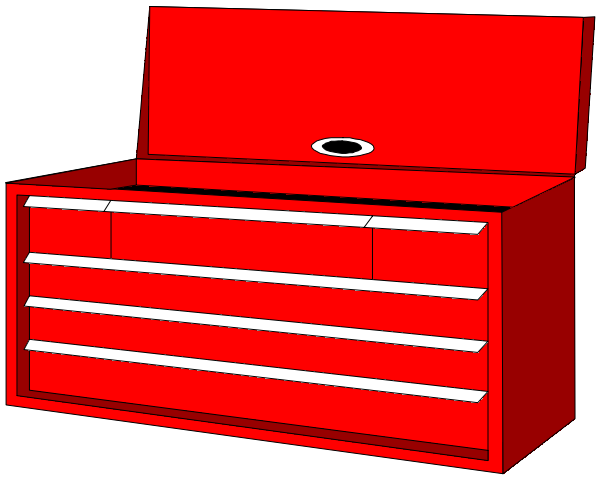
Industrial Musculoskeletal Injury Reduction Program

Common Industry Jobs (CIJs)

Boom Area 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

BOOM AREA TOOL KIT
Table of Contents

Overview

Boom Area Employee

Job Summary

A Boom Area Employee is involved in moving logs from the water into the mill. The Boom Area Employee Tool Kit includes the following job titles: Boomman, Slipman, Sidewinder Operator, Boom Boat Operator, Tug Boat Operator, Deck Hand, Splitting Saw Operator, Log Haul Feeder, Log Marker, and Bundle Crane Swamper. The types of tasks performed by a Boom Area Employee will vary depending on the specific job title and mill location/set-up. Refer to the Physical Demands Analysis for more detail.

Physical Demands

The physical demands of a Boom Area Employee may include:

a) Forceful movements of the neck/shoulders, shoulders, elbow/wrists, low back, and hips
b) Repetitive movements of the neck/upper back, neck/shoulders, shoulders, elbow/wrists, wrist/hands, low back, hip, knees, and feet
c) Awkward postures of the neck, neck/upper back, shoulders, elbow/wrists, wrist/hands, low back, and knees
d) Static postures of the neck, neck/upper back, elbow/wrists, wrist/hands, low back, and knees
e) Contact stress on the knees
f) Walking on logs, slips, and/or boats
g) Sitting for long durations on boats
h) Standing on logs, slips, and/or boats
i) Climbing on and around logs and/or boat engines and stairs to and from slips
j) Balancing on logs and/or boats
k) Kneeling/crouching on logs and/or boats
l) Lifting and lowering of boom chains, swifter lines, saw parts, and/or various hand tools
m) Pushing and pulling of logs in the water
n) Carrying of boom chains, swifter lines, saw parts, and/or various hand tools

Mental Demands

A Boom Area Employee may be required to have a good understanding of tidal fluxes and must react accordingly to changes in water flow. A Boom Area Employee may also require sustained concentration when working around the water to prevent accidental falls into the water.

Major Variations

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

1) The logs may be brought to the mill via:
   a) The ocean
   b) A river
   c) A lake

2) The logs may be loaded into the mill:
   a) By a boat
   b) Manually

The Physical Demands Analysis outlines the different processes viewed in the boom area.

Minor Variations

With different mills, the division of tasks between a number of job titles may vary. In order to determine the tasks (and associated risks) appropriate for your boom area, review the task lists in the Physical Demands Analysis. In order to determine the injury education and injury prevention material appropriate for your boom area, review the risk factor/body part descriptions and the summary of solutions tables in the Work Manual.

Physical Demands Analysis
Boom Area Employee

PDA General Instructions: Boom Area Employee

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

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

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

Boom Area jobs viewed during the creation of this PDA:

- Boomman
- Slipman
- Sidewinder Operator
- Boom Boat Operator
- Tug Boat Operator
- Deck Hand
- Splitting Saw Operator
- Log Haul Feeder
- Log Marker
- Bundle Crane Swamper

Disclaimer

The IMIRP Society accepts no responsibility for the use or misuse of the PDA, or the accuracy of the PDA as it applies to any specific workplace.

PDA Table of Contents

In the following pages, the processes involved with loading logs from the water to the mill will be outlined. As there are a number of ways in which this process can occur, we have broken down the process into the following distinct categories:

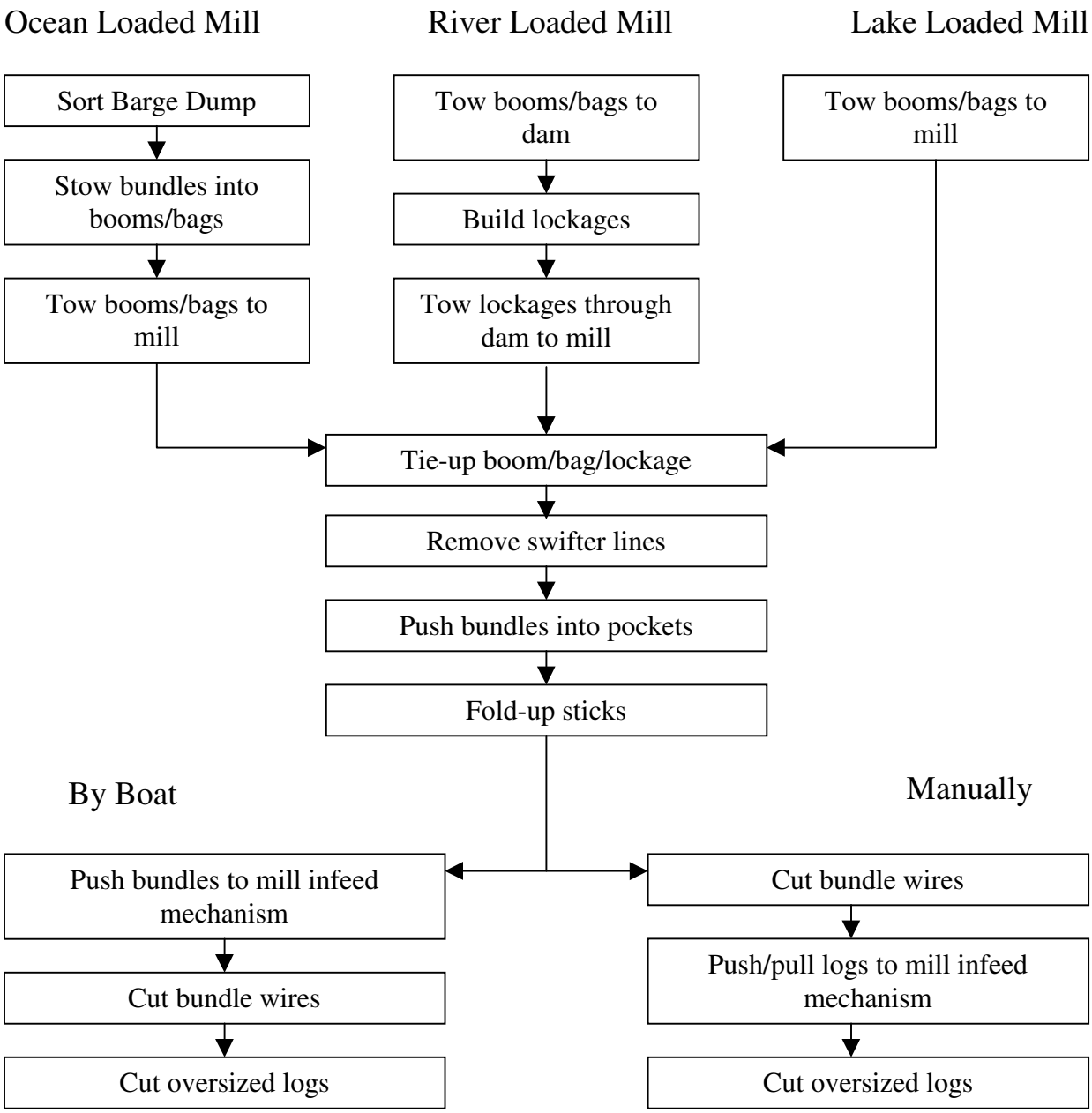
1. **Getting the Logs to the Mill:**
    a) Ocean Loaded Mill
    b) River Loaded Mill
    c) Lake Loaded Mill

