



**SAFE  
WORK**

**S** SPOT THE HAZARD  
**A** ASSESS THE RISK  
**F** FIND A SAFER WAY  
**E** EVERYDAY

**EVERYONE'S  
RESPONSIBILITY**



# Guideline for Preventing Musculoskeletal Injuries

# **Guideline**

## **for the Prevention of**

# **Musculoskeletal Injuries**

**Workplace Safety & Health  
Division  
200 – 401 York Avenue  
Winnipeg, Manitoba  
R3C 0P8**

**December, 2006**

**Manitoba** 

# Guideline for the Prevention of Musculoskeletal Injuries

## Table of Contents

<i>Introduction</i> .....	3
Examples of musculoskeletal injuries .....	3
<i>Assessing the risk</i> .....	4
Risk factors.....	4
Assessment methods .....	5
• Job hazard analysis.....	5
• Physical demands description .....	6
• Ergonomic risk control factors .....	6
<i>Control Measures</i> .....	7
Engineering controls.....	7
Administrative controls .....	8
Appropriate work schedules .....	8
Personal protective equipment .....	9
<i>Training and Education (on Control Measures)</i> .....	10
<i>Training and Education (on MSI)</i> .....	11
Step-by-step training plan.....	12
 <i>Appendices</i>	
Appendix A - Conducting a job hazard analysis (JHA)	
- Job Hazard Analysis Form	
- Physical Demands Description form	
Appendix B - Ergonomic Risk Factor (ERF) Checklist	
Appendix C - Guide to completing the ERF checklist	

## INTRODUCTION

### Introduction

Musculoskeletal injuries (MSI) account for a significant number of work injuries in Manitoba. Musculoskeletal injury means an injury or disorder of the muscles, tendons, ligaments, joints, nerves, blood vessels or related soft tissue including a sprain, strain or inflammation.

Since work-related MSI tends to occur when the physical demands of the action, task, movement or job exceeds the ability of the body, changes must be considered for the workstation, equipment, tools, work practices, work rate, body movements and employee training to reduce the risk of injury.

### Examples of MSI

- muscle strain
- tendon and/or ligament sprain
- herniated intervertebral disk (slipped disc)
- osteo arthritis
- adaptive changes to muscle length
- ligament disorders
- circulatory disorders (ex: varicose veins)

### Workplace Safety and Health Regulation Requirements

Part 8 of Manitoba Workplace Safety and Health Regulation, M.R. 217/2006 requires employers to do a risk assessment, in consultation with the safety and health committee, or representative. If there is no committee or representative the employer must do a risk management in consultation with employees where a risk of MSI:

- is known to be present
- is reasonably obvious
- has been identified
  
- If the assessment identifies a risk to employees, measures must be taken to implement: engineering controls (design, position of equipment)
- administrative controls (safe work procedures)
- appropriate work schedules, or personal protective equipment

Employers must ensure employees who may be at risk of MSI are informed of the risk as well as signs and symptoms of MSI. Employers must also ensure employees are trained in control measures to eliminate or reduce the risk of MSI.

## ASSESSING THE RISK

### Introduction

When employers are aware or have been told that a work activity creates a risk of musculoskeletal injury, they must ensure the risk is assessed. This assessment must identify:

- risk factors acting on the worker (ex: forceful exertion)
- areas of the body at risk of MSI (ex: lower back)
- source of the risks (ex: lifting boxes)

Based on the assessment, employers must implement controls to eliminate or reduce, as much as reasonably practical, the risk of musculoskeletal injury.

### Risk factors

Following is a list of MSI risk factors. To properly reduce or control the risk, it is important to recognize why these factors create a risk of injury. Any combination of the listed physical demands will increase the risk of injury.

Awkward or sustained postures: These occur when employees must adopt non-neutral postures to perform their duties. Neutral posture is a relaxed body standing upright with the arms hanging comfortably at the side. Non-neutral postures (ex: slouching, bending forward at the waist, twisting through the trunk, working with the elbows away from the body, prolonged standing on a hard surface, etc.) increase the load on the musculoskeletal system. Non-neutral postures reduce blood flow to working muscles and increase leverage (ex: the longer the crowbar, the greater the force). Consider reducing non-neutral postures by making the work environment more adjustable and bring the work closer to the centerline of the employees' body to increase the employees' control over body movement and reduce the risk of injury.

Forceful exertions: These occur when employees must adopt perform actions that have the potential to overload the musculoskeletal system. There is a physical limit to the amount of stress the musculoskeletal system can endure before a structural failure occurs. It is much like a metal chain lifting more than its rated capacity and one of the links fails as a result. Depending on the posture during the forceful exertion, the link which fails may be the wrist, elbow, shoulder, lower back, or any other part of the musculoskeletal system. Forceful exertions may cause failure on the gross scale (ex: a herniated or slipped disc), or the micro scale (ex: microscopic tears in the muscles, tendons, or ligaments) which may develop into a MSI. To reduce the risk of injury, consider decreasing the physical effort required to perform work.

