; and
- The use of OVKA requires thorough training of the observation techniques as well as skills to design the observation strategy.

For further information on how to apply the OVAKA refer to the following link:
www.ttl.fi/en/ergonomics/methods/workload_exposure_methods/table_and_methods/Documents/OWAS.pdf

Rapid Upper Limb Assessment (RULA):

RULA was developed by Professor E.N Corlett and Dr L McAtamney and is a tool to evaluate the exposure or workers with MSD risk factors in the upper arms. It considers biomechanical and postural load requirements of job tasks on the upper body. A single page worksheet evaluates body posture, force and repetition and enables the evaluator to assign a score for each of the upper body regions. Once the data has been compiled the evaluator can identify the level of MSD risk.

Limitations: The limitations of RULA:

- It does not consider the duration of exposures
- It is not applicable for tasks involving manual materials handling and whole body movements
- Right and left hands have to be assessed separately
- RULA is less suitable for duration of work that cannot be broken down to tasks.

There is a lot of information on the internet about RULA. Sites that provide guidance on the risk tool can be found at :
www.rula.co.uk/
or
www.ergo-plus.com/healthandsafetyblog/wp-content/uploads/2012/11/RULA-A-Step-by-Step-Guide1.pdf
or
www.ttl.fi/en/ergonomics/methods/workload_exposure_methods/table_and_methods/Documents/RULA.pdf

Rapid Entire Body Assessment (REBA)

REBA was developed as a means to risk assess posture for work-related musculoskeletal disorders. The results of REBA should be interpreted with data on real life injury rates, absenteeism and any research relevant to the industry under investigation. REBA was developed by Sue Hignett and Dr Lynn McAtamney and further information can be found at : *Hignett, S & McAtamney, L. 2000. Rapid Entire Body Assessment (REBA); Applied Ergonomics, Vol 31. PP 201-205.*

REBA is similar to RULA where the evaluator assigns a score for each of the body regions. After the data is collected and scored you are able to compile the risk factors variables by the tables provided. REBA can be conducted quickly and on multiple positions and tasks and can be evaluated effectively.

When using the REBA ratingsuse direct observation or photographs by following steps including:

- observing the angles of the following body segment and assign each segment a rating depending on its orientation/posture using the zone rating system
- collate body segments ratings using the REBA scoring sheets
- cross referencing the scores of A & B with C
- adding score C to activity score to obtain REBA score
- obtaining the REBA action level
- making recommendations for change (Bridger, 2009).

Limitations: Limitations of f REBA include:

- It can be time consuming
- No opportunity to combine data
- The user has to determine what to observe
- Duration is not considered.

The following links provide further information on REBA

www.ergo-plus.com/healthandsafetyblog/ergonomics/reba-assessment-tool-guide/
or
www.ttl.fi/en/ergonomics/methods/workload_exposure_methods/table_and_methods/Documents/REBA.pdf

NIOSH lifting equation guidelines

NIOSH has produced a work practice guide for the design of manual handling tasks and an equation for determining safe loads. The equation calculates the recommended weight limit for a specific lifting tasks that a worker can perform without an increased risk of lower back pain.

The NIOSH lifting equation is best represented in the following table from Bridger.

NIOSH lifting equation	
Equation	RWL= LCxHMxVMXDMxAMxFMxCM
LC	Load consistent of 23kg
HM	Horizontal multiplier (25/H)
VM	Vertical multipler (1-(0.003/{V-75})
DM	Distance multiplier (0.82+(4.5/D)
AM	Asymmetric multipler (1- (0.0032A)
FM	Frequency multiplier http://www.ergo-plus.com/healthandsafetyblog/ergonomics/niosh-lifting-equation-single-task/
CM	Coupling multipler http://www.ergo-plus.com/healthandsafetyblog/ergonomics/niosh-lifting-equation-single-task/
Where H is the horizontal distance of the hands from midpoint of the ankles V is the vertical distance of the hands from the floor D is the distance through which the load is lifted A is the angle of asymmetry F is the frequency of lifting (lifts/ min every 1,2 or 8 h)	

Table: NIOSH lifting equation. Bridger, 2009.

Limitations: Limitations of the NIOSH lifting equation include:

- the assumption of a controlled environment with limited postural variables
- increased skills and time to make estimation as you need to use several technical measures and calculations
- practical limitations.

