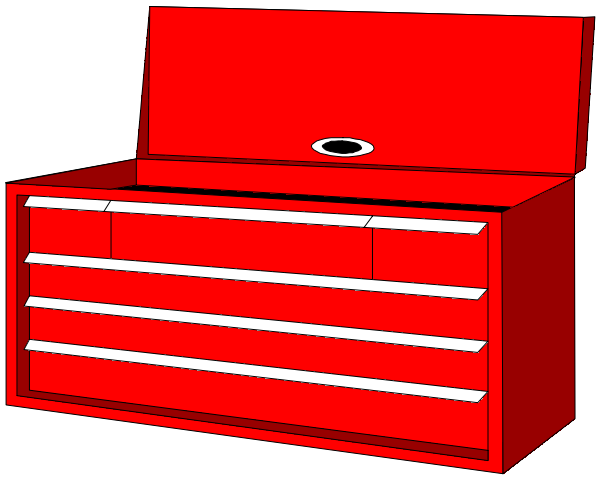
Industrial Musculoskeletal Injury Reduction Program

Common Industry Jobs (CIJs)

Clean-up 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

CLEAN-UP TOOL KIT
Table of Contents

Overview
Clean-up

Job Summary

Clean-up persons are responsible for maintaining a clean mill. They accomplish this job by picking-up large debris, air hosing machinery, sweeping and shovelling debris, and sometimes operating mobile equipment like bobcats or ramrods, and bucking-up logs or boards. Refer to the Physical Demands Analysis for more details.

Physical Demands

The physical demands of this job may include:

a) Repetitive neck flexion when picking up debris, shovelling, and sweeping
b) Repetitive back bending when picking up debris, and shovelling
c) Repetitive kneeling and squatting when picking up debris, and sweeping under equipment
d) Repetitive gripping of objects like boards, and tools

Mental Demands

Workers operating mobile equipment require good hand-eye co-ordination.

Major Variations

Depending on the mill, the following major variations may be found:

1) Basement clean-up methods vary by the layout of the workplace:
   a) Some mills use brooms to sweep debris onto floor chains
   b) Other mills use ramrods to lift debris piles onto conveyors
   c) Other mills use shovels to lift debris onto conveyors

2) Other major variations include:
   a) Order of tasks depends on worker's preferences
   b) Working postures vary by area and the type of equipment being cleaned
   c) Task duration varies by area and the type of equipment being cleaned

Minor Variations

Depending on the mill, the following minor variations may be found:

a) Work pace depends on the size of the area to be cleaned and the amount of debris
b) The amount of back bending depends on the lengths of tool handles

Physical Demands Analysis
Clean - up

PDA General Instructions: Clean - up

This Physical Demands Analysis (PDA) identifies the physical demands of the Clean-up job as assessed by IMIRP ergonomists. The information reported was collected from a sample of Clean-up jobs 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 Clean-up 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
Clean-up

Task List

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

Picks up large debris

A Clean-up worker usually starts by picking-up large debris. For large debris like logs, workers use an overhead crane.

Does this task occur at your mill?

☐ Yes ☐ No

For medium size debris like large boards, workers use their hands.

Does this task occur at your mill?

☐ Yes ☐ No

For smaller debris like small pieces of boards, workers may use pike poles to lift the debris off the ground.

Does this task occur at your mill?

☐ Yes ☐ No

Air hoses small debris

A Clean-up worker may use an air lance to blow smaller debris like saw dust off machines and equipment.

Does this task occur at your mill?

☐ Yes ☐ No

Collects small debris

A Clean-up worker may use a broom, shovel or rake to push the debris through floor openings and collect debris in the basement.

Does this task occur at your mill?

☐ Yes ☐ No

Cleans the basement

A Clean-up worker may also be responsible for picking up debris in the basement. Some workplaces use a piece of equipment called a ramrod to pick up debris and load it onto conveyor belts.

Does this task occur at your mill?

☐ Yes ☐ No

Some workplaces use shovels and brooms to clean the basement.

Does this task occur at your mill?

☐ Yes ☐ No

Others may sweep debris onto floor chains that transport debris away from the basement.

Does this task occur at your mill?

☐ Yes ☐ No

Other Task

Bucks-up logs and boards

A Clean-up worker may use a chain saw or circular saw to cut-up debris into smaller pieces.

Does this task occur at your mill?

☐ Yes ☐ No

Operates bobcat

A Clean-up worker may use a bobcat to pick up debris outside like broken sticks.

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 Clean-up.

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

Note the corresponding values for the percentage of the shift spent performing the task (Percent of Shift) as 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%	
	Picks up large debris		✓			• *Time ranges from 20 minutes to 2 hours.*
	Air hoses small debris		✓			• *Time ranges from 20 minutes to 2 hours on an intermittent basis.*
	Collects small debris		✓			
	Cleans the basement		✓		✓	• *Some workplaces have people dedicated to cleaning the basement for the entire 8 hour shift.*
	Bucks up logs and boards	✓				• *Time ranges vary depending on the amount of wood to be cut.*
	Operates bobcat	✓				• *Only occurs at some places.*
	Other:					

Organisational Factors

The table below contains a list of organisational factors for a Clean-up. 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* ☐
Formal breaks	☐ *30 minute lunch, Two 15 minute breaks* ☐
Informal breaks	☐ *Yes* ☐
Work pace	☐ *Depends on area and amount of cleaning to be done* ☐
Work pace control	☐ *Self paced* ☐
Job rotation ☐ Yes *(Check one)* ☐ No	If **Yes:** Rotation with what job(s):_____ _____ How often: (e.g., every 2 hours)_____

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, which 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 ☐ Industrial ☐ In-house Design Height of seat: _____cm Depth of seat: _____cm Width of seat: _____cm
	Check all that apply ☐ Armrests ☐ Backrest ☐ Swivel Seat ☐ Slide track ☐ Castors #_____ ☐ Lumbar support ☐ Foot rest 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 Clean-up worker.

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

Indicate their corresponding functions by checking off the applicable box(es). The Comments section may contain information that describes variations between mills.

	Type of Control	Function	Frequency	Comments
	Levers on ramrod	☐ *Ramrod movements* ☐ *Bucket controls (up and down)*	☐ *100% when using ramrod* ☐ *60% when using ramrod* ☐	
	Levers on bobcat	☐ *Bobcat movements* ☐ *Bucket controls*	☐ *100% when using bobcat* ☐ *60% when using bobcat* ☐	
	Thumb activated switch on air hose	☐ *Open air ways*	☐ *100% when blowing down debris* ☐	
	Other:			

Physical Demands

Whole Body Physical Demands

Identify each of the physical demands required by a Clean-up worker, by placing a check mark (✓) in the far left column.

The Comments section may contain information relating to duration, frequencies and other variations in the physical demands.