**Repetitive motions:** These occur when employees are required to perform the same sequence of actions for extended periods with little or no variation in the muscles used. Repeated movements, without significant change in work activity, may cause the musculoskeletal system of the body to suffer small injuries. With repeated exposure, these injuries may develop into a MSI. Consider rest breaks and job rotation throughout the day to reduce the risk of injury.

**Vibration:** This is the direct transfer of repeating movements of a machine, or tool, to the body. It is an action (ex: when a hand tool or heavy machine shakes repeatedly) causing the muscles to tighten and circulation to decrease. Consider using tools with less vibration; wrapping tools with anti-vibration wrap; using anti-vibration gloves; and ensuring machinery is maintained to reduce vibration.

**Mechanical compression:** This occurs when there is external pressure on the soft tissues, either at high forces and/or for prolonged periods of time (ex: leaning on a barrier, resting hands on a desk while typing, using tools that dig into the hand). When there is external pressure on the soft tissues, the blood flow and nerve function may be affected. Consider removing or modifying barriers, using tools with improved design and putting padding on hard edges or surfaces.

## **Assessment methods**

When an assessment is performed, the risk factor(s) which may cause an injury must be identified. Consider using one or more of the following tools to identify the risks for MSI associated with the job.

### **Job Hazard Analysis**

*What:* This process describes the steps required for job completion, and identifies the risks which may cause injury. Typically this analysis includes all risks which may cause any injury, including MSI.

*Why:* Analyzing a task step-by-step allows easier identification of risks, which may be difficult to see, or describe, when the task is observed as a whole. A job hazard analysis is standard in workplace safety and health risk analysis.

*When:* Use this tool before developing safe work procedures, or standard operating procedures for a job, especially one that has not been assessed for risks.

See Appendix A –job hazard analysis for further information.

### Physical Demands Description

*What:* This is a clear and complete list of the movements and other physical requirements needed to perform a job. This list describes the weights, forces, frequencies and postures employees will be exposed to during their work.

*Why:* Effective communication of the physical demands of a task with those who may require this information is important to help identify risks. Examples may include: current employees, new employees, supervisors, human resource people, or health care professionals. Uncontrolled risks for injury may exist if the identified demands and the actual processes are different. Employees can help ensure any differences between these demands and processes are brought to the attention of the appropriate person.

*When:* Use this tool when a complete list of the physical demands of a job, or task, is required. Start with the physical demands description of the modified or light duty jobs to better accommodate the physical capabilities of employees returning to work following an injury. This tool may also help injured employees give an effective description of their jobs to their health care provider, who in turn, may then offer effective treatment.

See Appendix B – physical demands description for further information.

### **Ergonomic Risk Factor Checklist**

*What:* A checklist designed to identify specific risks for musculoskeletal injury with the effect of increased exposure on the risk of injury. This checklist assigns scores to each risk factor, which are added together for an overall job score. This information is useful for prioritizing and identifying jobs, tasks and movements with increased risk of MSI.

*Why:* This checklist can identify risks for MSI present in a specific aspect of a job, or the job as a whole. It allows employees to assign a score to each movement which can be used to identify hazardous aspects of jobs (or whole jobs) which require control measures. These scores can also serve as a benchmark for any further modifications.

*When:* Use this tool during the assessment of jobs suspected of containing risks for musculoskeletal injury. When any changes are made to the physical demands of the work, use this checklist to see if the changes are effective.

## CONTROL MEASURES

### Introduction

“Control measures,” when applied to musculoskeletal injuries, refer to deliberate changes to a job to reduce the employees’ risk of suffering MSI.

These changes must be designed to reduce the physical demands of work to a level at, or below, the physical capabilities of the employee. Changes may be made to:

- the physical design of the work and workspace
- the procedures and body movements used to perform the work
- the pace at which the work is performed
- to personal protective equipment

It is preferable to use a combination of these controls when considering the best method to reduce the risk of employee injury.

### Engineering Controls

Since MSI occurs when the physical capabilities of the employee are exceeded, making physical changes to the work is the most effective way to reduce the risk of injury. Risk for MSI increases when the physical demands increase so, consider ways to reduce those demands. Keep in mind that the weight of body parts (ex: arms or torso) can increase the risk of injury when employees use awkward postures. Engineering controls should focus on reducing force and exposure to awkward postures.

