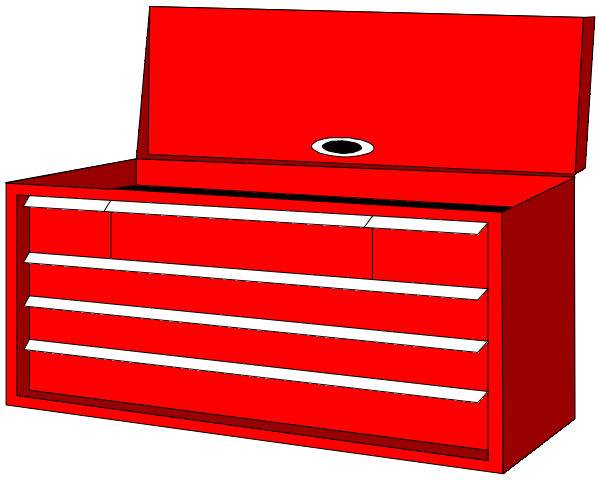
Industrial Musculoskeletal Injury Reduction Program

Common Industry Jobs (CIJs)
By Products Management
Tool Kit



IMIRP program coordinated by:

Council of Forest Industries

Industrial Wood & Allied Workers of Canada

Advanced Ergonomics Inc.

In cooperation with the Workers' Compensation Board of British Columbia

BY PRODUCTS MANAGEMENT TOOL KIT
Table of Contents

Overview

By-Products Management Person

Job Summary

A By-Products Management Person is responsible for clean-up and management of sawmill by-products. A By-Products Management Person will clean under conveyor belts, clear jam-ups, and change and sharpen knives. Refer to the Physical Demands Analysis for more detail.

Jobs covered by this Tool Kit are By-Products/Waste System Serviceperson, Chipper Operator, Divider Station Operator, and Hog Operator.

Physical Demands

The physical demands of the By-Products Management Person may include:

a) Forceful exertion of the shoulder, elbow, wrist, and low back
b) Awkward postures of the neck, shoulder, elbow/wrist, low back, and knee
c) Static postures of the neck, low back, knee, and foot
d) Contact stress of the wrist/hand, and knee
e) Whole body vibration
f) Walking continuously while cleaning up
g) Standing or sitting on a vibrating surface while operating the Hog, Chipper, or Divider station
h) Climbing stairs to monitor conveyors and silos
i) Kneeling while cleaning under conveyors
j) Balancing while unjamming waste material, cleaning up, and changing knives
k) Crouching while unjamming waste material, cleaning up, and changing knives
l) Pushing hand tools for cleaning up
m) Pushing a cart or wheelbarrow for moving debris
n) Pulling debris from conveyor
o) Lifting and carrying chipper knives, debris, or scrap metal from hog conveyor

Mental Demands

A By-Products Management Person has to monitor conveyors for jam-ups. This monitoring requires sustained alertness.

Major Variations

With different mills, the following major variations may be found:

1) Removal of metal from the Hog conveyor may be achieved by:
   a) Manual lifting
   b) Using a lifting hoist

Physical Demands Analysis
By-Products Management Person

PDA General Instructions: By-Products Management Person

The purpose of this PDA is to familiarise healthcare professionals with the physical demands of a By-Products Management Person. This PDA can be used to gather information about an individual's job and to assist in developing a rehabilitation and return-to-work plan. It is not intended for use in claims adjudication.

Where applicable, common industry job data (e.g., hand tools, tasks) have been included in the tables of this document. The information reported was collected from a sample of By-Products Management People in the BC Sawmill Industry. However, the PDA requires completion by the healthcare professional, with input from the injured worker to highlight tasks that aggravate the injury or prevent the worker from returning to their job. The worker's supervisor may be contacted for further information or verification of tasks.

A PDA should be filled out for each individual worker following an injury. Subsequent changes in the work process may reduce the accuracy of any pre-existing physical demands assessments.

By-Products Management People assessed include:
1. By-Products/Waste System Serviceperson
2. Chipper Operator
3. Divider Station Operator
4. Hog Operator

PDA Table of Contents

Physical Demands Analysis

By-Products Management Person

Task List

For each of the tasks listed below, please indicate whether it occurs at your site.

Clean under and around conveyors

A By-Products Management Person removes debris under and around conveyors.

Does this task occur at your site?

☐ Yes ☐ No

Clear jam-ups

A By-Products Management Person clears jam-ups on conveyors.

Does this task occur at your site?

☐ Yes ☐ No

Monitor Hog conveyor

A By-Products Management Person monitors the Hog conveyor.

Does this task occur at your site?

☐ Yes ☐ No

Operate Divider station

A By-Products Management Person operates the Divider station.

Does this task occur at your site?

☐ Yes ☐ No

Operate a chainsaw

A By-Products Management Person operates a chainsaw to buck pieces.

Does this task occur at your site?

☐ Yes ☐ No

Operate lift hoist

A By-Products Management Person removes logs from a conveyor with a lifting device.

Does this task occur at your site?

☐ Yes ☐ No

Lift logs manually

A By-Products Management Person lifts logs manually.

Does this task occur at your site?

☐ Yes ☐ No

Transfer logs

A By-Products Management Person removes logs from the Hog conveyor.

Does this task occur at your site?

☐ Yes ☐ No

Work in confined spaces

A By-Products Management Person works in confined spaces.

Does this task occur at your site?

☐ Yes ☐ No

Monitor Chipper conveyors

A By-Products Management Person monitors the Chipper infeed conveyors.

Does this task occur at your site?

☐ Yes ☐ No

Change Chipper knives

A By-Products Management Person changes the Chipper knives.

Does this task occur at your site?

☐ Yes ☐ No

Remove metal from conveyors

A By-Products Management Person removes metal from conveyors.

Does this task occur at your site?

☐ Yes ☐ No

Job Profile

Date: _____

Company Name: _____ Division: _____

Employee Name: _____ Supervisor: _____

Phone: _____ Fax: _____

Is a Return-to-Work (RTW) strategy in place? ☐ Yes ☐ No

If yes, check all that apply: ☐ Modified Job ☐ Modified Worksite ☐ Graduated RTW

Describe:

_____

_____

_____

Length of shift _____ hours

Formal breaks

- ☐ Two 10 minute breaks
- ☐ One 30 minute lunch break
- ☐ Other: _____

Informal breaks

- ☐ Yes, length of break varies
- ☐ Yes, _____ minutes/shift

Work pace control

- ☐ Self-paced
- ☐ Time pressure (e.g., completing a task during the 30 minute lunch break)
- ☐ Other: _____

Job rotation

☐ Yes ☐ No

Describe:

_____

_____

_____

_____

Work Organisation

Task Description

The table below contains a list of tasks performed by a By-Products Management Person. Use the left column to check off (✓) tasks that are present. Estimate the *Percent of Shift* each task is performed and place a check mark (✓) in the appropriate column. The *Comments* section may be used to include information related to duration, frequency, and cycle times. Additional tasks can also be included under *Other*.

	Task	Percent of Shift				Comments
		Rarely 0 to 5%	Occasionally 6 to 33%	Frequently 34 to 66%	Constantly 67 to 100%	
	Clean under and around conveyors					
	Clear jam-ups					
	Monitor Hog conveyors					
	Operate Divider station					
	Operate a chainsaw					
	Operate lift hoist					
	Lift logs manually					
	Transfer logs					
	Work in confined spaces					
	Monitor Chipper conveyors					
	Change Chipper knives					
	Remove metal from conveyors					
	Other:					

Workstation Characteristics

Dimensions & Layout

Sketch workstation(s) and indicate relevant measurements, such as working heights and reaches.

Flooring, Displays & Seating

The table below lists several components of a workstation. For *Flooring* and *Displays* there are several options provided. Please indicate all of the options that apply to the workstation. For the *Seating* section, describe and identify the features of the seat, if applicable. The *Comments* section may be used to include additional information, especially any workstation characteristics of concern.

Workstation Characteristics	**Comments**
Flooring *(Check all that apply)* ☐ Cement ☐ Wood ☐ Rubber matting ☐ Metal ☐ Other: _____	
Displays *(Check all that apply)* ☐ Lights on console ☐ Mirrors ☐ Video monitors ☐ Computer monitors ☐ Scrolling display ☐ Signal lights ☐ Other: _____	
Seating *(Check all that apply)* ☐ Armrests ☐ Backrest ☐ Swivel seat ☐ Slide track ☐ Lumbar support ☐ Foot rest ☐ Casters #: _____ *Indicate if adjustable:* ☐ Height ☐ Armrests ☐ Backrest ☐ Forward tilt	Height of seat: _____ cm Depth of seat: _____ cm Width of seat: _____ cm Covering type: _____

Equipment & Machinery Controls

The table below contains a list of the types of controls used by a By-Products Management Person. Use the left column to check off (✓) controls that are present at the work site. Highlight controls that may aggravate an injury, or which the worker finds difficult to use. The *Comments* section may be used to include any additional information. Additional controls can be included under *Other*.

	Type of Control	**Function**	**Comments**
	Finger push button	• *Start/stop conveyor* • *On/off switch for metal detector*	• *Infrequently*
	Push/pull switches	• *Start/stop conveyor*	• *Infrequently*
	Foot pedal	• *Control gate at Divider station*	
	Toggle switch	• *Reversal of Hog conveyor*	
	Rotary selector switch	• *Start/stop/reversal of Hog conveyor*	
	Other:		

Physical Demands

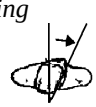
Whole Body Physical Demands

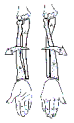
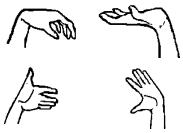
Identify each of the physical demands required by a By-Products Management Person and list the corresponding tasks in the second column. Check off (✓) the estimated *Percent of Shift*, and use the *Comments* section to include information related to duration, frequency, and cycle times.

Physical Demands	Tasks or Activity	Percent of Shift				Comments
		Rarely 0 to 5%	Occasionally 6 to 33%	Frequently 34 to 66%	Constantly 67 to 100%	
Example: Crouching	• *Clean under and around conveyors*			✓		
Walking						
Sitting						
Standing						
Climbing						
Balancing						
Kneeling/ Crouching						
Other:						

Body Postures

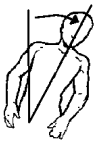
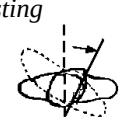
The table below outlines the body postures that may be adopted throughout the shift by a By-Products Management Person, related to tasks. Check off (✓) the estimated *Percent of Shift*, and use the *Comments* section to include information describing posture duration, frequency, cycle times, and hand used.

Body Posture	Task(s)	Percent of Shift				Comments
		Rarely 0 to 5%	Occasionally 6 to 33%	Frequently 34 to 66%	Constantly 67 to 100%	
Example: Back flexion	• *Remove metal from conveyors*		✓			
Neck						
Flexion 						
Extension 						
Twisting 						
Shoulder						
Flexion 						
Abduction/ adduction 						
Extension 						

Body Posture	Task(s)	Percent of Shift				Comments
		Rarely 0 to 5%	Occasionally 6 to 33%	Frequently 34 to 66%	Constantly 67 to 100%	
Forearm						
Rotation 						
Wrist						
Wrist Movements 						
Hand/Fingers						
**Handling*						
**Fingering*						
**Gripping*						

Legend for Hand/Fingers

Handling	*Grasping, turning, holding, etc.*			
Fingering	*Picking, pinching, etc.*			
Gripping	*Power* 	*Pinch* 	*Hook* 	*Precision* 

Body Posture	Task(s)	Percent of Shift				Comments
		Rarely 0 to 5%	Occasionally 6 to 33%	Frequently 34 to 66%	Constantly 67 to 100%	
Back						
Flexion 						
Lateral Flexion 						
Twisting 						
Extension 						

Manual Material Handling

The table below contains a list of general manual material handling activities performed by a By-Products Management Person. Indicate tasks that require one or more of these activities, and fill in the weight of the objects, or the force required, for each action. Check off (✓) the estimated *Percent of Shift*, and use the *Comments* section to include information related to duration, frequency, cycle times, and characteristics of objects handled. If necessary, please refer to Appendix A to calculate the weight of the wood being handled.

Activity	Task Description	Weight (kg)	Percent of Shift				Comments
			Rarely 0 to 5%	Occasionally 6 to 33%	Frequently 34 to 66%	Constantly 67 to 100%	
Pushing	• *Clean under and around conveyors*						
Pulling	• *Clear jam-ups*						
Lifting	• *Remove metal from conveyors*						
Lowering	• *Remove metal from conveyors*						
Carrying	• *Remove metal from conveyors*						

Hand Tools

Indicate the hand tools used by a By-Products Management Person by placing a check mark (✓) in the far left column. Determine the weight of the hand tool and enter it in the appropriate column. Check off (✓) the estimated *Percent of Shift,* and use the *Comments* section to include information related to duration, frequency, cycle times, and characteristics of the hand tools.

	Type of Tool	Task(s)	Weight (kg)	Percent of Shift				Comments
				Rarely 0 to 5%	Occasionally 6 to 33%	Frequently 34 to 66%	Constantly 67 to 100%	
	Pike pole	• *Clear jam-ups*						
	Picaroon	• *Clear jam-ups*						
	Chainsaw	• *Clear jam-ups*						
	Axe	• *Clear jam-ups*						
	Sledge hammer	• *Clear jam-ups*						
	Impact wrench	• *Change Chipper knives*						
	Pitchfork	• *Remove metal from conveyors*						
	Magnetic wand	• *Remove metal from conveyors*						
	Shovel	• *Clean under and around conveyors*						
	Broom	• *Clean under and around conveyors*						
	Scraper	• *Clean under and around conveyors*						
	Other:							

Environmental Conditions

Work Environment

The table below contains a list of environmental conditions that may be of concern. If any of these factors aggravate the injury, include this information in the *Comments* section.

Factor	Comments
Vibration *(Indicate source)* ☐ Seat ☐ Floor ☐ Tool ☐ Other: _____	
Noise level	
Lighting level	
Other:	

Location of Workstation

The table below contains a list of potential work environments. Indicate with a check mark (✓) in the left column which of the work environments apply to the specific workstation. For example, the workstation may be inside a building with both a local fan and heater, exposed to the outside by a doorway that is always open. In this situation, 'Inside exposed', 'Heater present', and 'Fan present' would all be checked.

	Work Environment
	Outside uncovered
	Outside covered
	Inside enclosed
	Inside exposed
	Heater present
	Fan present

Temperature

The table below contains a list of the geographical regions of British Columbia. Indicate the appropriate region with a check mark (✓) in the left column. Refer to the regional map in Appendix B of the PDA.

	Region	Avg. Max July/Aug	Avg. Min Dec/Jan	Extreme Max.	Extreme Min.
	Vancouver Island	22.5 °C	-0.6 °C	36.1 °C	-18.8 °C
	Southwestern BC	22.9 °C	0.4 °C	35.6 °C	-18.3 °C
	Cariboo Chilcotin Coast	22.2 °C	-11.6 °C	36.4 °C	-42.5 °C
	High Country	26.3 °C	-9.9 °C	39.6 °C	-39.7 °C
	Okanagan Similkameen	26.5 °C	-8.4 °C	36.0 °C	-36.3 °C
	Kootenay Country	26.2 °C	-6.7 °C	38.5 °C	-32.0 °C
	British Columbia Rockies	24.7 °C	-12.3 °C	37.5 °C	-42.2 °C
	North by Northwest	19.5 °C	-11.7 °C	32.9 °C	-38.1 °C
	Peace River Alaska Highway	20.0 °C	-20.2 °C	34.6 °C	-47.7 °C

Personal Protective Equipment

The table below contains a list of the personal protective equipment (PPE). For the By-Products Management Person at your site, indicate with a check mark (✓) which of the PPE items are required.

	Gloves Type:		Hard Hat		Leather Apron
	Glove Liners		Steel-toed Boots		Dust Mask
	Eye Protection		Hearing Protection		Seat Belt
	Face Shield/Helmet		Life Jacket		Harness
	Knee Pads		Other:		Other:

Appendix A – Weight of Wood Equation

1. Type of Wood Handled

The table below contains a list of the types of wood processed in British Columbia. The weight per board foot wet and dry is given for each species. This information will be used in the table in *Section 4* to calculate the weight of the wood handled. Please indicate all of the types of wood processed.

	Wood Handled	Wet lb./ Board Foot	Dry lb./ Board Foot		Wood Handled	Wet lb./ Board Foot	Dry lb./ Board Foot
	Douglas Fir	3.60	2.83		Larch	3.48	N/A
	Hemlock	3.42	2.49		Spruce/Pine/Fir*	2.95	2.18
	Red Cedar	2.42	2.00		Alpine Fir	2.67	2.00
	Yellow Cedar	3.01	2.49		Lodge Pole Pine	3.26	2.41
	Sitka Spruce	2.76	2.23		White Spruce	2.93	2.15

*The Spruce/Pine/Fir values are an average of White Spruce, Lodge Pole Pine, and Alpine Fir.

2. Size of Wood*

The table below contains a list of different sizes or dimensions of wood. The percentage next to the size of the wood is the multiple used to compare the size of the board to a board foot (1" by 12" by 12"). This multiple will be used in the table in *Section 4* to calculate the weight of wood handled. Please indicate all of the applicable sizes of wood handled at the workstation. Add any other sizes to the bottom of the table if your particular size of wood is not listed.