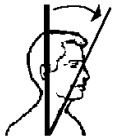
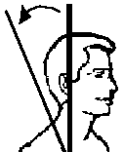
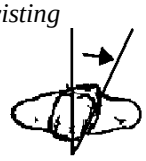
	Physical Demands	Tasks or Activity	Percent of Shift				Comments
			Rarely 0 to 5%	Occasionally 6 to 33%	Frequently 34 to 66%	Constantly 67 to 100%	
	Walking	• *Sweeping* • *Picking-up debris* • *Air hosing.*			✓		• *Workers are constantly walking.*
	Sitting	• *Operating ramrod* • *Operating bobcat*		✓			• *Some workplaces have workers who are dedicated to operating ramrods.*
	Climbing Stairs	• *Air hosing* • *Picking-up debris*	✓				
	Climbing (over equipment)	• *Air hosing* • *Picking-up debris*		✓			
	Balancing	• *Air hosing*	✓				• *Some balancing on equipment during clean-up duties may be necessary.*
	Kneeling/ Crouching	• *Air hosing* • *Picking-up debris* • *Shovelling and sweeping*		✓			
	Other:						

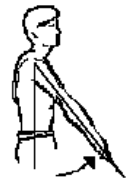
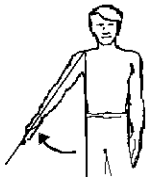
Body Postures

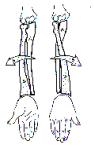
The table below outlines the body postures held or repeated throughout the shift by a Clean-up worker.

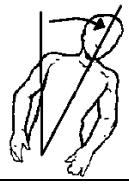
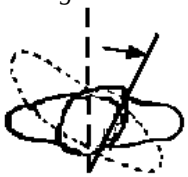
For each of the postures identified, indicate whether it occurs by placing a check mark (✓) in the far left column.

The Comments section may contain information relating to duration, frequencies, and other variations in posture.

	Body Posture	Task(s)	Percent of Shift				Comments
			Rarely 0 to 5%	Occasionally 6 to 33%	Frequently 34 to 66%	Constantly 67 to 100%	
Neck							
	Flexion 	• *Picking-up debris* • *Shovelling, and sweeping when collecting debris* • *Shovelling and sweeping when cleaning basements*			✓		
	Extension 	• *Looking-up while under equipment when picking up debris* • *Looking-up while under equipment when shovelling and sweeping.*		✓			
	Twisting 						

Body Posture		Task(s)	Percent of Shift				Comments
			Rarely 0 to 5%	Occasionally 6 to 33%	Frequently 34 to 66%	Constantly 67 to 100%	
Shoulder							
	Flexion 	• *Air hosing* • *Shovelling when collecting debris* • *Shovelling when cleaning the basement*		✓			
	Abduction 	• *Shovelling debris.*		✓			
	Extension 	• *Shovelling and sweeping when collecting debris.*		✓			

Body Posture		Task(s)	Percent of Shift				Comments
			Rarely 0 to 5%	Occasionally 6 to 33%	Frequently 34 to 66%	Constantly 67 to 100%	
Forearm							
	Rotation 	• *Shovelling debris*		✓			
Wrist							
	Flexion 	• *Shovelling debris*		✓			
	Extension 	• *Crawling*	✓				
	Ulnar Deviation 	• *Using a pike pole when picking-up debris* • *Shovelling when collecting debris and cleaning the basement* • *Sweeping when collecting debris and cleaning the basement.*		✓			• *The duration of ulnar deviation depends on the amount of shovelling, sweeping, and use of pike pole. This will vary between places.*
	Radial Deviation 						*Not Applicable*

Body Posture		Task(s)	Percent of Shift				Comments
			Rarely 0 to 5%	Occasionally 6 to 33%	Frequently 34 to 66%	Constantly 67 to 100%	
Back							
	Flexion 	• *Picking-up debris off the floor and under equipment.* • *Shovelling and sweeping when collecting debris.*		✓			• *Depending on the area, some workers will spend more time bent over.*
	Lateral Flexion 	• *Shovelling and sweeping debris.*		✓			
	Twisting 	• *Picking-up debris under equipment.* • *Shovelling and sweeping when collecting debris.*		✓			• *Depending on the area, some workers will spend more time twisted*
	Extension 						
Other:							

Hand Grips

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

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.

The Comments section may contain information relating to duration, frequencies, hand used, etc.

	Type	Task(s)	Percent of Shift				Comments
			Rarely 0 to 5%	Occasionally 6 to 33%	Frequently 34 to 66%	Constantly 67 to 100%	
	Power 	• *Using broom, pike pole, shovel, air hose, chain saw and circular saw.*			✓		
	Pinch 	• *Picking up debris*		✓			
	Hook 						*Not Applicable*
	Precision 						*Not Applicable*
	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 Clean-up worker.

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).

The Comments section may contain information relating to duration, frequencies, and details regarding characteristics of the object handled.

	Task Description	Weight (kg)	Percent of Shift				Comments
			Rarely 0 to 5%	Occasionally 6 to 33%	Frequently 34 to 66%	Constantly 67 to 100%	
	Pushing a broom when collecting debris	*5(estimated)*		✓			
	Pulling a rake to collect debris	*1 –10 (estimated)*		✓			• *Weight depends on the amount of debris.*
	Lifting large debris by hand	*Varies*		✓			• *Weight varies from large to small pieces of wood.*
	Carrying air hose to blown down small debris	*1*		✓			• *Distances carried depend on area being cleaned.*
	Other:						

Hand Tools

Indicate the hand tools used by a Clean-up worker 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.

The Comments section may contain information relating to duration and frequencies of use.

	Type of Tool	Task(s)	Weight of Tool (kg)	Percent of Shift				Comments
				Rarely 0 to 5%	Occasionally 6 to 33%	Frequently 34 to 66%	Constantly 67 to 100%	
	Pike pole	• *Picking-up debris*	*1-2*		✓			
	Broom	• *Collecting debris*	*0.5*		✓			
	Shovel	• *Collecting debris and cleaning the basement*	*1-2*		✓			
	Air hose	• *Air hosing small debris*	*1*		✓			
	Pitch fork	• *Collecting debris*	*1-2*	✓				• *Some workers prefer to use the pitchfork over the shovel in some areas.*
	Chain saw	• *Bucking-up logs*	*15 est.*	✓				
	Circular saw	• *Bucking-up boards*	*4.8*	✓				
	Other							

Environmental Conditions

Work Environment

The table below contains a list of environmental conditions that may be of concern at the Clean-up 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 Clean-up job. 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	*Range found: 76.7 - 85.6 dB* *Mill specific:*
Lighting level	*Range found: 1.4 lux – 411 lux* *Mill specific:*
Other:	

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 Clean-up 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

