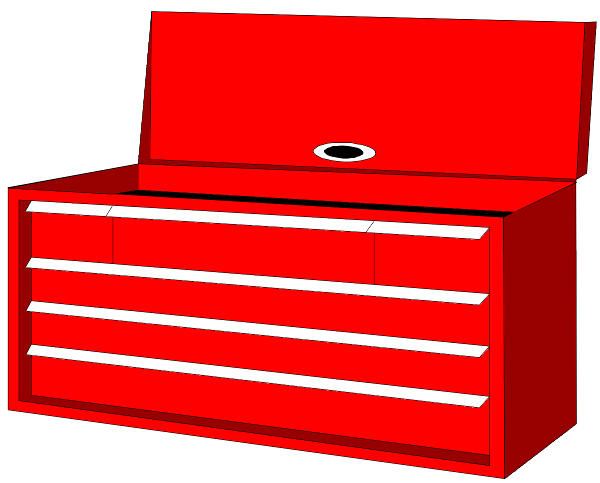
Industrial Musculoskeletal Injury Reduction Program

Common Industry Jobs (CIJs)

Chipper Operator

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

CHIPPER OPERATOR TOOL KIT
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WORK MANUAL 53

Overview
Chipper Operator

Job Summary

A Chipper Operator is responsible for ensuring a continuous flow of wood debris on conveyors to the chipper. A Chipper Operator monitors and maintains the flow of debris in conveyor systems, moves debris to find pieces of metal, changes chipper knives, checks chip quality, and moves debris on the floor using hand tools (e.g., shovel, hoe) or large pieces of equipment (e.g., wheelbarrow, Ramrod). Refer to the Physical Demands Analysis for more detail.

Physical Demands

The physical demands of the Chipper Operator may include:

a) Forceful movements of the neck/shoulder, shoulder, elbow/wrist, wrist, and low back
b) Repetitive movements of the neck, neck/shoulder, shoulder, elbow/wrist, wrist and low back
c) Awkward postures of the neck, neck/shoulder, shoulder, wrist, and low back
d) Static postures of the neck, low back, and foot
e) Vibration of the wrist/hand, low back, and foot
f) Walking to different areas of the mill to maintain conveyor flow
g) Sitting while monitoring the vibrating conveyor systems, and moving large amounts of debris
h) Standing during all tasks
i) Climbing stairs to reach different areas of the mill to perform most tasks
j) Pushing and pulling on debris by hand or with a tool

Mental Demands

A Chipper Operator must be mentally alert to anticipate problems, such as jam-ups, in a conveyor system. A Chipper Operator responds quickly to changes in the sounds of machinery or alarms, as this usually reflects a change in the debris flow in a conveyor system.

Major Variations

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

1) Monitoring conveyor systems may be accomplished by viewing:
   a) Actual conveyor systems (operator is physically in front of a conveyor system)
   b) Video monitors (shows activity from a conveyor system in another part of the mill)
   c) System board (details conveyor status by use of lights)

2) Changing the chipper knives may be performed by:
   a) The Chipper Operator
   b) Trades personnel (e.g., Grinderman, Saw Fitter, Saw Filer, Benchman)

3) Checking chip quality may be performed:
   a) Once every hour by a Chipper Operator
   b) Once a day by a Chipper Operator
   c) By Quality Control personnel

4) Movement of large amounts of debris may be performed:
   a) By a Chipper Operator using a wheelbarrow
   b) By a Chipper Operator using a Ramrod
   c) By a Chipper Operator using a Front-end Loader
   d) By Clean-up crews (see the Tool Kit for Clean-up)

Minor Variations

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

1) Tools used to move debris on the floor include:
   a) Shovels
   b) Brooms
   c) Pitchforks
   d) Hoes

Physical Demands Analysis
Chipper Operator

PDA General Instructions: Chipper Operator

This Physical Demands Analysis (PDA) identifies the physical demands of the Chipper Operator job as assessed by IMIRP ergonomists. The information reported was collected from a sample of Chipper Operators in the BC Sawmill Industry. Where possible, state-of-the-art equipment and techniques were used in data collection and analysis to increase accuracy. However, some information is based on third party comments that are often subjective and not subject to verification.

Subsequent changes to the work process may reduce the validity of any pre-existing physical demands analysis. The IMIRP Society accepts no responsibility for the use or misuse of the Physical Demands Analysis, or for the accuracy of the PDA as it applies to any specific workplace.

To make the PDA specific to your workplace, determine which of the tasks identified are present in your mill. For each section, check off the items (e.g., tasks, tools, etc.) listed that reflect the Chipper Operator job at your mill.

Rehabilitation professionals are encouraged to verify and update critical information through the client and through workplace sources to ensure that the content (e.g., tasks, weights of objects handled, etc.) accurately reflects the job.

PDA Table of Contents

Physical Demands Analysis
Chipper Operator

Task List

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

Monitor and maintain flow

A Chipper Operator monitors and maintains the conveyor systems to ensure movement of debris to the chipper. In order to accomplish this, a Chipper Operator clears jam-ups and cross-ups by hand, and with hand tools, while a conveyor is moving or stopped.

Does this task occur at your mill?

☐ Yes ☐ No

Move debris to find metal

A metal detector alerts the Chipper Operator that a piece of metal is in the vibrating conveyor system. The conveyor stops automatically. The Chipper Operator moves the debris (e.g., pieces of wood, sawdust, chips) by hand or with hand tools (e.g., picaroon), removes the metal object, and then restarts the conveyor.

Does this task occur at your mill?

☐ Yes ☐ No

Change chipper knives

A Chipper Operator changes chipper knives. The knives are brought to the chipper using hoists, carts, boxes, etc. Items used during the change include impact wrenches (to remove and replace the knives) and air hoses (to clear sawdust and other small pieces of debris).

Does this task occur at your mill?

☐ Yes ☐ No

Check chip quality

A Chipper Operator checks the quality of the chips produced from the wood debris.

Does this task occur at your mill?

☐ Yes ☐ No

Move debris on floor

A Chipper Operator moves debris on the floor using hand tools. Some of the hand tools include shovels, hoes, brooms, and pitch forks.

Does this task occur at your mill?

☐ Yes ☐ No

Move large amounts of debris

In order to move a large amount of debris, a Chipper Operator may use wheelbarrows, Front End Loaders, and Ramrods.

Does this task occur at your mill?

☐ Yes ☐ No

Company Profile

Company Name:______________________________Division:_____________________________________

Number of Employees: ________________________Turnover in last 12 months: +/-___________or____%

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

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

Work Organisation

Task Description

The table below contains a list of tasks performed on an everyday basis by a Chipper Operator.

Indicate each of the tasks performed by placing a check mark (✓) in the far left column.

Check marks (✓) in the Percent of Shift columns correspond to percentages found during the ergonomic investigation. The Comments section may be used to elaborate on the task description (e.g., variations between mills, frequencies, cycle times, etc.).

	Task	Percent of Shift				Comments
		Rarely 0 to 5%	Occasionally 6 to 33%	Frequently 34 to 66%	Constantly 67 to 100%	
	Monitor and maintain flow			✓		• *Sitting or standing to monitor flow at conveyor, systems board, or via video monitors* • *Prevent jam-ups and assist movement of debris using hands or hand tools*
	Move debris to find metal		✓			• *Involves removal of lumber, chips, and sawdust to find various sizes of metal* • *More metal found during morning start-up (after maintenance activity)*
	Change chipper knives		✓			• *Task not always performed by Chipper Operator* • *Performed once a day or is dependent on condition of knives*
	Check chip quality		✓			• *Task not always performed by Chipper Operator* • *Performed every hour*
	Move debris on floor		✓			• *Includes use of shovels, hoes, pitchforks, and brooms*
	Move large amounts of debris	✓				• *Task not always performed by Chipper Operator* • *May be a Clean-up duty (see Clean-up Tool Kit for details)*

Organisational Factors

The table below contains a list of organisational factors for a Chipper Operator. For each of the items input the necessary information to reflect the situation at your mill.

For the last item, if the job has scheduled job rotation (i.e., rotate from one job to another during a shift) check 'Yes' and then write in the jobs the worker rotates to and how often these rotations occur. If you do not have job rotation for this job, check 'No'.

Length of shift	☐ *8 hours* ☐ *0.5 hour overtime* ☐
Formal breaks	☐ *Two 10 minute coffee breaks* ☐ *30 minute lunch* ☐
Informal breaks	☐ *Yes, during down-time* ☐
Work pace	☐ *Not Applicable*
Work pace control	☐ *Not Applicable*
Job rotation ☐ Yes *(Check one)* ☐ No	If **Yes:** Rotation with what job(s):_______________________________ ____ How often: (e.g., every 2 hours)________________________________

Workstation Characteristics

Dimensions & Layout

Indicate the specified dimensions of the workstation to the nearest centimetre. Please refer to Figure 1 for the measurement locations.