2. **Feeding the Mill:**
    a) By Boat
    b) Manually

Use the flow chart on the following page to help you determine which of the above categories apply to your work environment. Additional information on the tasks outlined in the flow chart is available in subsequent pages.

3. **Maintenance Tasks**
    - Boat maintenance
    - Sharpen/maintain saw blades and other saw parts
    - Repairs/area maintenance

Boom Area Process Flow Chart



For additional information on the tasks listed above, read the task descriptions on subsequent pages.

Physical Demands Analysis
Boom Area Employee

Task List

For each of the processes outlined below, please indicate whether the tasks listed occur at the mill.

1. Getting the Logs to the Mill

a) Ocean Loaded Mill

Sort barge dump

A Boom Area Employee will operate a designated boat to count bundles and check species. Bundles will also be sorted into groups, to be later placed into booms. Logs from broken bundles may have to be gathered and re-bundled.

Does this task occur at your mill?

☐ Yes ☐ No

Stow bundles into booms/bags

A Boom Area Employee will operate a designated boat to tow out boomsticks (form the sticks into a boom if creating booms), push bundles into the boom sticks, and align bundles within the boom sticks (if forming a boom).

Does this task occur at your mill?

☐ Yes ☐ No

When forming booms, the Boom Area Employee will also place swifter lines around the boom.

Does this task occur at your mill?

☐ Yes ☐ No

Tow booms/bags to the mill

A Boom Area Employee will operate a designated boat to tow formed booms and/or bags to the mill for hook up.

Does this task occur at your mill?

☐ Yes ☐ No

When towing booms/bags to the mill, chains are handled in order to hook the boom/bag to the boat and to unhook the boom/bag from the boat.

Does this task occur at your mill?

☐ Yes ☐ No

b) River Loaded Mill

Tow booms/bags to dam

A Boom Area Employee will operate a designated boat to tow booms from a log dump area to the dam.

Does this task occur at your mill?

☐ Yes ☐ No

When towing booms to the dam, chains are handled in order to hook the boom to the boat at the log dump and to unhook the boom from the boat and hook it to the dam.

Does this task occur at your mill?

☐ Yes ☐ No

Build lockages

A Boom Area Employee will operate a designated boat to tow and form boom sticks into lockages. As the lockage is being formed, a Boom Area Employee will operate a designated boat to push bundles out of a boom and into the boom sticks formed for a lockage.

Does these tasks occur at your mill?

☐ Yes ☐ No

A Boom Area Employee will release the swifter lines from a boom and open up the boom sticks for a boat. As the lockages are completed a Boom Area Employee will attached swifter lines to the lockages, and tie the lockage to the boat.

Does these tasks occur at your mill?

☐ Yes ☐ No

Tow lockages through dam and to mill

A Boom Area Employee will operate a designated boat to in order to tow lockages through the dam and to the mill.

Does this task occur at your mill?

☐ Yes ☐ No

c) Lake Loaded Mill

Tow booms/bags to mill

A Boom Area Employee will operate a designated boat to in order to tow booms from a log dump area to the mill.

Does this task occur at your mill?

☐ Yes ☐ No

When towing booms to the mill, chains are handled in order to hook the boom to the boat and to unhook the boom from the boat.

Does this task occur at your mill?

☐ Yes ☐ No

2. Feeding the Mill

Tie-up boom/bag/lockage

A Boom Area Employee will operate a boat to create space for the incoming booms/bags/lockages.

Does this task occur at your mill?

☐ Yes ☐ No

A Boom Area Employee may also handle chains and hand tools when securing the bags/booms/lockages to the mill.

Does this task occur at your mill?

☐ Yes ☐ No

A Boom Area Employee may be required to count bundles and verify species as the boom/bag/lockage is tied to the mill (this is usually done when a contractor brings the logs to the mill).

Does this task occur at your mill?

☐ Yes ☐ No

Remove swifter lines

A Boom Area Employee will climb onto booms in order to release swifter lines. This task may also involve removing and recoiling the swifter lines.

Does this task occur at your mill?

☐ Yes ☐ No

Push bundles into pockets

A Boom Area Employee will handle boom chains in order to open up the boom/bag/ lockage order to allow a boat to get in.

Does this task occur at your mill?

☐ Yes ☐ No

A Boom Area Employee will operate a designated boat in order to push bundles from inside the boom/bag/lockage into pockets.

Does this task occur at your mill?