More information can be found at:
www.ttl.fi/en/ergonomics/methods/workload_exposure_methods/table_and_methods/Documents/NioshLiftingEquqtion.pdf

Borg rating of perceived exertion

This tool determines how exhausting a task is. The Borg fitness level takes into account fitness level. It also matches the perception with how a person thinks they are working. The rating scale is relative, with the scale starting at with no feeling of exertion (which rates a 6) and ends up hard to very hard (which rates 15 to 20). By adding a zero to the number this should equate to the person's heart rate. Higher numbers are then related to the resting heart rate to get an estimation of the individual's capacity and exertion. (McPhee, 2005)

Limitations: Limitations of the Borg scale include:

- It does not consider the direct risk factors, only exertion
- It does not provide focus on the controls needed.

PErforM tool

This is a risk assessment tool that is effective in participative ergonomic programs due to its ability to identify the degree and source of the risk. The PErforM tool has been used in underground and open cut mines. The guide provides a number of worked through case studies in the appendices. An example documented has been adopted from Xstrata and involves using a modified version of the PErforM tool.

Note: The PErforM tool has been developed as part of an ACARP project that has been presented, promoted and disseminated at a number of Qld and NSW mining safety conferences in 2004. The project was led by Dr Robin Burgess-Limerick and is titled *Reducing Musculoskeletal Risk in Open Cut Coal Mining*.

The assessment considers the direct risk factors of exertion, postures, vibration, duration and repetition required to perform the task- that is the direct risk factors. In addition it takes into account contributory risk factors such as environmental characteristics.

Limitations: Limitations of PErforM include:

- No method of combing scores
- Limited information on evaluation of risk
- No reference to the mass of the object.

For further information go to:
www.deir.qld.gov.au/workplace/subjects/manualhandling/perform/index.htm

or

ergonomics.uq.edu.au/download/mantra2.pdf

Managing musculoskeletal disorders practical guide worksheet

The manual handling risk assessment worksheet (Section 4.6 of the *Guide to the Management of Musculoskeletal Disorders)* provides the opportunity for specific risk factors to be considered via a checklist. The worksheet on page 31 and 32 of the guide, considers the posture, load and force, duration and frequency and management and environment. It also provides the opportunity for the person completing the checklist to consider other factors not listed.

The checklist does not assisting in evaluating the risk but provides a starting point to identify hazardous manual task risks.

The limitations of the checklist includes:

- No consideration to vibration
- No guidance on what is a repetitive action or what would be considered duration of a task.

More information can be found at: www.resources.nsw.gov.au/safety/world-leading-ohs/musculoskeletal-disorders

Choose a hazardous manual task risk assessment tool (this can be decided by the facilitator or the participants). Ask the participants before the next session to provide:

- a complete risk assessment sheet
- the sheet showing consultation by indicating everyone who has participated in the risk assessment
- a verbal report at the next session on the outcomes of the risk assessment with particular attention on the controls or solutions.

The aim of the activity is for the participants to:

- demonstrate an understanding on how to complete a risk assessment for a hazardous manual task
- demonstrate consultation within the work place
- articulate the hierarchy of controls when examining the solutions to the hazardous manual task.

Following completion of the assessment using the selected assessment tool, discuss the process.

- Was it easy to gain agreement on the score for specific risk factors? (It is often helpful to have the people performing the task participate in the assessment as they can more accurately rate the risk).
- Did the assessment identify those risk factors that contribute to the task being hazardous? This will assist directing you to where you require controls.
- Was it relatively easy to complete?

To increase the applicability of the training, the presenter may use the organisation's risk assessment tool if it is appropriate to manual tasks.

Module 3 Implementation & evaluation

Image: A worker at the end of his shift

3.1 Prioritising hazardous manual tasks

Prioritising for action

Once you have identified which manual tasks are likely to be a problem, how do we prioritise which tasks to assess first and allocate the first share of resources? Higher priority tasks may include those:

- tasks with a high occurrence of injuries – look at injury/incident records
- that if something does go wrong it will have very serious consequences
- where there is a number of hazard reports or complaints from workers
- which rate highly on the risk assessment form (i.e. on one or more of: forceful exertions, fast movement/no movement, awkward postures, repetition, duration, vibration)
- which have performance/productivity problems
- tasks that are conducted by a lot of workers
- tasks that are conducted often.