	1" Sizes	Multiple		2" Sizes	Multiple		4" Sizes	Multiple		6" Sizes	Multiple		8" Sizes	Multiple
	1 by 4	0.33		2 by 4	0.67		4 by 4	1.33		6 by 6	3.00		8 by 8	5.33
	1 by 6	0.50		2 by 6	1.00		4 by 6	2.00		6 by 8	4.00		8 by 10	6.67
	1 by 8	0.67		2 by 8	1.33		4 by 8	2.67		6 by 10	5.00		8 by 12	8.00
	1 by 10	0.83		2 by 10	1.67		4 by 10	3.33		6 by 12	6.00			
	1 by 12	1.00		2 by 12	2.00		4 by 12	4.00						

* Conservative estimates of actual wood dimensions

If the size of the board is different from those in this table, use this equation to find out the multiple value.

[(Dimensions of wood) x 12] / 144 = Multiple
For example: For a 5 by 5 piece of wood [(5x5) x 12]/144 = 2.08

3. Length of Wood

The table below contains a list of the common lengths of wood. Please indicate which of these lengths are being handled at this particular workstation. Add additional lengths to the table if necessary. This information will be used in the table in *Section 4*.

Length of Wood							
	6 foot		12 foot		18 foot		22 foot
	8 foot		14 foot		20 foot		24 foot
	10 foot		16 foot		Other:		Other:

4. Weight of Wood Equation*

The table below is used to calculate the weight of the boards being handled. The weight is calculated by multiplying the species weight/board foot (*Section 1 value*) by the size of wood multiple (*Section 2 value*) and by the length of wood (*Section 3 value*).

Example: For a run of wet Spruce/Pine/Fir, 2" x 4", 16 feet long

2.95 *(wet lb./ board foot)* x **0.67** *(size of wood multiple for 2" x 4")* x **16** *(length of board in feet)* = **32 lbs**.

For the heaviest species handled, enter the lb./board foot value, the multiple for the largest size of this wood, and the largest length of this wood. Multiply these values together to determine the weight of the board in pounds.

For the most common species handled, enter the lb./board foot value, the multiple for the most common size of wood, and the most common length of this wood. Multiply these values together to determine the weight of the board in pounds.

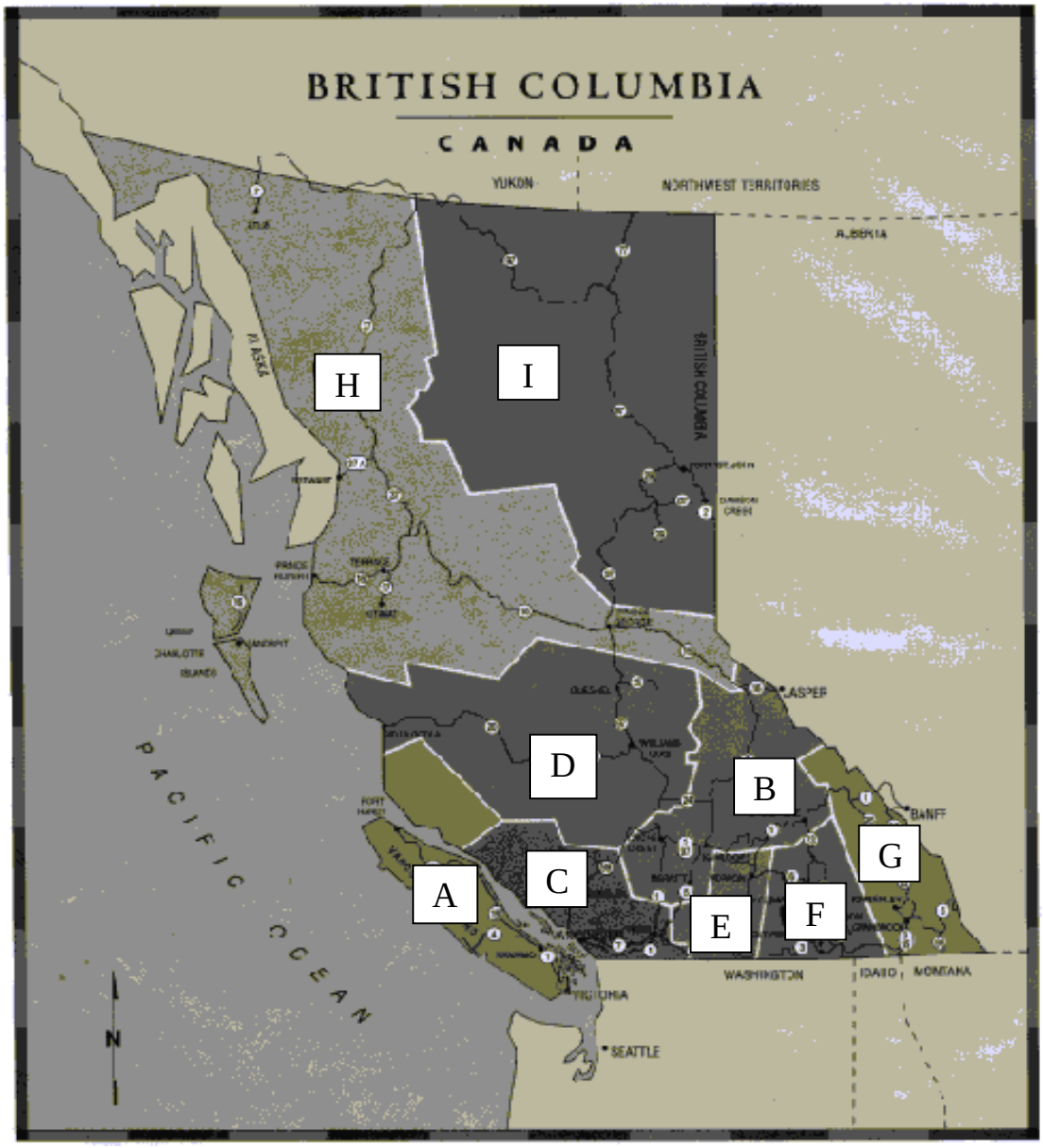
For the lightest species handled, enter the lb./board foot value, the multiple for the smallest size of wood, and the shortest length of this wood. Multiply these values together to determine the weight of the board in pounds.

If required, divide the pound value by 2.2 to obtain the weight of the board in kilograms.

Type of Wood Handled (lb./ board foot) *From Section 1*		**x**	**Multiple (size of wood)** *From Section 2*	**x**	**Length of Wood** *From Section 3*	**=**	**Weight of the Board in pounds**	**Divide by 2.2 to calculate value in kilograms**
Heaviest Species Handled		x		x		=		
Most Common Species Handled		x		x		=		
Lightest Species Handled		x		x		=		

* Weight may vary from the above calculation depending on the cell moisture content of the wood, actual wood dimensions, and wood density.

Appendix B – Regional Map



A - Vancouver Island	**F** - Kootenay Country
B - High Country	**G** - British Columbia Rockies
C - Southwestern BC	**H** - North by Northwest
D - Cariboo Chilcotin Coast	**I** - Peace River Alaska Highway
E - Okanagan Similkameen	

Risk Factor Identification Checklist
By-Products Management Person

Purpose

The Risk Factor Identification Checklist for a By-Products Management Person is used to **identify** potential ergonomic risk factors. Keep in mind that the purpose of this checklist is only to **identify** potential ergonomic risk factors, **not** to assess them.

The checklist can be used as part of your ergonomic intervention process, when workers express concerns about their work environment, during regular workplace inspections and observations, or when conducting an accident or injury investigation. Ideally, management and worker representatives who have completed the IMIRP Occupational Health & Safety Committee and Supervisor Ergonomic Training Session should complete this checklist. Try to view different workers in the same occupation when completing the checklist. Some specific examples are given to help answer the questions.

Instructions

General

Except for the first two questions, all remaining questions will require an answer with an implied frequency. For appropriate questions indicate with a check mark (✓) whether the answer to the question is 'No' or **'**Yes'. This way you will have a record indicating that all risk factors have been considered in the identification process.

If you indicate 'No', please continue to the next question. If the question refers to a situation which does not exist (e.g., there is no seating available), please indicate 'No' in the appropriate box and continue to the next question.

If your answer is 'Yes', please check the appropriate box and then circle the frequency ('S' for 'Sometimes' or 'O' for 'Often'). If you answer 'Yes – Sometimes', then this risk factor **may be** a potential area of concern. If you answer 'Yes – Often' then there is an increased likelihood that this risk factor **is** an issue. Each mill will be responsible for defining what 'Sometimes' and 'Often' will mean to them. It is important that all people who complete the checklist are consistent in how they determine if a risk factor occurs 'Sometimes' or 'Often'. Use the 'Comments' section to indicate specific tasks, or to make other notes about the direct risk factors.

Since ergonomic risk factors frequently occur in combinations, you may find similar questions in different sections. Answering all questions will ensure that the situations that involve combinations of ergonomic risk factors are identified. It is very important to recognise all risk factors that occur in the work area.

Please note that for some of the questions it will be beneficial to ask the worker for their input. Please take the opportunity to include the operator in the risk factor identification process as much as possible. Videotaping the job of interest and reviewing the checklist in a quiet area with the worker may allow for more discussion.

Summary Tables

At the end of each body part section, summarise your findings in the table provided. If any of the direct risk factor sections contain a 'Yes', indicate 'Yes' in the appropriate section of the summary table. Answer the questions referring to injury statistics and discomfort survey findings. If there are only 'No' answers in a direct risk factor section, indicate 'No' in the summary table for that section. Use the summary information to determine how you will use the Work Manual.

Risk Factor Identification Checklist – By-Products Management Person

Management Representative _____

Worker Representative _____

Date _____

Risk Identification completed:

☐ Before implementation of solutions

☐ After implementation of solutions

Job History		No	Yes	Comments
1	Are there records of musculoskeletal injuries or accidents to indicate a risk of musculoskeletal injury? (refer to Worksheet 1 in Implementation Guide)			
2	Are there worker comments to indicate a risk of musculoskeletal injuries? (refer to Worksheet 2 in Implementation Guide)			

Definitions

Force: Force is the amount of physical effort required by the person to do a task and/or maintain control of tools and equipment. The effort depends on the type of grip, object weight and dimensions, body posture, type of activity, surface of the object, temperature, vibration, duration of the task, and number of repetitions.

Repetition: Repetition is defined as similar or the same motions performed repeatedly. The severity of risk depends on the frequency of repetition, speed of the movement or action, the number of muscle groups involved, and the required force. Repetition is influenced by machine or line pacing, incentive programs, piecework, and deadlines.

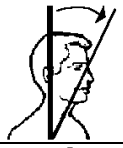
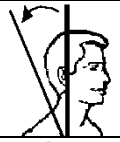
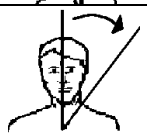
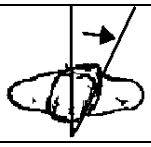
Static Postures: Static loading (sustained exertions) is physical effort (body postures) that is held, requiring muscle contraction for more than a short time.

Contact Stress: Contact stress is the contact of the body with a hard surface or edge. Contact stress can also result when using a part of the body as a hammer or striking instrument.

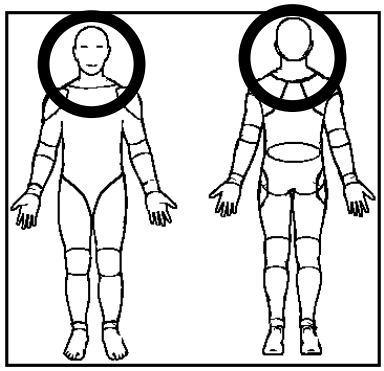
Awkward Postures: Awkward postures occur when there is a deviation from a power working posture. Some examples of awkward postures typically include reaching behind, twisting, working overhead, and forward or backward bending.

Vibration: Vibration is oscillation of a tool or surface. Vibration can be transmitted through the arm or through the whole body.

NECK

Repetition		N	Y		Comments:
Are identical or similar motions performed over and over again? (e.g., looking up or down frequently)				S O	
Ask the worker: Do you spend a large percentage of the day performing one action or task? (e.g. monitoring flow in conveyor)				S O	
Static Posture					
Ask the worker: Do tasks require your neck or shoulders to be maintained in a fixed or static posture? (e.g., looking down at a conveyor for a long period)				S O	
Awkward Posture					
Flexion				S O	
Extension				S O	
Lateral Bending				S O	
Rotation				S O	

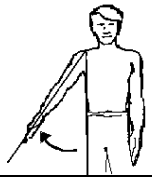
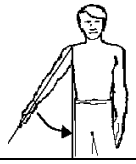
Please indicate whether the following direct risk factors were identified at the **NECK**.		
Direct Risk Factors	Repetition	☐Yes ☐No
	Static Posture	☐Yes ☐No
	Awkward Posture	☐Yes ☐No
In the **Injury Statistics** investigation, were there injury reports for the Neck or Head/Eye or Upper Back? (see Worksheet 1 in the Implementation Guide)		☐Yes ☐No
In the **Discomfort Survey** investigation, were there reports of discomfort for the Neck or Head/Eye or Upper Back? (see Worksheet 2 in the Implementation Guide)		☐Yes ☐No



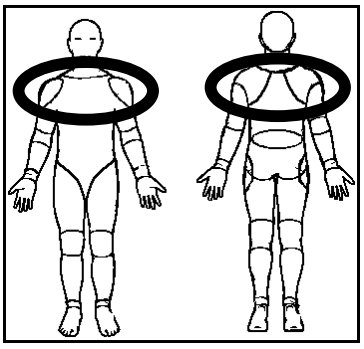
Body parts within the circled area will be classified as NECK issues.

SHOULDER

Force	N	Y		Comments:
Is forceful physical handling performed? Such as: Lifting			S O	
Lowering			S O	
Pushing			S O	
Pulling			S O	
Carrying			S O	
Repetition				
Are identical or similar motions performed over and over again? (e.g., pulling on logs or waste material with a pike pole)			S O	
Ask the worker: Do you spend a large percentage of the day performing one action or task? (e.g., pulling logs toward the body)			S O	
Static Posture				
Ask the worker: Do tasks require your shoulders to be maintained in a fixed or static posture? (e.g., holding arms overhead while cleaning)			S O	
Ask the worker: Do you hold parts, tools, or objects for long periods? (e.g., holding an air hose with arms overhead)			S O	

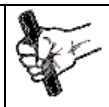
Awkward Posture		N	Y		Comments:
Flexion				S O	
Extension				S O	
Abduction				S O	
Adduction				S O	

Please indicate whether the following direct risk factors were identified at the **SHOULDER**.		
Direct Risk Factors	Force	☐Yes ☐No
	Repetition	☐Yes ☐No
	Static Posture	☐Yes ☐No
	Awkward Posture	☐Yes ☐No
In the **Injury Statistics** investigation, were there injury reports for the Shoulder or Neck or Upper Back? (see Worksheet 1 in the Implementation Guide)		☐Yes ☐No
In the **Discomfort Survey** investigation, were there reports of discomfort for the Shoulder or Neck or Upper Back? (see Worksheet 2 in the Implementation Guide)		☐Yes ☐No



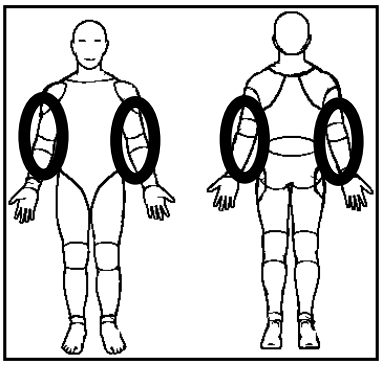
Body parts within the circled area will be classified as SHOULDER issues.

ELBOW

Force	N	Y		Comments:
Is forceful physical handling performed? Such as: Lifting			S O	
Lowering			S O	
Pushing			S O	
Pulling			S O	
Carrying			S O	
Turning materials			S O	
Are objects handled in a power grip? (e.g., pike pole) 			S O	
Are objects handled in a pinch grip? 			S O	
Are objects handled in a hook grip? 			S O	
Ask the worker: Do you wear gloves while performing your job? If the answer is **No**, check the **No** box and go to next section.		*	S O	
*If the answer to the above question is **Yes**, ask the worker: Are the gloves too large/small?			S O	
Does the thickness of the gloves cause problems with gripping?			S O	
Repetition				
Are identical or similar motions performed over and over again? (e.g., pulling logs or pieces of debris from a conveyor)			S O	
Ask the worker: Do you spend a large percentage of the day performing one action or task? (e.g., pulling logs from a conveyor)			S O	

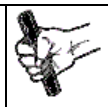
Static Posture	N	Y		Comments:
Ask the worker: Do tasks require your hand and arm to be maintained in a fixed or static posture?			S O	
Ask the worker: Do you apply constant pressure on controls/objects with your hand?			S O	
Ask the worker: Do you hold parts, tools, or objects for long periods?			S O	
Contact Stress				
Ask the worker: Do **any** objects, tools or parts of the workstation put pressure on **any** parts of your hand or arm, such as the backs or sides of fingers, palm or base of the hand, forearm, elbow? (e.g., hand tools that dig into the palm of the hand, metal edges of consoles or workstation digging into elbow)			S O	
Vibration				
Ask the worker: Is vibration transmitted to your hand through a tool or piece of equipment? (e.g., chainsaw)			S O	

Please indicate whether the following direct risk factors were identified at the **ELBOW**.		
Direct Risk Factors	Force	☐Yes ☐No
	Repetition	☐Yes ☐No
	Static Posture	☐Yes ☐No
	Contact Stress	☐Yes ☐No
	Vibration	☐Yes ☐No
In the **Injury Statistics** investigation, were there injury reports for the Elbow or Forearm? (see Worksheet 1 in the Implementation Guide)		☐Yes ☐No
In the **Discomfort Survey** investigation, were there reports of discomfort for the Elbow or Forearm? (see Worksheet 2 in the Implementation Guide)		☐Yes ☐No



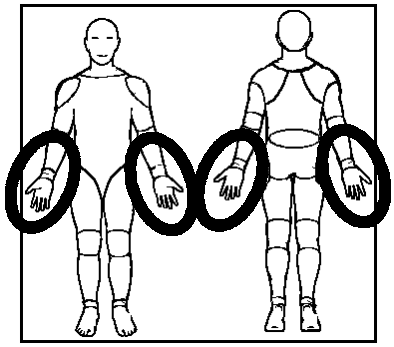
Body parts within the circled area will be classified as ELBOW issues.