☐ Yes ☐ No

Fold up sticks

A Boom Area Employee will handle chains in order to hook up the boom sticks from empty booms/bags/lockages to a boat; and operate the boat to tow them away for storage and/or maintenance.

Does this task occur at your mill?

☐ Yes ☐ No

a) By Boat

Push bundles from pockets to mill infeed mechanism

A Boom Area Employee will operate a boat in order to push bundles and stray logs from the pockets to a crane/log haul/grapple for loading into the mill. The boat may push the bundles/logs directly onto the mill infeed mechanism or they may push the bundles/logs to a machine (i.e., grapple) that will then load the mill infeed mechanism or remove the bundles/logs from the water.

Does this task occur at your mill?

☐ Yes ☐ No

For jobs requiring the operation of a grapple or crane to load the mill infeed mechanism or remove bundles/logs from the water, see the toolkit for the Grapple Operator or the toolkit for the Crane Operator.

Cut bundle wires

A Boom Area Employee will climb onto the bundles in order to cut the bundle wires before the logs are fed into the mill by a crane, or pushed up the log haul. This may also involve re-coiling cut bundle wires.

Does this task occur at your mill?

☐ Yes ☐ No

A Boom Area Employee will cut bundle wires after the bundles have been removed from the water. This may involve reaching overhead with a hand tool and recoiling cut bundle wires.

Does this task occur at your mill?

☐ Yes ☐ No

Cut oversized logs

A Boom Area Employee will split logs that are too large to be put through the mill. This may be done with a splitting saw or arbour saw.

Does this task occur at your mill?

☐ Yes ☐ No

A Boom Area Employee will buck logs that are too large to be put through the mill. This may be done with a chainsaw.

Does this task occur at your mill?

☐ Yes ☐ No

b) Manually

Cut bundle wires

A Boom Area Employee will climb onto bundles in order to cut the bundle wires before the logs are pushed up to the mill.

Does this task occur at your mill?

☐ Yes ☐ No

Push/pull logs to mill infeed mechanism

A Boom Area Employee will manually guide logs towards the mill infeed mechanism (jackladder, side lift, log haul).

Does this task occur at your mill?

☐ Yes ☐ No

Cut oversized logs

A Boom Area Employee will split logs that are too large to be put through the mill. This may be done with a splitting saw or arbour saw.

Does this task occur at your mill?

☐ Yes ☐ No

A Boom Area Employee will buck logs that are too large to be put through the mill. This may be done with a chainsaw.

Does this task occur at your mill?

☐ Yes ☐ No

3. Maintenance Tasks

Boat maintenance

A Boom Area Employee will perform boat maintenance duties.

Does this task occur at your mill?

☐ Yes ☐ No

Sharpen/maintain saw blades and other saw parts

A Boom Area Employee will sharpen and maintain saw blades and other saw parts.

Does this task occur at your mill?

☐ Yes ☐ No

Repairs/area maintenance

A Boom Area Employee will repair break waters, boom sticks, or other structures around the boom area as required.

Does this task occur at your mill?

☐ Yes ☐ No

Job Profile

Date: _____ Specific Job Title: _____

Company Name: _____ Division: _____

Employee Name: _____ Supervisor: _____

Phone: _____ Fax: _____

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

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

Describe:

_____

_____

_____

Length of shift _____ hours

Formal breaks

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

Informal breaks

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

Work pace control

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

Job rotation

☐ Yes ☐ No

Describe:

_____

_____

_____

_____

Work Organisation

Task Description

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

	Task	Percent of Shift				Comments
		Rarely 0 to 5%	Occasionally 6 to 33%	Frequently 34 to 66%	Constantly 67 to 100%	
Getting the Logs to the Mill - Ocean Loaded Mills						
	Sort barge dump					• *Duration of approximately 8 hours, frequency depends on barge dumps*
	Stow bundles into booms/bags					• *Duration of approximately 4 hours, frequency depends on barge dumps*
	Tow booms/bags to mill					• *Duration and frequency varies depending on the distance between the barge dump and the mill*
Getting the Logs to the Mill - River Loaded Mills						
	Tow boom/bags to dam					• *Duration and frequency varies depending on the distance between the log dump and the dam*
	Build lockages					• *Duration and frequency varies*
	Tow lockages through dam to mill					• *Duration and frequency varies depending on the distance between the dam and the mill*
Getting the Logs to the Mill - Lake Loaded Mills						
	Tow booms/bags to mill					• *Duration and frequency varies depending on the distance between the log dump and the mill*
Feeding the Mill - General						
	Tie-up boom/bag/lockage					• *Duration and frequency varies depending on whether the bundles need to be counted and species verified or not*
	Remove swifter lines					• *Duration is fairly short, frequency varies depending on number of booms/lockages handled per shift*

Task		Percent of Shift				Comments
		Rarely 0 to 5%	Occasionally 6 to 33%	Frequently 34 to 66%	Constantly 67 to 100%	
	Push bundles into pockets					• *Duration and frequency will vary depending on the boat operated, designated boats usually spend a large percentage of the shift performing this task*
	Fold up sticks					• *Duration is fairly short, frequency varies depending on the number of booms/lockages handled per shift*
Feeding the Mill – By Boat						
	Push bundles from pockets to mill infeed mechanism					• *Duration and frequency will vary depending on the boat operated, designated boats usually spend a large percentage of the shift performing this task*
	Cut bundle wires					• *Duration is fairly short, frequency varies depending on the number of bundles handled per shift*
	Cut oversized logs					• *Duration and frequency varies depending on the size of logs delivered to the mill*
Feeding the Mill – Manually						
	Cut bundle wires					• *Duration is fairly short, frequency varies depending on the number of bundles handled per shift*
	Push/pull logs to mill infeed mechanism					• *Percentage of shift is high as an employee will usually be assigned to this task full time*
	Cut oversized logs					• *Duration and frequency varies depending on the size of logs delivered to the mill*
Maintenance						
	Boat maintenance					• *Duration and frequency varies depending on mill, some mills have the Heavy Duty Mechanics perform boat maintenance*
	Sharpen/maintain saw blades and other saw parts					• *Duration and frequency varies depending on the number of oversized logs cut*
	Repairs/area maintenance					• *Duration and frequency varies depending on work load, usually performed during slower times*