1. Type of Wood Handled

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

2. Size of Wood*

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

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

* Conservative estimates of actual wood dimensions

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

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

3. Length of Wood

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

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

4. Weight of Wood Equation*

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

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

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

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

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

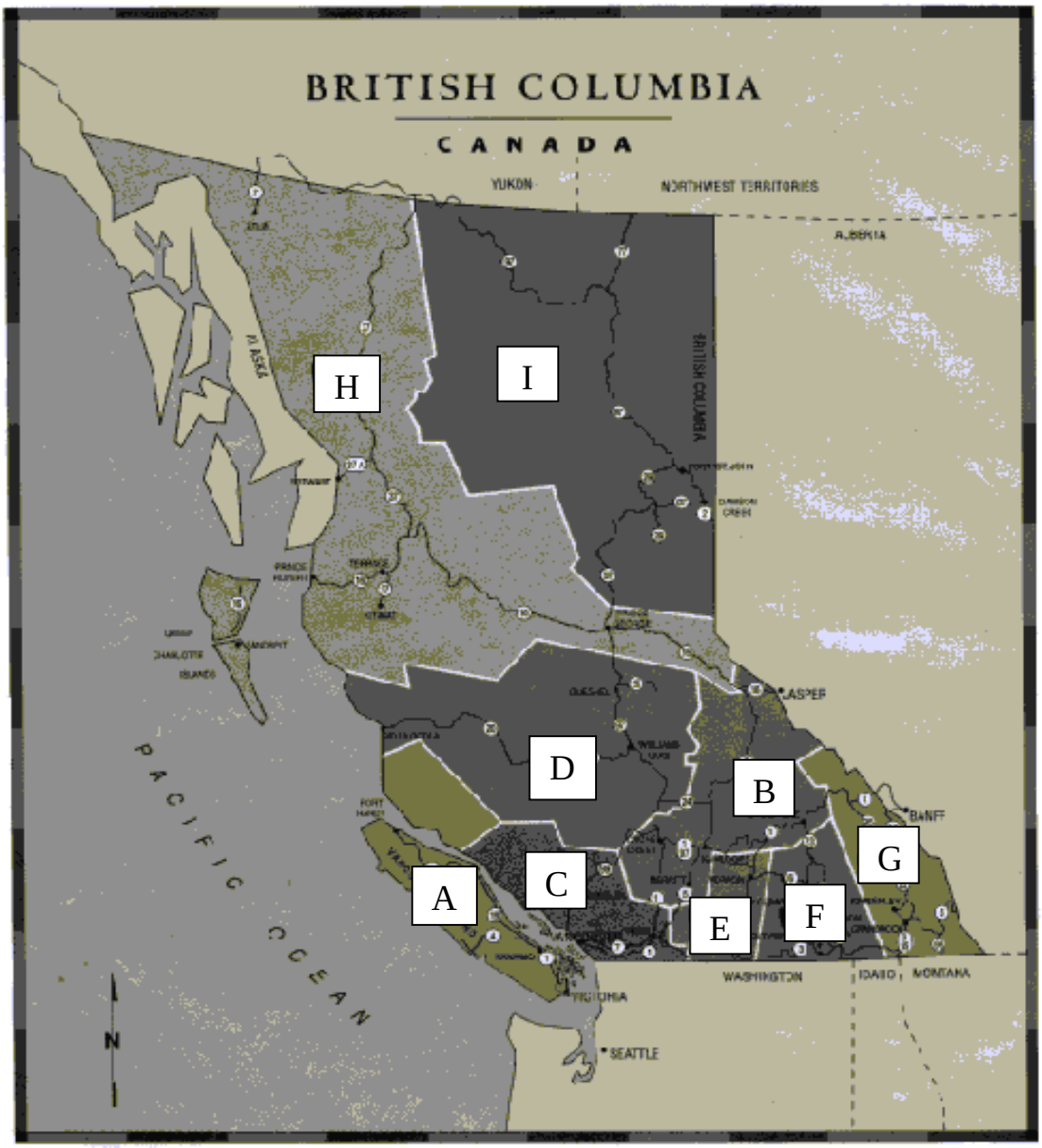
For the lightest species handled, enter the lb./board foot value, the multiple for the smallest size of wood, and the shortest length of this wood. Multiply these values together to determine the weight of the board in pounds.

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

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

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

Appendix B – Regional Map



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

Risk Factor Identification Checklist
Clean-up

Purpose

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

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

Instructions

General

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

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

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

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

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

Summary Tables

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

Risk Factor Identification Checklist – Clean-up

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.

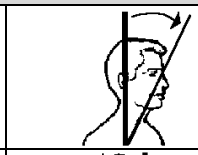
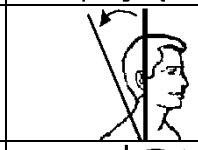
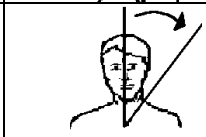
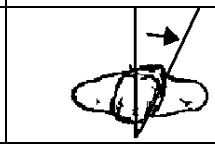
Static Postures: Static loading (sustained exertions) is physical effort (body postures) that is held, requiring muscle contraction for more than a short time.

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.

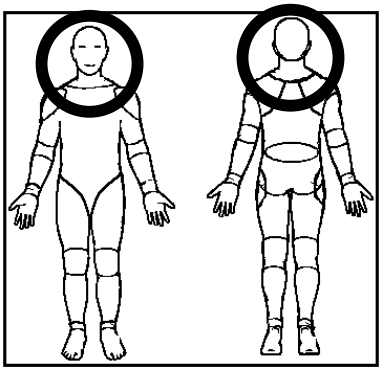
Awkward Postures: Awkward postures occur when there is a deviation from a power working posture. Some examples of awkward postures typically include reaching behind, twisting, working overhead, and forward or backward bending.

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 down and up)			S O	
Ask the worker: Do you spend a large percentage of the day performing one action or task? (e.g., picking-up debris, sweeping, shoveling)			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 for prolong periods)			S O	
Awkward Posture				
Flexion 			S O	
Extension 			S O	
Lateral Bending 			S O	
Rotation 			S O	

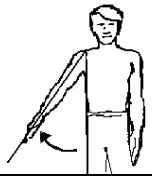
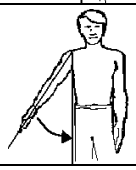
Please indicate whether the following direct risk factors were identified at the **NECK**.		
Direct Risk Factors	Repetition	☐Yes ☐No
	Static Posture	☐Yes ☐No
	Awkward Posture	☐Yes ☐No
In the **Injury Statistics** investigation, were there injury reports for the Neck or Head/Eye or Upper Back? (see Worksheet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



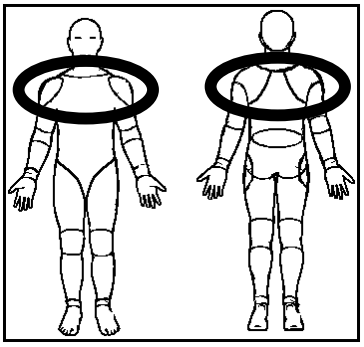
Body parts within the circled area will be classified as NECK issues.

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 chips)			S O	
Ask the worker: Do you spend a large percentage of the day performing one action or task? (e.g., picking-up debris, sweeping, shoveling)			S O	
Static Posture				
Ask the worker: Do tasks require your shoulders to be maintained in a fixed or static posture? (e.g., holding an air hose)			S O	
Ask the worker: Do you hold parts, tools, or objects for long periods? (e.g., broom)			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



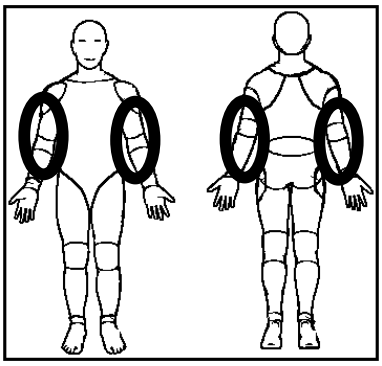
Body parts within the circled area will be classified as SHOULDER issues.