WRIST/HAND

Force	N	Y		Comments:
Is forceful physical handling performed? Such as: Lifting			S O	
Lowering			S O	
Pushing			S O	
Pulling			S O	
Carrying			S O	
Turning materials			S O	
Are objects handled in a power grip? (e.g., pike poles) 			S O	
Are objects handled in a pinch grip? 			S O	
Are objects handled in a hook grip? 			S O	
Ask the worker: Do you wear gloves while performing your job? If the answer is **No**, check the **No** box and go to next section.		*	S O	
*If the answer to the above question is **Yes**, ask the worker: Are the gloves too large/small?			S O	
Does the thickness of the gloves cause problems with gripping?			S O	
Repetition				
Are identical or similar motions performed over and over again?			S O	
Ask the worker: Do you spend a large percentage of the day performing one action or task?			S O	

Static Posture		N	Y		Comments:
Ask the worker: Do tasks require any part of your arm or hand to be maintained in a fixed or static posture?				S O	
Ask the worker: Do you apply constant pressure on controls/objects with your hand?				S O	
Ask the worker: Do you hold parts, tools, or objects for long periods?				S O	
Contact Stress					
Ask the worker: Do **any** objects, tools or parts of the workstation put pressure on **any** parts of your hand or arm, such as the backs or sides of fingers, palm or base of the hand, forearm?				S O	
Ask the worker: Do you use your hand like a hammer for striking?				S O	
Awkward Posture					
Flexion				S O	
Extension				S O	
Ulnar Deviation				S O	
Radial Deviation				S O	
Vibration					
Ask the worker: Is vibration transmitted to your hand through a tool or piece of equipment? (e.g., chainsaw)				S O	

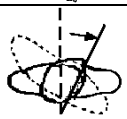
Please indicate whether the following direct risk factors were identified at the **WRIST/HAND**.		
Direct Risk Factors	Force	☐Yes ☐No
	Repetition	☐Yes ☐No
	Static Posture	☐Yes ☐No
	Contact Stress	☐Yes ☐No
	Awkward Posture	☐Yes ☐No
	Vibration	☐Yes ☐No
In the **Injury Statistics** investigation, were there injury reports for the Wrist or Hand/Finger or Forearm? (see Worksheet 1 in the Implementation Guide)		☐Yes ☐No
In the **Discomfort Survey** investigation, were there reports of discomfort for the Wrist or Hand/Finger or Forearm? (see Worksheet 2 in the Implementation Guide)		☐Yes ☐No



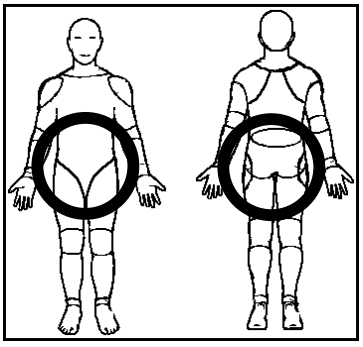
Body parts within the circled area will be classified as WRIST issues.

LOW BACK OR HIP/THIGH

Force	N	Y		Comments:
Is forceful physical handling performed? Such as: Lifting			S O	
Lowering			S O	
Pushing			S O	
Pulling			S O	
Carrying			S O	
Repetition				
Are identical or similar motions performed over and over again?			S O	
Ask the worker: Do you spend a large percentage of the day performing one action or task? (e.g., bending to lift waste material)			S O	
Static Posture				
Ask the worker: Do tasks require your trunk and upper body to be maintained in a fixed or static posture? (e.g., working in a confined space)			S O	
Are workers required to sit or stand in a stationary position for long periods of time during the shift? (e.g., monitoring flow of waste material in a conveyor)			S O	
Contact Stress				
Ask the worker: Do **any** objects, tools or parts of the workstation put pressure on **any** parts of your hip/thigh? (e.g., conveyors that dig into hip or thigh)			S O	

Awkward Posture		N	Y		Comments:
Flexion				S O	
Extension				S O	
Lateral Bending				S O	
Twisting				S O	
Vibration					
Ask the worker: Is your whole body exposed to vibration for significant portions of the work shift? (e.g., standing on machinery)				S O	

Please indicate whether the following direct risk factors were identified at the **LOW BACK or HIP/THIGH**.		
Direct Risk Factors	Force	☐Yes ☐No
	Repetition	☐Yes ☐No
	Static Posture	☐Yes ☐No
	Contact Stress	☐Yes ☐No
	Awkward Posture	☐Yes ☐No
	Vibration	☐Yes ☐No
In the **Injury Statistics** investigation, were there injury reports for the Low Back or Hip/Thigh? (see Worksheet 1 in the Implementation Guide)		☐Yes ☐No
In the **Discomfort Survey** investigation, were there reports of discomfort for the Low Back or Hip/Thigh? (see Worksheet 2 in the Implementation Guide)		☐Yes ☐No

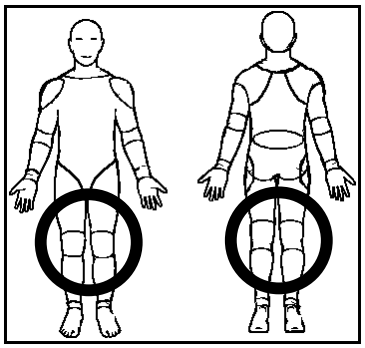


Body parts within the circled area will be classified as LOW BACK issues.

KNEE

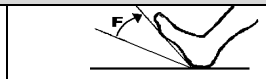
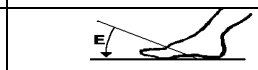
Repetition	N	Y		Comments:
Are identical or similar motions performed over and over again? (e.g., climbing stairs, crouching)			S O	
Static Posture				
Ask the worker: Do tasks require you to maintain your knee(s) in a fixed or static posture? (e.g., crouching while performing maintenance on equipment)			S O	
Are workers required to sit or stand in a stationary position for long periods of time during the shift? (e.g., monitoring flow of waste material in a conveyor)			S O	
Do workers kneel (with one or both knees)?			S O	
Contact Stress				
Ask the worker: Do **any** objects or parts of the workstation put pressure on your knee(s)? (e.g., kneeling on a hard surface)			S O	
Awkward Posture				
Extreme Flexion 			S O	

Please indicate whether the following direct risk factors were identified at the **KNEE**.		
Direct Risk Factors	Repetition	☐Yes ☐No
	Static Posture	☐Yes ☐No
	Contact Stress	☐Yes ☐No
	Awkward Posture	☐Yes ☐No
In the **Injury Statistics** investigation, were there injury reports for the Knee or Hip/Thigh? (see Worksheet 1 in the Implementation Guide)		☐Yes ☐No
In the **Discomfort Survey** investigation, were there reports of discomfort for the Knee or Hip/Thigh? (see Worksheet 2 in the Implementation Guide)		☐Yes ☐No

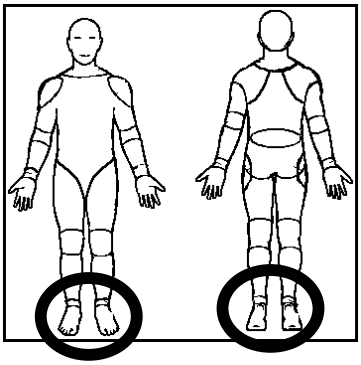


Body parts within the circled area will be classified as KNEE issues.

ANKLE/FOOT

Repetition	N	Y		Comments:
Are identical or similar motions performed over and over again? (e.g., walking on uneven surfaces)			S O	
Static Posture				
Are workers required to stand in a stationary position for long periods of time during the shift? (e.g., standing)			S O	
Awkward Posture				
Flexion 			S O	
Extension 			S O	
Vibration				
Ask the worker: Is your whole body exposed to vibration for significant portions of the work shift? (e.g., standing on catwalks and machinery)			S O	

Please indicate whether the following direct risk factors were identified at the **ANKLE/FOOT**.		
Direct Risk Factors	Repetition	☐Yes ☐No
	Static Posture	☐Yes ☐No
	Awkward Posture	☐Yes ☐No
	Vibration	☐Yes ☐No
In the **Injury Statistics** investigation, were there injury reports for the Ankle or Foot? (see Worksheet 1 in the Implementation Guide)		☐Yes ☐No
In the **Discomfort Survey** investigation, were there reports of discomfort for the Ankle or Foot? (see Worksheet 2 in the Implementation Guide)		☐Yes ☐No



Body parts within the circled area will be classified as ANKLE/FOOT issues.

CHARACTERISTICS OF OBJECTS BEING HANDLED

	N	Y		Comments:
Are there problems handling a load due to its size or shape? (e.g., logs)			S O	
Are there problems handling a load due to its fragile, unbalanced, or non-rigid conditions?			S O	
Ask the worker: Do you experience situations where mechanical aids or equipment are not readily available to assist with manipulating an object? (e.g., hoists)			S O	
Are handles for tools and equipment inappropriate in terms of size or shape? (e.g., hand tools)			S O	
Ask the worker: Do any objects that you work with (other than tools or equipment) have handles? If the answer is **No**, check the **No** box and go to the next section.			S O	
If the answer to the above question is **Yes**, ask the worker: Are the handles an inappropriate size or shape for the characteristics of the object?			S O	

ENVIRONMENTAL CONDITIONS

Temperature				
Ask the worker: Are your hands or arms exposed to cold from exhaust air, cold liquids or solids?			S O	
Ask the worker: Are you exposed directly to temperature extremes that may cause you to use more force or cause you to fatigue quicker than normal? (e.g., hot or cold, either by equipment or natural environment)			S O	
Lighting				
Ask the worker: Do you assume awkward postures to overcome problems associated with glare, inadequate lighting, or poor visibility? (e.g., working under equipment)			S O	

ENVIRONMENTAL CONDITIONS [CONTINUED]

Noise	N	Y		Comments:
Have there been complaints on the level of noise in the work area?			S O	
Ask the worker: Are there any distracting or annoying noises at the workstation? (e.g., air hoses)			S O	

WORK ORGANISATION

	N	Y		Comments:
Is the work externally-paced or controlled by a machine or the process?			S O	
Do peak workloads or sudden increases in pace occur with the tasks? (e.g., working during mill downtime)			S O	
Ask the worker: Are there indications of excessive fatigue or pain, or symptoms of adverse health effects due to extended work days or overtime? (e.g., extended weekend maintenance)			S O	
Ask the worker: Are there indications of excessive fatigue or adverse health effects due to shiftwork?			S O	
Ask the worker: Are rest periods or task variety insufficient to prevent the build-up of fatigue or the risk of adverse health effects?			S O	
Ask the worker: Are tasks in a job rotation program similar to one another, and therefore not providing a variation in movements?			S O	

Work Manual

Industrial
Musculoskeletal
Injury
Reduction
Program

By-Products Management Person

This Work Manual contains information about the body parts found to be at risk of musculoskeletal injury (MSI) for the By-Products Management Person (Injury Education), and how to reduce the risk of MSIs using various control measures (Injury Prevention). Each Work Manual is intended to help Occupational Health and Safety Committee members establish effective solutions to reduce MSIs, and as a resource for workers to understand the MSI risks that they may encounter on the job.

The Body Manual, referenced throughout the Work Manual, is a separate document that contains information on how to prevent common MSIs through exercise. Please note exercises described in the Body Manual should only be used after consulting a healthcare practitioner.

The General Risk Factor Solutions Manual, referenced throughout the Work Manual, is a separate document that contains general, preventative information on Environmental Conditions and Work Organisation issues.

Work Manual

By-Products Management Person

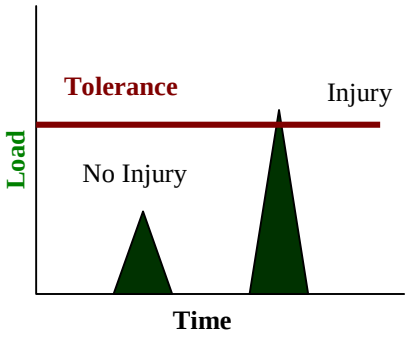
Disclaimer

The BC sawmill IMIRP documents were developed by Advanced Ergonomics Inc. (AEI) based on analyses conducted in a number of voluntary, participating sawmills in British Columbia and should be considered applicable only to the BC sawmill industry. Modification to these documents may reduce their usefulness and/or lead to hazardous situations. Individuals or committees wishing to make Physical Demands Analyses (PDAs) site-specific, or wishing to implement options from the Work Manuals, are advised to first complete the two-day OHSC and Supervisors Ergonomics Training Session. Modifications to a PDA must be within the scope of competence of those individuals making the changes and must be reported to any rehabilitation professional using the PDA. Neither AEI nor the IMIRP Society accepts any responsibility for the use or misuse of these documents.

WM Table of Contents

Injury Education

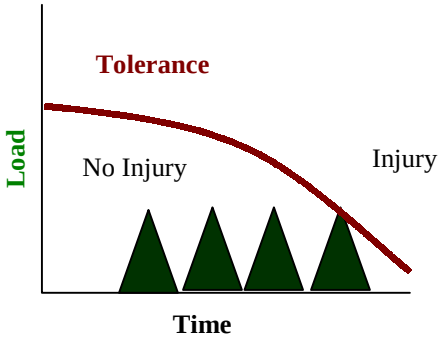
Injuries occur when …
Loads exceed tissue tolerances



Excessive Force

This type of injury occurs from a single event, where the loads or forces are so great they exceed tissue tolerances and cause an immediate injury. This type of injury is more common with trips and falls.

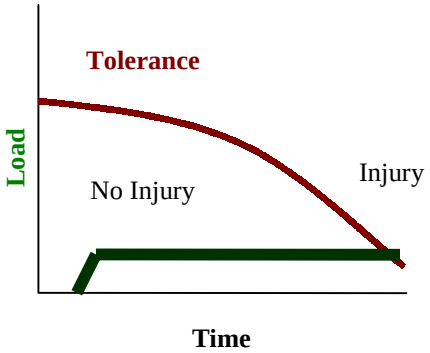
Example – a worker going over on their ankle and spraining it.



Excessive Repetition

This type of injury occurs from repeated loading weakening tissue to the point of failure. It progresses slowly to the point where a subfailure load can cause an injury. This type of injury is more common with repetitive tasks.

Example – a worker pulling lumber off a chain developing a herniated disc.



Excessive Duration

This type of injury occurs from constant loading weakening tissue to the point of failure. This type of injury is more common with tasks that require workers to adopt static or awkward postures for extended periods.

Example – a Grader developing neck tension.

Body Parts at Risk

The previous page on injury education explains how injuries can occur. The Injury Education section of this Work Manual expands on these principles, relating them to the specific body parts at risk of being injured.

After all of the appropriate information is collected during the investigation of the By-Products Management Person job (i.e., injury statistics, discomfort surveys, results from the Identification Checklist), the next steps are to:

1. Match the body parts of concern from your investigation to those described in this section of the Work Manual.

2. Note the direct risk factors associated with each body part of concern.

3. Read the information on the page and try to understand why a body part, in combination with each of the direct risk factors, is of concern.

4. Discover which indirect risk factors are associated with a particular body part problem and the headings under which they are found in the Injury Prevention section of the Work Manual.

5. Note the consequences of the direct risk factor relative to a body part.

6. Note where the potential solutions can be found within the Injury Prevention section of the Work Manual. In addition, for many of the body parts, a reference may be provided to refer to specific sections of the Body Manual.

At the end of the Body Parts at Risk Section, there is a summary page of all the body parts of concern for the By-Products Management Person. In addition, a reference table, with a summary of the direct and indirect risk factors by body part, is provided.

In the last section on Injury Prevention, the Work Manual discusses specific solution options for each of the body parts at risk.

Major Risk Identification

IMIRP ergonomists have assessed the By-Products Management Person position and found that the low back, neck, and shoulder are the body parts of major concern while performing their duties. Focussing on solutions that target the areas of major concern will likely reduce the greatest risks associated with this job.

Neck: Major risks include repetitive movements and awkward and static postures of the neck while monitoring conveyors.

The following solutions are targeted at reducing the risk of injury to the neck:

1. Adequate space (page 90)
2. Look down with eyes (page 91)
3. Ear muffs (page 91)
4. Mirror (page 91)
5. Increase neck tissue tolerances (page 92)
6. Video monitor placement (page 97)
7. Computer representation (page 98)
8. Stretches (page 99)
9. View with eyes (page 102)
10. Turn body (page 102)
11. Reduce glare (page 108)
12. Lighting (page 108)

Shoulder: Major risks include forceful and repetitive movements, and awkward postures of the shoulder while manually handling debris.