It is important to note the following:

- weight of materials, tools, and equipment handled
- force required for holding, grasping, turning, flipping any materials, tools, equipment
- distances employees are required to reach, bend, lift
- Postures used during work (ex: stoop-lift, squat-lift, non-neutral shoulder and wrist joint angles)

All of these forces, weights, angles, postures and distances may increase the risk of MSI through an increase in the physical demands on employees’ bodies. Successful engineering controls reduce these risks by reducing the physical demands. Increasing adjustability will allow employees to adjust the work to a comfortable position and avoid awkward or sustained postures.

## Administrative Controls

Safe work procedures fall under administrative controls. These controls decrease the risk of MSI by changing the way work is performed. It is important to remember that supervisors and employees need adequate training and time to adjust to changes in work procedure and body movements. After physical changes have been made, consider the movements and procedures employees use to perform the task. Administrative controls should be used to reduce employees' exposure to risks when physical changes are not practical.

Some awkward postures used during work, include:

- stoop-lift (bending at the waist)
- twisting the trunk (especially while lifting)
- elbow movement away from the body (side, front, or behind)
- wrist movements (rapid, forceful, and/or extreme)

Make changes to the way work is performed from this and other control measures. Prolonged exposure to awkward postures and repetitive movements increases the risk of MSI. Successful administrative controls result in body movements and procedures that reduce the risk of MSI.

Administrative controls include employee training on all control measures implemented to reduce the risk of MSI. For example, if a hoist or lift is introduced to the work environment, any workers who may be affected by this new equipment must be trained on the safe operation of the hoist or lift. Supervisors must receive the same training to properly demonstrate and reinforce the safe performance of work.

## Appropriate Work Schedules

Increased tiredness can increase the risk of MSI. The rate at which work is performed, the amount of control over the work rate; and the variety of different movements employees can perform during their shift are directly related to the risk of MSI. The risk of MSI increases when workers do not have enough variability in their movements, or enough time to take a short break, or pause as needed, to improve blood circulation. Work schedules can be modified to reduce the severity, frequency or duration of the exposure to the risks for MSI outlined in the section on risk factors. Note the signs of MSI risks:

- highly repetitive movements
- employees rubbing arms, hands, wrists, shoulders
- white knuckles
- employees perspiring or breathing heavily

Consider reducing the rate at which employees perform their jobs to reduce the risk of MSI. Design work that gives workers time for several seconds of rest in between

and after each job, as needed. Allow employees to lower their arms and hands instead of staying in the ready position. Encourage employees in the proper use of short breaks (lasting no more than a minute or two) where they pause and rest at their workstations.

Wherever practical, have employees on a job rotation schedule. Job rotation involves switching jobs or tasks with other employees during the shift. This is usually done after a break. Job rotation may be effective in reducing the risk of MSI from awkward postures, and repetitive movements, but not from forceful exertions. This rotation schedule must have employees rotating to jobs, or tasks with significantly different physical demands and movements.

### **Personal Protective Equipment**

Since the risks for MSI are strongly related to the job, and work procedures, personal protective equipment is only practical in a few situations. When considering personal protective equipment to reduce the risk of MSI, it is important that the equipment fits properly and does not hinder work. Note that placing a glove on a hand will increase the grip force required to perform work since the finger tips will be unable to determine if the hand is slipping or not.

Vibrating hand tools can be wrapped in anti-vibration tape, or employees can be provided with anti-vibration gloves to reduce the risk of MSI. Employees who kneel on floors may be exposing their knees to a risk of MSI through compression of the tissues and should have appropriate padding for the knees.

Back belts have not been proven to reduce the risk of injury to the lower back and should only be used when recommended by a doctor.

## **TRAINING AND EDUCATION (on Control Measures)**

### **Employee and Supervisor Training**

When employers implement workplace controls, employees and supervisors must be trained in the changes and new or modified procedures.

Employees need information and training on:

- safe performance of work
- reasons for making the changes (why previous methods are no longer suitable)

Supervisors should be trained in the same way so they can reinforce the safe work procedures with workers. When considering training and education for employees and supervisors, include the following:

- injuries that have occurred, and controls implemented to prevent them
- signs and symptoms of MSI that employees may experience (Employees who know the early warning signs of MSI can get medical help sooner. Assess any job where employees report MSI.)
- All control measures implemented to reduce the risk. These include: physical changes to the design of the work and workspace safe procedures and body movements to perform the job; changes to work rate, breaks, recovery pauses, job rotation schedules and personal protective equipment provided.

Keep employees training records. To ensure accountability, ask employees and supervisors to sign an acknowledgement of the training and information received. Both new and experienced employees should receive training when controls have been implemented. Since most, but not all musculoskeletal injuries develop gradually, the signs and symptoms of MSI are better able to respond effectively to early signs of MSI and get medical help sooner.