Workstation Characteristics

Dimensions & Layout

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

Flooring, Displays & Seating

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

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

Equipment & Machinery Controls

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

	Type of Control	**Function**	**Comments**
	Wheel	• *Steer boat*	• *May be a hand or a thumb wheel*
	Lever	• *Throttle for boat*	• *May be a lever moved in a forward/backward motion or a lever that is squeezed for activation*
		• *Steering for boat*	• *Jog steering, arm levers for steering*
		• *Forward/reverse for boat*	• *Determines direction of movement*
		• *Gear shift*	
		• *Movement*	• *Movement of log turning mechanisms, end plate positions, saws, carriages (splitting saw/arbour saw)*
		• *Winch controls*	• *For boats with winches*
	Foot pedal	• *Throttle for boat*	• *Some Sidewinders had a foot pedal as well as a squeeze lever style throttle control*
		• *Secure saw*	• *Secures saw in place when sharpening teeth*
	Push button	• *On/off for boat engine*	
		• *On/off mill infeed control*	• *Safety control*
		• *Hydraulics*	• *Hydraulics for saws, chains, log turners, end plates (splitting saw/arbour saw)*
	Pull cord	• *On/off mill infeed control*	• *Safety control*
		• *Chainsaw motor*	
	Paddle switch	• *On/off mill infeed control*	• *Safety control*
	Kick board	• *On/off mill infeed control*	• *Safety control*
	Turn dial	• *Speed/power control*	• *Controls the speed of carriage and power of saw (splitting/arbour saw)*
	Trigger	• *Chainsaw blade*	
	Other:		

Physical Demands

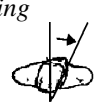
Whole Body Physical Demands

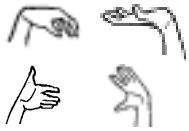
Identify each of the physical demands required by a Boom Area Employee and list the corresponding tasks in the second column. Check off (✓) the estimated *Percent of Shift,* and use the *Comments* section to include information related to duration, frequency, and cycle times.

Physical Demands	Tasks or Activity	Percent of Shift				Comments
		Rarely 0 to 5%	Occasionally 6 to 33%	Frequently 34 to 66%	Constantly 67 to 100%	
Example: Balancing (Deck Hand)	• *All tasks associated with walking on logs*			✓		• *Balancing on logs floating in the water, surface is wet and slippery*
Walking						
Sitting						
Standing						
Climbing						
Balancing						
Kneeling/ Crouching						
Other:						

Body Postures

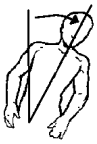
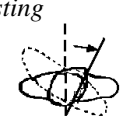
The table below outlines the body postures that may be adopted throughout the shift by a Boom Area Employee, related to tasks. Check off (✓) the estimated *Percent of Shift,* and use the *Comments* section to include information describing posture duration, frequency, cycle times, and hand used.

Body Posture	Task(s)	Percent of Shift				Comments
		Rarely 0 to 5%	Occasionally 6 to 33%	Frequently 34 to 66%	Constantly 67 to 100%	
Example: Shoulder Flexion (Tug Boat Operator)	• *All tasks associated with towing loads*			✓		• *Duration and frequency of shoulder flexion will vary depending on distance travelled in boat*
Neck						
Flexion 						
Extension 						
Twisting 						
Shoulder						
Flexion 						
Abduction/ adduction 						
Extension 						

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

Legend for Hand/Fingers

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

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

Manual Material Handling

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

Activity	Task Description	Weight (kg)	Percent of Shift				Comments
			Rarely 0 to 5%	Occasionally 6 to 33%	Frequently 34 to 66%	Constantly 67 to 100%	
Pushing							
Pulling							
Lifting							
Lowering							
Carrying							

Hand Tools

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

	Type of Tool	Tasks or Activity	Weight (kg)	Percent of Shift				Comments
				Rarely 0 to 5%	Occasionally 6 to 33%	Frequently 34 to 66%	Constantly 67 to 100%	
	Wire/bolt cutters	• *Cut bundle wires*						
	Grinder saw	• *Cut bundle wires*						
	Power saw cable cutter	• *Cut bundle wires*						
	Pike pole	• *Balancing on logs* • *Handling chains*						
	Peevee	• *Manoeuvring logs* • *Handling chains*						
	Picaroon	• *Manoeuvring logs*						
	Axe	• *Driving in staples* • *Chopping sticks* • *Release swifter lines*						
	Hammer (sledge/ regular)	• *Repairs/area maintenance*						
	Toggle hook	• *Feeding boom chains through sticks*						
	Pin driver	• *Release swifter lines*						
	Hook	• *Handling chains*						
	Wrenches	• *Boat maintenance* • *Tighten winch cables*						
	Pry bar	• *Manoeuvring logs*						
	Chainsaw	• *Buck logs*						
	File	• *Sharpen chainsaw*						
	Scaling stick	• *Measure logs*						
	Spray paint	• *Mark logs/signs*						
	Other:							

Environmental Conditions

Work Environment

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

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

Location of Workstation

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

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

Temperature

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

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

Personal Protective Equipment

The table below contains a list of the personal protective equipment (PPE). For the Boom Area Employee at your mill, indicate with a check mark (✓) which of the PPE items are required.