The following solutions are targeted at reducing the risk of injury to the shoulder:

1. Use tools to reach (page 86)
2. Removal of metal with another conveyor (page 87)
3. Diagonal fin (page 87)
4. L-shaped chute (page 88)
5. Removable safety barrier (page 88)
6. Decrease metal in system during production (page 89)
7. Maintain chainsaws (page 89)
8. Adequate space (page 90)
9. Stretches (page 99)
10. Hoists (page 104)
11. Pike pole use (page 104)
12. Lightweight, sharp tools (page 104)

Low Back: Major risks include forceful and repetitive movements and awkward and static postures of the low back while lifting debris from the conveyor. Other major risks include awkward and static postures while sitting on a vibrating surface.

The following solutions are targeted at reducing the risk of injury to the low back:

1. Use tools to reach (page 86)
2. Removal of metal with another conveyor (page 87)
3. Diagonal fin (page 87)
4. L-shaped chute (page 88)
5. Removable safety barrier (page 88)
6. Modify safety barrier (page 88)
7. Decrease metal in system during production (page 89)
8. Maintain chainsaws (page 89)
9. Hand-held metal detectors (page 89)
10. Braced postures (page 90)
11. Adequate space (page 90)
12. Handling small pieces of debris (page 91)
13. Spot vacuum system (page 92)
14. Keep the back straight (page 92)
15. Lumbar support (page 93)
16. Adjustable seating (page 93)
17. Vary body posture (page 94)
18. Keep the back straight (page 92)
19. Sit/stand stool (page 94)
20. Seat maintenance (page 95)
21. Anti-fatigue matting (page 96)
22. Anti-fatigue insoles (page 96)
23. Conveyor seals (page 97)
24. Minimise lifting distance (page 98)
25. Stretches (page 99)
26. Power positions (page 103)
27. Manual material handling (page 103)
28. Hoists (page 104)
29. Pike pole use (page 104)
30. Lightweight, sharp tools (page 104)
31. Reduce hand tool weight (page 105)
32. Use Front End Loader or Ramrod (page 105)
33. Hand tool use (page 107)
34. Vibration (page 108)

For additional stretching and strengthening exercises that would benefit a By-Products Management Person, refer to the Neck, Shoulder, and Back sections of the Body Manual.

NECK

Direct Risk Factors:
Awkward Postures
Static Postures

A By-Products Management Person may hold the head forward or backward in order to observe monitors or conveyors.

A By-Products Management Person may also hold the head forward while changing chipper knives, checking chip quality, and moving debris on the floor.

BACKGROUND INFORMATION

- A number of smaller muscles around the neck produce the forces necessary to support and move the head. These muscles remain relatively relaxed when the head is balanced over the spine (neutral posture). The neutral posture occurs when the head is upright, and the ears and shoulders are aligned.

DIRECT RISK FACTORS

Awkward Postures

- Neck muscles must support the weight of the head while in a forward, backward, or side bent position. The more the neck is bent, the greater the load on the muscles and tendons.

Static Postures

- When the neck is held still in a forward position, the muscles of the neck must remain tense to support the weight of the head. With no time allowed for recovery, the constant state of tension in the neck muscles may cause fatigue. If the constant stress is sufficient, and recovery is not adequate, the tissues may fatigue to the point of injury.

INDIRECT RISK FACTORS

Workstation Design

Working Heights

- Loading on the neck muscles is increased when items or areas to be viewed are below shoulder height.

Additional Workstation Design Options

- Loading on the neck muscles is increased when the location of viewing areas (e.g., vibrating conveyor systems, video monitors) is outside normal viewing angles.

Environmental Conditions

Lighting

- Loading on the neck muscles is increased when the items or areas to be viewed have low lighting levels, as more awkward postures need to be adopted for longer periods. This issue is especially important when searching for pieces of metal in debris, or while checking chip quality.

Work Organisation

Task Variability

- Working at one task for an extended period of time can increase the duration of loading on the neck muscles.

CONSEQUENCES

- When the head is held in a forward and/or twisted posture, muscles and soft tissues of the neck may fatigue. Fatigue leads to an accumulation of waste products and/or a decrease in the ability to tolerate additional stress.
- Signs and symptoms include pain, tenderness, muscle spasm in the neck area, and headaches.

SUGGESTED SOLUTIONS

- For specific solutions that may prevent injuries to the neck, please see the column labelled “Neck” in the Summary of Solutions on pages 109 to 113.
- For exercises that can help to prevent ***neck*** injuries, see the ***Neck section of the Body Manual.***

NECK

Direct Risk Factors:
Repetition
Awkward Postures
Static Postures

A By-Products Management Person may repeatedly twist the neck or hold the head in a twisted posture in order to view video monitors or the flow of the conveyors.

BACKGROUND INFORMATION

- A number of smaller muscles around the neck produce the forces necessary to support and move the head. These muscles remain relatively relaxed when the head is balanced over the spine (neutral posture). The neutral posture occurs when the head is upright and the ears and shoulders are aligned.

DIRECT RISK FACTORS

Repetition

- When the head is repeatedly turned to the side, the muscles of the neck are subjected to repeated stress with little time for recovery. If the repetitive stress is excessive, and recovery is not adequate, the tissues can fatigue to the point of injury.

Awkward Postures

- Neck muscles are required to turn the head to the side. The further the head is turned to the side, the greater the load on the muscles and tendons.
- Neck muscles must support the weight of the head while in a side bent position. The more the neck bends the greater the load on the muscles and tendons.

Static Postures

- When the neck is held still in a twisted position, the muscles of the neck must remain tense to support the weight of the head. With no time allowed for recovery, the constant state of tension in the neck muscles may cause fatigue. If the constant stress is sufficient, and recovery is not adequate, the tissues may fatigue to the point of injury.

INDIRECT RISK FACTORS

Workstation Design

Additional Workstation Design Options

- Loading on the neck muscles is increased when the placement of viewing areas (e.g., vibrating conveyor systems, video monitors) is outside normal viewing angles.

CONSEQUENCES

- When the head is held in a twisted posture, muscles and soft tissues of the neck may fatigue. Fatigue leads to an accumulation of waste products and/or a decrease in the ability to tolerate additional stress.
- Signs and symptoms include pain, tenderness, muscle spasm in the neck area, and headaches.

SUGGESTED SOLUTIONS

- For specific solutions that may prevent injuries to the neck, please see the column labelled “Neck” in the Summary of Solutions on pages 109 to 113.
- For exercises that can help to prevent ***neck*** injuries, see the ***Neck section of the Body Manual.***

NECK/SHOULDER

Direct Risk Factors:
Force
Repetition

A By-Products Management Person may pull upward on logs or waste material from a conveyor or shaker in order to separate, remove, or unjam material.

BACKGROUND INFORMATION

- The neck and shoulder regions work together to produce certain movements, or to hold certain postures. The larger muscles of the neck and upper back (e.g., trapezius) elevate the shoulders, and the larger muscles of the shoulders (e.g., deltoids) raise the arms.

DIRECT RISK FACTORS

Force

- Neck and shoulder muscles support the weight of objects held in the hands. The heavier the object, the greater the load on the muscles and tendons.

Repetition

- When workers repeatedly pull on logs, the muscles of the neck and shoulder are subjected to repeated stress with little time for recovery. If the repetitive stress is excessive, and recovery is not adequate, the tissues can fatigue to the point of injury.

INDIRECT RISK FACTORS

Workstation Design

Working Reaches

- Loading on the neck and shoulder muscles is increased when obstacles prevent the operator from getting close to a piece of debris for removal.

Working Heights

- Loading on the neck and shoulder muscles is increased when a piece of debris is lifted greater distances for removal.

Characteristics of Objects Being Handled

Size and Shape

- Loading on the neck and shoulder muscles is increased as the size of debris handled increases. When a piece of debris is removed, the volume of debris in the conveyor or shaker and the position of the debris relative to other pieces will influence the required force.

CONSEQUENCES

- Forceful and repeated pulling on objects can lead to neck and/or shoulder strain.
- Signs and symptoms of neck and shoulder tissue injury include pain, tenderness, muscle spasm in the neck/shoulder area, and headaches.

SUGGESTED SOLUTIONS

- For specific solutions that may prevent injuries to the neck/shoulder, please see the column labelled "Neck/Shoulder" in the Summary of Solutions on pages 109 to 113.
- To help prevent ***neck*** discomfort, see the upper trapezius stretch in the ***Neck section of the Body Manual.***

SHOULDER

Direct Risk Factors:
Force
Repetition
Awkward Postures

A By-Products Management Person may push, pull, or handle debris by hand or with hand tools in order to prevent jam-ups, find pieces of metal, and move debris on the floor.

BACKGROUND INFORMATION

- The shoulder joint is designed for mobility. The joint is held together by muscles and soft tissues. The larger muscle groups around the shoulder are responsible for producing movement (e.g., deltoids). The deeper muscles stabilise the shoulder joint as well as produce movement. These deeper muscles and their tendons are referred to as the rotator cuff.

DIRECT RISK FACTORS

Force

- The rotator cuff stabilises the shoulder joint when objects are pulled. The heavier the object, or the larger the force required, the greater the load on the rotator cuff.
- If the force placed on the rotator cuff exceeds the tissue tolerances, injury may occur.

Repetition

- When the arms are repeatedly raised, the rotator cuff is subjected to repeated stress with little time for recovery. If the repetitive stress is excessive, and recovery is not adequate, the tissues may fatigue to the point of injury.

Awkward Postures

- The rotator cuff stabilises the shoulder joint when the arms are away from the body. The farther away the arms are from the body, the greater the load on the rotator cuff.

INDIRECT RISK FACTORS

Workstation Design

Working Reaches

- Loading on the rotator cuff muscles is increased when the arms must be further away from the body in order to pull, push, or manipulate debris by hand or with tools.

Working Heights

- Loading on the rotator cuff muscles is increased when the height at which debris is pulled, pushed, or handled does not allow the operator to produce sufficient force in the muscles of the legs and trunk.

CONSEQUENCES

- When using the arms to push or pull objects, the rotator cuff may fatigue. Fatigue leads to an accumulation of waste products and/or a decrease in the ability to tolerate additional stress.
- Stressing a fatigued shoulder may lead to degeneration or injury in the rotator cuff muscles of the shoulder joint.
- Signs and symptoms include pain, tenderness, and decreased range of motion and strength in the shoulder joint.

SUGGESTED SOLUTIONS

- For specific solutions that may prevent injuries to the shoulder, please see the column labelled “Shoulder” in the Summary of Solutions on pages 109 to 113.
- For exercises that can help to prevent ***shoulde****r* injuries, see the ***Shoulder section of the Body Manual.***

ELBOW/WRIST

Direct Risk Factors:
Force
Repetition
Awkward Postures

A By-Products Management Person may grip hand tools in order to remove pieces of debris or logs from a conveyor. A By-Products Management Person may also grip tools in order to sweep, shovel, and use an air hose to remove debris.

BACKGROUND INFORMATION

- Muscles used for gripping are found in the forearm. The tendons of these muscles cross over the elbow and the wrist joints before connecting to bones. The elbow area may be affected by tension generated in the forearm muscles.

DIRECT RISK FACTORS

Force

- Gripping an object requires activation of the forearm muscles, which generates tension at the tendon/bone connection of the elbow. The harder that an object must be gripped, the greater the load on the tendon/bone connection.

Repetition

- Repeated stress to the elbow without adequate rest could slowly fatigue tissues to the point of injury.

Awkward Postures

- The width of an object affects how much muscle tension needs to be generated. There is an optimal grip width where the forearm muscles work efficiently. Outside this width, muscles have to work harder to generate equivalent tension. Consequently, objects that are too large (e.g., large cuts of wood) or too small (e.g., narrow tool handles) could increase the tension generated by muscles, and lead to tissue fatigue at the tendon/bone connection.

- The position of the wrist also affects how much muscle tension needs to be generated. There is an optimal wrist position where the forearm muscles work efficiently. This occurs when the wrist is in its natural relaxed (neutral) position. Bending the wrist forward or backward deviates from this position, and the forearm muscles have to work harder to maintain the grip. Consequently, gripping objects with the wrist bent increases the tension generated by muscles, and could lead to tissue fatigue at the tendon/bone connection.

INDIRECT RISK FACTORS

Characteristics of Objects Being Handled

Size and Shape

- Loading on the elbow/wrist is increased due to the gripping of large pieces of debris in the vibrating conveyor system. Larger pieces require larger grip spans. When a particular piece of debris is removed, the amount of debris in the conveyor and the position of the debris relative to other pieces will influence the required force.

Container, Tool, and Equipment Handles

- Tool handles that are too wide or too narrow can result in grip spans that are outside the preferred range. Working with these overly small or large grip spans requires excess force, which can lead to muscle fatigue and injury.
- The design of tool handles can result in awkward wrist postures for the By-Products Management Person.

CONSEQUENCES

- Repeated forceful gripping may lead to fatigue at the tendon/bone connection near the elbow.
- Signs and symptoms include pain in the elbow area and decreased grip strength.

SUGGESTED SOLUTIONS

- For specific solutions that may prevent injuries to the elbow/wrist, please see the column labelled “Elbow/Wrist” in the Summary of Solutions on pages 109 to 113.
- For exercises that can help to prevent ***elbow*** injuries, see the ***Elbow section of the Body Manual.***

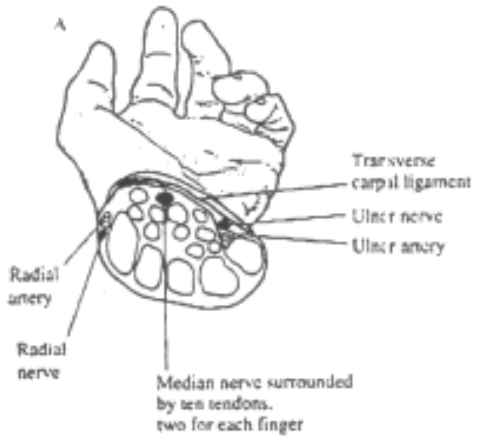
WRIST

Direct Risk Factors:
Force
Repetition
Awkward Postures

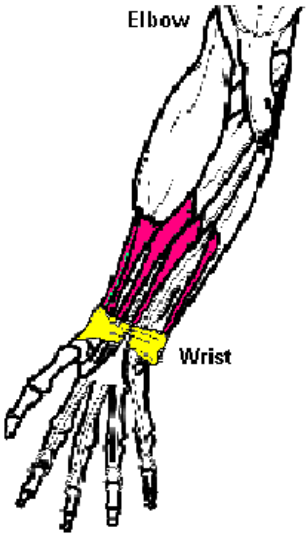
A By-Products Management Person may grip waste material with the wrist bent in order to un-jam or remove material from a conveyor.

BACKGROUND INFORMATION

- Most of the muscles involved in gripping and manoeuvring the hands are found in the forearms. These muscles attach at the elbow and their tendons (surrounded by a protective sheath) run down the forearm into the hand. At the wrist, the tendons and a nerve run under a thick band, which forms the roof of the carpal tunnel.



The Carpal Tunnel



DIRECT RISK FACTORS

Force

- Gripping an object requires activation of the forearm muscles, which generates tension in the tendons and tendon sheaths running through the wrist. The harder an object is gripped, the greater the tension in the tendons. As tension increases, the pressure within the carpal tunnel may also increase.

Repetition

- Repeated gripping and/or repeated bending of the wrist causes stress to the tendon sheaths. If the repetitive stress is excessive, and recovery is not adequate, the tendon sheaths may fatigue to the point of injury.

Awkward Postures

- As the wrist is bent, the tendon sheaths will rub up against the walls of the carpal tunnel. The further the wrist is bent, the more friction experienced in the tendon sheaths.

INDIRECT RISK FACTORS

Characteristics of Objects Being Handled

Size and Shape

- Loading on the tendons and tendon sheaths that run through the wrist is increased as the size of the object (debris or tool handle) being gripped increases.

CONSEQUENCES

- Repeatedly gripping objects with the wrist bent may lead to irritation and damage in the tendon sheaths.
- Signs and symptoms include pain, tenderness, and inflammation in the wrist area.

SUGGESTED SOLUTIONS

- For specific solutions that may prevent injuries to the wrist, please see the column labelled “Wrist” in the Summary of Solutions on pages 109 to 113.

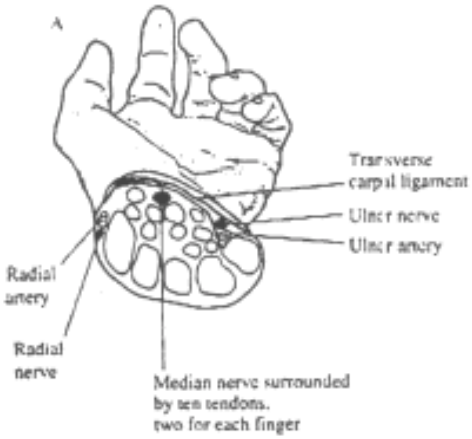
WRIST/HAND

Direct Risk Factors:
Contact Stress
Vibration

A By-Products Management Person may be exposed to hand/arm vibration when operating power hand tools, such as impact wrenches and chainsaws, or when hands are placed on debris in a vibrating conveyor.

BACKGROUND INFORMATION

- The carpal tunnel is located at the base of the palm; it contains the tendons of the muscles that bend the hand and wrist inwards and an important nerve (median nerve).