Workstation Dimensions	
(A) Height to top of vibrating conveyor	cm
(B) Width at bottom of vibrating conveyor	cm
(C) Width at top of vibrating conveyor	cm
(D) Height at bottom of vibrating conveyor	cm
(E) Height at top of railing or barrier	cm
(F) Height at bottom of control panel	cm
(G) Height at top of control panel	cm

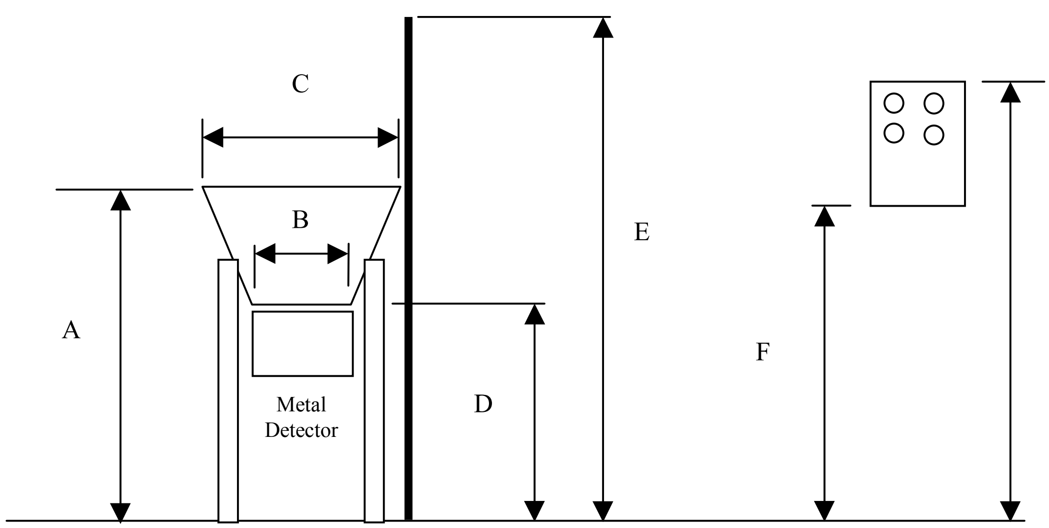


Figure 1: Chipper Operator Workstation (right side view)

Flooring, Displays, and 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 at your mill.

For the Seating section, first indicate whether seating is present at the workstation and then continue by elaborating on the features of the seating.

Workstation Characteristics	
Flooring	*Check all that apply* ☐ Cement ☐ Wood ☐ Rubber Matting ☐ Metal ☐ Other (e.g., tile, carpet) ______________________
Displays	*Check all that apply* ☐ Lights on Console ☐ Mirrors ☐ Video Monitors ☐ Computer Monitors ☐ None ☐ Scrolling Display ☐ Signal Lights ☐ Other _____________
Seating: ☐ Yes *(Check one)* ☐ No	☐ Sit/stand ☐ Office Height of seat: ________ cm ☐ Industrial ☐ In-house Design Depth of seat: ________ cm Width of seat: ________ cm
	Check all that apply ☐ Armrests ☐ Backrest ☐ Swivel Seat ☐ Slide track ☐ Foot rest ☐ Lumbar support ☐ Castors # _____________ Covering type: ____ Seat adjustable? ☐ Yes ☐ No If yes, adjustable: ☐ Height ☐ Armrests ☐ Backrest ☐ Forward tilt

Equipment & Machinery Controls

The table below contains a list of the types of controls used by a Chipper Operator.

Indicate the controls which are present at your mill by placing a check mark (✓) in the far left column.

The Comments section may contain information that describes variations between mills.

Type of Control		Function	Frequency	Comments
	Push/pull button	• *Start/stop conveyor*	• *Frequency dependent on number of jam-ups or number of times metal is detected*	
		• *Open housing to chipper for knife change*	• *Frequency dependent on frequency of knife change*	
	Lever	• *Turn air hose on/off*	• *Frequency dependent on need*	• *May be used to blow down machinery during operation or blow down chipper during knife change*
		• *Open housing to chipper for knife change*	• *Frequency dependent on frequency of knife change*	
		• *Activate controls on Front End Loader*	• *Frequency dependent on need*	
		• *Lock out hog*	• *Frequency dependent on need*	
	Foot pedals	• *Brake and clutch on Front End Loader*	• *Frequency dependent on need*	

Physical Demands

Whole Body Physical Demands

Identify each of the physical demands required by a Chipper Operator, by placing a check mark (✓) in the far left column.

Check marks (✓) in the **Percent of TASK** columns correspond to percentages found during the ergonomic investigation. The Comments section may contain information relating to duration, frequencies and other variations in the physical demands.

	Physical Demands	Task(s)	Percent of TASK: Rarely 0 to 5%	Occasionally 6 to 33%	Frequently 34 to 66%	Constantly 67 to 100%	Comments
	Walking	• *Monitor and maintain flow*		✓	✓		• *Operator may be responsible for several different conveyor systems* • *Operator may walk up and down alongside the length of the conveyor while monitoring for potential jam-ups* • *Area alongside vibrating conveyor often is vibrating* • *Some conveyor (chain) systems may be located outside*
		• *Change chipper knives*	✓				• *Operator may need to retrieve knives and carry them to chipper*
		• *Check chip quality*		✓			• *Dependent on location of retrieved chips relative to quality testing area* • *Dependent on how often chips are checked*
		• *Move debris on floor*	✓				• *Operator may need to walk to several areas within the mill* • *Use of some hand tools may require more walking (e.g., use of broom to push debris)*

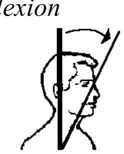
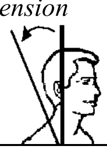
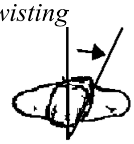
Physical Demands	Task(s)	Percent of TASK Rarely 0 to 5%	 Occasionally 6 to 33%	 Frequently 34 to 66%	 Constantly 67 to 100%	Comments
Sitting	• *Monitor and maintain flow*		✓	✓		• *Operator may sit in a booth beside or removed from a vibrating conveyor, or in an open area beside vibrating conveyor(s)* • *Operator may tend to sit more if conveyor systems are running well*
	• *Move large amounts of debris*				✓	• *Operating Front End Loader or Ramrod* • *Operator subjected to vibration from motorised vehicles and uneven driving surfaces*
Standing	• *Monitor and maintain flow*			✓		• *Operator may stand alongside conveyor while monitoring for potential jam-ups and while unjamming debris* • *Operator often subjected to vibration as conveyors or other machinery is running* • *Operator may tend to stand more if conveyor system(s) are not running well*
	• *Move debris to find metal*				✓	• *Operator <u>is not</u> subjected to vibration as metal removal is performed while vibrating conveyor is not running*
	• *Change chipper knives*				✓	• *Operator may be in a confined space as this task is being performed, thus affecting postures*
	• *Check chip quality*				✓	
	• *Move debris on floor*				✓	• *Dependent on hand tool being used, operators may stand for varying lengths of time*
	• *Move large amounts of debris*				✓	• *Percentage appropriate when using wheelbarrow only*

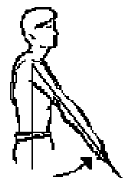
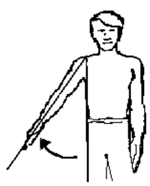
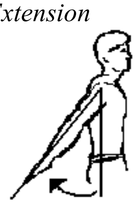
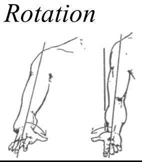
Physical Demands	Task(s)	Percent of TASK Rarely 0 to 5%	Occasionally 6 to 33%	Frequently 34 to 66%	Constantly 67 to 100%	Comments
Climbing (stairs)	• *Monitor and maintain flow*	✓				• *Operator may need to climb stairs to get to sections of the mill with jammed conveyors*
	• *Move debris to find metal*	✓				• *Operators may have a step up to a conveyor*
	• *Change chipper knives*	✓				• *Dependent on location of chipper relative to operators' position monitoring conveyors* • *To and from lock out area*
	• *Check chip quality*	✓				• *Dependent on location of chip quality testing area relative to operators' position monitoring conveyors and location of chip retrieval*
	• *Move large amounts of debris*	✓				• *Stepping up into cab of a Front End Loader or Ramrod*
Climbing (ladder)	• *Monitor and maintain flow*	✓				• *Operator viewing debris in conveyor system*
Balancing	• *Change chipper knives*	✓				• *While operating impact wrench*
Kneeling/ Crouching						*Not Applicable*
Cycling	• *Monitor and maintain flow*		✓			• *Operator may have access to a bicycle or tricycle that can be used to get to conveyor systems*

Body Postures

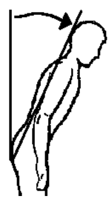
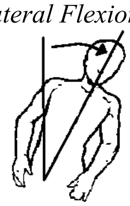
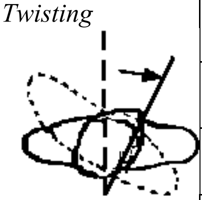
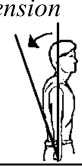
The table below outlines the body postures held or repeated throughout the shift by a Chipper Operator.

For each of the postures identified, indicate whether it occurs by placing a check mark (✓) in the far left column. Check marks (✓) in the **Percent of TASK** columns correspond to percentages found during the ergonomic investigation. The Comments section may contain information relating to duration, frequencies, and other variations in posture.