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

Appendix A – Weight of Wood Equation

1. Type of Wood Handled

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

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

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

2. Size of Wood*

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

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

* Conservative estimates of actual wood dimensions

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

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

3. Length of Wood

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

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

4. Weight of Wood Equation*

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

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

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

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

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

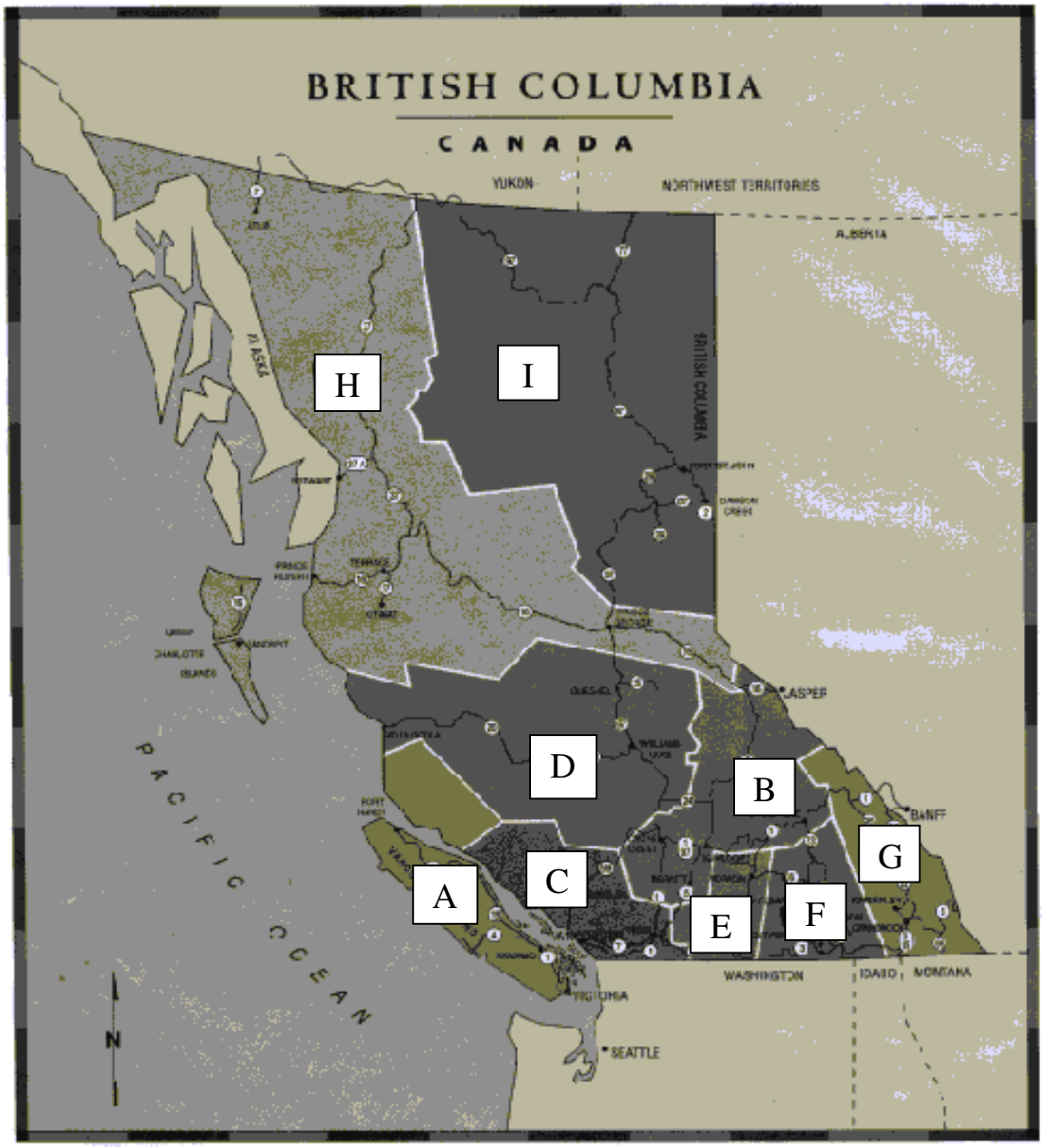
For the lightest species handled, enter the lb./board foot value, the multiple for the smallest size of wood, and the shortest length of this wood. Multiply these values together to determine the weight of the board in pounds.

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

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

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

Appendix B – Regional Map



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

Risk Factor Identification Checklist
Boom Area Employee

Purpose

The Risk Factor Identification Checklist for a Boom Area Employee 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 – Boom Area Employee

Management Representative _____

Worker Representative _____

Date _____

Risk Identification completed:

☐ Before implementation of solutions

☐ After implementation of solutions

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

Definitions

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

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

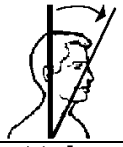
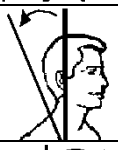
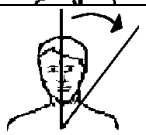
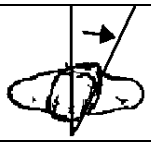
Static Postures: Static loading (sustained exertions) is physical effort (body postures) that is held, requiring muscle contraction for more than a short time.

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

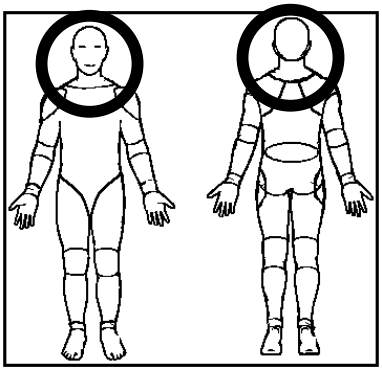
Awkward Postures: Awkward postures occur when there is a deviation from a power working posture. Some examples of awkward postures typically include reaching behind, twisting, working overhead, and forward or backward bending.

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

NECK

Repetition	N	Y		Comments:
Are identical or similar motions performed over and over again? (e.g., looking up or down frequently)			S O	
Ask the worker: Do you spend a large percentage of the day performing one action or task? (e.g., guiding logs onto mill infeed mechanism)			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., driving tug or boom boat)			S O	
Awkward Posture				
Flexion 			S O	
Extension 			S O	
Lateral Bending 			S O	
Rotation 			S O	

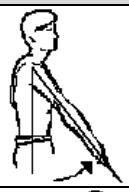
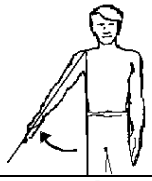
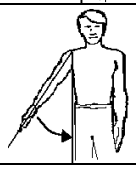
Please indicate whether the following direct risk factors were identified at the **NECK**.		
Direct Risk Factors	Repetition	☐Yes ☐No
	Static Posture	☐Yes ☐No
	Awkward Posture	☐Yes ☐No
In the **Injury Statistics** investigation, were there injury reports for the Neck or Head/Eye or Upper Back? (see Worksheet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



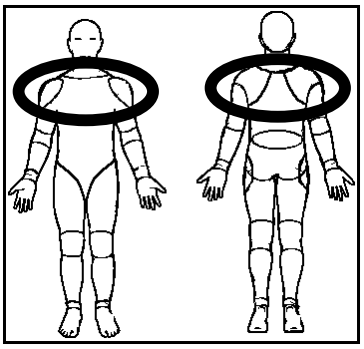
Body parts within the circled area will be classified as NECK issues.