## **TRAINING AND EDUCATION (on MSI)**

### **Employee and Supervisor Training**

Since employees are the best judge of their own health and well-being, the most effective way of preventing serious MSI is to train employees in the signs and symptoms of MSI, and any risks of MSI associated with their work. Employers must identify the kind of MSI employees could suffer from performing their regular duties. This information can be gathered by:

- reviewing previous injury reports
- job hazard analysis for risks of MSI
- surveying employees about current or past pain or discomfort

Once MSI has been identified, the signs and symptoms of it must be included in the training given to employees, both new and experienced. Training should include what to do if employees suspect they are developing MSI, including reporting it to their supervisor and safety and health committee and getting medical help.

Once an employee has reported an MSI, it is very important that an assessment is done on the particular job. Appropriate control measures must be developed and implemented to prevent further injury to employees or development of an injury by other employees who may perform the same.

## **STEP-BY-STEP TRAINING PLAN**

Consider the following procedure when training workers and supervisors in control measures for risk of MSI:

### **Step 1: Prepare the worker for training**

- find the focus of the employee
- determine their current level of knowledge of the task
- position the employee so they share your physical point of view when you teach the skill or procedure

### **Step 2: Exhibit and explain**

- show the employees each movement and procedure, step-by-step
- emphasize the important points, especially when teaching biomechanics
- explain clearly and entirely

### **Step 3: Observe and examine**

- Ask the employee to demonstrate each skill back to you. Have them verbally explain what they are demonstrating.
- Observe the demonstrations and comment on the effective and ineffective things they do.
- Repeat instruction if necessary.
- Have employees show they can do the job, and practise until you are certain they know how to perform each movement and procedure effectively.

### **Step 4: Monitor employees**

- Give clear information on where to get further instruction on safe work procedures.
- Allow the employee to perform the work unassisted.
- Review the employees' understanding after a few days or a week.
- Have the supervisor monitor employees daily until confident the controls have become standard practice.

## APPENDIX A

### Job Hazard Analysis

#### Conducting a Job Hazard Analysis (JHA)

There are three steps to conducting a job hazard analysis (JHA):

1. Break the job down into its basic steps.
2. Identify the hazards present in each step.
3. Develop controls for all hazards you have identified.

#### **Step 1 – Breaking the Job into Steps**

Every task can be broken down into steps. These steps should become the basis of the safe work procedure.

Identifying every step of the task is essential. Write down **everything**. After each step is identified, go back and combine things or eliminate unnecessary detail.

To give a clear understanding of the task, the steps must include every key step required to do the task correctly, but don't include excess detail that will over burden the process.

Limit the number of steps you actually record. If there are too many steps in the job, break it down into two jobs. Generally there should be no more than 15 steps in a job.

Five steps involved in analysis by observation and discussion:

1. Select several employees willing to share their knowledge and experience.
2. Be clear about what is being done and ensure the employees understand it is the work – not the employee -- being evaluated.
3. Watch the employees do the jobs and record the initial breakdown.
4. Discuss the breakdown with the employees for accuracy, and encourage them to share their knowledge and experience.
5. Repeat steps 2, 3 and 4 with other employees, if appropriate and record the basic steps again.

Company Name: \_\_\_\_\_

Date: \_\_\_\_\_

**JOB HAZARD ANALYSIS FORM**

Job Name:	Facility:	Conducted By:
-----------	-----------	---------------

Job Steps	Hazards	Corrective Actions

**PHYSICAL DEMANDS DESCRIPTION (PDD)**

Date		Analyst								
Department			Job Title					Shift		
PHYSICAL DEMANDS		Not Component	* FREQUENCY				LOAD (object/tool)		COMMENTS	
			Seldom	Minor	Required	Major	Maximum (kg)	Usual (kg)		
<b>STRENGTH</b>	Lifting									
	Carrying									
	Pushing									
	Pulling									
	Handling									
	Throwing									
	Gripping	Power Grasp								
		Pinch Grasp								
	Reaching	Above Shoulder								
Below Shoulder										
To the Side										
<b>POSTURES</b>	Shoulder	Abduction								
		Flexion								
	Hip	Abduction								
		Wrist	Flexion / Extension							
			Radial / Ulnar Devn							
	Trunk	Pronate / Supinate								
		Flexion								
		Extension								
		Side Bend								
	Neck	Twist								
		Flexion								
		Extension								
Side Bend										
<b>MOBILITY</b>	Twist									
	Sitting									
	Standing									
	Walking									
	Climbing									
	Crawling									
	Crouching									
	Kneeling									
	Balancing									
Foot Action	One Foot									
	Both Feet									
Fine Finger Movements										

**\* FREQUENCY**

SELDOM = Not always performed during completion of job  
 MINOR = Performed less than 25% of job