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., paint can) 			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 chips)			S O	
Ask the worker: Do you spend a large percentage of the day performing one action or task? (e.g., picking-up debris, sweeping, shoveling)			S O	

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



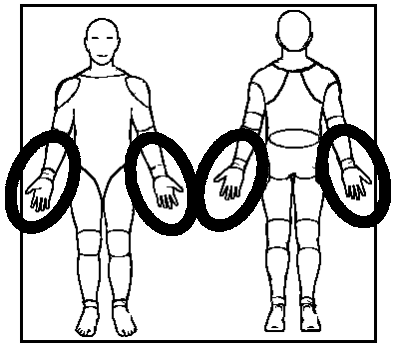
Body parts within the circled area will be classified as ELBOW issues.

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 pole) 			S O	
Are objects handled in a pinch grip? (e.g., lumber) 			S O	
Are objects handled in a hook grip? (e.g., paint can) 			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 chips)			S O	
Ask the worker: Do you spend a large percentage of the day performing one action or task? (e.g., picking-up debris, sweeping, shoveling)			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? (e.g., pike pole)				S O	
Contact Stress					
Ask the worker: Do **any** objects, tools or parts of the workstation put pressure on **any** parts of your hand or arm, such as the backs or sides of fingers, palm or base of the hand, forearm? (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?				S O	

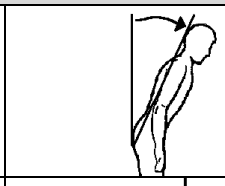
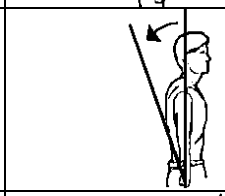
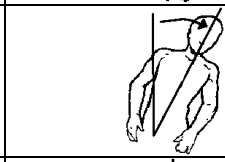
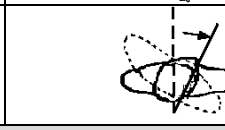
Please indicate whether the following direct risk factors were identified at the **WRIST/HAND**.		
Direct Risk Factors	Force	☐Yes ☐No
	Repetition	☐Yes ☐No
	Static Posture	☐Yes ☐No
	Contact Stress	☐Yes ☐No
	Awkward Posture	☐Yes ☐No
	Vibration	☐Yes ☐No
In the **Injury Statistics** investigation, were there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



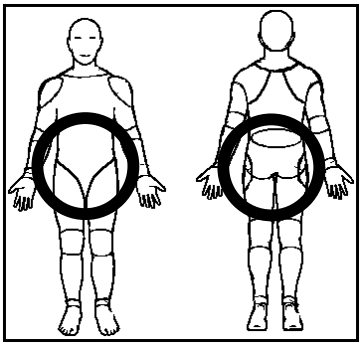
Body parts within the circled area will be classified as WRIST issues.

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? (e.g., shoveling chips)			S O	
Ask the worker: Do you spend a large percentage of the day performing one action or task? (e.g., picking-up debris, sweeping, shoveling)			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., bending forward continuously to pick-up debris)			S O	
Are workers required to sit or stand in a stationary position for long periods of time during the shift?			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., workstation that digs into the hip or thigh)			S O	

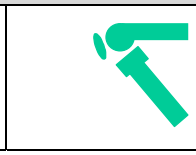
Awkward Posture		N	Y		Comments:
Flexion				S O	
Extension				S O	
Lateral Bending				S O	
Twisting				S O	
Vibration					
Ask the worker: Is your whole body exposed to vibration for significant portions of the work shift? (e.g., standing on vibrating surface)				S O	

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

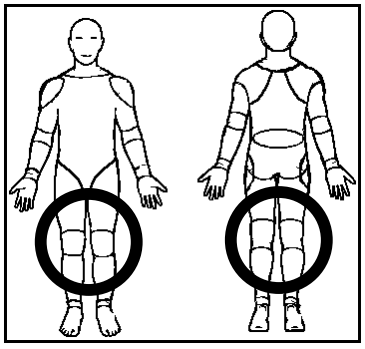


Body parts within the circled area will be classified as LOW BACK issues.

KNEE

Repetition	N	Y		Comments:
Are identical or similar motions performed over and over again? (e.g., climbing stairs)			S O	
Static Posture				
Ask the worker: Do tasks require you to maintain your knee(s) in a fixed or static posture? (e.g., kneeling)			S O	
Are workers required to sit or stand in a stationary position for long periods of time during the shift?			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 hard surfaces)			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

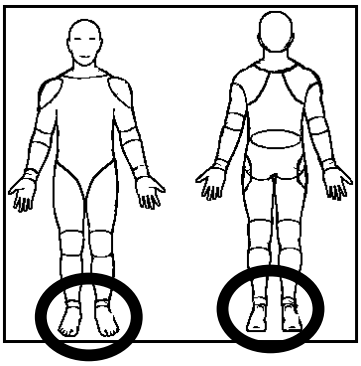


Body parts within the circled area will be classified as KNEE issues.

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?			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., operating mobile equipment)			S O	

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



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

CHARACTERISTICS OF OBJECTS BEING HANDLED

	N	Y		Comments:
Are there problems handling a load due to its size or shape? (e.g., ladder)			S O	
Are there problems handling a load due to its fragile, unbalanced, or non-rigid conditions? (e.g., broken pieces of lumber)			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., hoist)			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]