A good strategy is to implement controls that are less complex. Tackling and implementing controls for easier hazards at the initial stages of the program can provide the team with a sense of achievement resulting in greater momentum. The early wins give the team “breathing space” to contemplate more complicated issues.

The priorities should be discussed between the participants and management. It is important that the manager is a part of the process to provide support and approval. One team member will be required to champion a task. An action plan should be developed by the work group to track the outcomes of their work as well as prioritising tasks. When prioritising the tasks the team should focus on controls that are cheap, quick and easy to implement.

Make sure these are documented and referenced during each session.

3.2 Apply control hierarchy towards hazardous manual tasks

Controls

The aim of the participative ergonomic approach is to target manual tasks at the source of the hazard, rather than improving workers' tolerances to be more resistant to manual task risk factors. The hierarchy of controls provides a good framework for considering the effectiveness of the controls. It is important to note that the effectiveness of a barrier that is intended to reduce a risk decreases from top to bottom of the list. In other words the closer the barrier type to the top of the hierarchy the more potentially effective the control.

Hierarchy of control		Examples of control measures
Level 1	Elimination	• Automate the manual task (remote control) • Deliver goods directly to the point of use to eliminate multiple handling
Level 2	Substitution	• Replace heavy items with those that are lighter, smaller and or easier to handle • Replace hand tools with power tools to reduce the level of force required to do the task
	Isolation	• Isolate vibrating machinery from the user for example by providing fully independent seating on mobile plant
	Engineering	• Use mechanical lifting aids • Provide workstations that are height adjustable
Level 3	Administrative	• Rotate worker between different tasks • Train workers to use control measures implemented when carrying out manual tasks
	Personal protective equipment	• Heat resistant gloves for handling hot items • Shock absorbent shoes for work on hard concrete floors

Table 2: The hierarchy of controls

Applying controls

Traditionally, control options are evaluated according to the hierarchy of controls. This hierarchy also applies to controls for hazardous manual tasks. In manual tasks, elimination of the task is the first step. This will be the most effective way of reducing injuries. Some manual tasks can be eliminated by examining the flow of materials and reducing double handling. Others may be able to be eliminated by changing to bulk handling systems.

Other manual task controls can be divided into *design controls* and *administrative controls*.

Show examples of innovations other organisations have implemented to control hazardous manual tasks.

A good starting point is the NSW Minerals Councils Innovations awards which can be found **www.nswmin.com.au/Policy-and-Advocacy/Health-and-Safety/default.aspx**

Or the QLD PErforM site has fact sheets on innovations which have been implemented utilising a PE approach.
www.deir.qld.gov.au/workplace/subjects/manualhandling/perform/index.htm

In addition if the facilitator has an example of controls then this can also be presented. The aim of this process is to have the workers think outside the square with regards to controlling hazardous manual tasks.

Design controls

Design refers to a control strategy that involves redesigning the task, workplace or tools to reduce the risk. Design controls include substitution and engineering controls.

Substitution

- Replace heavy items with lighter objects, smaller objects and/or objects with better improved handling characteristics (such as handles, less awkward size and shape). This may involve making arrangements with suppliers, packaging departments or delivery providers.
- Upgrade to better quality tools with improved efficiency to reduce force required to perform task.
- Select power tools that have less vibration, replace vehicle seats with anti-vibration seats.

Isolation

- Keep a machine in a closed room and operate it remotely.
- Isolate vibrating machinery from the user for example by providing fully independent seating on mobile plant.

Engineering

Redesign the workplace layout, for example provide:

- more workspace to reduce awkward postures
- adjustable benches or seating
- mechanical lifting aids to eliminate manual handling
- damping materials around tool handles to isolate, absorb vibration and reduce impact on workers. Damping materials can also be used in floors and around vibrating machinery to reduce worker exposure to whole body vibration.

A good source of equipment design and engineering controls for MSD risk factors such as manual tasks, whole body vibration, equipment access and egress can be found at the EMESRT website www.emesrt.org

Administrative controls

Administrative controls are far less effective than design controls. Rather than controlling the risk directly, by designing out the hazard, administrative controls rely on the behaviour or actions of the worker or supervisor to control the risk. Administrative controls are best used as part of a comprehensive control strategy, to compliment design controls or for short-term risk management.

Additional Note: When identifying controls ensure to look at the contributory risk factors.