The Carpal Tunnel

DIRECT RISK FACTORS

Contact Stress

- Contact between hard or sharp surfaces and the base of the palm places stress on the tendons and nerves in the carpal tunnel.
- Continual contact with hard or sharp surfaces may damage the nerve and/or gradually weaken the tendons, and cause injury.

Vibration

- Exposure to vibration, through the use of power tools or through contact with other vibrating objects, places a unique form of mechanical stress on the tissues of the hand and wrist. Factors like vibration level and vibration frequency influence the amount of mechanical stress.
- Continual exposure to hand/arm vibration may gradually damage neurovascular tissue (nerves and blood vessels) in the hand, and may contribute to problems in the wrist.

INDIRECT RISK FACTORS

Characteristics of Objects Being Handled

Container, Tool, and Equipment Handles

- Loading on the structures at the base of the palm is increased due to the vibration frequency of the tool. In addition, the weight of the tool and the gripping force required influences the transmission of vibration to the hand/arm.

Environmental Conditions

Cold Exposure

- Exposure to extreme cold temperatures, in combination with any of the previously discussed risk factors, can increase the risk of tissue injury.

CONSEQUENCES

- Continual exposure to hand/arm vibration and contact stress may lead to neurovascular damage.
- Signs and symptoms include pain, whitening of the fingers, and a loss of feeling and strength in the hand.

SUGGESTED SOLUTIONS

- For specific solutions that may prevent injuries to the wrist/hand, please see the column labelled “Wrist/Hand” in the Summary of Solutions on pages 109 to 113.

LOW BACK

Direct Risk Factors:
Force
Repetition
Awkward Postures
Static Postures

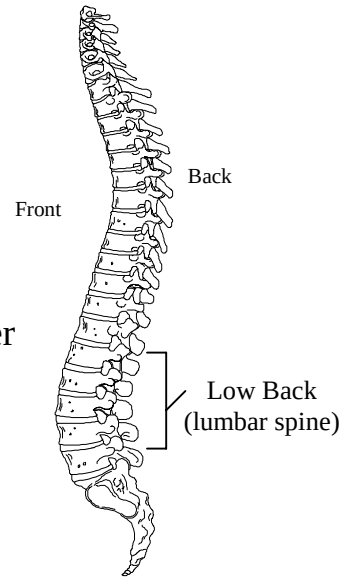
A By-Products Management Person may bend forward and/or to the side in order to lift logs, move debris on the floor, move debris to find metal, change chipper knives, perform maintenance on equipment, and to work in confined spaces.

A By-Products Management Person may use hands or hand tools to pull, push, and lift debris from a conveyor while bent forward and/or to the side.

BACKGROUND INFORMATION

- The spine is made up of 33 bones called vertebrae. Each of these vertebrae is specially designed to protect the spinal cord and provide support for the back. Between each of the vertebrae are discs. Discs have tough elastic walls that are filled with a watery gel-like substance. These discs are like jelly donuts; when they are pressed down on one side, the other side bulges and puts increased pressure on the wall of the disc. To maintain an even distribution of pressure across the discs, the spine has to be kept in the neutral posture.

Neutral Spine



DIRECT RISK FACTORS

Force

- Lifting increases the loading on the spine. Weight held in the hands is transmitted to the low back. The greater the weight, the greater the loading on the structures of the low back.

Repetition

- Repeated forward bending and/or lifting can gradually fatigue the structures of the low back. If the repetitive stress is excessive, and recovery is not adequate, the disc walls may fatigue to the point of injury.

Awkward Postures

- Back muscles must support the weight of the upper body when leaning forward. Increased bending of the back increases the loading on the spine and increases the pressure on the walls of the discs.

Static Postures

- When the back is held in a forward position, the muscles of the back must remain tense to support the weight of the upper body. With no time allowed for recovery, the constant state of tension in the back muscles may cause fatigue. If the constant stress is sufficient, and recovery is not adequate, the tissues may fatigue to the point of injury.

INDIRECT RISK FACTORS

Workstation Design

Working Heights

- Loading on the back is increased as the By-Products Management Person bends to pick up material from the floor or within a conveyor.
- Confined work spaces around and underneath machinery may lead to awkward postures of the back while cleaning.

Work Organisation

Task Variability

- Working at one task for an extended period of time can increase the duration of loading on the low back muscles.

CONSEQUENCES

- Repeatedly bending forward may lead to damage in the disc walls.
- Signs and symptoms may include muscle spasm and sharp or radiating pain in the back and/or lower extremities.

SUGGESTED SOLUTIONS

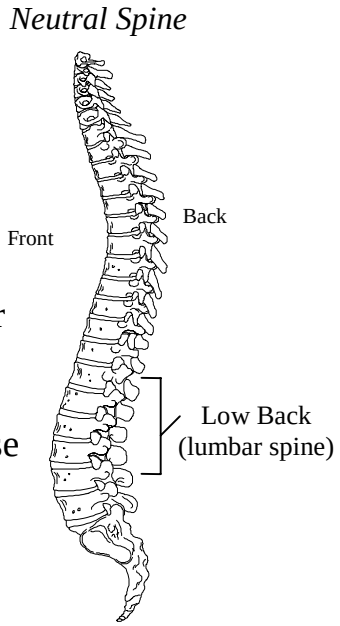
- For specific solutions that may prevent injuries to the back, please see the column labelled “Back” in the Summary of Solutions on pages 109 to 113.
- For exercises that can help to prevent ***back*** injuries, see the ***Back section of the Body Manual.***

LOW BACK

Direct Risk Factors:
Awkward Postures
Static Postures
Vibration

A By-Products Management Person may continually sit on a vibrating surface.

BACKGROUND INFORMATION



- The spine is made up of 33 bones called vertebrae. Each of these vertebrae is specially designed to protect the spinal cord and provide support for the back. Between each of the vertebrae are discs. Discs have tough elastic walls that are filled with a watery gel-like substance. These discs are like jelly donuts; when they are pressed down on one side, the other side bulges and puts increased pressure on the wall of the disc. To maintain an even distribution of pressure across the discs, the spine has to be kept in the neutral posture. Sitting will cause the pelvis to rotate out of a neutral posture, as the lumbar spine will flatten.

DIRECT RISK FACTORS

Awkward Postures
Static Postures

- Sitting increases the loading on the walls of the discs. If the duration of sitting is excessive, and the recovery is not adequate (e.g., spine not returned to neutral posture), the tissues may deform to the point of injury.

Vibration

- Whole body vibration is usually transmitted through the seat into the low back. Exposure to whole body vibration introduces a unique mechanical stress to the structures of the spine that can significantly increase the loading on the low back. Prolonged sitting on a vibrating surface may contribute to the gradual weakening of the lumbar discs.

INDIRECT RISK FACTORS

Workstation Design

Seating

- Sitting for long periods of time without adequate lumbar support will increase muscle fatigue in the back.
- Vibration can be transmitted to the By-Products Management Person through poorly damped seating.

Environmental Conditions

Vibration

- Vibration from the machinery outside of the booth is transmitted to the seat and console.

Work Organisation

Task Variability

- Sitting for prolonged periods stresses the tissues of the low back. Allowing these tissues to recover from stress can prevent injuries and increase tolerances.

CONSEQUENCES

- Continually sitting on a vibrating surface may lead to deformation in the disc walls and accelerated degeneration of the tissues.
- Signs and symptoms include muscle spasm and sharp or radiating pain in the back and/or lower extremities.

SUGGESTED SOLUTIONS

- For specific solutions that may prevent injuries to the back, please see the column labelled “Back” in the Summary of Solutions on pages 109 to 113.
- For exercises that can help to prevent ***back*** injuries, see the ***Back section of the Body Manual.***

KNEE

Direct Risk Factors:
Repetition
Awkward Postures
Static Postures
Contact Stress

A By-Products Management Person frequently squats and/or kneels in order to pick up debris and/or to perform equipment maintenance.

A By-Products Management Person may also be required to climb stairs or ladders repeatedly throughout the day.

BACKGROUND INFORMATION

- At the knee joint, the knee cap (patella) is held in place over the thigh bone (femur) by connective tissue. When the leg is straight, there is little or no contact between these two bones. However, as the knee bends, the knee cap can come into contact with the thigh bone.

DIRECT RISK FACTORS

Repetition

- Repeated squatting, kneeling, and/or climbing may gradually irritate the knee. Irritation of the knee may lead to muscle wasting, which in turn leads to poor tracking of the knee cap on the thigh bone and increased contact stress between these bones.

Awkward Postures
Static Postures

- Bending the knee increases the contact stress between the knee cap and the thigh bone. Contact stress increases significantly when the knee is bent over 90 degrees.

Contact Stress

- Kneeling on a hard surface increases the contact stress between the knee cap and the thigh bone.

INDIRECT RISK FACTORS

Workstation Design

Working Heights

- Squatting and kneeling occurs because workers have to clear debris under machines.

Floor Surfaces

- Workers typically kneel on hard floor surfaces like wood or metal, which increases contact stress on the knee.

CONSEQUENCES

- Repeated squatting and kneeling could cause inflammation under the knee cap, which may cause pain and may change the mechanics of knee cap tracking. Changes in knee cap tracking may lead to premature wear of the knee cap and/or the thigh bone.
- Signs and symptoms include muscle wasting around the inner knee, creaking in the knee, and chronic pain if left unchecked.

SUGGESTED SOLUTIONS

- For specific solutions that may prevent injuries to the knee, please see the column labelled “Knee” in the Summary of Solutions on pages 109 to 113.
- For exercises that could help to prevent ***knee*** injuries, see the ***Knee section of the Body Manual.***

FOOT

Direct Risk Factors:
Static Postures
Vibration

A By-Products Management Person may stand on a hard, vibrating surface in order to monitor conveyor systems.

BACKGROUND INFORMATION

- There are a number of small muscles in the base of the foot, as well as a tough band that attaches to the heel bone and runs down towards the toes. This band is called the plantar fascia, and is responsible for producing the arch in our feet.

DIRECT RISK FACTORS

Static Postures

- While standing, the weight of the body loads the plantar fascia. If the duration of standing is excessive, and recovery is not adequate, the fascia may deform to the point of injury.

Vibration

- Vibrating floors can increase the loading on the foot. Factors like vibration level and vibration frequency increase the amount of loading on the foot, and could lead to irritation. The longer the By-Products Management Person is exposed to vibration, the greater the risk of injury.

INDIRECT RISK FACTORS

Workstation Design

Floor Surfaces

- Loading on the tissues of the foot increases if a By-Products Management Person is required to work while continually standing on a hard, uneven, or vibrating floor surface.

CONSEQUENCES

- Continual standing may cause damage to the plantar fascia.
- Signs and symptoms include pain and stiffness at the base of the heel, initially in the morning. As problems progress the pain may become chronic.

SUGGESTED SOLUTIONS

- For specific solutions that may prevent injuries to the foot, please see the column labelled "Ankle/Foot" in the Summary of Solutions on pages 109 to 113.
- For exercises that can help to prevent ***foot*** injuries, see the ***Foot section of the Body Manual.***

Summary of Body Parts at Risk

NECK

- A By-Products Management Person may hold the head forward or backward in order to observe monitors or conveyors.

- A By-Products Management Person may also hold the head forward while changing chipper knives, checking chip quality, and moving debris on the floor.

- A By-Products Management Person may repeatedly twist the neck or hold the head in a twisted posture in order to view video monitors or the flow of the conveyors.

NECK/SHOULDER

- A By-Products Management Person may pull upward on logs or waste material from a conveyor or shaker in order to separate, remove, or unjam material.

SHOULDER

- A By-Products Management Person may push, pull, or handle debris by hand or with hand tools in order to prevent jam-ups, find pieces of metal, and move debris on the floor.

ELBOW/WRIST

- A By-Products Management Person may grip hand tools in order to remove pieces of debris or logs from a conveyor. A By-Products Management Person may also grip tools in order to sweep, shovel, and use an air hose to remove debris.

WRIST

- A By-Products Management Person may grip waste material with the wrist bent in order to un-jam or remove material from a conveyor.

WRIST/HAND

- A By-Products Management Person may be exposed to hand/arm vibration when operating power hand tools, such as impact wrenches and chainsaws, or when hands are placed on debris in a vibrating conveyor.

LOW BACK

- A By-Products Management Person may bend forward and/or to the side in order to lift logs, move debris on the floor, move debris to find metal, change chipper knives, perform maintenance on equipment, and to work in confined spaces.

- A By-Products Management Person may use hands or hand tools to pull, push, and lift debris from a conveyor while bent forward and/or to the side.

LOW BACK

- A By-Products Management Person may continually sit on a vibrating surface.

KNEE

- A By-Products Management Person frequently squats and/or kneels in order to pick up debris and/or to perform equipment maintenance.

- A By-Products Management Person may also be required to climb stairs or ladders repeatedly throughout the day.

FOOT

- A By-Products Management Person may stand on a hard, vibrating surface in order to monitor conveyor systems.

Risk Factors by Body Part

Direct Risk Factors	Neck	Neck/ Shoulder	Shoulder	Elbow/ Wrist	Wrist	Wrist/ Hand	Low Back	Hip	Knee	Ankle	Foot
Force		✓	✓	✓	✓		✓				
Repetition	✓	✓	✓	✓	✓		✓		✓		
Awkward Postures	✓		✓	✓	✓		✓		✓		
Static Postures	✓						✓		✓		✓
Contact Stress						✓			✓		
Vibration - Whole body*							✓				✓
Vibration - Hand Transmitted*						✓					

Indirect Risk Factors		Neck	Neck/ Shoulder	Shoulder	Elbow/ Wrist	Wrist	Wrist/ Hand	Low Back	Hip	Knee	Ankle	Foot
Duration*	Duration	✓	✓	✓	✓	✓	✓	✓		✓		✓
Workstation Design	Working Reaches		✓	✓								
	Working Heights	✓	✓	✓				✓		✓		
	Seating							✓				
	Floor Surfaces									✓		✓
Characteristics of Objects Being Handled	Size and Shape		✓		✓	✓						
	Load Condition and Weight Distribution											
	Container, Tool and Equipment Handles				✓		✓					
Environmental Conditions	Heat Exposure	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦
	Cold Exposure	♦	♦	♦	♦	♦	✓♦	♦	♦	♦	♦	♦
	Lighting	✓♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦
	Noise	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦
	Vibration**	♦	♦	♦	♦	♦	♦	✓♦	♦	♦	♦	♦
Work Organisation	Work-Recovery Cycles	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦
	Task Variability	✓♦	♦	♦	♦	♦	♦	✓♦	♦	♦	♦	♦
	Work Rate	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦

** Extended exposure to <u>any</u> risk factor can increase the likelihood of injury. For solutions designed to decrease the duration of exposure to any risk factor please refer to the Work Organisation section of the General Risk Factor Solutions Manual*

*** Vibration is categorised under both direct and indirect risk factors. Vibration can directly increase the likelihood of injury to the back and wrist as well as indirectly (environmental conditions) promote injuries in other parts of the body.*

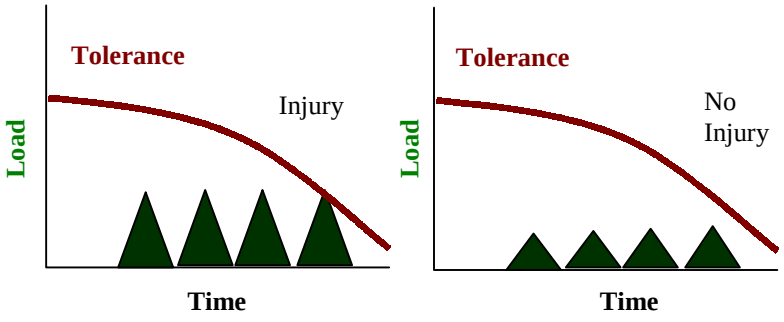
☐ = Indicates that the risk factor was assessed and was not found to be a contributor to the body part problem.

♦ = Indicates that the risk factor assessed is commonly found in sawmills, and may need to be addressed at your mill. See the appropriate section of the General Risk Factor Solutions Manual for more information.

✓ = Indicates that the risk factor was assessed as a contributor to the body part problem. Please see the Summary of Solutions Table on pages 109 to 113 for specific problem/solution information. Additional information on some risk factors can be found in the General Risk Factor Solutions Manual.

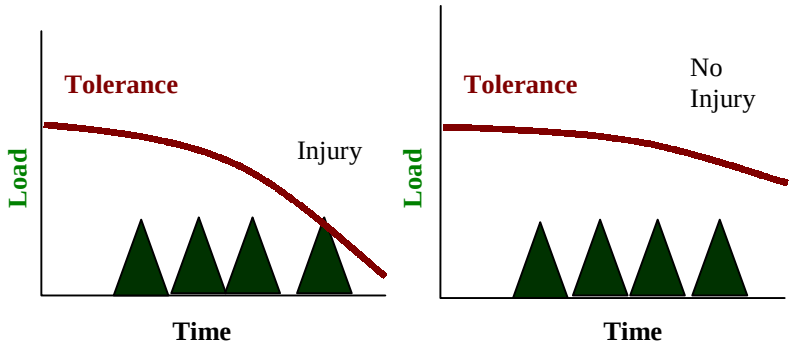
Injury Prevention

Injuries are prevented by …
Decreasing loads and increasing tissue tolerances



Injuries may be avoided by decreasing the size of the loads on the tissue.

Example – using a torque multiplier wrench to loosen bolts.



Injuries may be avoided by increasing tissue tolerances, and allowing the body to endure more loading.