	Body Posture	**Task(s)**	**Percent of TASK** Rarely 0 to 5%	Occasionally 6 to 33%	Frequently 34 to 66%	Constantly 67 to 100%	**Comments**
Neck							
	Flexion 	• *Monitor and maintain flow*		✓	✓		• *Angle of flexion dependent on height of operator and conveyor system* • *Includes use of tools to unjam*
		• *Change chipper knives*	✓		✓		• *Angle of flexion dependent on amount of allotted space to change knives and location of knife being changed*
		• *Check chip quality*			✓	✓	• *Angle of flexion dependent on height of operator and surface height of quality check table* • *Occurs as bark is removed from chips and when chips are weighed*
		• *Move debris on floor*			✓		
	Extension 	• *Move debris to find metal*		✓			• *Operator may tend to look at debris being throw out of conveyor system*
		• *Move debris on floor*	✓				• *May occur during shovelling*
	Twisting 	• *Monitor and maintain flow*	✓	✓	✓		• *Percent of Task dependent on location of conveyor systems and any video monitors* • *Operator may hold position while viewing video monitors* • *Includes use of tools for unjamming*
		• *Move debris to find metal*	✓	✓			• *Occurs as operator views debris thrown to side of metal detection area*
		• *Change chipper knives*	✓				
		• *Move debris on floor*			✓		

Body Posture	Task(s)	Percent of TASK				Comments
		Rarely 0 to 5%	Occasionally 6 to 33%	Frequently 34 to 66%	Constantly 67 to 100%	
Shoulder						
Flexion 	• *Monitor and maintain flow*			✓		• *Occurs as operator uses hand tools to unjam debris in conveyor*
	• *Move debris to find metal*			✓		
	• *Change chipper knives*		✓			• *Forceful postures while using impact wrench*
	• *Check chip quality*		✓			
	• *Move debris on floor*		✓	✓		
Abduction 	• *Monitor and maintain flow*		✓	✓		• *Percent of Task dependent on location of control panel relative to conveyor system* • *Involves use of hand tools*
	• *Move debris to find metal*		✓			• *Dependent on operator technique used to clear debris from metal detection area*
	• *Change chipper knives*		✓			• *Forceful postures while using impact wrench to place knives into chipper*
	• *Check chip quality*	✓				• *Occurs as operator places bucket on scale*
	• *Move debris on floor*		✓	✓		
Extension 	• *Monitor and maintain flow*		✓			• *Unjamming while using hand tools*
	• *Change chipper knives*	✓				• *Reaching behind operator to retrieve knives or tools while in a confined space*
	• *Move debris on floor*		✓	✓		
Forearm						
Rotation 	• *Move debris on floor*		✓			• *Using hand tools to throw debris*

Body Posture	Task(s)	Percent of TASK				Comments
		Rarely 0 to 5%	Occasionally 6 to 33%	Frequently 34 to 66%	Constantly 67 to 100%	
Wrist						
Flexion 	• *Monitor and maintain flow*	✓	✓			• *Using hand tools to unjam debris* • *Use of control panel items*
	• *Move debris to find metal*	✓	✓			
	• *Change chipper knives*	✓	✓			
	• *Check chip quality*	✓				
	• *Move debris on floor*	✓	✓			
Extension 	• *Monitor and maintain flow*		✓			
	• *Move debris to find metal*	✓				
	• *Change chipper knives*	✓	✓			• *Placing or holding knives in place*
	• *Move debris on floor*	✓	✓			
Ulnar Deviation 	• *Monitor and maintain flow*		✓			
	• *Change chipper knives*	✓				
	• *Check chip quality*	✓				• *Removing trays*
	• *Move debris on floor*	✓	✓			
Radial Deviation 	• *Check chip quality*	✓				• *Sweeping chips into bucket*
	• *Move debris on floor*	✓				

Body Posture	Task(s)	Percent of TASK				Comments
		Rarely 0 to 5%	Occasionally 6 to 33%	Frequently 34 to 66%	Constantly 67 to 100%	
Back						
Flexion 	• *Monitor and maintain flow*			✓		• *Using hand tool to unjam* • *Leaning against a barrier while attempting to accomplish task* • *Console may be too low for operator to avoid some back flexion*
	• *Move debris to find metal*			✓	✓	• *Leaning against outer lip of conveyor system* • *Angle of flexion (and where flexion originates) is dependent on height of conveyor system and worker height*
	• *Change chipper knives*		✓	✓		• *Lifting knives from box in a confined workspace*
	• *Check chip quality*	✓	✓			• *Angle of flexion (and where flexion originates) is dependent on height of quality check area and worker height*
	• *Move debris on floor*		✓	✓		
Lateral Flexion 	• *Monitor and maintain flow*	✓				• *Position of console to primary viewing area may result in lateral flexion* • *Operator often stands on a vibrating surface*
	• *Change chipper knives*		✓			• *Operator may be required to work in a confined workspace*
	• *Check chip quality*		✓			• *Sweeping chips into pail*
	• *Move debris on floor*			✓		
Twisting 	• *Monitor and maintain flow*	✓	✓	✓		• *Dependent on positioning when unjamming using hand tools*
	• *Move debris to find metal*	✓				
	• *Change chipper knives*		✓			• *Operator in a confined workspace*
	• *Move debris on floor*		✓			
Extension 						*Not Applicable*

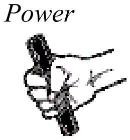
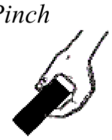
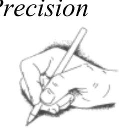
Body Posture		Task(s)	Percent of TASK: Rarely 0 to 5%	Percent of TASK: Occasionally 6 to 33%	Percent of TASK: Frequently 34 to 66%	Percent of TASK: Constantly 67 to 100%	Comments
Other:							
	Shoulder - Adduction	• *Monitoring and maintaining flow*			✓		
		• *Move debris to find metal*		✓			
		• *Move debris on the floor*		✓			

Hand Grips

The table below contains a list of the common types of hand grips (i.e., how objects are held) used by a Chipper Operator.

For each of the hand grips, indicate which types of grips are used at your mill by placing a check mark (✓) in the far left column.

Check marks (✓) in the **Percent of TASK** columns correspond to percentages found during the ergonomic investigation. The Comments section may contain information relating to duration, frequencies, hand used, etc.

	Type	Task(s)	Percent of TASK				Comments
			Rarely 0 to 5%	Occasionally 6 to 33%	Frequently 34 to 66%	Constantly 67 to 100%	
	Power 	• *Monitor and maintain flow*	✓	✓			• *Use of hand tools to unjam*
		• *Change chipper knives*	✓				• *Carrying knives* • *Using impact wrench*
		• *Move debris on the floor*			✓		• *Use of hand tools*
	Pinch 	• *Monitor and maintain flow*		✓			• *Both hands are used*
	Hook 	• *Check chip quality*		✓			• *Carrying pail of chips from collection area to quality check area*
	Precision 	• *Check chip quality*		✓			
	Other:						

Manual Material Handling

The table below contains a list of manual material handling tasks (e.g., pushing, pulling, lifting, lowering, and carrying) performed by a Chipper Operator.

Indicate which tasks are performed by placing a check mark (✓) in the far left column. Fill in the weight (or force) required to move the objects (may have to estimate).

Check marks (✓) in the **Percent of TASK** columns correspond to percentages found during the ergonomic investigation. The Comments section may contain information relating to duration, frequencies, and details regarding characteristics of the object handled.

	Task Description	Weight (kg)	Percent of TASK: Rarely 0 to 5%	Occasionally 6 to 33%	Frequently 34 to 66%	Constantly 67 to 100%	Comments
	Monitor and maintain flow *Push/pull on lumber by hand*	*Varies*		✓			
	Monitor and maintain flow *Push/pull on lumber using a pike pole or picaroon*	*Varies*		✓			
	Monitor and maintain flow *Carry wooden blocks*	*1.3*	✓				• *Weight is per block* • *Usage dependent on number of times solution can be used to unjam*
	Change chipper knives *Carry knives in boxes*	*20.0*	✓				• *Operator will often carry two boxes*
	Change chipper knives *Lift/lower trays with knives*	*2.6 to 5.2*	✓				
	Change chipper knives *Lift/lower knives in boxes*	*20.0*	✓				
	Other:						

Hand Tools

Indicate the hand tools used by a Chipper Operator at your mill 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 marks (✓) in the **Percent of TASK** columns correspond to percentages found during the ergonomic investigation. The Comments section may contain information relating to duration and frequencies of use.

	Type of Tool	Task(s)	Weight (kg)	Percent of TASK				Comments
				Rarely 0 to 5%	Occasionally 6 to 33%	Frequently 34 to 66%	Constantly 67 to 100%	
	Pike pole	• *Monitor and maintain flow*	*1.8 to 2.8*	✓				
	Picaroon	• *Monitor and maintain flow*	*0.8 to 1.3*	✓	✓			
	Chainsaw	• *Monitor and maintain flow*	*8.6 to 9.0*	✓	✓			
	Peevee	• *Monitor and maintain flow*	*4.7*	✓				
	Axe	• *Monitor and maintain flow*	*2.8*		✓			
	Magnetic Stick	• *Move debris to find metal*	*1.0*	✓				
	Clipboard	• *Move debris to find metal*	*0.5*	✓				
	Impact wrench	• *Change chipper knives*	*3.0 to 5.7*	✓				
	Wrench	• *Change chipper knives*	*1.5*	✓				
	Air hose	• *Change chipper knives*	*1.3 to 3.2*	✓				
	Hoe	• *Move debris on floor*	*1.0*		✓			
	Pitchfork	• *Move debris on floor*	*1.9*		✓			
	Grain shovel	• *Move debris on floor*	*3.2*			✓		
	Flat shovel	• *Move debris on floor*	*2.6*	✓				
	Shovel	• *Move debris on floor*	*1.9 to 2.1*	✓	✓			
	Push broom	• *Move debris on floor*	*2.2*			✓		

Environmental Conditions

Work Environment

The table below contains a list of environmental conditions that may be of concern at the Chipper Operator job.

Vibration occurs when the body is in contact with a vibrating object or surface such as a tool, a seat, or the floor. If vibration occurs at this job, check 'Yes' and then mark whether the vibration is whole body and/or hand transmitted and the path through the body by which the vibration is transmitted. If vibration does not occur at this job, check 'No'.

If possible, indicate the appropriate value for the noise and lighting levels at your mill for the Chipper Operator. For the lighting level, include the location of the measurements within the workstation.