REQUIRED = Frequent Repetition for 25% -50% of job  
 MAJOR = Frequent Repetition for more than 50% of job



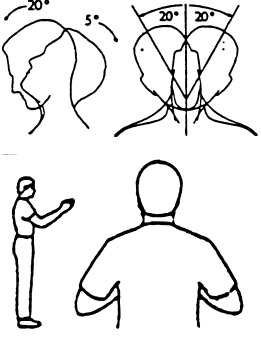
PHYSICAL DEMANDS		Not a Component	* FREQUENCY				COMMENTS
			Seldom	Minor	Required	Major	
<b>SENSORY/PERCEPTUAL</b>	Hearing	Conversations					
		Other Sounds					
	Vision	Far					
		Near					
		Colour					
		Depth					
	Perception	Spatial - organization					
		Form - recognition					
	Feeling						
	Reading						
	Writing						
Keying/Typing							
Speech							
<b>WORK ENVIRONMENT</b>	Outside Work						
	Hot						
	Cold						
	Humid						
	Dry						
	Dust						
	Vapour Fumes						
	Noise						
	Vibration	Whole Body					
		Upper Extremity					
	Contact Stress						
	Striking with Hand/Fist						
	Moving Objects						
	Hazardous Machines						
	Electrical						
	Sharp Tools						
	Radiant/Thermal Energy						
Slippery							
Congested Worksite							
Chemical Irritants							
<b>CONDITIONS</b>	Work Independent but in Group						
	Operate Equipment/Machinery						
	Machine Paced						
	Production Quotas						
	Deadline Pressures						
	Irregular/Extended Hours						
* FREQUENCY							
SELDOM = Not always performed during completion of job			REQUIRED = Frequent Repetition for 25% - 50% of job				
MINOR = Performed less than 25% of job			MAJOR = Frequent Repetition for more than 50% of job				

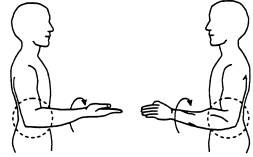
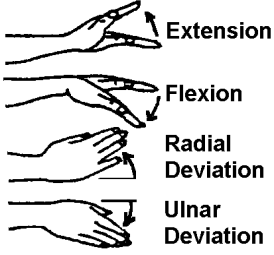

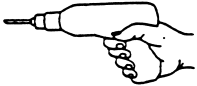

**APPENDIX B**

**ERGONOMIC RISK FACTOR CHECKLIST**

**UPPER EXTREMITY RISK FACTOR CHECKLIST**

Date: \_\_\_\_\_ Analyst: \_\_\_\_\_ Job: \_\_\_\_\_ Location: \_\_\_\_\_


RISK FACTOR CATEGORY	RISK FACTORS	EXPOSURE Is the risk factor present within the job or task?  <input type="checkbox"/> Yes <input type="checkbox"/> No	TIME				SCORE
			0% to 25% of total time	25% to 50% of time	50% to 100% of time	If total time for job is >8 hrs, add 0.5 per hour	
<b>Upper Limb Movements</b>	1. Moderate: steady motion with regular pauses	<input type="checkbox"/> Yes <input type="checkbox"/> No	0	1	2		
	2. Intensive: rapid steady motion without regular pauses	<input type="checkbox"/> Yes <input type="checkbox"/> No	1	2	3		
<b>Keyboard Use</b> 	3. Intermittent keying	<input type="checkbox"/> Yes <input type="checkbox"/> No	0	0	1		
	4. Intensive keying	<input type="checkbox"/> Yes <input type="checkbox"/> No	0	1	3		
<b>Hand Force (Repetitive or Static)</b> 	5. Squeezing hard with the hand in a power grip	<input type="checkbox"/> Yes <input type="checkbox"/> No	0	1	3		
	6. Pinch more than 2 pounds	<input type="checkbox"/> Yes <input type="checkbox"/> No	1	2	3		
<b>Awkward Postures</b> 	7. Neck: twist/bend (twisting neck >20°, bending neck forward >20° or back <5°)	<input type="checkbox"/> Yes <input type="checkbox"/> No	0	1	2		
	8. Shoulder: unsupported arm or elbow above mid-torso height	<input type="checkbox"/> Yes <input type="checkbox"/> No	1	2	3		