Example – using maintenance exercises to strengthen tissues.

Suggested Solutions

The previous page explains how injuries may be prevented by decreasing the load on a tissue or by increasing the tissue tolerances. The Injury Prevention section of the Work Manual provides possible solutions that can be implemented to decrease the size of the loads on the tissues.

Each of the solutions described in the Work Manual has a risk control icon. The Risk Control Key provides guidelines on how to distinguish between different types of risk controls. Generally, engineering, administrative, and work practice controls are considered more effective than the use of personal protective equipment to decrease the risk of musculoskeletal injuries.

The focus of the Injury Prevention section is on solutions developed following the ergonomic investigation of the By-Products Management Person job. The solutions are presented under the headings of Workstation Design, Characteristics of Objects Being Handled, Environmental Conditions, and Work Organisation.

The Summary of Solutions table provides a quick reference guide to solutions for specific body part problems.

Please note that the information provided in the Body Manual addresses the issue of injury prevention in terms of increasing tissue tolerances through exercise. This information is not provided in the Work Manual.

Risk Control Key

Risk control measures (solutions) are commonly grouped into four categories:

E

ENGINEERING CONTROLS

These include physical changes to workstations, equipment, materials, production facilities, or any other relevant aspect of the work environment, that reduce or prevent exposure to risk factors.

A

ADMINISTRATIVE CONTROLS

These include any change in procedure that significantly limits daily exposure to risk factors, by control or manipulation of the work schedule or manner in which work is performed. Administrative controls include, but are not limited to, job rotation, rest breaks, alternative tasks, job enlargement, redesign of work methods, and adjustment of work pace or output. Some models of risk control include work practice controls within this category.

WP

WORK PRACTICE CONTROLS

These include techniques used to perform the tasks of a job, such as reaching, gripping, using tools and equipment, or discarding objects, etc. Education and training are an integral part of work practice controls.

PPE

PERSONAL PROTECTIVE EQUIPMENT

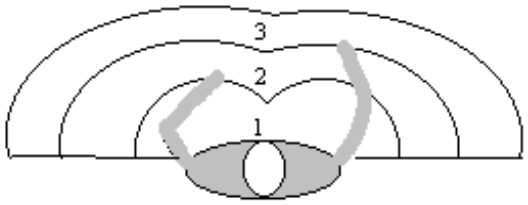
These are devices worn by a worker to reduce the risk of injury, including gloves, kneepads, hearing protection, and leather aprons.

On the following pages, the icons next to the solution options indicate the type of risk control.

Workstation Design

WORKING REACHES

A working reach that is too far for the worker will require stressful shoulder, elbow, wrist, and back postures. Reaching to the side, behind, or too far in front of the body can put stress on the smaller muscles. Ideally, working reaches should be within a normal reach envelope, as laid out below, with the controls and materials that are handled most often closest to the body. It is also ideal to have controls that perform similar or combined functions grouped together to decrease awkward postures that may otherwise occur.



1 = Controls/items most frequently used
2 = Controls/items less frequently used
3 = Controls/items least frequently used

Generally, the most frequently used items should be placed within a forearm's reach, with less frequently used items placed within a comfortable arm's reach, and infrequently used items placed within a fully extended arm's reach. For more specific recommendations on working reaches, please consult anthropometric tables or an ergonomist.

Use tools to reach

E
WP

In order to decrease awkward postures of the low back and shoulders when reaching, use a lightweight long pike pole or picaroon to straighten lumber and remove waste pieces. Provide various lengths of pike poles for different tasks or situations.

Alert operator

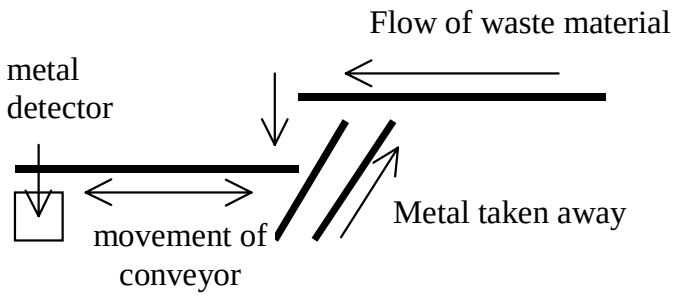
E
A
WP

Develop a system that alerts the operator of an increase in the likelihood of jam-ups. Alerting the operator can be based on an electronically determined process or by communication with appropriate personnel. Once alerted, an operator would closely monitor a conveyor system for potential jam-ups. In this way operators will have the opportunity to anticipate and fix a minor problem before a major one develops.

Removal of metal with another conveyor

E

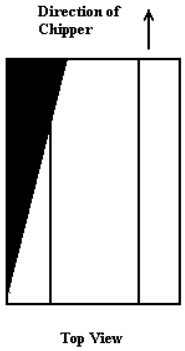
In order to reduce forceful and repetitive movements, and awkward posture of the low back, some designs have another conveyor that takes metal to another disposal site. The chip or hog material comes in to the workstation first on an elevated conveyor. The material is then dropped onto a 2nd conveyor. When metal is detected, this conveyor automatically reverses direction and dumps the metal onto a 3rd conveyor that flows to another disposal site.



Diagonal fin

E

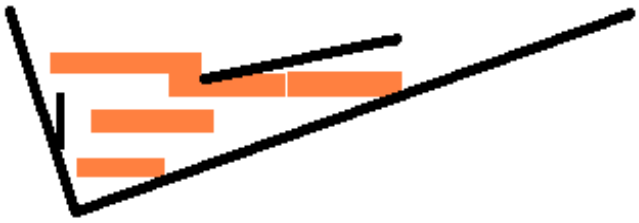
In order to minimise the frequency of manipulating or removing debris in a conveyor system, introduce a diagonal fin into the conveyor system as near to the chipper as possible. The intention of the fin is to tip all lumber into an appropriate orientation, relative to the chipper knives, as it enters the chipper. The position of the fin should result in pieces of debris tipping upwards as they enter the chipper, which should prevent large sizes of debris (often the cause of jam-ups) from entering into the chipper in an orientation likely to cause problems. This solution can reduce the number of jam-ups in a conveyor system.



L-shaped chute

E

In order to minimise the frequency of manipulating debris in the conveyor system, the chute shape closest to the chipper could be more like an 'L' on its side rather than the usual trapezoidal shape. The orientation of the corner of the "L" should correspond to the layout of the chipper knives.



Padding on sides

E

If leaning into the conveyor system is necessary, provide padding on the sides.

Removable safety barrier

E
WP

In some situations, static and awkward postures of the neck/shoulder, shoulder, and back are increased when using a chainsaw in the conveyor system. This risk is partially due to the positioning of safety barrier systems, and the excessive reaching required. Removable safety barrier systems may allow operators to adopt better positions when performing certain tasks. If this solution is implemented, safety mechanisms must be installed to prevent conveyor operation while the barrier is open.

Modify safety barrier

E
WP

If it is not practical to have removable safety barrier systems, make the barrier more of an advantage to the operator. Allow operators to lean against railings to stabilise the lower body as they use equipment, such as chainsaws. In this situation, make sure the railings are properly reinforced to support the weight of the operators and are padded. If padding is not an option, consider round railings rather than railings with sharp edges.

Decrease metal in system during production

A

Under certain circumstances, an operator can spend a considerable amount of time looking for metal within the conveyor system. This is especially true after maintenance work has been done in the mill. Maintenance workers should be encouraged to collect as much of the fallen metal debris as possible. In addition, it may be useful to run the mill material transfer system (production and waste) empty after maintenance work is completed to collect any metal. When production is started, most of the metal will have already been collected.

Maintain chainsaws

E
WP

Decrease the duration spent in awkward and static neck/shoulder, shoulder, and low back positions by making sure chainsaws are maintained.

Hand-held metal detectors

E
WP

In order to reduce the amount of time spent searching for pieces of metal with the back in a forward bent position, two types of hand-held metal detectors could be used to pinpoint the location of the metal.

A **hand-held magnet** is most useful when the operator has removed most of the large pieces of wood debris and can search through chips and sawdust at the bottom of the conveyor system. A magnet, which can be attached to a handle, can be moved over the bottom of the conveyor to find the metal. The length of the handle should make low back flexion unnecessary.

A **metal detector wand**, similar to those used by security in airports, may also reduce search times. Such a device would be useful in pinpointing the location of the metal within the conveyor.

WORKING HEIGHTS

A working height that is too high for the worker will require stressful shoulder and arm postures, while a height that is too low will require stressful bending of the neck and trunk. The height of a work surface should allow room to change position and move the legs and feet (WCB Draft Ergonomic Regulations, 1994).

The ideal workstation is height adjustable, allowing a large percentage of the population to adjust the work surface height to suit their dimensions.

To determine the appropriate work height specific for the By-Products Management Person, identify the body part of most concern. If the main concern is the:

Neck - minimise forward bending of the neck by increasing working height.
Shoulders - minimise elevation of the arms by lowering working height.
Low Back - minimise forward bending of the back by increasing working height.

For more specific guidelines on matching the working heights with the tasks performed please consult anthropometric tables or an ergonomist.

Braced postures

WP

To reduce the load on the low back, a By-Products Management Person should use the safety rail or guard to brace the lower body. When reaching forward, bracing the lower body against the safety rail or guard reduces the amount of muscle activity in the low back. The safety rail or guard should be padded to avoid excessive contact stress. The By-Products Management Person should try to use a free arm to support the upper body when possible (i.e., when stooping over to pick up debris).

Adequate space

E

Improper working heights are common in the work of By-Products Management Personnel and contribute to the risk factors for the neck, shoulders, low back, and knees. Improvements through modifications to the workplace can be challenging, both for practical reasons and due to the nature of clean-up activities. Proper access spaces should be provided to allow workers to perform clean-up activities.

Look down with eyes

WP To reduce neck bending, look down with the eyes.

Ear muffs

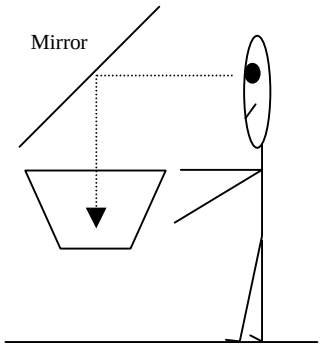
PPE To reduce the loading on neck muscles, avoid wearing ear muffs. Use ear plugs instead, or custom fitted ear pieces if more protection is needed.

Handling small pieces of debris

E
WP In order to reduce awkward and static postures of the low back, the working heights while manipulating small pieces of debris within a conveyor should be located between elbow and waist height. This may be accomplished by raising the height of the conveyor, lowering the floor near the conveyor, or lowering the worker by using a sit/stand stool. Only small/light pieces of debris can be manipulated while using a sit/stand stool.

Mirror

E In order to reduce awkward postures of the neck while monitoring conveyor flow, place an adjustable mirror above the conveyor system so that an operator may stand, sit, or use a sit/stand stool to comfortably view the contents. It is advisable to consult the operators on this issue.



Increase neck tissue tolerances

WP

To increase the tissue tolerances of the neck, see the maintenance and postural exercises in the Neck section of the Body Manual.

Spot vacuum system

E
WP

A spot vacuuming system located at strategic points in the mill will minimise manual lifting (e.g., shovelling) of small pieces of debris from the floor. In addition, this system could also be used to vacuum beams, shelves, and other horizontal surfaces where debris accumulates. If a vacuuming system is considered, suitable attachments are required to minimise the likelihood of bending the back forward. Operators should maintain neutral postures whenever possible.

Keep the back straight

WP

To maintain tissue tolerances in the back, lift heavy objects with a straight back. Try to maintain a straight back if possible when working under machines. To loosen tight back muscles, stretch the back using the *hanging stretch* found in the Back section of the Body Manual.

SEATING

Many By-Products Management Personnel are required to sit when monitoring conveyors. Sitting for long periods of time increases the load on the spine, which stresses the ligaments and discs of the low back. The load is increased when the By-Products Management Person does not maintain a neutral spine (see Injury Education for the Low Back on page 72).

Lumbar support

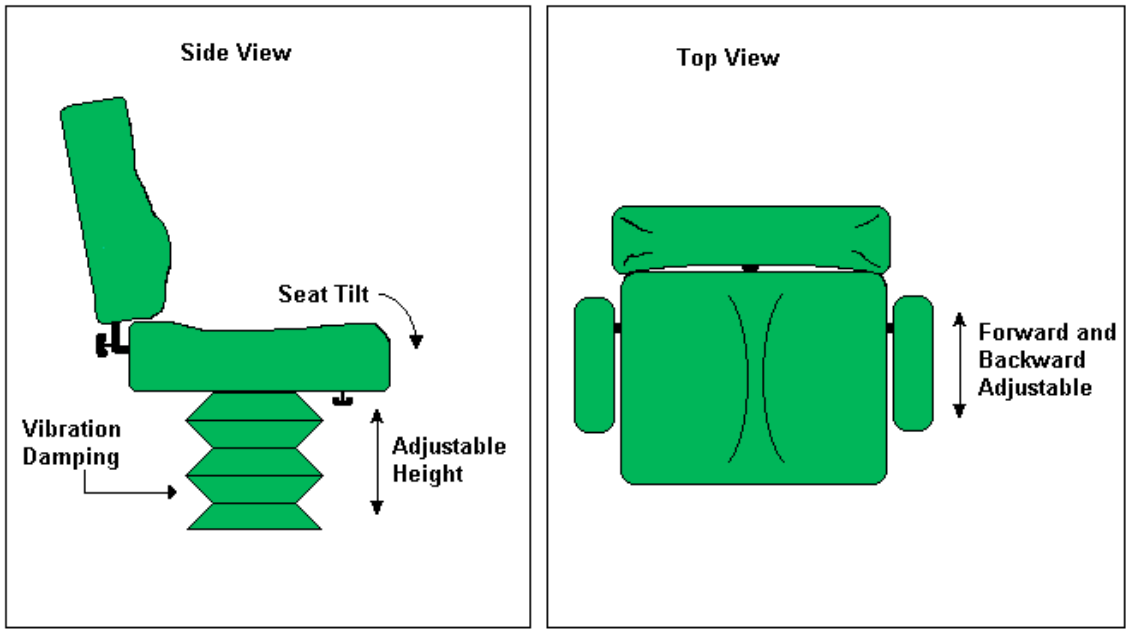
E

In order to reduce awkward postures in the low back while seated, adjustable lumbar support should be provided. Seats that wrap around the low back and allow the curve in the low back to be maintained should be considered for purchase. Padded lumbar cushions can also be added to existing seats.

Adjustable seating

E

In order to minimise awkward and static postures of the low back, seating should have several adjustable features (see list below) to accommodate various operators, and allow for continual postural adjustments.



- Seating should have adjustable lumbar support
- Seats should be adjustable forward/backward and up/down
- Seats should have seat pans which tilt forward and backward
- Seats should be air-ride, or have vibration damping cushions
- Seats should be covered with a breathable, non-slip material

Vary body posture

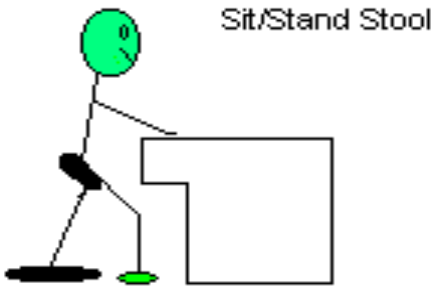
WP

In order to reduce awkward and static postures in the low back, encourage the By-Products Management Person to get up from the seated posture throughout the day. This activity alleviates the load on the spine, allows the discs to equalise, and allows ligaments to regain their stiffness after being stretched out from sitting.

Sit/stand stool

E
WP

In order to minimise fatigue in the lower extremities, sit/stand stools can be provided. Sit/stand stools are preferred over regular stools, as the design provides height adjustability in addition to making it easier to alternate between sitting and standing. The design of a sit/stand stool allows the larger muscles of the lower extremities to be used when handling objects. If a sit/stand stool is used near a conveyor system, vibration should first be minimised.



Seat maintenance

E
A
WP

Seats and supports are the only layer of protection between an operator and whole-body vibration transmitted from equipment. For these reasons, seats need to be properly maintained to help prevent injuries.

Seat maintenance should begin when a workstation is being created or renovated. Many equipment manufacturers offer a selection of seats. Use the information on the previous page to select a seat that satisfies your ergonomic criteria. Where possible, have the intended operators try several different seat styles before deciding on a seat design. If the manufacturer does not offer seats of suitable quality, it might be necessary to order a custom seat. Remember: heavy equipment manufacturers do not specialise in ergonomic seat design. Good quality seats may require separate ordering and installation.

Any new seat should come with a clear set of instructions for adjustment and use. Photocopy a set of these instructions for each operator, and laminate another copy for prominent viewing in the work area. Make sure all operators are familiar with the purpose and use of all seat features.

Regular seat maintenance

Regular vehicle seat maintenance should follow a schedule based on duration of use. At the prescribed time, all components of the seat should be inspected for wear, and damaged parts should be replaced. This inspection should include seat suspension, seat cushioning, seat covering, and arm supports. Seats should be replaced when they are too worn, or when they can no longer be repaired to safe working levels. Seats, like work boots, have a life span limited by their daily exposure to vibration, shock impact, and continuous load bearing.

Daily inspection of seat

Seat users should also be responsible for ongoing maintenance. A short daily inspection of the vehicle seat could identify wear or damage before it becomes a major problem. Keeping the seat as clean as possible and regularly using all adjustments on the chair can also help to minimise uneven wear and prevent damage.