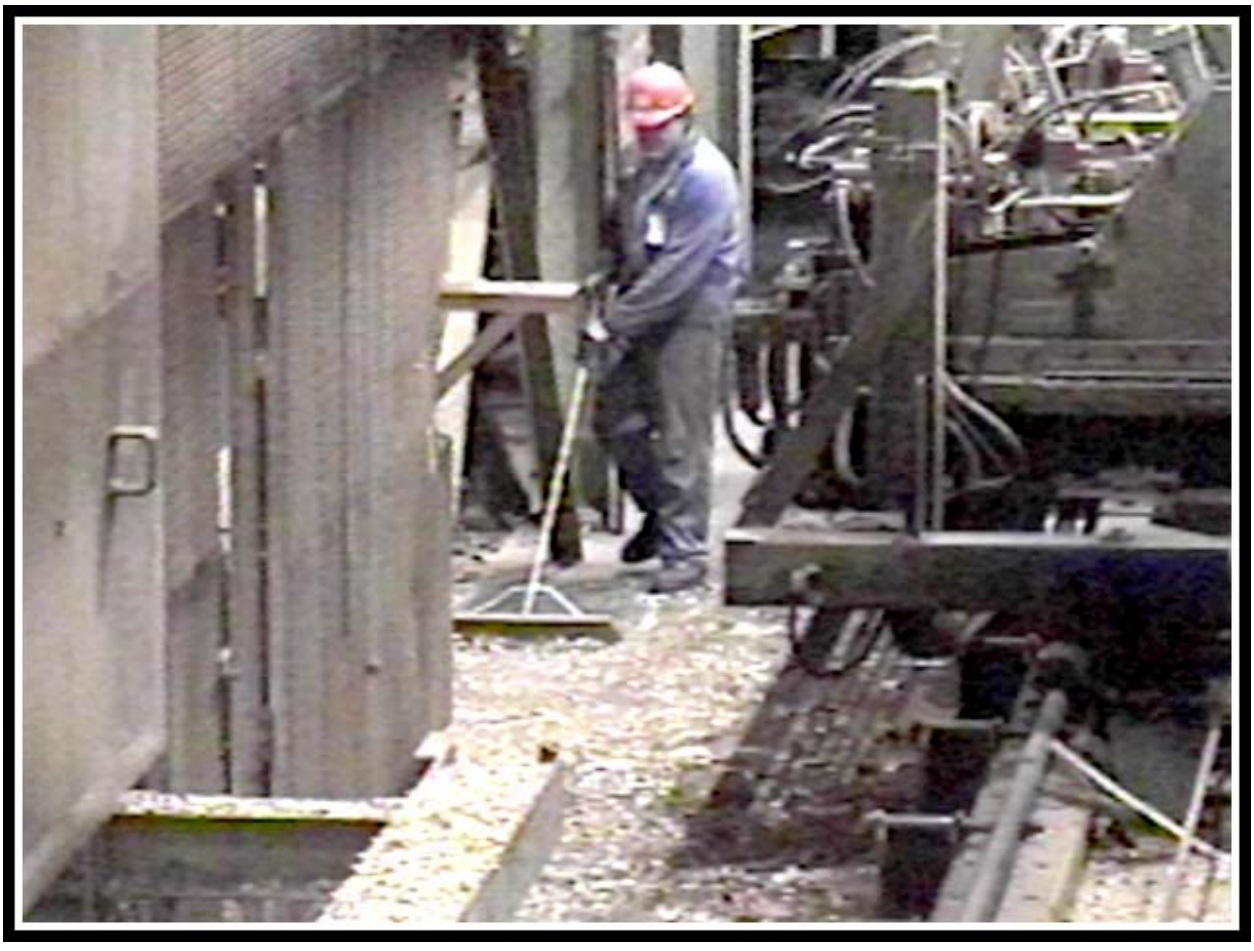
Noise	N	Y		Comments:
Have there been complaints on the level of noise in the work area?			S O	
Ask the worker: Are there any distracting or annoying noises at the workstation?			S O	

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?			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



Clean-up

This Work Manual contains information about the body parts found to be at risk of musculoskeletal injury (MSI) for the Clean-up job (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

Clean-up

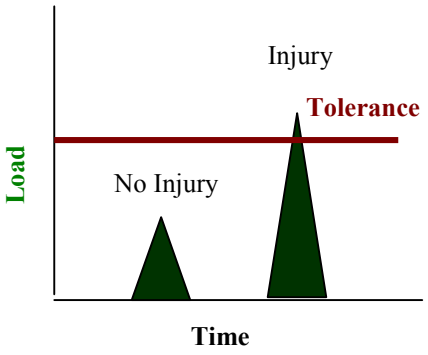
Disclaimer

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

WM Table of Contents

Injury Education

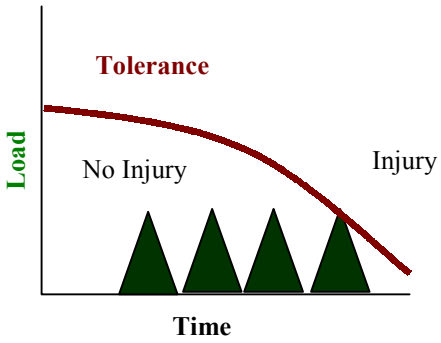
Injuries occur when ...
Loads exceed tissue tolerances



Excessive Force

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

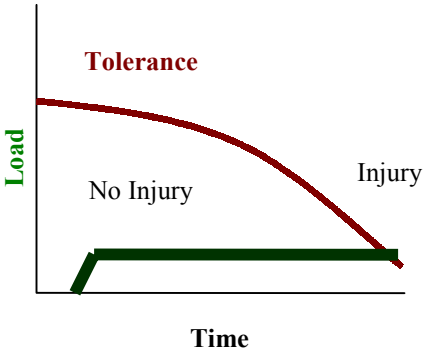
Example – a worker going over on their ankle and spraining it.



Excessive Repetition

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

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



Excessive Duration

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

Example – a grader developing neck tension.

Body Parts at Risk

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

After all of the appropriate information is collected during the investigation of the Clean-up 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 Clean-up job. 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.

NECK

Direct Risk Factors:
Awkward Postures
Static Postures
Repetition

A Clean-up worker must hold the head forward in order to clear debris.

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

Static Postures

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

Repetition

- When the head is repeatedly bent forward, 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

Working Heights

- Loading on the neck muscles is increased because the head is held in a forward bent position while looking at the floor for cleaning.

Work Organisation

Task Variability

- Workers who tend to clean only around a single area with a similar layout may use the same neck postures for a prolonged duration.

CONSEQUENCES

- When the head is held in a forward bent 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 82 & 83.
- For exercises that can help to prevent ***neck*** injuries, see the ***Neck section of the Body Manual.***

ELBOW/WRIST

Direct Risk Factors:
Force
Awkward Postures
Repetition

A Clean-up worker must grip tools in order to sweep, shovel, and air hose debris.

BACKGROUND INFORMATION

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

DIRECT RISK FACTORS

Force

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

Awkward Postures

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

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

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

Container, Tool, and Equipment Handles

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

CONSEQUENCES

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

SUGGESTED SOLUTIONS

- For specific solutions that may prevent injuries to the Elbow/Wrist, please see the column labelled "Elbow/Wrist" in the Summary of Solutions on pages 82 & 83.
- For exercises that can help to prevent ***elbow*** injuries, see the ***Elbow section of the Body Manual.***

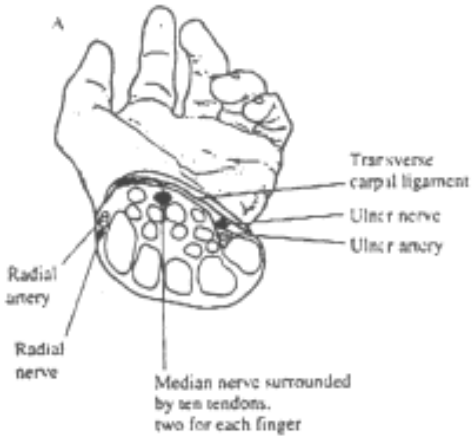
WRIST/HAND

Direct Risk Factors:
Contact Stress
Vibration

A Clean-up worker may be exposed to contact stress and hand/arm vibration when operating a Ramrod or a Bobcat.