RISK FACTOR CATEGORY	RISK FACTORS	EXPOSURE Is the risk factor present within the job or task?  <input type="checkbox"/> Yes <input type="checkbox"/> No	TIME				SCORE
			0% to 25% of job time	25% to 50% of time	50% to 100% of time	If job time is >8 hrs, add 0.5 per hour	
	9. Rapid forearm rotation	<input type="checkbox"/> Yes <input type="checkbox"/> No	0	1	2		
		10. Wrist: bend or deviate	<input type="checkbox"/> Yes <input type="checkbox"/> No	1	2	3	
<b>Contact Stress</b> 	11. Hard/sharp objects press into skin	<input type="checkbox"/> Yes <input type="checkbox"/> No	0	1	2		
	12. Using the palm of the hand or wrist as a Hammer	<input type="checkbox"/> Yes <input type="checkbox"/> No	1	2	3		
<b>Vibration</b>  	13. Localized vibration (without dampening)	<input type="checkbox"/> Yes <input type="checkbox"/> No	0	1	2		
	14. Whole-body vibration (without dampening)	<input type="checkbox"/> Yes <input type="checkbox"/> No	0	1	2		
<b>Environment</b>	15. Lighting (poor illumination or glare)	<input type="checkbox"/> Yes <input type="checkbox"/> No	0	0	1		
	16. Adverse temperatures	<input type="checkbox"/> Yes <input type="checkbox"/> No	0	0	1		
<b>Control Over Work Pace</b>	17. One control factor present = 1 Two or more control factors present = 2	<input type="checkbox"/> Yes <input type="checkbox"/> No					
<b>TOTAL UPPER EXTREMITY SCORE</b>							

## BACK AND LOWER EXTREMITY RISK FACTOR CHECKLIST

Date: \_\_\_\_\_ Analyst: \_\_\_\_\_ Job: \_\_\_\_\_ Location: \_\_\_\_\_

RISK FACTOR CATEGORY	RISK FACTORS	EXPOSURE Is the risk factor present within the job or task?  <input type="checkbox"/> Yes <input type="checkbox"/> No	TIME				SCORE
			0% to 25% of time	25% to 50% of time	50% to 100% of time	If job time is >8 hrs, add 0.5 per hour	
<p><b>Awkward Postures</b></p>	18. Mild forward or side bending of torso more than 20°; less than 45°	<input type="checkbox"/> Yes <input type="checkbox"/> No	0	1	2		
	19. Severe forward bending of torso more than 45°	<input type="checkbox"/> Yes <input type="checkbox"/> No	1	2	3		
	20. Backward bending of torso	<input type="checkbox"/> Yes <input type="checkbox"/> No	0	1	2		
	21. Twisting of torso	<input type="checkbox"/> Yes <input type="checkbox"/> No	1	2	3		
	22. Prolonged sitting without adequate back support	<input type="checkbox"/> Yes <input type="checkbox"/> No	0	1	2		
	23. Standing stationary or inadequate foot support while seated	<input type="checkbox"/> Yes <input type="checkbox"/> No	0	0	1		
	24. Foot action (pedal), standing stationary with inadequate foot support, balancing	<input type="checkbox"/> Yes <input type="checkbox"/> No	0	1	2		
	25. Kneeling/squatting	<input type="checkbox"/> Yes <input type="checkbox"/> No	1	2	3		
	26. Hip abduction (repetitive/prolonged)	<input type="checkbox"/> Yes <input type="checkbox"/> No	0	1	2		
27. Repetitive ankle extension/flexion	<input type="checkbox"/> Yes <input type="checkbox"/> No	0	1	2			

RISK FACTOR CATEGORY	RISK FACTORS	EXPOSURE Is the risk factor present within the job or task?	TIME				SCORE
			0% to 25% of time	25% to 50% of time	50% to 100% of time	If job time is >8 hrs, add 0.5 per hour	
<b>Contact Stress</b>	28. Hard/Sharp objects press into skin	<input type="checkbox"/> Yes <input type="checkbox"/> No	0	1	2		
	29. Using the knee as a hammer or kicker	<input type="checkbox"/> Yes <input type="checkbox"/> No	1	2	3		
<b>Vibration</b> 	30. Whole-body vibration (without dampening)	<input type="checkbox"/> Yes <input type="checkbox"/> No	0	1	2		
<b>Push/Pull</b>	31. Moderate load	<input type="checkbox"/> Yes <input type="checkbox"/> No	0	1	2		
	32. Heavy load	<input type="checkbox"/> Yes <input type="checkbox"/> No	1	2	3		
<b>Control Over Work Pace</b>	33. One control factor present = 1 Two or more control factors present = 2	<input type="checkbox"/> Yes <input type="checkbox"/> No					
<b>Manual Handling Checklist Score</b> (Add scores 2 & 3 from page 3 and insert total here)							
<b>Total Back and Lower Extremity Score</b>							

MANUAL HANDLING CHECKLIST			
34(a). STEP I:  Determine if the lift is near, middle, or far (body to hands)  - Use an average horizontal distance if a lift is made every 10 minutes or less. - Use the largest horizontal distance if more than 10 minutes pass between lifts.	NEAR LIFT	MIDDLE LIFT	FAR LIFT