FLOOR SURFACES

Anti-fatigue matting

E

In order to minimise fatigue in the lower extremities, anti-fatigue matting can be installed. The use of anti-fatigue matting in the work area will help to increase comfort and reduce muscle fatigue. The cushioned surface encourages continuous micro-movements of the feet, which minimises blood pooling in the feet and legs and the associated discomfort. In addition, anti-fatigue matting may also aid in damping vibration levels.

Anti-fatigue matting is a practical solution when a worker spends a majority of their time in one area, and the matting does not hinder the safety of the worker or the performance of the task.

Anti-fatigue insoles

WP
PPE

If however a worker must stand in several different areas for long periods of time, in order to minimise fatigue in the lower extremities, it may be more practical to use anti-fatigue insoles in work boots. The cushioned surface of the insole can absorb repeated impact from walking on metal catwalks, and may aid in damping vibration while standing in one spot.

Knee pads

WP

To disperse contact stress on the knee cap when kneeling, use knee pads or wear coveralls with foam inserts in the knees.

To reduce contact stress between the thigh bone and the knee cap, avoid bending the knee over 90 degrees when squatting. Instead kneel on one knee with knee pads or foam insert in coveralls.

To ensure that the knee cap is tracking properly, perform the step down exercise found in the Knee section of the Body Manual.

ADDITIONAL WORKSTATION DESIGN OPTIONS

Conveyor seals

E

Properly sealed conveyors and tail spools allow more debris to travel to the Chipper than to be picked up by the operator from off the floor. Identify problem areas by determining where significant amounts of debris accumulate.

Video monitor placement

E

In order to reduce the frequency of neck twisting to view video monitors, placement should be in a comfortable viewing position for a By-Products Management Person. The ability to view the video monitors should not be hindered by obstructions in the environment (e.g., machinery, guards) or sources of glare, and should be positioned at a proper viewing height. If the obstructions are necessary for safety reasons, ensure they are transparent. Consider monitor placement based on the working position of the By-Products Management Person and worker input from all operators. Initially, it may be necessary to experiment with several positions before making a decision.

Video monitor quality

E

The cameras that feed the signal to the video monitors frequently become out of focus due to vibration around the chipper and in the mill. In some cases, the video monitors are only used to ensure that the flow of material in the conveyor system is continuous, and not necessarily to see the detail of individual pieces. In these situations, it may not be necessary to supply colour monitors. Consult with the operators on this issue.

Computer representation

E

Computer representations based on electronic sensory information from the conveyor could eliminate some of the concerns with regards to vibration and a video feed.

Minimise lifting distance

In order to reduce the amount of force on the low back required when debris is lifted from the floor, By-Products Management Personnel can minimise the distance that the material is lifted from the floor to a tail spool. Some suggestions include:

E

Lower the height of the tail spool.

WP

Allow a pile of debris to accumulate so that material can be lifted from the top of the pile to the tail spool.

E

Raise the portion of the floor near the tail spool by using a table or platform.

Additional Work Practices

Stretches

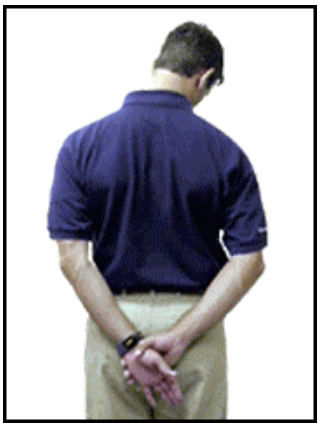
WP In order to minimise awkward and static postures of the body related to warehouse work, use these stretches throughout the day to enhance tissue tolerance for those muscle groups. For additional stretches see the **Body Manual**.

Chin Tuck

With your head upright, tuck chin in. You should feel a gentle stretch, in the back of the neck. Hold for 20 seconds and then relax. Repeat 3 times.

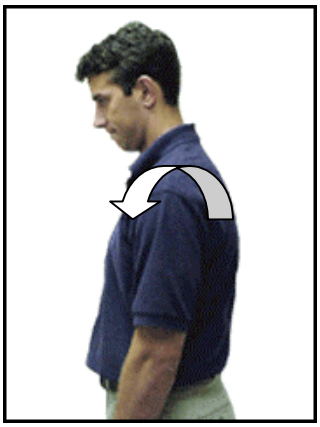
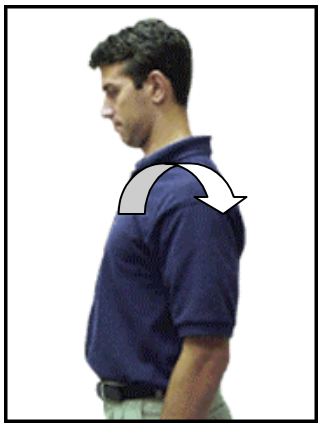

Neck Stretch

Turn the head slightly to one side and reach for the ground behind you with the opposite arm. Hold for 10 seconds. Repeat 3 times on each side.




Shoulder Circles

Rotate the shoulders in forward circles for 5 rotations. Repeat rotating the shoulders backward.

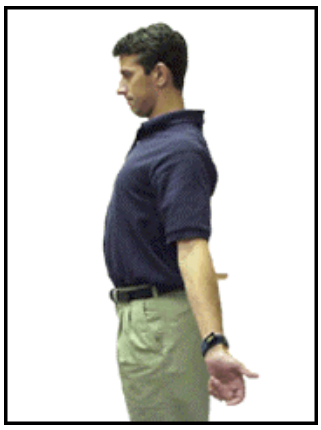



Shoulder Stretch

Gently pull elbow towards opposite shoulder, keeping both shoulders relaxed. You should feel a mild stretch in the back of the shoulder. Hold for 5 seconds. Repeat with the other arm.

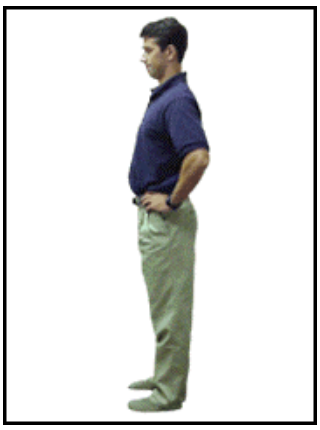
Upper Back & Chest Stretch

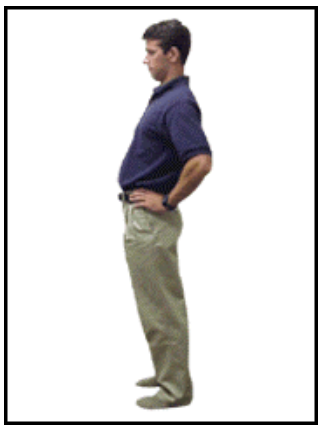
Place the hands together in front of the body and push them outwards. Bring the arms behind the body and squeeze the shoulder blades together while pressing the shoulders down and keeping the chin tucked in. Repeat 5 times.



Back Extension

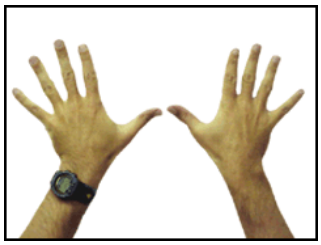
Start by standing in an upright position (the back is in neutral posture). Lean backwards slightly, pushing the hips gently forward. Hold for 5 seconds. Repeat 3 times.



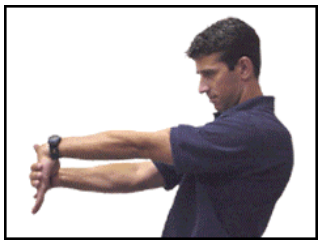


Hands and Fingers Stretch

Clench both fists and hold for 3 seconds. Then open your hands and spread fingers apart. Hold for 3 seconds. Repeat.

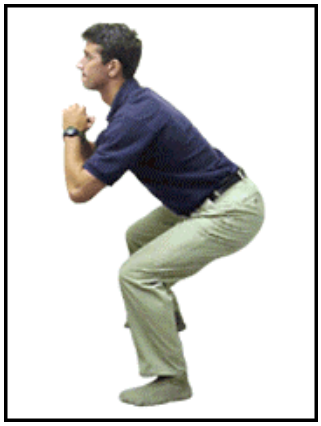


Wrist Flexor and Extensor Stretch



With your arm extended and fingers pointing up, gently pull hand towards your body until you feel a mild stretch in the forearm. (**Note**: do not stretch to the point where you feel pain or tingling). Hold for 15 – 30 seconds. Repeat with fingers pointing down. Repeat with the other arm.

Squats (low back)

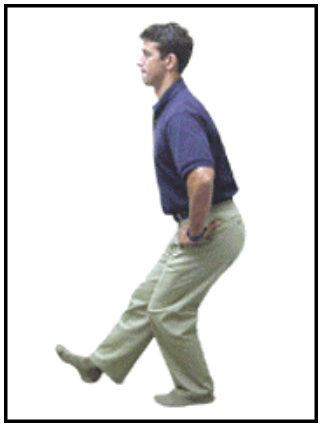


Place feet shoulder width apart, sit down and then stand back up. Repeat 5 times.

Hip Flexor Stretch

Place one foot in front of the other and lower the body, keeping your pelvis tilted. You should feel this stretch in the front hip and thigh of the back leg. Hold for 5 seconds. Repeat 3 times with each leg.

Hamstring Stretch



Place the heel of one foot in front of the body, and bend the other leg. Keep your back upright and in the neutral position. You should fell this stretch in the back of the thigh of the forward leg. Hold for 5 seconds. Repeat 3 times with each leg.

View with eyes

WP In order to reduce awkward postures of the neck, rotate the eyes and neck, not just the neck, to view the work area. If neck twisting cannot be avoided, try to alternate turning the head in both directions. When twisting the head, keep the chin tucked in and the ears in alignment with the shoulders.

Turn body

WP In order to decrease repetitive and awkward postures of the neck, turn the trunk and the eyes, not just the neck, to watch lumber flow.

Proper climbing

WP When ascending stairs, avoid taking more than one step at a time, as this increases the contact stress between the thigh bone and the knee cap. When descending stairs, avoid rapid descent as this also increases the contact stress between the thigh bone and the knee cap.

Characteristics of Objects Being Handled

Power positions

WP

Use power positions when handling loads or exerting force on objects. Using larger and stronger muscles when doing heavy or forceful work reduces the risk of muscle strain. For lifting, a power position is adopted when a worker remembers to 'lift with the legs, not the back'. This phrase is based on the fact that the muscles of the thighs are larger and more powerful than the muscles of the low back. Other examples of using power positions include using leverage to help move heavy objects and lumber when possible, and using the hips and legs to push debris on the floor when sweeping.

Manual material handling

WP

The following work practices refer specifically to manual material handling tasks. These tasks include lifting, lowering, pushing, pulling, carrying, and holding objects.

- Use the entire body, especially the large muscle groups of the lower body, to perform a movement.
- To reduce loading on the soft tissues of the back, lift heavy objects with a neutral back posture while maintaining the 3-point curve (the natural "S" shaped curve of the back – see the Injury Education section for more information). Do not use pelvic tilt to position the trunk for lifting.
- Do not twist while holding or moving a load. This places the back in a weaker posture that can lead to injury.
- When possible, balance loads being carried on each side of the body. This minimises loading on the soft tissues of the back and hips.
- When lifting, carrying, or holding objects, keep them as close to the body as possible. The farther the load is away from the body, the more stress it puts on the back.

SIZE AND SHAPE

Two hands at once

WP

In order to reduce loading on elbow/wrist when handling lumber, use both hands to push, pull, lift, or lower larger pieces of lumber. This coupling will significantly decrease the load on one hand and arm when doing the same task.

Hoists

E
WP

A hoist may be useful to reduce the forceful movements and awkward postures on the neck/shoulder and low back and also to reduce forceful, repeated gripping when lifting large pieces of debris from within the conveyor. If a hoist is being considered as an option, keep in mind that many operators will only use a hoist system if it is at least as quick as doing the same task by hand or when using other hand tools such as picaroons, etc. Consult with the operators on this matter.

LOAD CONDITION AND WEIGHT DISTRIBUTION

Pike pole use

WP

In order to reduce loading on the shoulder and back when handling logs or waste material on the end of pike poles, pick the appropriate pike pole for the job. The pike pole should be longer than the distance from the operator to the object to be retrieved. This extra distance will prevent the pike pole from striking the operator if the pike pole detaches from the object, and will also give the operator some extra grip length if the pike pole pulls away from the operator. Two hands should be used when handling the pike pole. Once the sharp end of the pike pole is stuck in the lumber, only pull on it twice before removing it from the wood. Repeat this process until the lumber is uncrossed or the jam is cleared. Also, keep the body in a strong posture by keeping arms close to the body, with elbows bent and wrists straight.

Lightweight, sharp tools

A
WP

In order to decrease the force required by a By-Products Management Person to pull waste material or logs, ensure that the tools used to manipulate the wood (e.g., pike poles, picaroons) are lightweight and sharp.

Reduce hand tool weight

E
WP

In order to reduce the weight lifted, and thus reduce the force on the low back, ensure that lightweight tools are available to lift the debris. Use pitchforks or shovels with holes for drainage whenever possible.

Use Front End Loader or Ramrod

WP

In order to reduce manual lifting of debris from the floor, and thus reduce forces on the low back, use a Front End Loader or Ramrod to remove large amounts of accumulated debris. Find an appropriate opening in the conveyor system to replace the debris with minimal spillage.

CONTAINER, TOOL AND EQUIPMENT HANDLES

Modify tool handle friction

E

In order to reduce the force required to grip hand tools, increase the friction between the tool handles and the operator's glove. Due to the smooth, slippery surface of metal or wooden tool handles (e.g., pike pole, picaroon) a By-Products Management Person must use a higher grip force in order to maintain control of the tool. This can put the elbow, and possibly the wrist and hand, at risk of injury. Wrapping the tool handles with foam, rubber, medical/athletic tape, or modifying the surface using other friction increasing material (e.g., gritty paint if plastic substances are not allowed) would increase the friction between the handle and the By-Products Management Person's glove, and thus decrease the grip forces required.

Use the whole body

WP

To reduce grip force when using a broom, use the hips and legs to push debris on the floor.

Grip lightly

WP

To reduce grip force when using a shovel, grip the shovel lightly and accelerate shovel into pile.

Improve leverage

WP

To reduce grip force when using a shovel to lift debris onto a conveyor, choke up on the handle and improve leverage. Note that choking up on the handle may increase back bending, resulting in more stress to the back.

Maintain neutral wrist posture

WP

In order to reduce awkward postures of the wrist maintain a neutral posture (straight wrist) whenever possible while operating lever controls.

Sticky palm gloves

PPE

In order to reduce grip forces required by the By-Products Management Person, the operator should wear thin, close fitting gloves with a "sticky" palm surface to increase the friction between the gloves and the tool handles.

Hand tool use

WP Move larger pieces of debris from within a pile by using a pitchfork rather than a shovel.

With any hand tool:

- Establish a power position by adopting a wide stance
- Alternate positioning to the pile of debris so that debris is thrown in front, as well as to the side of the operator
- Accelerate the shovel or pitchfork through the first part of the movement and do not over extend to get the material into the tail spool
- To improve leverage, make sure the hands are far apart on the tool handle
- Remember to change the orientation of the hands
- Use the stronger muscles of the arms and shoulder to 'flick' material into the spool rather than making flexion or extension movements with the wrists
- Attempt to keep the spine in a neutral position throughout the movements and attempt to use the larger muscles of the lower body to assist in lifting debris

Environmental Conditions

Reduce glare

PPE

To minimise awkward neck postures due to glare, operators may wear sunglasses, or windows can be treated to filter sunlight.

Lighting

E

In order to minimise the number of times a By-Products Management Person may bend the neck forward, experiment with different types of lighting that may be better suited to "hi-light" the presence of metal in the vibrating conveyor. Adequate lighting should also be considered in the chip quality check area.

Vibration

E

To minimise whole body vibration due to vibrating equipment, place anti-fatigue matting over the metal grating next to the conveyor.

To eliminate whole body vibration due to vibrating equipment, isolate the control booth from the vibrating equipment by building it on a separate foundation.

Please refer to the General Risk Factor Solutions Manual for solutions regarding environmental conditions.

Work Organisation

Task variability

WP

In order to minimise forward bending of the neck and back, and twisting of the neck, consider performing less time dependent tasks in stages rather than all at once. For example when checking the chip quality, perform only some of the necessary tasks then check the operation of the chipper. Once this is done, return to complete the remainder of the chip quality tasks. The same strategy could be used when shovelling.

Please refer to the General Risk Factor Solutions Manual for solutions regarding work organisation risk factors.

Summary of Solutions

Refer to the table below to help determine which solution alternatives will aid in addressing risk factors in the particular body parts of concern.