BACKGROUND INFORMATION

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



The Carpal Tunnel

DIRECT RISK FACTORS

Contact Stress

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

Vibration

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

INDIRECT RISK FACTORS

Characteristics of Objects Being Handled

Container, Tool, and Equipment Handles

- Continual exposure to hand/arm vibration and contact stress occurs because hand rest bars on Ramrods have no damping material to reduce vibration levels and disperse contact pressures.

Environmental Conditions

Cold Exposure

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

CONSEQUENCES

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

SUGGESTED SOLUTIONS

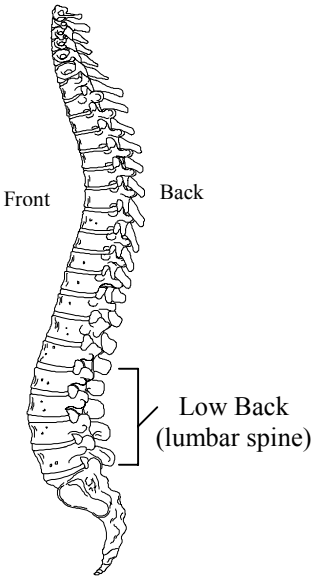
- For specific solutions that may prevent injuries to the Wrist/Hand, please see the column labelled "Wrist/Hand" in the Summary of Solutions on pages 82 & 83.

LOW BACK

Direct Risk Factors:
Awkward Postures
Repetition

A Clean-up worker frequently bends down or to the side to access small spaces and pick up 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

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 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

- The confined working spaces available for cleaning around and underneath machinery lead to frequent awkward back postures.

Work Conditions

Task Variability

- Workers who tend to clean only around areas with similar layouts may hold the same back postures for a prolonged duration.

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

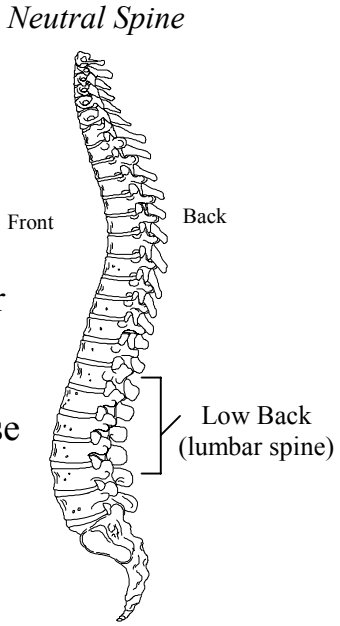
- For specific solutions that may prevent injuries to the Back, please see the column labelled "Back" in the Summary of Solutions on pages 82 & 83.
- For exercises that could help to prevent ***back*** injuries, see the ***Back section of the Body Manual.***

LOW BACK

Direct Risk Factors:
Awkward & Static Postures
Vibration

A Clean-up worker frequently sits on a vibrating surface.

BACKGROUND INFORMATION



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

DIRECT RISK FACTORS

Awkward & 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

- Old, worn-out seats on mobile equipment can increase the strain on the back. As the seat on equipment ages, support to the low back and vibration damping decreases.

Environmental Conditions

Vibration

- While operating mobile equipment, workers are exposed to vibration. Vibration intensity and frequency will determine the level of mechanical stress to the low back. Factors like tire pressure, seat type, and floor surfaces help to determine vibration levels and frequency.

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 82 & 83.
- For exercises that can help to prevent ***back*** injuries, see the ***Back section of the Body Manual.***

KNEE

Direct Risk Factors:
Awkward and Static Postures
Contact Stress
Repetition

A Clean-up worker frequently squats and kneels in order to pick up debris.

BACKGROUND INFORMATION

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

DIRECT RISK FACTORS

Awkward & Static Postures

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

Contact Stress

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

Repetition

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

INDIRECT RISK FACTORS

Workstation Design

Working Heights

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

Floor Surfaces

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

CONSEQUENCES

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

SUGGESTED SOLUTIONS

- For specific solutions that may prevent injuries to the Knee, please see the column labelled "Knee" in the Summary of Solutions on pages 82 & 83.
- For exercises that could help to prevent ***knee*** injuries, see the ***Knee section of the Body Manual.***

Summary of Body Parts at Risk

NECK

- A Clean-up worker must hold the head forward in order to clear debris.

ELBOW/WRIST

- A Clean-up worker must grip tools in order to sweep, shovel, and air hose debris.

WRIST/HAND

- A Clean-up worker may be exposed to contact stress and hand/arm vibration when operating a Ramrod or a Bobcat.

LOW BACK

- A Clean-up worker frequently bends down or to the side to access small spaces and pick up debris.

- A Clean-up worker frequently sits on a vibrating surface.

KNEE

- A Clean-up worker frequently squats and kneels in order to pick up debris.

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.*

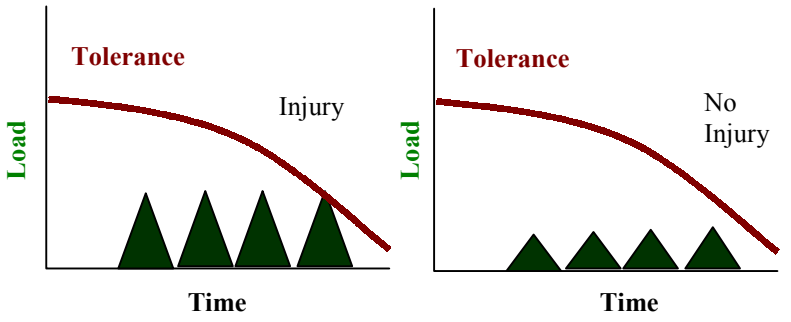
= Indicates that the risk factor was assessed and was not found to be a contributor to the body part problem.

♦ = 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 82 & 83 for specific problem/solution information. Additional information on some risk factors can be found in the General Risk Factor Solutions Manual.

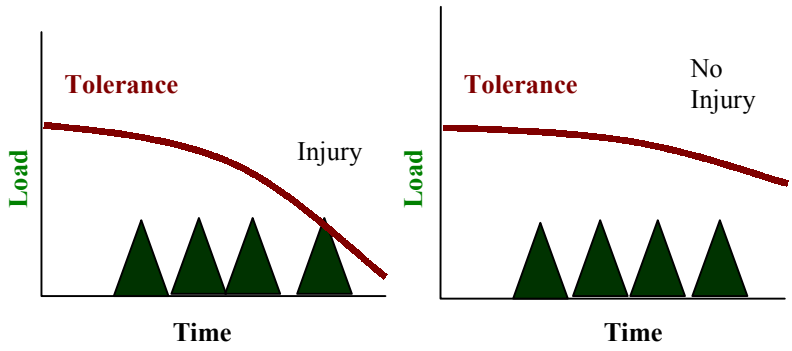
Injury Prevention

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 Clean-up job. The solutions are presented under the headings of Workstation Design, Characteristics of Objects Being Handled, Environmental Conditions, and Work Organisation.