34(b). STEP II:  Estimate the weight lifted in kg (pounds) - Use an average weight if a lift is made every 10 minutes or less. - Use the heaviest weight if more than 10 minutes pass between lifts. - Enter 0 in the total score if the weight is 4.54 kg (10 lb.) or less.	NEAR LIFT		MIDDLE LIFT		FAR LIFT	
	<b>DANGER ZONE</b>	More than 51 lb. 23.13 kg 5* points	<b>DANGER ZONE</b>	More than 15.88 kg (35 lb.) 6 points	<b>DANGER ZONE</b>	More than 12.7 kg (28 lb.) 6 points
	<b>CAUTION ZONE</b>	7.71 to 23.13 kg (17 to 51 lb.) 3 points	<b>CAUTION ZONE</b>	5.44 to 15.88 kg (12 to 35 lb.) 3 points	<b>CAUTION ZONE</b>	4.54 to 12.7 kg (10 to 28 lb.) 3 points
	<b>SAFE ZONE</b>	Less than 7.71 kg (17 lb.) 0 points	<b>SAFE ZONE</b>	Less than 5.44 kg (12 lb.) 0 points	<b>SAFE ZONE</b>	Less than 4.54 kg (10 lb.) 0 points

\*If lifts are performed more than 15 times per shift, use 6 points. Step II Score:

STEP III:  Determine the points for other risk factors  - Use occasional lifts if more than 10 minutes pass between lifts  - Use the more than 1 hour points if the risk factor occurs with most lifts and lifting is performed for more than 1 hour	Factor	Occasional lifts (<1 hr/shift)	Frequent lifts (>1 hr/shift)
	35. Twist torso during lift	1	1
	36. Lift one-handed	1	2
	37. Lift unexpected loads	1	2
	38. Lift 1-5 times/minute	1	1
	39. Lift > 5 times/minute	2	3
	40. Lift above the shoulder	1	2
	41. Lift below the knuckle	1	2
	42. Carry objects 3.05 to 9.14m (10 to 30 feet)	1	2
	43. Carry objects > 9.14 m (30 feet)	2	3
44. Lift while seated or kneeling	1	2	
<b>Step III Score:</b>			

## APPENDIX C

### Guide to completing the ergonomic risk factor checklist

#### Introduction

This section explains the content and use of the ergonomics risk factor (ERF) checklist (Appendix B).

The ERF checklist is only one part of an ergonomics analysis. It works best as a preliminary tool for observing a job and defining the levels of risk factors in a job. Although it does not provide answers, it helps define what should be analyzed, and indicates the factors that may cause problems in a job.

The checklist was created for an industrial manufacturing environment. It emphasizes identification of a combination of risk factors common in industry, and those that have higher risk.

It is divided into three parts:

- 1) risk factors for the upper extremity
- 2) risk factors for the back and lower extremity
- 3) risk factors in manual materials handling

Within each of these parts, risk factors are given scores that increase with the amount of exposure time. To use the checklist, evaluate a work task to determine which, if any, risk factors are present and the time the employee is exposed to each.

Scores for each combination of risk factor exposure/time for the upper limb and lower back are added separately. They are kept separate because simultaneous exposure to risk factors for upper and lower extremities does not generally affect the same joint or anatomic region.

All components of the checklist should be completed for each job to ensure a comprehensive analysis.

#### **STEP 1 - Familiarize Yourself with the Job**

Two key ways to do this are through *observation* and *interview*. Watch the employee do the job for a few minutes. Get a feel for the range of activities in a day. Talk with the employees and ask questions about their jobs. Then complete the Ergonomics Analysis Worksheet.

Within the **job description** area of the checklist, describe the job on two levels: *general* and *specific*. The general will detail the goals and duties involved with this job to understand why the person is performing various tasks. The specifics will break the job down into required actions (ex: employee picks up part A from bin B and places on table C). These statements describe the general movements of the person and their sequence.

The **comments** you make about a job should provide additional, useful information that does not fit within the structure of the checklist, and may be useful for further analysis. Within this section, note general remarks about the workstation, environment, job, or employee. Include any measurements (ex: mass, dimensions, temperature, etc.). Also include information about the anthropometrics (body shape, size and type) of the person, and how well this matches with the workstation. After the risk factor analysis (Steps 2 to 4), provide comments on any parts of the task containing risk factors (ex: a specific task that causes trouble).

The goal of an ergonomic analysis is to ensure the job fits the employee and input from the employee doing the job is a key part of the analysis. To fill out the **employee interview** portion of the checklist, talk with the employee and ask for any relevant information about the daily workings of the job. Questions that may provide useful information include:

- Can you explain your work duties?
- Do you perform these duties all day, or do they change at any time?
- If you could improve this job in any way, what would you change?
- Do you feel any aches, pains, etc., that may be related to your job?
- What parts of your job cause problems?