		Injury Prevention Potential										
SOLUTIONS	**Page**	Neck	Neck/ Shoulder	Shoulder	Elbow/Wrist	Wrist	Wrist/ Hand	Low Back	Hip	Knee	Ankle	Foot
Use tools to reach	**86**			**A**				**A**				
Alert operator	**86**		**F A**	**F A**				**F A**				
Removal of metal with another conveyor	**87**		**F**	**F A**				**F R A S**				
Diagonal fin	**87**			**F A**				**F A S**				
L-shaped chute	**88**			**F A**				**F A S**				
Padding on sides	**88**						**C**					
Removable safety barrier	**88**			**F A**				**F A S**				
Modify safety barrier	**88**							**A**				
Decrease metal in system during production	**89**		**F R**	**F R**				**F R**				

Direct Risk Factors

F = *Force* **R** = *Repetition* **A** = *Awkward Postures*
S = *Static Postures* **C** = *Contact Stress* **V** = *Vibration*

Summary of Solutions

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		Injury Prevention Potential										
SOLUTIONS	**Page**	Neck	Neck/ Shoulder	Shoulder	Elbow/Wrist	Wrist	Wrist/ Hand	Low Back	Hip	Knee	Ankle	Foot
Maintain chainsaws	**89**			**A**				**A S**				
Hand-held metal detectors	**89**							**A S**				
Braced postures	**90**							**A**				
Adequate space	**90**	**A**		**A**				**A**		**A C**		
Look down with eyes	**91**	**A**										
Ear muffs	**91**	**F**										
Handling small pieces of debris	**91**							**A S**				
Mirror	**91**	**A**										
Increase neck tissue tolerances	**92**	**F**										
Spot vacuum system	**92**			**A**				**R A**				
Keep the back straight	**92**							**A**				
Lumbar support	**93**							**A**				

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SOLUTIONS	**Page**	Neck	Neck/ Shoulder	Shoulder	Elbow/Wrist	Wrist	Wrist/ Hand	Low Back	Hip	Knee	Ankle	Foot
Adjustable seating	**93**							**A S**				
Vary body posture	**94**							**A S**				
Sit/stand stool	**94**							**F S**				**S**
Seat maintenance	**95**							**V**				
Anti-fatigue matting	**96**							**V**				**S**
Anti-fatigue insoles	**96**							**V**				**S**
Knee pads	**96**									**C**		
Conveyor seals	**97**							**R A**				
Video monitor placement	**97**	**R A**										
Video monitor quality	**97**	**A**										
Computer representation	**98**	**A**										
Minimise lifting distance	**98**							**F A**				

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Summary of Solutions

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		Injury Prevention Potential										
SOLUTIONS	**Page**	Neck	Neck/ Shoulder	Shoulder	Elbow/Wrist	Wrist	Wrist/ Hand	Low Back	Hip	Knee	Ankle	Foot
Stretches	**99**	directly reduces risk of injury to the body										
View with eyes	**102**	**A**										
Turn body	**102**	**R A**										
Proper climbing	**102**									**C**		
Power positions	**103**							**F A**				
Manual material handling	**103**							**F A**				
Two hands at once	**104**			**F**	**F**							
Hoists	**104**		**F**	**F A**	**F**			**F A**				
Pike pole use	**104**			**F**				**F**				
Lightweight, sharp tools	**104**		**F**	**F**	**F**			**F**				
Reduce hand tool weight	**105**							**F**				
Use Front End Loader or Ramrod	**105**							**F**				
Modify tool handle friction	**106**				**F**							
Use the whole body	**106**				**F**							

Direct Risk Factors

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Summary of Solutions

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		Injury Prevention Potential										
SOLUTIONS	**Page**	Neck	Neck/ Shoulder	Shoulder	Elbow/Wrist	Wrist	Wrist/ Hand	Low Back	Hip	Knee	Ankle	Foot
Grip lightly	**106**				**F**							
Improve leverage	**106**				**F**							
Maintain neutral wrist posture	**106**					**A**						
Sticky palm gloves	**106**				**F**							
Hand tool use	**107**							**F A**				
Reduce glare	**108**	**A**										
Lighting	**108**	**A**										
Vibration	**108**							**V**				
Task variability	**108**											
Heat Exposure	◆	indirectly reduces risk of injury to the body										
Cold Exposure	◆	indirectly reduces risk of injury to the body										
Lighting	◆	indirectly reduces risk of injury to the body										
Noise	◆	indirectly reduces risk of injury to the body										
Vibration	◆	directly reduces risk of injury to the back and wrist										
Rest breaks	◆	indirectly reduces risk of injury to the body										
Job Rotation	◆	indirectly reduces risk of injury to the body										
Task Rotation	◆	indirectly reduces risk of injury to the body										
Work Pace	◆	indirectly reduces risk of injury to the body										
Scheduling	◆	indirectly reduces risk of injury to the body										

Direct Risk Factors

F = *Force* **R** = *Repetition* **A** = *Awkward Postures*
S = *Static Postures* **C** = *Contact Stress* **V** = *Vibration*
◆ = *See General Risk Factor Solutions Manual*

BY-PRODUCTS MANAGEMENT PERSON MSI SAFETY GUIDE

OBJECTIVE:
To identify ergonomic risks involved in the By-Products Management Person job and to reduce the potential for musculoskeletal injuries. More detailed information about risk reducing recommendations can be found in the Work Manual for the By-Products Management Person.

CHECK IF THIS APPLIES	ACTIVITY OF RISK	DIRECT RISK FACTOR(S)	POTENTIAL HAZARDS	SUGGESTED SOLUTIONS
	Neck A By-Products Management Person may hold the head forward or backward in order to observe monitors or conveyors. A By-Products Management Person may also hold the head forward while changing chipper knives, checking chip quality, and moving debris on the floor.	**Awkward Postures** **Static Postures**	• Neck muscles must support the weight of the head while in a forward position. The more the neck bends the greater the load on the muscles and tendons. • When the neck is held still in a forward position, the muscles of the neck must remain tense to support the weight of the head. With no time allowed for recovery, the constant state of tension in the neck muscles may cause fatigue. If the constant stress is sufficient, and recovery is not adequate, the tissues may fatigue to the point of injury.	• Try to keep the head in an upright position while monitoring a conveyor. • Turn the eyes and the neck, not just the neck to monitor a conveyor. • Alternate viewing angles by periodically sitting or using a sit/stand stool. • When the head is bent, try to keep the chin tucked in. • For exercises that can help prevent ***neck*** injuries, ***see the Neck section of the Body Manual***.

CHECK IF THIS APPLIES	ACTIVITY OF RISK	DIRECT RISK FACTOR(S)	POTENTIAL HAZARDS	SUGGESTED SOLUTIONS
	Neck A By-Products Management Person may repeatedly twist the neck or hold the head in a twisted posture in order to view video monitors or the flow of the conveyors.	**Repetition** **Awkward Postures** **Static Postures**	• When the head is repeatedly turned to the side, the muscles of the neck are subjected to repeated stress with little time for recovery. If the repetitive stress is excessive, and recovery is not adequate, the tissues can fatigue to the point of injury. • Neck muscles are required to turn the head to the side. The further the head is turned to the side, the greater the load on the muscles and tendons. • When the neck is held still in a twisted position, the muscles of the neck must remain tense to support the weight of the head. With no time allowed for recovery, the constant state of tension in the neck muscles may cause fatigue. If the constant stress is sufficient, and recovery is not adequate, the tissues may fatigue to the point of injury.	• When twisting the head, keep the chin tucked in and the ears in alignment with the shoulders. • Exercise to improve endurance of neck muscles, improve posture, and to prevent neck discomfort. • For exercises that can help prevent ***neck*** injuries, ***see the Neck section of the Body Manual***.

CHECK IF THIS APPLIES	ACTIVITY OF RISK	DIRECT RISK FACTOR(S)	POTENTIAL HAZARDS	SUGGESTED SOLUTIONS
	Neck/Shoulder A By-Products Management Person may pull upward on logs or waste material from a conveyor or shaker in order to separate, remove, or unjam material.	**Force** **Repetition**	• Neck and shoulder muscles support the weight of objects held in the hands. The heavier the object and/or greater the downward pulling force, the greater the load on the muscles and tendons. • When workers repeatedly pull on and/or lift pieces of debris, the muscles of the neck and shoulder are subjected to repeated stress with little time for recovery. If the repetitive stress is excessive, and recovery is not adequate, the tissues can fatigue to the point of injury.	• Position yourself as close to the pieces of debris as possible. • Avoid sudden forceful movements of the arms. Use smooth motions while keeping the arms close to the body. • For exercises that can help prevent ***neck*** and ***shoulder*** injuries, ***see the Neck and Shoulder sections of the Body Manual***.
	Shoulder A By-Products Management Person may push, pull, or handle debris by hand or with hand tools in order to prevent jam-ups, find pieces of metal, and move debris on the floor.	**Force** **Repetition** **Awkward Postures**	• The rotator cuff stabilises the shoulder joint when objects are pushed, pulled, or manipulated. The larger the force required, the greater the load on the rotator cuff. • If the force placed on the rotator cuff exceeds the tissue tolerances, injury may occur. • When the arms are repeatedly used to push, pull, or manipulate debris, the rotator cuff is subjected to repeated stress with little time for recovery. If the repetitive stress is excessive, and recovery is not adequate, the tissues may fatigue to the point of injury. • The rotator cuff stabilises the shoulder joint when the arms are away from the body. The further away the arms are from the body, the greater the load on the rotator cuff.	• Position yourself as close to the pieces of debris as possible. • Avoid sudden forceful movements of the arms. Use smooth motions while keeping the arms close to the body. • For exercises that can help prevent ***shoulder*** injuries, ***see the Shoulder sections of the Body Manual***.

CHECK IF THIS APPLIES	ACTIVITY OF RISK	DIRECT RISK FACTOR(S)	POTENTIAL HAZARDS	SUGGESTED SOLUTIONS
	Elbow/Wrist A By-Products Management Person may grip hand tools in order to remove pieces of debris or logs from a conveyor. A By-Products Management Person may also grip tools in order to sweep, shovel, and use an air hose to remove debris.	**Force** **Repetition** **Awkward Postures**	• Gripping an object requires activation of the forearm muscles, which generates tension at the tendon/bone connection of the elbow. The harder that an object must be gripped, the greater the load on the tendon/bone connection. • Repeated stress to the elbow without adequate rest could slowly fatigue tissues to the point of injury. • The width of an object (e.g., piece of debris, size of tool handle) affects how much muscle tension needs to be generated. There is an optimal grip width where the forearm muscles work efficiently. Outside this width, muscles have to work harder to generate equivalent tension. Consequently, objects that are too large or too small could increase the tension generated by muscles, and lead to tissue fatigue at the tendon/bone connection.	• Use thinner gloves when gripping debris or hand tools, for this will result in less force needed to hold the item. Wear dry gloves. • Use only as much gripping force as is necessary. • Maintain a straight wrist position. • Whenever possible, try using both hands. • Exercise to help strengthen the forearm muscles and tendons. Stretch to help relax forearm muscles. • ***See the Elbow and Wrist sections of the Body Manual.***

CHECK IF THIS APPLIES	ACTIVITY OF RISK	DIRECT RISK FACTOR(S)	POTENTIAL HAZARDS	SUGGESTED SOLUTIONS
	Wrist A By-Products Management Person may grip waste material with the wrist bent in order to unjam or remove material from a conveyor.	**Force** **Repetition** **Awkward Postures**	• Gripping an object requires activation of the forearm muscles, which generates tension in the tendons and tendon sheaths running through the wrist. The harder an object is gripped, the greater the tension in the tendons. As tension increases, the pressure within the carpal tunnel may also increase. • Repeated gripping and/or bending of the wrist causes stress to the tendon sheaths. If the repetitive stress is excessive, and recovery is not adequate, the tendon sheaths may fatigue to the point of injury. • As the wrist is bent, the tendon sheaths will rub up against the walls of the carpal tunnel. The further the wrist is bent, the more friction experienced in the tendon sheaths.	• Use thinner gloves when gripping pieces of lumber or hand tools, for this will result in less force needed to hold the item. Wear dry gloves. • Use only as much gripping force as is necessary. • Maintain a straight wrist position as often as possible. • Whenever possible, try using both hands. • Exercise to help strengthen the forearm muscles and tendons. Stretch to help relax forearm muscles. • ***See the Elbow and Wrist sections of the Body Manual.***

CHECK IF THIS APPLIES	ACTIVITY OF RISK	DIRECT RISK FACTOR(S)	POTENTIAL HAZARDS	SUGGESTED SOLUTIONS
	Wrist/Hand A By-Products Management Person may be exposed to hand/arm vibration when operating power hand tools, such as impact wrenches and chainsaws, or when hands are placed on debris in a vibrating conveyor.	**Contact Stress** **Vibration**	• Contact between hard or sharp surfaces and the base of the palm places stress on the tendons and nerves in the carpal tunnel. • Continual contact with hard or sharp surfaces may damage the nerve and/or gradually weaken the tendons, and cause injury. • Exposure to vibration, through the use of power tools or through contact with other vibrating objects, places a unique form of mechanical stress on the tissues of the hand and wrist. Factors like vibration level and vibration frequency influence the amount of mechanical stress. • Continual exposure to hand/arm vibration may gradually damage neurovascular tissue (nerves and blood vessels) in the hand, and may contribute to problems in the wrist.	• Operate vibrating tools/equipment with the wrists in a neutral (straight) posture. • If available, wear anti-vibration gloves. • Minimise grip and push force used to operate the tools/equipment. • ***See the Wrist section of the Body Manual.***

CHECK IF THIS APPLIES	ACTIVITY OF RISK	DIRECT RISK FACTOR(S)	POTENTIAL HAZARDS	SUGGESTED SOLUTIONS
	Low Back A By-Products Management Person may bend forward and/or to the side in order to lift logs, move debris on the floor, move debris to find metal, change chipper knives, perform maintenance on equipment, and to work in confined spaces. A By-Products Management Person may use hands or hand tools to pull, push, and lift debris from a conveyor while bent forward and/or to the side.	**Force** **Repetition** **Awkward Postures** **Static Postures**	• Lifting increases the loading on the spine. Weight held in the hands is transmitted to the low back. The greater the weight, the greater the loading on the structures of the low back. • Repeated forward and/or side bending can gradually fatigue the structures of the low back. If the repetitive stress is excessive, and recovery is not adequate, the disc walls may fatigue to the point of injury. • Back muscles must support the weight of the upper body when leaning forward or to the side. Increased bending of the back increases the loading on the spine and increases the pressure on the walls of the discs. • When the back is held still in a forward or sideways position, the muscles of the back must remain tense. With no time allowed for recovery, the constant state of tension in the back muscles may cause fatigue. If the constant stress is sufficient, and recovery is not adequate, the tissues may fatigue to the point of injury.	• Try to keep the back in a neutral position (ears, shoulders, and hips aligned). • Lower the body by slightly squatting at the knees rather than bending at the back. • Vary the tasks throughout the day to minimize the duration of static posture. • If a static posture must be maintained for any period of time, occasionally stand and stretch the lower back muscles. • For exercises that can help prevent ***low back*** injuries, ***see the Back section of the Body Manual***.

CHECK IF THIS APPLIES	ACTIVITY OF RISK	DIRECT RISK FACTOR(S)	POTENTIAL HAZARDS	SUGGESTED SOLUTIONS
	Low Back A By-Products Management Person may continually sit on a vibrating surface.	**Awkward Postures** **Static Postures** **Vibration**	• Sitting increases the loading on the walls of the discs. If the duration of sitting is excessive, and the recovery is not adequate (e.g., spine not returned to neutral posture), the tissues may deform to the point of injury. • Whole body vibration is usually transmitted through the seat into the low back. Exposure to whole body vibration introduces a unique mechanical stress to the structures of the spine that can significantly increase the loading on the low back. Prolonged sitting on a vibrating surface may contribute to the gradual weakening of the lumbar discs.	• Ensure that your seat is properly adjusted to support the curve in your lower spine. • For exercises that can help prevent ***low back*** injuries, ***see the Back section of the Body Manual***.

CHECK IF THIS APPLIES	ACTIVITY OF RISK	DIRECT RISK FACTOR(S)	POTENTIAL HAZARDS	SUGGESTED SOLUTIONS
	Knee A By-Products Management Person frequently squats and/or kneels in order to pick up debris and/or to perform equipment maintenance. A By-Products Management Person may also be required to climb stairs or ladders repeatedly throughout the day.	**Repetition** **Awkward Posture** **Static Posture** **Contact Stress**	• Repeated squatting, kneeling, and/or climbing may gradually irritate the knee. Irritation of the knee may lead to muscle wasting, which in turn leads to poor tracking of the knee cap on the thigh bone and increased contact stress between these bones. • Bending the knee increases the contact stress between the kneecap and the thighbone. Contact stress increases significantly when the knee is bent over 90 degrees. • Kneeling on a hard surface increases the contact stress between the kneecap and the thighbone.	• Use kneepads or wear coveralls with foam inserts in the knees. • Avoid bending the knee past 90 degrees when squatting. • For exercises that can help prevent ***knee*** injuries, ***see the Knee section of the Body Manual***

CHECK IF THIS APPLIES	ACTIVITY OF RISK	DIRECT RISK FACTOR(S)	POTENTIAL HAZARDS	SUGGESTED SOLUTIONS
	Foot A By-Products Management Person may stand on a hard, vibrating surface in order to monitor conveyor systems.	**Static Postures** **Vibration**	• While standing, the weight of the body loads the plantar fascia. If the duration of standing is excessive, and recovery is not adequate, the fascia may deform to the point of injury. • Vibrating floors can increase the loading on the foot. Factors like vibration level and vibration frequency increase the amount of loading on the foot, and could lead to irritation. The longer the Chipper Operator is exposed to vibration, the greater the risk of injury.	• Wear anti-vibration insoles. • If anti-fatigue matting is available, place it in the area stood most often. • For exercises that can help prevent ***foot*** injuries, ***see the Foot section of the Body Manual***.