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

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

Risk Control Key

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

E

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

A

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

WP

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

PPE

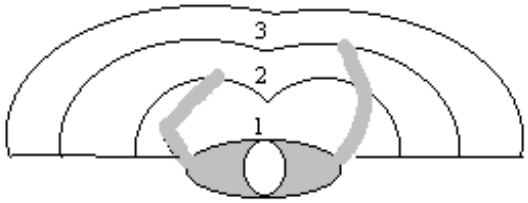
PERSONAL PROTECTIVE EQUIPMENT
These are devices worn by a worker to reduce the risk of injury, including gloves, kneepads, hearing protection, and leather aprons.

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

Workstation Design

WORKING REACHES

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



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

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

WORKING HEIGHTS

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

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

To determine the appropriate height specific for the Clean-up workstations, identify the body part of most concern. If the main concern is the:

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

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

Adequate space

E

Improper working heights are common to Clean-up persons and contribute to the risk factors for the neck, shoulders, low back and knees. Improvements through modifications to the workplace can be challenging, both for practical reasons and due to the nature of clean-up activities. It is important that workstation designs keep not only the workers who operate machines at the station in mind, but also the Clean-up persons. Proper access spaces should be provided to allow workers to perform clean-up activities.

Look down with eyes

WP

To reduce neck bending, look down with the eyes.
To maintain good postural alignment and decrease loading on tissue from head forward posture, perform the postural check exercise in Body Manual for the Back.

Ear muffs

PPE

To reduce the loading on neck muscles, avoid wearing ear muffs. Use ear plugs instead, or custom fitted ear pieces if more protection is needed.
To reduce loading on the low back, brace the upper body with the arm when stooping over to pick up debris.

Use a pike pole

WP To reduce the amount of low back bending, use a pike pole to pick up medium size debris off the floor. Note that this might increase the stress to the hands and arms if performed frequently.

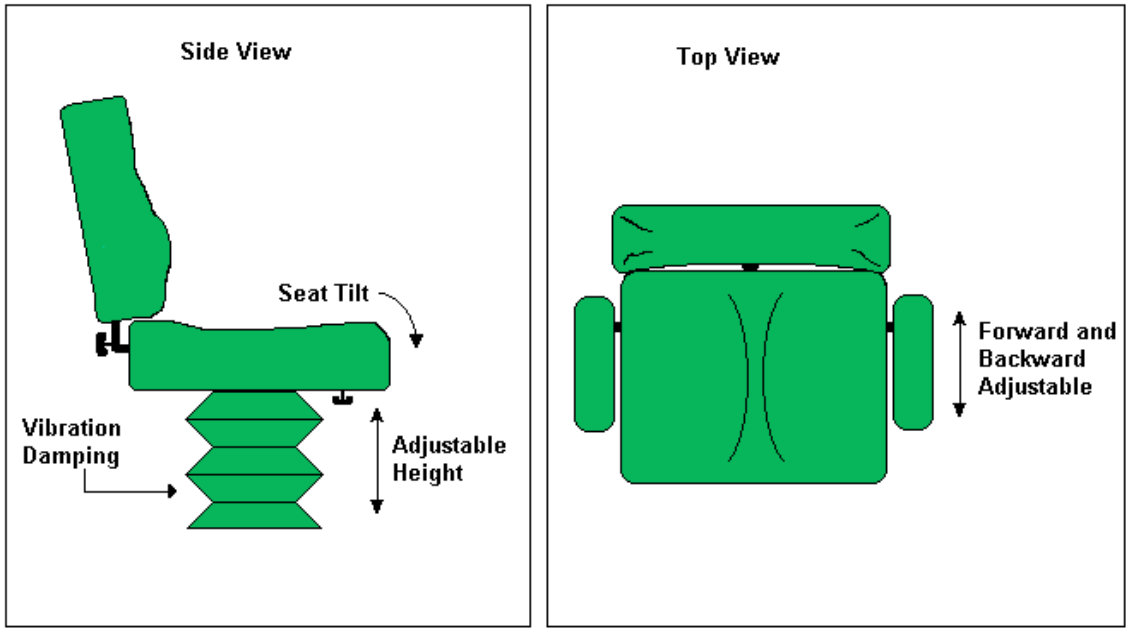
Keep the back straight

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

SEATING

Many Clean-up workers sit when operating Ramrods or Bobcats. Sitting for long periods of time increases the load on the spine, which stresses the ligaments and discs of the low back. The load is increased when the Clean-up worker does not maintain a neutral spine (see Injury Education for the Low Back on page 9).

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



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

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

WP In order to reduce awkward and static postures in the low back, encourage Clean-up workers 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.

FLOOR SURFACES

Anti-fatigue matting

E

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

Knee pads

PPE

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

WP

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

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

Characteristics of Objects Being Handled

CONTAINER, TOOL AND EQUIPMENT HANDLES

Tool handles

E

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

Wrap tools

E

To improve gripping and reduce impact shock to the hands, place foam wraps around the handles of pike poles, brooms, and shovels.

Lightweight tools

E

To reduce the force required to shovel, reduce the weight of the shovel by purchasing lightweight aluminium heads. When shovelling wet debris, use shovels with small holes in head to allow water to drain.

Use the whole body

WP

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

Grip lightly

WP

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

Improve leverage

WP

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

Gloves

PPE

In order to reduce grip forces required by the Clean-up worker, the operator should wear thin, close fitting gloves with a "sticky" palm surface to increase the friction between the gloves and the tool handles. Padded gloves can also provide some hand protection from contact stress and vibration.

Environmental Conditions

VIBRATION

Cushioning around hand rest

E

To disperse contact stress and minimise vibration transmitted to the hand when operating Ramrods, place foam wraps or other cushioning material around hand rest bar on Ramrods.

Tires

A

To reduce vibration transmitted to the hand and back when operating Ramrods and Bobcats, ensure the tires are inflated properly.

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

Work Organisation

TASK VARIABILITY

Change postures

A To reduce the length of exposure to stress on the neck, back, and knees, break-up work into areas with varied layouts, and work at varied heights. Frequent changes in postures from working at varied heights will help avoid excess fatigue.

Alternate duties

A To reduce exposure to sitting on vibrating equipment, workers should be trained and encouraged to share duties of operating mobile equipment. Try to avoid having one person responsible for cleaning the basement using a ramrod.

Dynamic work breaks

WP To speed-up recovery from back stress, encourage workers who operate mobile equipment for long periods to go for walks on their breaks.