## **STEP 2 – Determine the Risk Factors**

The checklist is divided into columns and it's best to start with the **exposure** column. It contains simple questions about whether or not the employee is being exposed to the various risk factors described in each row. Remember to read and understand the risk factor definitions **before** doing further steps.

Look at each risk factor and watch to see if the employee is exposed to this factor at any time. Once you have addressed all of the risk factors, go to Step 3.

## **STEP 3 – Determine the Time of Exposure to the Risk Factors**

Step 2 shows what the employee is exposed to. The next step is to see how long the employee is exposed to each risk factor and mark it in the **time** column.

The time of exposure is not how long the employee performs a job, but how long he or she is exposed to the risk factor.

Example:

Joe performs a job on a production line that has a job time of 60 seconds. He does this job for eight hours per day. The job cycle involves the following body movements:

- 1) For 45 seconds of every cycle, Joe works with his wrist deviated.
- 2) For 20 seconds of every cycle, Joe's elbow is above mid-torso level.
- 3) For five seconds of every cycle, Joe is bent forward greater than 45°.

Consider the job cycle represents the entire day (ex: whatever Joe does for 60 seconds, he does for eight hours).

Therefore, if Joe's wrist is deviated for 45 seconds every cycle, *Joe spends ¾ of his day or six hours with his wrist deviated.* Joe has a score of three for wrist deviation.

Using the same formula, Joe spends approximately three hours per day with his elbow above mid-torso level, and less than one hour per day with his torso bent forward greater than 45°. This results in a score of two for shoulder posture and a score of one for trunk posture.

Regardless of the length of work cycle, the principal is the same for determining time of exposure.

Circle these combined scores in the appropriate column and write it down in the far right column. When both the upper limb and the back and lower extremity checklists are done, look over each to ensure that every risk factor marked "yes" in the **exposure** column has a score in the **time** column. Similarly, every risk factor marked "no" in the **exposure** column should have a blank **time** column.

#### **STEP 4 – Evaluation of Manual Materials-handling**

The manual materials-handling (MMH) checklist evaluates the risk with lifting and carrying materials. It includes the location of the item being lifted; the mass of the item; how often the item is lifted; and the posture of the employee while handling the item.

There are three steps:

- 1) Determine the **horizontal distance** of the load from the body. The distance is divided into three categories: *near* 0 to 10 cm (0 to four inches), *middle* 10 to 25 cm (four to 10 inches), and *far* more than 25 cm

(10 inches). These ranges refer to the distance from the employee's toes to the middle knuckle of the hand.

- 2) Estimate the **weight** of the item being lifted. If an item is lifted every 10 minutes or less, use the average weight of all the items being lifted. If more than 10 minutes pass between lifts, use the heaviest weight the person lifts.

Once the item's **weight is** established, combine it with the estimate of **horizontal distance** to determine the score for Step II.

For example: a job where a person lifts a 9.07 kg (20 lb.) load at a middle distance from the body 10 to 25 cm (four to 10 inches) would receive a score of three points. If the person does not lift any item greater than 4.45 kg (10 lb.), a score of 0 would be given to this job.

- 3) Evaluate the **other risk factors** that are related to handling loads. Even if the items being lifted are not above 4.45 kg (10 lb.) this section should still be filled out.

First, note the time of exposure: How often and how long do the MMH activities occur? If lifting is only occasional, and more than 10 minutes pass between lifts, use values from the first column 'Occasional Lifts.' If the risk factor occurs with most lifts, and lifting occurs for more than one hour, use the values from the second column 'Frequent Lifts.'

Review each risk factor and determine whether or not the employee is exposed to this factor. If so, circle the score in the appropriate column and transfer it to the far right column. Add up all the scores in the right hand column and place the total in the box marked 'Step III Score.'

The MMH checklist is really a component of the Back and Lower Extremity checklist. As such, the scores from the MMH checklist are recorded within the Back and Lower Extremity checklist, and contribute to the total score in this checklist. Once you have completed the MMH checklist, add up the scores from Steps 2 & 3 and record the total in the second last row of the Back and Lower Extremity checklist.

### **STEP 5- Add up the Checklist Scores**

To find the total scores for the Upper Limb and Back and Lower Extremity checklists add the scores in the far right column for each of the checklists, and record them at the bottom of each checklist.

## **STEP 6 – Opportunities for Improvement**

The final step is to record any actions that could improve the job. Note any recommendations after observing the employee do the job, talking with the employee, and performing the checklist analysis. It may be useful to recommend that the job be looked at in more detail before any decisions are made. The key is to record ideas while the information is fresh. Write down at least two or three ideas in the 'Comments' section of the Ergonomics Analysis Worksheet.