Factor	
Vibration ☐ Yes *(Check one)* ☐ No	☐ Whole body ☐ Seat ☐ Floor ☐ Hand transmitted ☐ Tool ☐ Other: ____________________

Noise level (dB)	*Range found: 87.7 to 99.5* *Mill Specific:*
Lighting level (lux)	*Range found: 0.2 to 420 (various locations)* *Mill Specific:*
Temperature (^{0}C)	*See Regional Temperatures on next page*

Location of Workstation

The table below contains a list of the type of work environments a workstation may be located in.

For the workstation, indicate which of the following types of work environments apply with a check mark (✓) in the left column.

For example, the workstation may be inside the main building but exposed to the outside via a doorway that is always open and has both a fan and a heater. In this situation all three, 'Inside exposed', 'Fan' and 'Heater', would be checked for this workstation.

	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.

For your mill, 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 Chipper Operator job at your mill, indicate which of the PPE items are required with a check mark (✓).

	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

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 at your mill.

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.

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

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:

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.

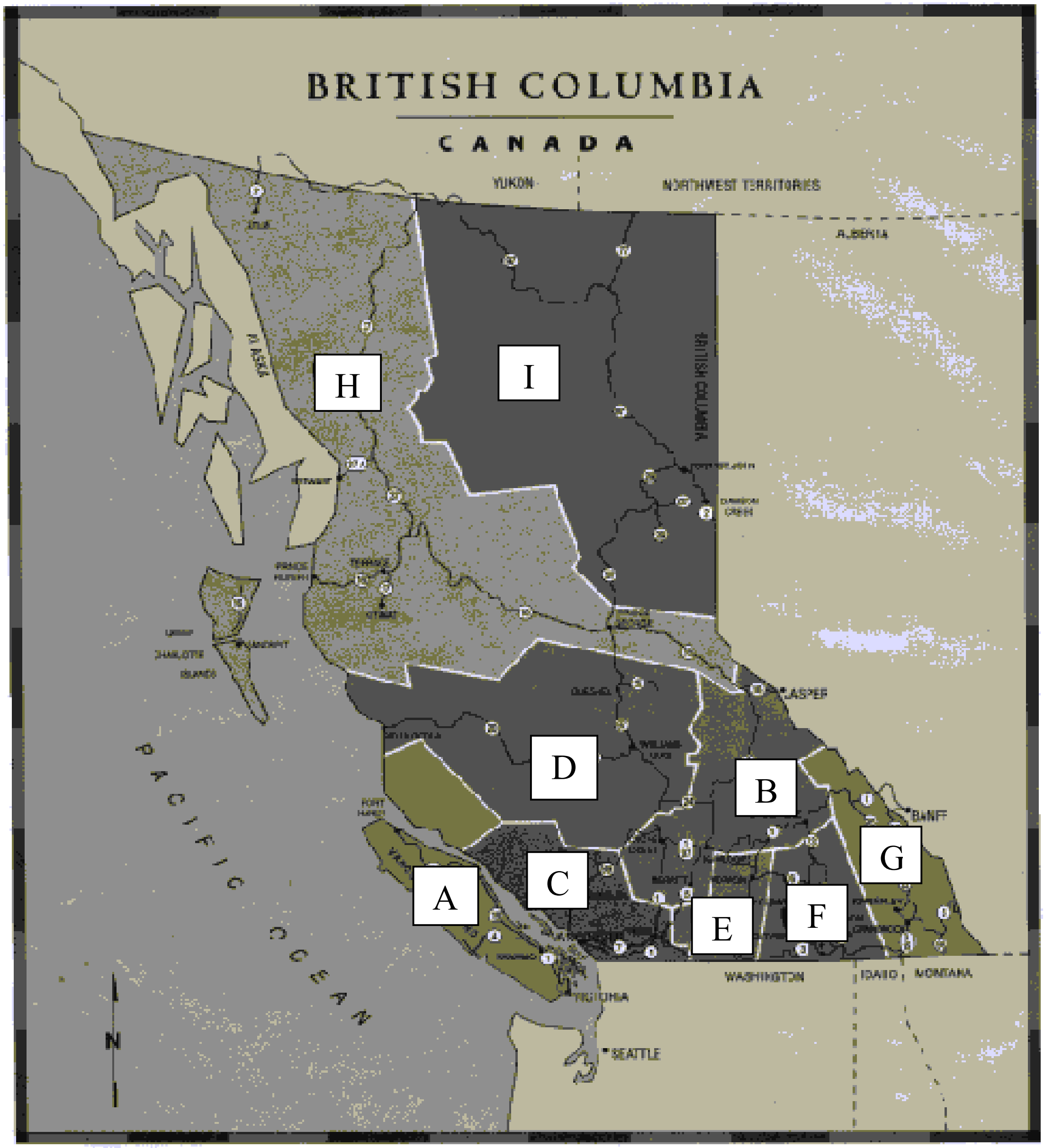
For the lightest species handled, enter the lb./board foot value, the multiple for the smallest size of wood, and the shortest length of this wood. Multiply these values together to determine the weight of the board in pounds.

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
Chipper Operator

<u>Purpose</u>

The Risk Factor Identification Checklist for a Chipper Operator is used to **<u>identify</u>** potential ergonomic risk factors. Keep in mind that the purpose of this checklist is only to **<u>identify</u>** potential ergonomic risk factors, **<u>not</u>** 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.

<u>Instructions</u>

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 – Chipper Operator

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.

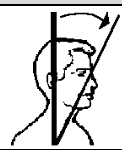
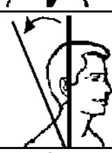
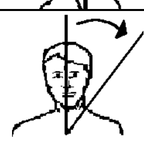
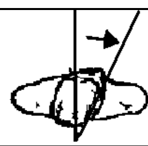
Static Postures: Static loading (sustained exertions) is physical effort (body postures) that is held, requiring muscle contraction for more than a short time.

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.

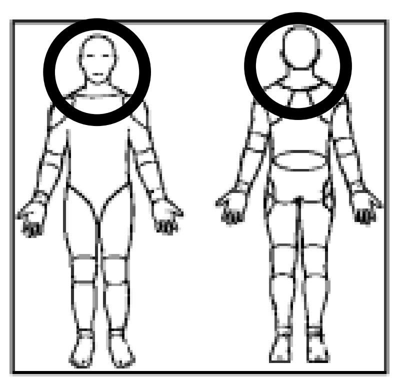
Awkward Postures: Awkward postures occur when there is a deviation from a power working posture. Some examples of awkward postures typically include reaching behind, twisting, working overhead, and forward or backward bending.

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	

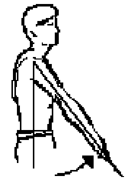
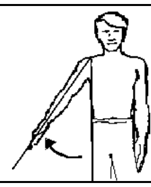
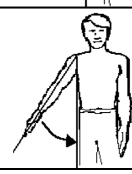
Please indicate whether the following direct risk factors were identified at the **NECK**.		
Direct Risk Factors	Repetition	☐Yes ☐No
	Static Posture	☐Yes ☐No
	Awkward Posture	☐Yes ☐No
In the **Injury Statistics** investigation, were there injury reports for the Neck or Head/Eye or Upper Back? (see Worksheet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



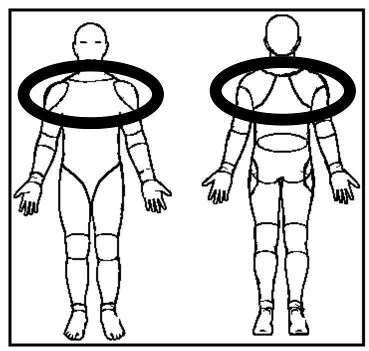
Body parts within the circled area will be classified as NECK issues.

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., shoveling debris into conveyor spools)			S O	
Ask the worker: Do you spend a large percentage of the day performing one action or task?			S O	
Static Posture				
Ask the worker: Do tasks require your shoulders to be maintained in a fixed or static posture?			S O	
Ask the worker: Do you hold parts, tools, or objects for long periods? (e.g., holding hand tools)			S O	

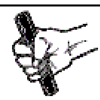
Awkward Posture		N	Y		Comments:
Flexion				S O	
Extension				S O	
Abduction				S O	
Adduction				S O	

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



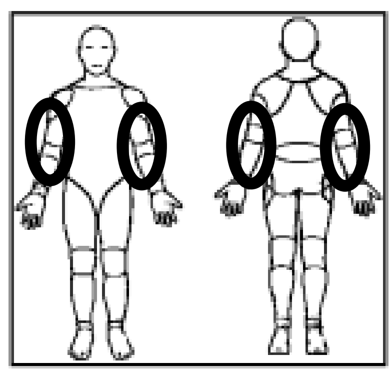
Body parts within the circled area will be classified as SHOULDER issues.

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? (e.g., lumber) 			S O	
Are objects handled in a hook grip? (e.g., bucket) 			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., shoveling debris into conveyor spools)			S O	
Ask the worker: Do you spend a large percentage of the day performing one action or task?			S O	

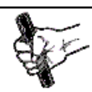
Static Posture	N	Y		Comments:
Ask the worker: Do tasks require your hand and arm to be maintained in a fixed or static posture?			S O	
Ask the worker: Do you apply constant pressure on controls/objects with your hand? (e.g., pressing push buttons for an extended period of time)			S O	
Ask the worker: Do you hold parts, tools, or objects for long periods?			S O	
Contact Stress				
Ask the worker: Do **<u>any</u>** objects, tools or parts of the workstation put pressure on **<u>any</u>** parts of your hand or arm, such as the backs or sides of fingers, palm or base of the hand, forearm, elbow? (e.g., 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	

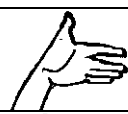
Please indicate whether the following direct risk factors were identified at the **ELBOW**.		
Direct Risk Factors	Force	☐Yes ☐No
	Repetition	☐Yes ☐No
	Static Posture	☐Yes ☐No
	Contact Stress	☐Yes ☐No
	Vibration	☐Yes ☐No
In the **Injury Statistics** investigation, were there injury reports for the Elbow 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



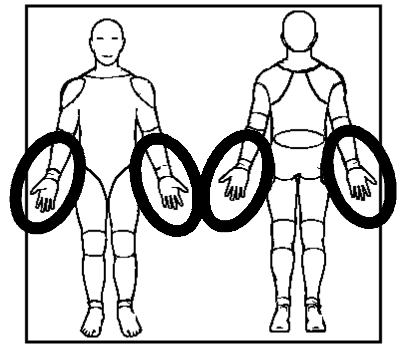
Body parts within the circled area will be classified as ELBOW issues.