The outcome of this activity is for the participants to develop an action plan. Provide the list of hazardous manual tasks (that was gathered earlier) and ask the team to discuss and prioritise the tasks that they would like to address in logical order for example 1 to 10. Once the team has the prioritised list have them work on the controls

As a facilitator please write up the following points to ensure the participants consider this when discussing controls.

- It is important that the identified controls is reassessed to ensure it eliminates or reduces the MSD risk and also does not introduce further hazards
- We may need to be mindful that we may not be able to get everything we want straight away.

The list that is formed will provide the basis for sessions three to six. In these four sessions the group will discuss the hazards, show photos or videos of the tasks and consult on the most appropriate control measures.

3.3 Implementing participatory ergonomic controls

Implementing controls

Controls may need to be identified based on short, medium and long term time frames to allow for consideration of cost on the business and where possible should be trialled before implementation.

Once the action plan has been successfully negotiated, the action plan is implemented in the context of ongoing consultation, participation and review with all key stakeholders. The implementation of the discussed controls needs to be systematic, measured, supported and followed through.

Once the controls are implemented consideration also needs to be given to the impact on the introduction of new equipment, changes to the work environment, organisation and changes to work practices, development of safe work procedures and training of workers.

When implementing controls the following principles should be applied:

- Use the hierarchy of control.
- Trial solutions before making them permanent.
- Review controls after initial testing period as they may need modification.
- Develop work procedures to ensure that the controls are understood and responsibilities are clear.
- Communicate the reason for the change to workers and others.
- Train workers to use the controls.
- Supervise the reliable implementation of controls.

Ensure the presence of a management representative who can talk about the feasibility of the control and direct the group on the best way of implementing the control. Each control should have a business case outlining the benefits from both the reduction of injuries and savings to the organisation. The management representative could help build the business case particularly if it needs to go higher up the chain of command for approval.

An example of a participatory ergonomics business case is in Appendix 1. Please note this is an example and can be modified to reflect the PE teams' desired outcomes.

3.4 Evaluating participatory ergonomic controls

Evaluation of the solution in operation is often forgotten as people solve the next problem. Sometimes people may be so committed to their idea that they are unaware or unwilling to recognise that there are difficulties, therefore evaluation is essential.

It is also necessary to evaluate the solutions adopted from other work places. A solution that is successful elsewhere may be introduced to solve a problem without assessment of local requirements. New equipment, tools, furniture or systems of work need to be challenged and tested before they can be accepted. It is important that the people who are most likely to be affected are informed of the options, problems and advantages as well as have the opportunity to trial the new design or process.

Solutions must be evaluated at appropriate times. Immediate success does not guarantee that it will remain successful. As a rule of thumb, controls should be evaluated two months after implementation and again six months after implementation (McPhee, 2005)

When reviewing the control measures, consult with everyone involved in the manual tasks and consider the following:

- Are the control measures working effectively in both their design and operation, without creating new risks?
- Are workers actively involved in the risk management process? Are they openly raising health and safety concerns and reporting problems promptly?
- Have new work methods or equipment reduced physical strain or difficulty?
- Has instruction and training on hazardous manual tasks and the implemented control measures been successful?
- Is the frequency and severity of MSDs reducing over time?
- Is an alteration planned to any structure, plant or process that is likely to result in a worker being exposed to a hazardous manual task?
- Has an incident occurred as a result of a worker being exposed to a hazardous manual task or as a result of a change?
- If new information becomes available, does it indicate current controls may no longer be the most effective?

If problems are found, go back through the risk management steps, review your information and make further decisions about risk controls.

Some useful ways to obtain this information is by:

- interviewing workers who are using the controls
- using surveys or checklists to compare exposure to risk factors after the control has been implemented

- reviewing data.

Have the participants discuss a process that they will use to evaluate the effectiveness of controls. Write up the answer and have the workers prioritise the process. Once the process has been agreed upon, have this documented as a procedure, and made available to the management, the safety coordinator and the safety committee.

PARTICIPATORY ERGONOMICS BUSINESS CASE

Name of task (can include photo attached): .....

.....

Associated injuries with task: .....

.....

Complete a hazardous manual task risk assessment (attach to back of business case):

How many injuries have occurred in the workplace and the cost of any workers compensations claims associated with this task to date?: .....

.....

.....

What is the proposed control?: .....

.....

.....

What is the proposed cost of the control?: .....

.....

.....

Additional notes: .....

.....

.....

Management notes: .....

.....

.....

Approved by: ..... Date: .....

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