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., steering Sidewinder)			S O	
Ask the worker: Do you spend a large percentage of the day performing one action or task? (e.g., guiding logs onto mill infeed mechanism)			S O	
Static Posture				
Ask the worker: Do tasks require your shoulders to be maintained in a fixed or static posture? (e.g., driving tug or boom boat)			S O	
Ask the worker: Do you hold parts, tools, or objects for long periods? (e.g., steering wheel, chainsaw)			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



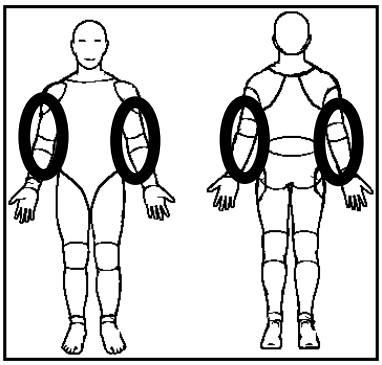
Body parts within the circled area will be classified as SHOULDER issues.

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., hammer, grinder saw) 			S O	
Are objects handled in a pinch grip? (e.g., nuts, bolt) 			S O	
Are objects handled in a hook grip? (e.g., oil cans, boom chains) 			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., steering Sidewinder)			S O	
Ask the worker: Do you spend a large percentage of the day performing one action or task? (e.g., guiding logs onto mill infeed mechanism)			S O	

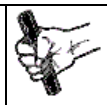
Static Posture	N	Y		Comments:
Ask the worker: Do tasks require your hand and arm to be maintained in a fixed or static posture? (e.g., holding Sidewinder throttle)			S O	
Ask the worker: Do you apply constant pressure on controls/objects with your hand? (e.g., holding Sidewinder throttle)			S O	
Ask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



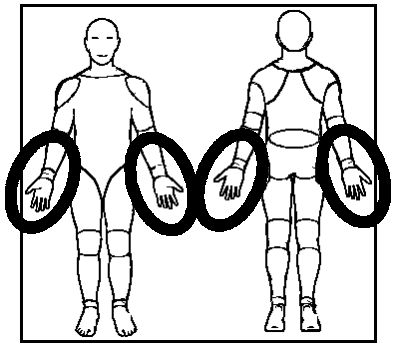
Body parts within the circled area will be classified as ELBOW issues.

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., hammer, grinder saw) 			S O	
Are objects handled in a pinch grip? (e.g., nuts, bolts, sheets of metal) 			S O	
Are objects handled in a hook grip? (e.g., oil cans, boom chains) 			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., steering Sidewinder)			S O	
Ask the worker: Do you spend a large percentage of the day performing one action or task? (e.g., operating a boat to guide logs onto a mill infeed mechanism)			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? (e.g., holding Sidewinder throttle)			S O	
Ask the worker: Do you apply constant pressure on controls/objects with your hand? (e.g., holding Sidewinder throttle)			S O	
Ask the worker: Do you hold parts, tools, or objects for long periods? (e.g., holding onto pike pole when guiding logs)			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? (e.g., manually releasing swifter lines)			S O	
Awkward Posture				
Flexion 			S O	
Extension 			S O	
Ulnar Deviation 			S O	
Radial Deviation 			S O	
Vibration				
Ask the worker: Is vibration transmitted to your hand through a tool or piece of equipment? (e.g., chainsaw, grinder saw)			S O	

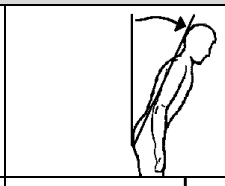
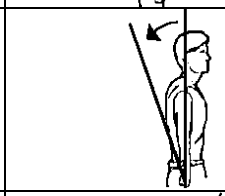
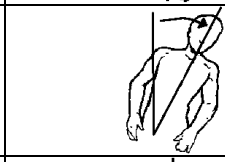
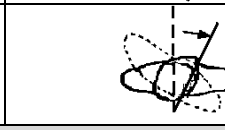
Please indicate whether the following direct risk factors were identified at the **WRIST/HAND**.		
Direct Risk Factors	Force	☐Yes ☐No
	Repetition	☐Yes ☐No
	Static Posture	☐Yes ☐No
	Contact Stress	☐Yes ☐No
	Awkward Posture	☐Yes ☐No
	Vibration	☐Yes ☐No
In the **Injury Statistics** investigation, were there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



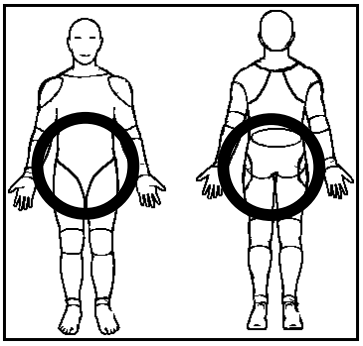
Body parts within the circled area will be classified as WRIST issues.

LOW BACK OR HIP/THIGH

Force	N	Y		Comments:
Is forceful physical handling performed? Such as: Lifting			S O	
Lowering			S O	
Pushing			S O	
Pulling			S O	
Carrying			S O	
Repetition				
Are identical or similar motions performed over and over again?			S O	
Ask the worker: Do you spend a large percentage of the day performing one action or task? (e.g., bending to lift boom chains)			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., boat maintenance)			S O	
Are workers required to sit or stand in a stationary position for long periods of time during the shift? (e.g., sitting or standing to drive a boat)			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., consoles that dig into the hip or thigh)			S O	

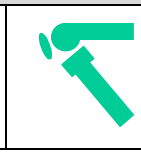
Awkward Posture		N	Y		Comments:
Flexion				S O	
Extension				S O	
Lateral Bending				S O	
Twisting				S O	
Vibration					
Ask the worker: Is your whole body exposed to vibration for significant portions of the work shift? (e.g., sitting on a vibrating boat)				S O	

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

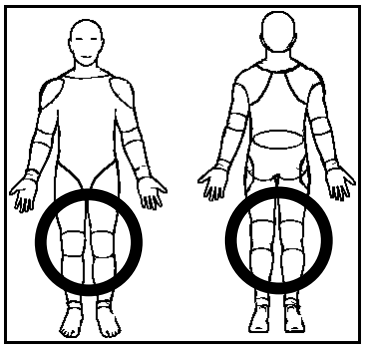


Body parts within the circled area will be classified as LOW BACK issues.