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? (e.g., lumber) 			S O	
Are objects handled in a hook grip? (e.g., bucket) 			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., shovel debris into conveyor spools)			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 **<u>any</u>** objects, tools or parts of the workstation put pressure on **<u>any</u>** parts of your hand or arm, such as the backs or sides of fingers, palm or base of the hand, forearm? (e.g., hand tools that dig into the palm of the hand)			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	

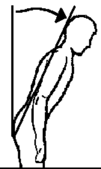
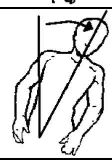
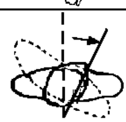
Please indicate whether the following direct risk factors were identified at the **WRIST/HAND**.		
Direct Risk Factors	Force	☐Yes ☐No
	Repetition	☐Yes ☐No
	Static Posture	☐Yes ☐No
	Contact Stress	☐Yes ☐No
	Awkward Posture	☐Yes ☐No
	Vibration	☐Yes ☐No
In the **Injury Statistics** investigation, were there 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



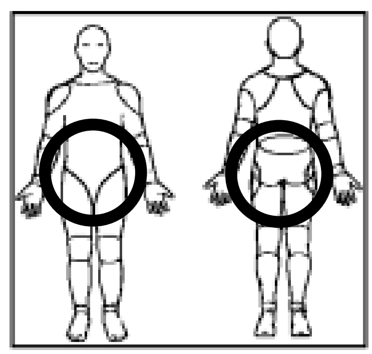
Body parts within the circled area will be classified as WRIST issues.

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

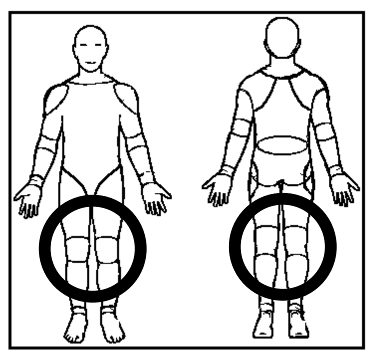


Body parts within the circled area will be classified as LOW BACK issues.

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?			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 **<u>any</u>** 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

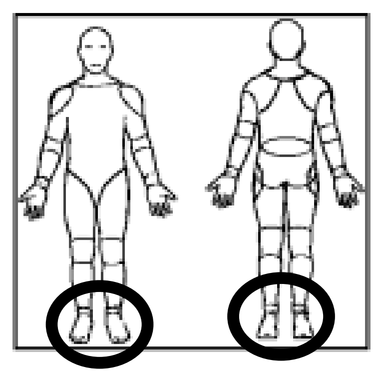


Body parts within the circled area will be classified as KNEE issues.

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?			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?			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?			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

Chipper Operator

This Work Manual contains information about the body parts found to be at risk of musculoskeletal injury (MSI) for a Chipper Operator (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.

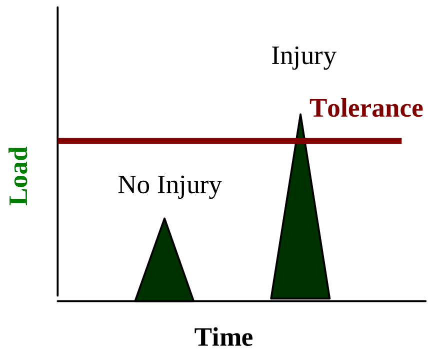
Work Manual

Chipper Operator

WM Table of Contents

Injury Education

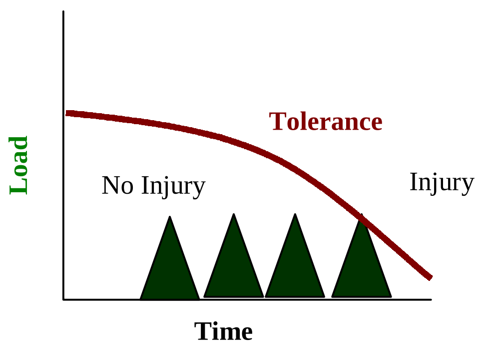
Injuries occur when …
Loads exceed tissue tolerances



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.

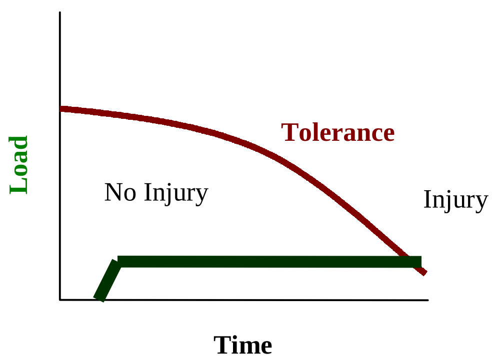
Example – a worker going over on their ankle and spraining it.



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 Chipper Operator 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 Chipper Operator. 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.

Direct Risk Factors:
Awkward Postures
Static Postures

NECK

A Chipper Operator may hold the neck in a forward position in order to monitor conveyors, change chipper knives, check chip quality, or move 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 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 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.

Environmental Conditions

Lighting

- Loading on the neck muscles is increased when the items or areas to be viewed have low lighting levels. 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 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 106 to 109.
- For exercises that can help to prevent ***neck*** injuries, see the ***Neck section of the Body Manual.***

Direct Risk Factors:
Awkward Postures
Static Postures

NECK

A Chipper Operator may hold the neck in a twisted position in order to view debris on the floor while using hand tools, such as shovels, hoes, brooms, and pitchforks. This position may also occur while monitoring and maintaining conveyor flow.

DIRECT RISK FACTORS

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.

Static Postures

- When the neck is held still in a twisted position, the muscles of the neck must remain tense. 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

Work Organisation

Task Variability

- Loading on the neck muscles is increased when the neck is held in a twisted position to view debris being moved from the floor to the conveyor spool.
- 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 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 106 to 109.
- For exercises that can help to prevent ***neck*** injuries, see the ***Neck section of the Body Manual.***

NECK

Direct Risk Factors:
Awkward Postures
Repetition

A Chipper Operator may repeatedly twist the neck to view video monitors or the flow of the vibrating 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

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.

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.

INDIRECT RISK FACTORS

Workstation Design

Additional Workstation Design Options

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

CONSEQUENCES

- When the head is twisted repeatedly, 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 106 to 109.
- For exercises that can help to prevent ***neck*** injuries, see the ***Neck section of the Body Manual.***

Direct Risk Factors:
Force
Repetition

NECK/SHOULDER

A Chipper Operator may repeatedly pull upward on pieces of debris in the vibrating conveyor (using hands or hand tools).

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 and/or greater the downward pulling force, the greater the load on the muscles and tendons.

Repetition

- 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.

INDIRECT RISK FACTORS

Workstation Design

Working Reaches

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

Working Heights

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

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 amount of debris within the conveyor and the position of the debris relative to other pieces will influence the force required.

CONSEQUENCES

- Forceful and repeated pulling on, and/or lifting of, waste lumber can lead to neck and/or shoulder strain.
- Signs and symptoms 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 pages 106 to 109.
- To help prevent ***neck*/*shoulder*** discomfort, see the upper trapezius stretch in the ***Neck section of the Body Manual.***

Direct Risk Factors:
Force
Awkward Postures
Repetition

SHOULDER

A Chipper Operator may push, pull, or manipulate debris by hand or with tools in order to prevent jam-ups, find pieces of metal, or 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 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.

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.

Repetition

- 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.

INDIRECT RISK FACTORS

Workstation Design

Working Reaches

- Loading on the rotator cuff muscles is increased the farther the arms must be 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 whenever the height at which debris is pulled, pushed, or manipulated does not allow the Chipper Operator to produce sufficient forces without the risk of injury.

CONSEQUENCES

- When using the arms to push, pull, or manipulate debris by hand or with tools, 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 106 to 109.
- For exercises that can help to prevent ***shoulder*** injuries, see the ***Shoulder section of the Body Manual.***

Direct Risk Factors:
Force
Repetition

ELBOW/WRIST

A Chipper Operator may grip pieces of debris in the vibrating conveyor.

A Chipper Operator grips hand tools in order to pull on pieces of debris in the vibrating conveyor.

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/wrist 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.

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 within the conveyor and the position of the debris relative to other pieces will influence the force required.

Container, Tool, and Equipment Handles

- Loading on the elbow/wrist is increased when tool handle sizes require greater levels of gripping force to use the tool effectively.