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
Working Reaches	**74**							**A**				
Working Heights	**75**	**A S**						**R A**		**R A S C**		
Adequate space	**75**	**A**		**A**				**A**		**A**		
Look down with eyes	**75**	**A**										
Ear muffs	**75**	**F**										
Use a pike pole	**76**							**A**				
Keep the back straight	**76**							**A**				
Seating	**77**							**A S V**				
Anti-fatigue matting	**78**							**S**		**A S C**		
Knee pads	**78**									**A C**		
Tool handles	**79**				**F A**		**C V**					
Wrap tools	**79**						**C F**					
Lightweight tools	**79**				**F A**							
Use the whole body	**79**				**F A**		**C**					

Direct Risk Factors

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

Summary of Solutions

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Grip lightly	**79**						**F**					
Improve leverage	**79**				**F**		**F**					
Gloves	**80**				**F A**		**C V**					
Cushioning around hand rest	**80**						**C V**	**V**				
Tires	**80**						**C V**	**V**				
Change postures	**81**	**R A S**			**F R A**			**R A S**		**R A S C**		
Alternate duties	**81**						**C V**	**S V**				
Dynamic work breaks	**81**							**A S V**				
Heat Exposure	◆	indirectly reduces risk of injury to the body										
Cold Exposure	◆	indirectly reduces risk of injury to the body										
Lighting	◆	indirectly reduces risk of injury to the body										
Noise	◆	indirectly reduces risk of injury to the body										
Vibration	◆	directly reduces risk of injury to the back and wrist										
Rest breaks	◆	indirectly reduces risk of injury to the body										
Job Rotation	◆	indirectly reduces risk of injury to the body										
Task Rotation	◆	indirectly reduces risk of injury to the body										
Work Pace	◆	indirectly reduces risk of injury to the body										
Scheduling	◆	indirectly reduces risk of injury to the body										

Direct Risk Factors

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◆ = *See General Risk Factor Solutions Manual*

CLEAN-UP MSI SAFETY GUIDE

OBJECTIVE: To identify ergonomic risks involved in the Clean-up job, and to reduce the potential for musculoskeletal injuries.
More detailed information about risk reducing recommendations can be found in the Work Manual for the Clean-up worker.

CHECK IF THIS APPLIES	ACTIVITY OF RISK	ERGONOMIC RISK FACTOR(S)	POTENTIAL HAZARDS	SUGGESTED SOLUTIONS
	Neck A Clean-up worker must hold the head forward in order to clear debris.	**Awkward Postures** **Static 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. • Neck muscles must support the weight of the head while in a forward position. The more the neck is bent, 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. • When the head is repeatedly bent forward, 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.	• To reduce the length of exposure to stress on the neck, break-up work into areas, and clean from top to bottom. Frequent changes in postures from working at various heights will help avoid excess fatigue. • To reduce neck bending, look down with eyes. • To reduce the loading on neck muscles, avoid wearing ear muffs. Use earplugs instead, or custom fitted ear pieces if more protection is needed. • For exercises that can help prevent ***neck*** injuries, ***see the neck section of the Body Manual***.

CHECK IF THIS APPLIES	ACTIVITY OF RISK	ERGONOMIC RISK FACTOR(S)	POTENTIAL HAZARDS	SUGGESTED SOLUTIONS
	Elbow/Wrist A Clean-up worker must grip tools in order to sweep, shovel, and air hose debris.	**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. • The width of an object affects how much muscle tension needs to be generated. Using either an overly large or a small grip requires more muscle force, and can lead to tissue fatigue at the tendon/bone connection.	• To reduce grip force when using a broom, use the hips and legs to push debris on the floor • To reduce grip force when using a shovel, grip the shovel lightly and accelerate shovel into pile. • To reduce grip force when using a shovel to lift debris onto a conveyor, choke up on the handle and improve leverage. Note that choking up on handle may increase back bending resulting in more stress to the back. • For exercises that can help prevent ***elbow*** injuries, ***see the elbow section of the Body Manual***
		Awkward Postures	• The position of the wrist also affects how much muscle tension needs to be generated. Gripping objects with the wrist bent increases the tension generated by muscles.	
		Repetition	• Repeated stress to the elbow without adequate rest could fatigue tissues to the point of injury.	

CHECK IF THIS APPLIES	ACTIVITY OF RISK	ERGONOMIC RISK FACTOR(S)	POTENTIAL HAZARDS	SUGGESTED SOLUTIONS
	Wrist/Hand A Clean-up worker may be exposed to contact stress and hand/arm vibration when operating a Ramrod or a Bobcat.	**Contact Stress** **Vibration**	• Contact between hard or sharp surfaces and the base of the palm places stress on the tendons and nerves in the carpal tunnel. • Continual contact with hard or sharp surfaces may damage the nerve and/or gradually weaken the tendons, and cause injury. • Exposure to vibration, through the use of power tools or through contact with other vibrating objects, places a unique form of mechanical stress on the tissues of the hand and wrist. Factors like vibration level and vibration frequency influence the amount of mechanical stress. • Continual exposure to hand/arm vibration may gradually damage neurovascular tissue (nerves and blood vessels) in the hand, and may contribute to problems in the wrist.	• ***See the wrist section of the Body Manual***.

CHECK IF THIS APPLIES	ACTIVITY OF RISK	ERGONOMIC RISK FACTOR(S)	POTENTIAL HAZARDS	SUGGESTED SOLUTIONS
	Low Back A Clean-up worker frequently bends down or to the side to access small spaces and pick up debris.	**Awkward Postures** **Repetition**	• 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 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.	• To reduce the length of exposure to stress on the back, break up work into areas, and clean from top to bottom. Frequent changes in postures, from working at various heights, will help avoid excess fatigue. • To reduce loading on the low back, brace the upper body with the arm when stooping over to pick up debris. • To reduce the amount of low back bending, use a pike pole to pick up medium size debris off the floor. • To increase back tolerances, lift heavy objects with a straight back. Try to maintain a straight back, if possible, when working under machinery. • For exercises that can help prevent ***low back*** injuries, ***see the back section of the Body Manual***.

CHECK IF THIS APPLIES	ACTIVITY OF RISK	ERGONOMIC RISK FACTOR(S)	POTENTIAL HAZARDS	SUGGESTED SOLUTIONS
	Low Back A Clean-up worker frequently sits 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.	• To speed-up recovery from back stress, encourage workers who operate mobile equipment for long periods to go for walks on their breaks. • For exercises that can help prevent *low **back*** injuries, ***see the back section of the Body Manual***.

CHECK IF THIS APPLIES	ACTIVITY OF RISK	ERGONOMIC RISK FACTOR(S)	POTENTIAL HAZARDS	SUGGESTED SOLUTIONS
	Knee A Clean-up worker frequently squats and kneels in order to pick up debris.	**Awkward Postures** **Static Postures** **Contact Stress** **Repetition**	• Bending the knee increases the contact stress between the kneecap and the thighbone. Contact stress increases significantly when the knee is bent over 90 degrees. • Kneeling on a hard surface increases the contact stress between the kneecap and the thighbone. • Repeated squatting and kneeling may gradually irritate the knee. Irritation of the knee may lead to muscle wasting, which in turn leads to poor tracking of the knee cap on the thigh bone and increased contact stress between these bones.	• To reduce the length of exposure to stress on the knees, break up work into areas, and clean from top to bottom. Frequent changes in postures will help avoid excess fatigue. • To disperse contact stress on the knee cap when kneeling, use knee pads or wear coveralls with foam inserts in the knees. • To reduce contact pressure between the thighbone and the kneecap, avoid bending the knee past 90 degrees when squatting. • For exercises that can help prevent ***knee*** injuries, ***see the knee section of the Body Manual***