KNEE

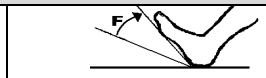
Repetition	N	Y		Comments:
Are identical or similar motions performed over and over again? (e.g., crouching to handle chains)			S O	
Static Posture				
Ask the worker: Do tasks require you to maintain your knee(s) in a fixed or static posture? (e.g., boat maintenance)			S O	
Are workers required to sit or stand in a stationary position for long periods of time during the shift? (e.g., sitting or standing to drive a boat)			S O	
Do workers kneel (with one or both knees)? (e.g., handling chains)			S O	
Contact Stress				
Ask the worker: Do **any** objects or parts of the workstation put pressure on your knee(s)? (e.g., kneeling on boat deck)			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

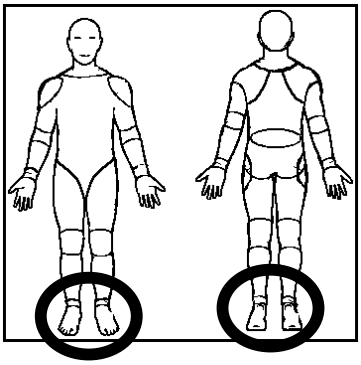


Body parts within the circled area will be classified as KNEE issues.

ANKLE/FOOT

Repetition	N	Y		Comments:
Are identical or similar motions performed over and over again? (e.g., balancing on logs)			S O	
Static Posture				
Are workers required to stand in a stationary position for long periods of time during the shift? (e.g., standing while driving a boat)			S O	
Awkward Posture				
Flexion 			S O	
Extension 			S O	
Vibration				
Ask the worker: Is your whole body exposed to vibration for significant portions of the work shift? (e.g., standing while driving a boat)			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., swifter lines, boom chains)			S O	
Are there problems handling a load due to its fragile, unbalanced, or non-rigid conditions? (e.g., swifter lines, boom chains)			S O	
Ask the worker: Do you experience situations where mechanical aids or equipment are not readily available to assist with manipulating an object? (e.g., hoists to lift saw bars)			S O	
Are handles for tools and equipment inappropriate in terms of size or shape? (e.g., saws, 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? (e.g., Deck Hands)			S O	
Ask the worker: Are you exposed directly to temperature extremes that may cause you to use more force or cause you to fatigue quicker than normal? (e.g., hot or cold, either by equipment or natural environment)			S O	
Lighting				
Ask the worker: Do you assume awkward postures to overcome problems associated with glare, inadequate lighting, or poor visibility? (e.g., glare from the water)			S O	

ENVIRONMENTAL CONDITIONS [CONTINUED]

Noise	N	Y		Comments:
Have there been complaints on the level of noise in the work area?			S O	
Ask the worker: Are there any distracting or annoying noises at the workstation? (e.g., horns)			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? (e.g., extended weekend maintenance)			S O	
Ask the worker: Are there indications of excessive fatigue or adverse health effects due to shiftwork? (e.g., employees on graveyards)			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? (e.g., Deck Hand constantly handling heavy chains)			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	

Injury Education **Injury Prevention**

Work Manual

Industrial
Musculoskeletal
Injury
Reduction
Program

Boom Area Employee

This Work Manual contains information about the body parts found to be at risk of musculoskeletal injury (MSI) for a Boom Area Employee (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

Boom Area Employee

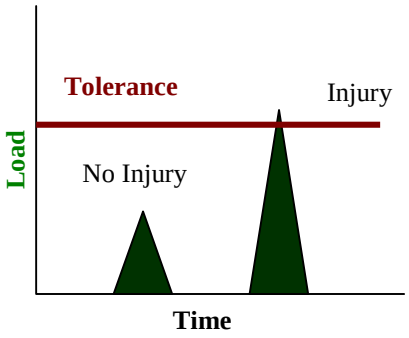
Disclaimer

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

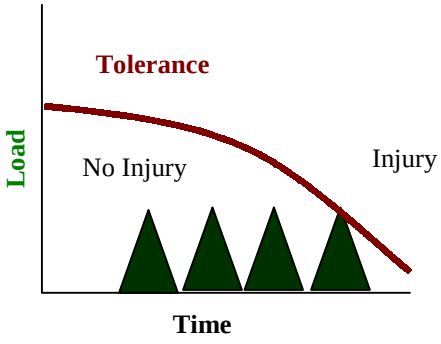
Injuries occur when …
Loads exceed tissue tolerances



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.

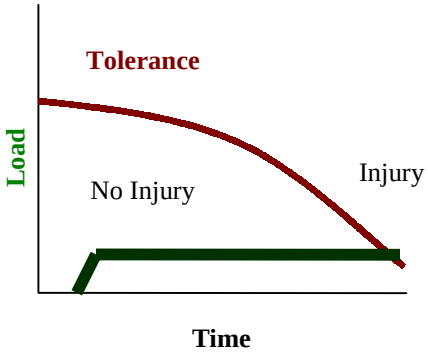
Example – a worker going over on their ankle and spraining it.



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 Boom Area Employee jobs (e.g., 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 a Boom Area Employee. In addition, a reference table, with a summary of the direct and indirect risk factors by body part, is provided.

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

Major Risk Identification

IMIRP ergonomists have assessed the Boom Area positions and found that the body parts of major concern vary depending on the tasks performed on a regular basis. Focussing on solutions that target the areas of major concern for each employee will likely reduce the greatest risks associated with Boom Area jobs. The information is presented in the following order:

General Boom Tasks

For Boom Area Employees who must repeatedly lift and handle boom chains, swifter lines, and bundle wires, and/or push or pull on pike poles and boom chains in order to manoeuvre logs and boom sticks the following body parts are of major concern.

Shoulder: Major risks include forceful use of the arms in an awkward posture while handling boom chains, swifter lines, and bundle wires, and/or pushing/pulling on pike poles and boom chains to manoeuvre logs and boom sticks. The risk of discomfort or injury in the shoulder is increased during extreme weather conditions (e.g., high winds, strong currents) and when these activities must be performed repeatedly, with little time for recovery.

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

Low Back: Major risks include forceful and repeated bending and twisting of the back while handling boom chains, swifter lines, and bundle wires, and/or pushing/pulling on pike poles and boom chains to manoeuvre logs and boom sticks. The risk of discomfort or injury in the low back is increased during extreme weather conditions (e.g., high winds, strong currents) and when these activities must be performed repeatedly, with little time for recovery.