CONSEQUENCES

- Repeated forceful gripping may lead to fatigue at the tendon/bone connection near the elbow or irritation at the wrist.
- Signs and symptoms include pain in the elbow or 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 pages 106 to 109.
- For exercises that can help to prevent ***elbow*** injuries, see the ***Elbow section of the Body Manual.***

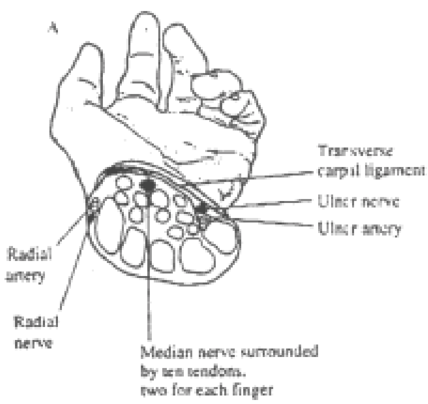
WRIST

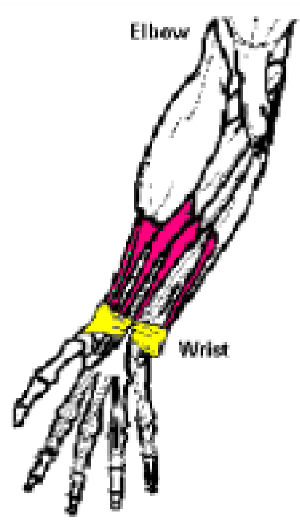
Direct Risk Factors:
Force
Awkward Postures
Repetition

A Chipper Operator may grip pieces of lumber with the wrist bent in order to move pieces in a vibrating 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 (see pictures below), which forms the roof of 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.

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.

Repetition

- 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.

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 106 to 109.

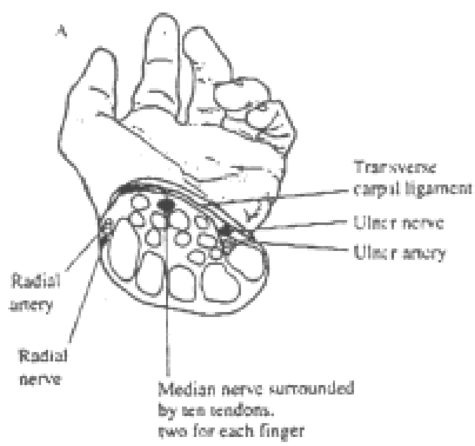
WRIST/HAND

Direct Risk Factors:
Vibration

A Chipper Operator may be exposed to hand/arm vibration when operating power hand tools, such as impact wrenches and chainsaws, or when hands are placed on vibrating debris within 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).



Direct Risk Factors

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.

Consequences

- Continual exposure to hand/arm vibration 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

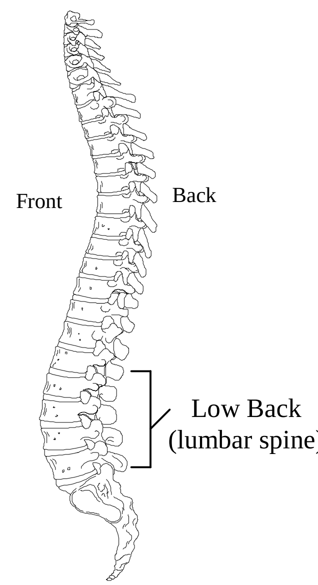
- For specific solutions that may prevent injuries to the Wrist/Hand, please see the column labelled “Wrist/Hand” in the Summary of Solutions pages 106 to 109.

LOW BACK

Direct Risk Factors:
Force
Awkward Postures
Repetition

A Chipper Operator may repeatedly bend the low back forward and/or to the side in order to move debris on the floor, move debris to find metal, and change chipper knives.

Neutral Spine



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.

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.

Awkward Postures

- 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.

Repetition

- 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.

INDIRECT RISK FACTORS

Workstation Design

Working Heights

- Loading on the back is increased as a Chipper Operator bends to pick up material from the floor or debris within a conveyor.

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 or to the side 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 106 to 109.
- For exercises that can help to prevent ***back*** injuries, see the ***Back section of the Body Manual.***

LOW BACK

Direct Risk Factors:
Force
Awkward Postures
Static Postures

A Chipper Operator may use hands to pull, push, and lift debris in the vibrating conveyor while bent forward and/or sideways.

A Chipper Operator may pull, push, and lift debris in the vibrating conveyor using hand tools while bent forward and/or sideways.

BACKGROUND INFORMATION

- The spine is designed to protect the spinal cord. The muscles surrounding the spine are designed to provide the support necessary to keep the spine in an upright position.

DIRECT RISK FACTORS

Force

- Pulling on debris within a vibrating conveyor requires back muscles to stabilise the spine. The greater the pull, the greater the tension developed in the muscles.
- If the force placed on the back muscles exceeds the tissue tolerances, injury may occur.

Awkward Postures

- 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.

Static Postures

- 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.

INDIRECT RISK FACTORS

Workstation Design

Working Reaches

- Loading on the low back is increased the further the item is manipulated beyond a comfortable reaching distance.

Working Heights

- Loading in the low back is increased when the item to be lifted is below waist level of a Chipper Operator.

CONSEQUENCES

- When the back is held in a forward posture, muscles and soft tissues 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 and stiffness. Muscle spasms may also occur.

SUGGESTED SOLUTIONS

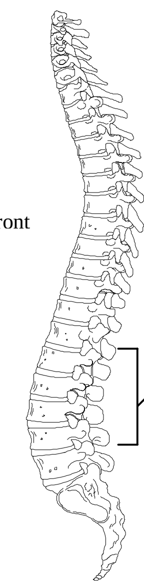
- For specific solutions that may prevent injuries to the Back, please see the column labelled "Back" in the Summary of Solutions on pages 106 to 109.
- For exercises that can help to prevent ***back*** injuries, see the ***Back section of the Body Manual.***

LOW BACK

Direct Risk Factors:
Force
Awkward Postures
Static Postures

A Chipper Operator may hold their arms away from the body in order to operate a tool (e.g., chainsaw) or manipulate a piece of debris.

Neutral Spine



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.

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.

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 still in a forward 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.

INDIRECT RISK FACTORS

Workstation Design

Working Reaches

- Loading on the low back is increased as a Chipper Operator reaches into the vibrating conveyor with the additional weight of the piece of debris or tool (e.g., chainsaw).

Working Heights

- Loading on the low back is increased whenever the working height is outside the range of waist to elbow height.

CONSEQUENCES

- Repeatedly forward bending 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

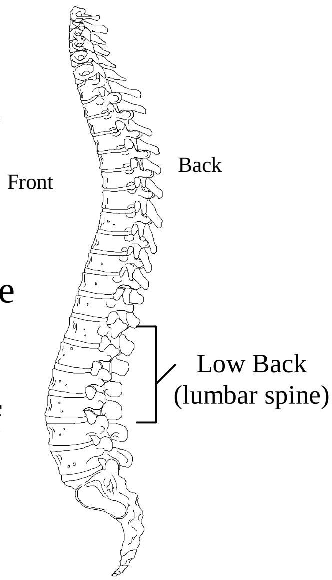
- For specific solutions that may prevent injuries to the Back, please see the column labelled “Back” in the Summary of Solutions on pages 106 to 109.
- For exercises that can help to prevent ***back*** injuries, see the ***Back section of the Body Manual.***

LOW BACK

Direct Risk Factors:
Awkward & Static Postures
Vibration

A Chipper Operator may continually sit on a vibrating surface.

Neutral Spine



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 & 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

- Loading on the low back is increased if a Chipper Operator's seat does not sufficiently damp vibration.

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 106 to 109.
- For exercises that can help to prevent ***back*** injuries, see the ***Back section of the Body Manual.***

Direct Risk Factors:
Static Postures
Vibration

FOOT

A Chipper Operator may stand on a hard, vibrating surface in order to monitor the vibrating 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 Chipper Operator 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 Chipper Operator 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 106 to 109.
- 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 Chipper Operator may hold the neck in a forward position in order to monitor conveyors, change chipper knives, check chip quality, or move debris on the floor.

- A Chipper Operator may hold the neck in a twisted position in order to view debris on the floor while using hand tools, such as shovels, hoes, brooms, and pitchforks. This position may also occur while monitoring and maintaining conveyor flow.

NECK/SHOULDER

- A Chipper Operator may repeatedly pull upward on pieces of debris in the vibrating conveyor (using hands or hand tools).

SHOULDER

- A Chipper Operator may push, pull, or manipulate debris by hand or with tools in order to prevent jam-ups, find pieces of metal, or move debris on the floor.

ELBOW/WRIST

- A Chipper Operator may grip pieces of debris in the vibrating conveyor.

- A Chipper Operator grips hand tools in order to pull on pieces of debris in the vibrating conveyor.

WRIST

- A Chipper Operator may grip pieces of lumber with wrist bent in order to move pieces in a vibrating conveyor.

WRIST/HAND

- A Chipper Operator may be exposed to hand/arm vibration when operating power hand tools, such as impact wrenches and chainsaws, or when hands are placed on vibrating debris within a vibrating conveyor.

LOW BACK

- A Chipper Operator may repeatedly bend the low back forward and/or to the side in order to move debris on the floor, move debris to find metal, and change chipper knives.

- A Chipper Operator may use hands to pull, push, and lift debris in the vibrating conveyor while bent forward and/or sideways.

- A Chipper Operator may pull, push, and lift debris in the vibrating conveyor using hand tools while bent forward and/or sideways.

- A Chipper Operator may hold their arms away from the body in order to operate a tool (e.g., chainsaw) or manipulate a piece of debris.

- A Chipper Operator may continually sit on a vibrating surface.

FOOT

- A Chipper Operator may stand on a hard, vibrating surface in order to monitor the vibrating 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	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	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	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦

***** *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.*
*** *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.*

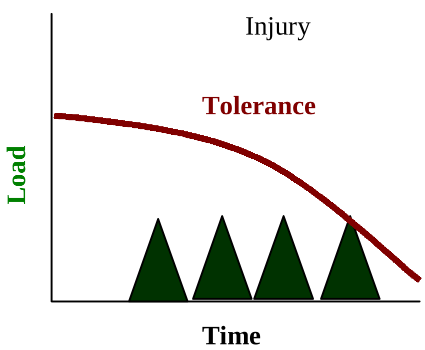
[ ] = Indicates that the risk factor was assessed and was not found to be a contributor to the body part problem.

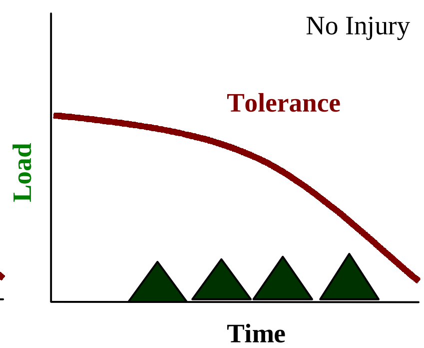
[♦] = Indicates that the risk factor assessed is commonly found in sawmills, and may need to be addressed at your mill. See the appropriate section of the General Risk Factor Solutions Manual for more information.

[✓] = Indicates that the risk factor was assessed as a contributor to the body part problem. Please see the Summary of Solutions Table on pages 106 to 109 for specific problem/solution information. Additional information on some risk factors can be found in the General Risk Factor Solutions Manual.

Injury Prevention

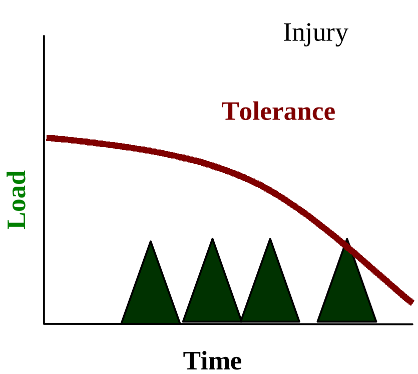
Injuries are prevented by …
Decreasing loads and increasing tissue tolerances

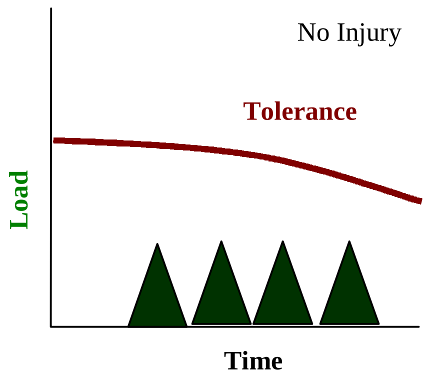




Injuries may be avoided by decreasing the size of the loads on the tissue.

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 Chipper Operator 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

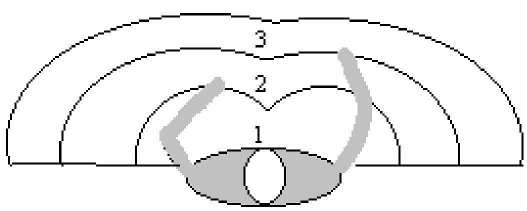
PERSONAL PROTECTIVE EQUIPMENT
These are devices worn by a worker to reduce the risk of injury, including gloves, kneepads, hearing protection, and leather aprons.

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 to the side, behind, or in front of the body may result in stressful neck/shoulder, shoulder, and low back postures. Ideally, working reaches should be within a normal reach envelope. Operators are able to generate greater amounts of force more safely when the arms are close to the body.



1 = Able to generate the most force
2 = Able to generate less force
3 = Able to generate the least force

For more specific recommendations on working reaches, please consult anthropometric tables or an ergonomist.

As part of the solution process, it is important to determine which pieces of wood debris are causing a majority of jam-ups. Many Chipper Operators commented that certain species and sizes of wood debris tended to jam-up the chipper or conveyor system more often. Therefore it is important to determine, with consultation with the operators, which items are more of a problem at your mill. If a particular species or size of wood debris causes a majority of the problems, some options include monitoring the flow of problem pieces through the system.

Alert operator

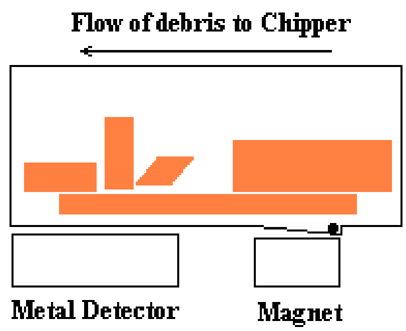
E
A
WP

Develop a system that alerts a Chipper 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 potentially fix a problem before a major one develops.

Collection of metal using magnets

E

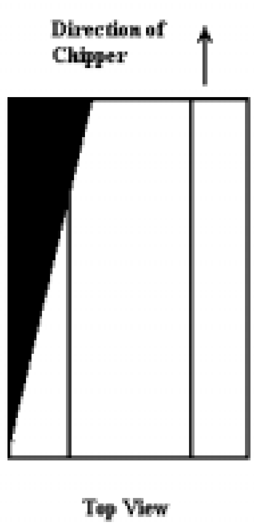
In order to reduce the number of times a Chipper Operator reaches into the metal detection area, some designs have a slight "pocketed" area below the bottom of the vibrating conveyor. A powerful magnet is placed before the metal detection area to collect the metal, and prevent small pieces from stopping the flow of wood debris to the chipper. Larger pieces of metal will still trip the metal detector and stop the system. When time permits, the small metal pieces are removed from the pocket.



Diagonal fin

E

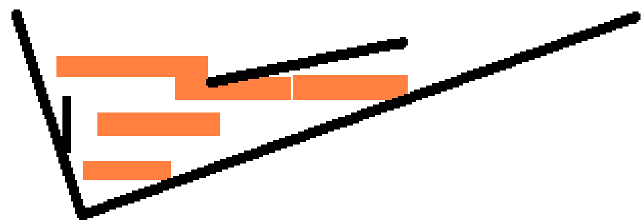
In order to minimise the frequency of manipulating or removing debris in the vibrating conveyor system, introduce a diagonal fin into the vibrating conveyor system as near to the chipper as possible. The intention of the fin is to tip all lumber into an appropriate orientation, relative to the chipper 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 can reduce the number of jam-ups in the vibrating conveyor system.



L-shaped chute

E

In order to minimise the frequency of manipulating debris in a vibrating 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 a 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 a vibrating conveyor system. This is partially due to the positioning of safety barrier systems, and the excessive reaching required. Removable safety barrier systems may allow Chipper Operators to adopt better positions when performing certain tasks. If this solution is implemented, safeties 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, a Chipper Operator can spend a considerable amount of time looking for metal within a vibrating 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.

E
WP

A **hand-held magnet** is most useful when a Chipper Operator has removed most of the large pieces of wood debris and can search through chips and sawdust at the bottom of the vibrating 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.

E
WP

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 vibrating 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.

To determine the appropriate heights specific for a Chipper Operator, identify the body part of most concern and if it is the:

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

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

Handling small pieces of debris

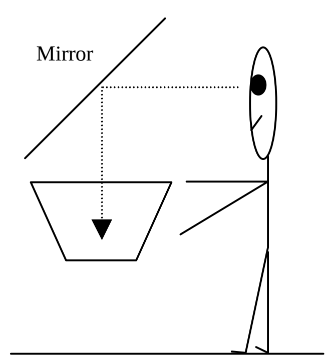
E WP

In order to reduce awkward and static postures of the low back, the working heights while manipulating small pieces of debris within a vibrating conveyor should be located between elbow and waist height. This may be accomplished by raising the height of the vibrating 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 vibrating conveyor flow, place an adjustable mirror above the vibrating conveyor system so that an operator may stand, sit, or use a sit/stand stool to view the contents comfortably. 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.

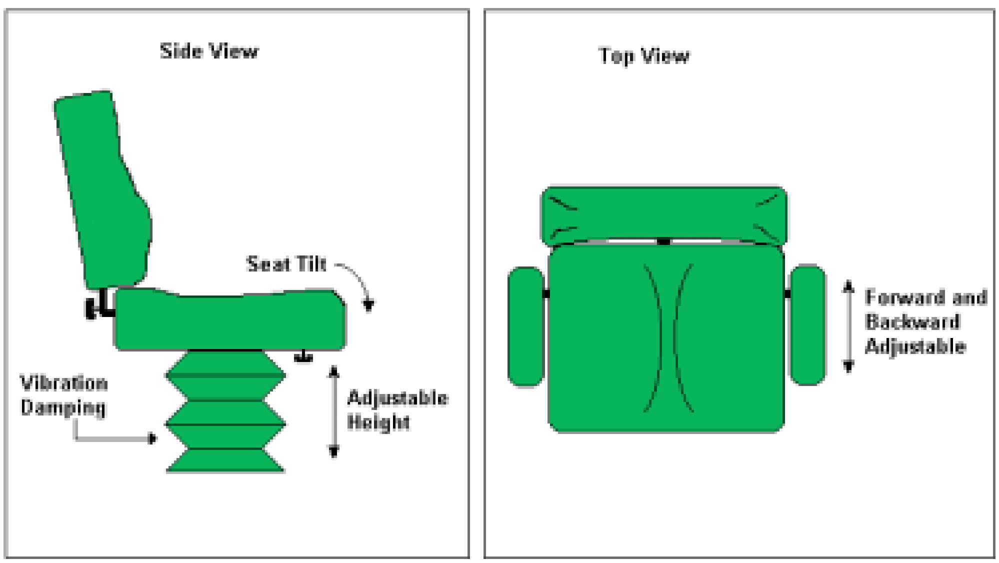
SEATING

Many Chipper Operators are required to sit when monitoring the flow of a vibrating conveyor. 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 a Chipper Operator does not maintain a neutral spine (see Injury Education for the Low Back on page 80).

Adjustable chairs

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. This type of seating will be more appropriate for a conveyor system that requires more monitoring than manipulation of debris.



- ★ 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 able to rotate to the left and right
- ★ Seats should be air-ride, or have vibration damping cushions
- ★ Seats should be covered with a breathable, non-slip material

Adjust lumbar support

WP

In order to reduce awkward postures of the low back, the lumbar support in the chair should be adjusted to maintain the curve in the low back while seated.

Encourage non-seated postures

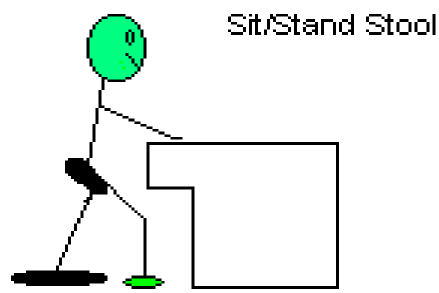
WP

In order to reduce awkward and static postures in the low back; encourage Chipper Operators to get up from the seated posture throughout the day. This 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.



FLOOR SURFACES

Anti-fatigue matting

E

In order to minimise fatigue and increase comfort in the lower extremities, anti-fatigue matting can be installed. The cushioned surface encourages continuous micro-movements of the feet, which minimises blood pooling in the feet and legs and the associated discomfort. The addition of anti-fatigue matting may also aid in damping vibration levels. Due to the nature of the work area, the anti-fatigue matting chosen should be easy to clean due to the amount of chips and sawdust that fall onto the floor.

Prevent snow/water accumulation

E

Prevent the accumulation of snow and water in the area where workers must stand.

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.

Cycle within the mill

E

In order to reduce the amount of walking, in environments in which it is safe to do so, cycle (tricycle or bicycle) to other vibrating conveyor systems that require monitoring or maintenance. A three-wheel cycle may be most appropriate since it requires less skill to ride and can be fitted with a basket at the back to carry tools. A rider should ride slowly, especially when turning, and must wear either a hard hat with a chinstrap or a cycling helmet. Cycling will encourage circulation, raise the heart rate, and remove the pressure of the body weight on the feet.

Video monitor placement

E

In order to reduce the frequency of neck twisting to view any video monitors, placement should be in a comfortable viewing position for a Chipper Operator. 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 see-through. Consider monitor placement based on the working position of the Chipper Operator 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. Some Chipper Operators indicated that 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, Chipper Operators 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

Characteristics of Objects Being Handled

SIZE AND SHAPE

Hoists

E WP	A hoist may be useful to reduce the force and awkward postures on the neck/shoulder and low back and also with forceful, repeated gripping when lifting large pieces of debris from within a vibrating 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

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

Increase hand tool/glove friction

E WP	In order to reduce the grip force on hand tools, increase the friction between the tool handles and gloves. Due to the smooth, slippery surface of metal or wooden tool handles (e.g., pike pole, picaroon, etc.) a Chipper Operator must use a higher grip force in order to maintain control of a 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 glove, and thus decrease the grip forces required.

Sticky palm gloves

PPE In order to reduce grip forces required by a Chipper Operator, the operator should wear 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.

WP Regardless of hand tool used:

- 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

Lighting

E

In order to minimise the number of times a Chipper Operator 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.

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

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
Alert operator	**93**		**F,R**	**F,R,A**				**F,R,A,S**				
Collection of metal using magnets	**94**		**F,R**	**F,R,A**				**F,R,A,S**				
Diagonal fin	**94**		**F,R**	**F,R,A**				**F,R,A,S**				
L-shaped chute	**95**		**F,R**	**F,R,A**				**F,R,A,S**				
Padding on sides	**95**								**C**			
Removable safety barrier	**95**		**F,A,S**	**F,R,A**				**F,A,S**				
Modify safety barrier	**95**		**F,A,S**	**F,R,A**				**F,A,S**				
Decrease metal in system during production	**96**			**F,R,A**				**F,R,A,S**				
Maintain chainsaws	**96**							**F,S**				
Hand-held magnet	**96**							**F,A,S**				
Metal detector wand	**96**							**F,A,S**				
Handling small pieces of debris	**97**							**F,A,R**				

Direct Risk Factors

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

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
Mirror	**97**	**A,S**										
Increase neck tissue tolerances	**98**	**A,S**										
Spot vacuum system	**98**							**F,R,A**				
Adjustable chairs	**99**	**A,S**						**A,S,V**				
Adjust lumbar support	**99**							**A,S**				
Encourage non-seated postures	**100**							**A,S**				
Sit/stand stool	**100**	**A,S**						**A,S**				
Anti-fatigue matting	**100**											**S,V**
Prevent snow/water accumulation	**100**											**S**
Conveyor seals	**101**	**A,S**				**F,R**		**F,R,A,S**				
Cycle within the mill	**101**											**S**

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		Injury Prevention Potential										
SOLUTIONS	**Page**	Neck	Neck/ Shoulder	Shoulder	Elbow/Wrist	Wrist	Wrist/ Hand	Low Back	Hip	Knee	Ankle	Foot
Video monitor placement	**101**	**R,A,S**										
Video monitor quality	**101**	**R**										
Computer representation	**102**	**R**										
Minimise lifting distance	**102**							**F,R,A**				
Hoists	**103**		**F,R**		**F,R**	**F,R,A**		**F,R,A,S**				
Reduce hand tool weight	**103**							**F,A**				
Use Front End Loader or Ramrod	**103**	**A,S**				**F,R**		**F,R,A,S**				
Increase hand tool/glove friction	**103**				**F,R**	**F,R,A**						
Sticky palm gloves	**104**				**F,R**	**F,R,A**						
Hand tool use	**104**							**F,R,A**				

Direct Risk Factors

F = *Force*
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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
Heat Exposure	◆	indirectly reduces risk of injury to the body										
Cold Exposure	◆	indirectly reduces risk of injury to the body										
Lighting	105,◆	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	105,◆	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*

CHIPPER OPERATOR MSI SAFETY GUIDE

OBJECTIVE: To identify ergonomic risks involved in operating a chipper and conveyor system, and to reduce the potential for musculoskeletal injuries. More detailed information about risk reducing recommendations can be found in the Work Manual for the Chipper Operator.

CHECK IF THIS APPLIES	ACTIVITY OF RISK	DIRECT RISK FACTOR(S)	POTENTIAL HAZARDS	SUGGESTED SOLUTIONS
	Neck A Chipper Operator may hold the neck in a forward position in order to monitor conveyors, change chipper knives, check chip quality, or move 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. • Use the eyes and the neck (not just the neck) to monitor a conveyor. • Adjust 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 Chipper Operator may hold the neck in a twisted position in order to view debris on the floor while using hand tools, such as shovels, hoes, brooms, and pitchforks. This position may also occur while monitoring and maintaining conveyor flow.	**Awkward Postures** **Static 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. • When the neck is held still in a twisted position, the muscles of the neck must remain tense. 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, neutral position or return to this position as often as possible. • Use the eyes and the neck (not just the neck) to view the conveyor. • Orient the body toward the viewing area. • Try to vary neck postures by returning to the neutral position as much as possible. • For exercises and stretches that can help prevent ***neck*** injuries, ***see the Neck section of the Body Manual***.
	A Chipper Operator may repeatedly twist the neck to view video monitors or the flow of the vibrating conveyors.	**Awkward Postures** **Repetition**	• 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 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.	• 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 Chipper Operator may repeatedly pull upward on pieces of debris in the vibrating conveyor (using hands or hand tools).	**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***.

CHECK IF THIS APPLIES	ACTIVITY OF RISK	DIRECT RISK FACTOR(S)	POTENTIAL HAZARDS	SUGGESTED SOLUTIONS
	Shoulder A Chipper Operator may push, pull, or manipulate debris by hand or with tools in order to prevent jam-ups, find pieces of metal, or move debris on the floor.	**Force** **Awkward Postures** **Repetition**	• 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. • 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. • 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.	• 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 Chipper Operator may grip pieces of debris in the vibrating conveyor. A Chipper Operator grips hand tools in order to pull on pieces of debris in the vibrating conveyor.	**Force** **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. • 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 Chipper Operator may grip pieces of lumber with the wrist bent in order to move pieces in a vibrating conveyor.	**Force** **Awkward Postures** **Repetition**	• 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. • 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. • 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.	• 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 Chipper Operator may be exposed to hand/arm vibration when operating power hand tools, such as impact wrenches and chainsaws, or when hands are placed on vibrating debris within a vibrating conveyor.	**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.	• 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 Chipper Operator may repeatedly bend the low back forward and/or to the side in order to move debris on the floor, move debris to find metal, and change chipper knives.	**Force** **Awkward Postures** **Repetition**	• 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. • 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. • 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.	• 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. • 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 Chipper Operator may use hands to pull, push, and lift debris in the vibrating conveyor while bent forward and/or sideways. A Chipper Operator may pull, push, and lift debris in the vibrating conveyor using hand tools while bent forward and/or sideways.	**Force** **Awkward Postures** **Static Postures**	• Pulling on debris within a vibrating conveyor requires back muscles to stabilise the spine. The greater the pull, the greater the tension developed in the muscles. • If the force placed on the back muscles exceeds the tissue tolerances, injury may occur. • 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). • When pushing, pulling, or lifting, get as close to the object as possible. • Lower the body by slightly squatting at the knees rather than bending at the back. • 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 Chipper Operator may hold their arms away from the body in order to operate a tool (e.g., chainsaw) or manipulate a piece of debris.	**Force** **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. • 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. • When the back is held still in a forward 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). • Keep arms and the object being held as close to the body as possible. • 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 Chipper Operator 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
	Foot A Chipper Operator may stand on a hard, vibrating surface in order to monitor the vibrating 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***.