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

1. Reduce reaching (page 129)
2. Standing work (page 129)
3. Brace upper body (page 132)
4. Remove loose bark (page 138)
5. Wire coiling device (page 138)
6. Staple (page 139)
7. String (page 139)
8. Pin driver (page 140)
9. Log infeed device (page 140)
10. Slip layout (page 140)
11. Flow control device (page 141)
12. Keep back straight (page 145)
13. Bend at hips (page 145)
14. Boat positioning (page 145)
15. Log pond organisation (page 146)
16. Dynamic activity (page 146)
17. Safe lifting area (page 147)
18. Use tools to lift (page 148)
19. Stretches (page 143)
20. Power positions (page 150)
21. Manual material handling (page 150)
22. Two person lift (page 151)
23. Lightweight, sharp tools (page 152)
24. Job rotation (page 156)
25. Task variability (page 157)

Boat Operators - General

For Boom Area Employees who must operate a boat for long periods, the low back is of major concern.

Low Back: Major risks include sitting on a vibrating surface for long periods and twisting to view the work area. The risk of discomfort or injury in the low back is increased if the boat operator must lift, handle, and/or manipulate heavy objects after sitting for long periods.

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

1. Swivel chair (page 130)
2. Swivel chair/control complex (page 130)
3. Chair orientation (page 130)
4. Adjustable seating (page 134)
5. Moveable chair (page 134)
6. Lumbar support (page 135)
7. Vary body posture (page 135)
7. Seat maintenance (page 136)
8. Mirrors (page 142)
9. Dynamic activity (page 146
10. Alternate sitting/standing (page 147)
11. Stretches/exercises (page 143)
12. Job rotation (page 156)
13. Task variability (page 157)

Sidewinder Operator

For Boom Area Employees who must operate Sidewinders for long periods, the elbow/wrist is of major concern.

Elbow/wrist: Major risks include forceful and static gripping of the throttle while the wrist is in an awkward posture. The risk of discomfort or injury in the elbow/wrist is increased when the throttle must be gripped for long duration.

The following solutions are targeted at reducing the risk of injury to the elbow/wrist:

1. Wire pulling mechanism (page 141)
2. Dynamic activity (page 146)
3. Stretches (page 143)
4. Throttle mechanism (page 151)
5. Foot controlled throttle (page 152)
6. Range of motion in throttle (page 152)
7. Neutral wrist postures (page 154)
8. Job rotation (page 156)
9. Task variability (page 157)

Boom and Tug Boat Operator

For Boom Area Employees who must operate Boomboats or Tugboats for long periods, the neck/upper back is of major concern.

Neck/upper back: Major risks include repeatedly holding an awkward posture of the neck and upper back while twisting the head to view around the boat. The risk of discomfort or injury in the neck/upper back is increased if the operator sits with poor posture.

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

1. Swivel chair (page 130)
2. Swivel chair/control complex (page 130)
3. Chair orientation (page 130)
4. Mirrors (page 142)
5. View with eyes (page 145)
6. Dynamic activity (page 146)
7. Stand sideways (page 147)
8. Stretches (page 143)
9. Job rotation (page 156)
10. Task variability (page 157)

Splitting Saw Operator

For Boom Area Employees who must lift heavy saw parts (e.g., saw bars), the low back is of major concern.

Low Back: Major risk is lifting heavy saw parts from a disadvantaged position during maintenance. The risk of discomfort or injury in the low back is increased when help (e.g., mechanical aids, additional person) is not available to lift heavy saw parts.

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

1. Mechanical aids (page 142)

Log Marker

For Boom Area Employees who must operate a chainsaw for long periods, the wrist/hand is of major concern.

Wrist/Hand: Major risk is gripping chainsaw for long periods in order to buck logs.

The following solutions are targeted at reducing the risk of injury to the wrist/hand:

1. Anti-vibration wrap (page 153)
2. Anti-vibration gloves (page 153)
3. Job rotation (page 156)
4. Task variability (page 157)

Bundle Crane Swamper

For Boom Area Employees who must cut bundle wires above shoulder height, the shoulder is of major concern.

Shoulder: Major risk is repeatedly lifting hand tools above shoulder height in order to cut bundle wires.

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

1. Cutting wires (page 133)
2. Dynamic activity (page 146)
3. Pulling stubborn wires (page 149)

NECK

Direct Risk Factors:
Repetition
Awkward Postures
Static Postures

A Boom Area Employee may hold the head forward or backward in order to guide logs and boomsticks with a pike pole, handle boom chains and swifter lines, and cut bundle wires with hand tools.

BACKGROUND INFORMATION

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

DIRECT RISK FACTORS

Repetition

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

Awkward Postures

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

Static Postures

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

INDIRECT RISK FACTORS

Workstation Design

Working Heights

- Loading on neck muscles is increased because the head is held in a forward bent position when viewing logs and bundles in the water. The additional height of the slips and decks may further increase neck bending.
- Loading on neck muscles is increased when the employee must bend forward and tilt the head backward in order to view the boom chains, swifter lines, and bundle wires in the water.

Work Organisation

Task Variability

- Loading on the neck muscles is increased when a lack of task variety prevents the Boom Area Employee from performing alternative tasks to allow the neck muscles time for a recovery break.

CONSEQUENCES

- When the head is held in a forward or backward bent position, 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 158 to 163.
- For exercises that can help to prevent ***neck*** injuries, see the ***Neck section of the Body Manual.***

NECK/UPPER BACK

Direct Risk Factors:
Repetition
Awkward Postures
Static Postures

A Boom Area Employee may turn the head to the side while operating a boat in order to view activities on the water and on shore. Some boat layouts lead to extremely poor postures.

BACKGROUND INFORMATION

- Muscle groups in the neck and upper back play a role in maintaining the spine in an upright posture. A number of the smaller muscles around the neck also 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, shoulders, and hips are aligned.

DIRECT RISK FACTORS

Repetition

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

Awkward Postures
Static Postures

- When sitting with a head-forward posture (head is not aligned over the spine), the muscles of the neck and upper back can become over-stretched and fatigued. The result is what is called "stretch-weakened" muscles.
- Neck and upper back 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.

INDIRECT RISK FACTORS

Workstation Design

Working Reaches

- Loading on the muscles of the neck and upper back is increased because the orientation and lack of adjustability of seating requires the boat operator to repeatedly turn the head in order to view the controls and the work area around the boat.

Additional Workstation Design Options

- Loading on the neck and upper back muscles is increased because the orientation of the employee in the boat, with respect to towed loads and/or the positioning of additional boat employees, requires the operator to repeatedly twist the neck in order to monitor the work area.

Work Organisation

Task Variability

- Loading on the neck muscles is increased when a lack of task variety prevents the Boom Area Employee from performing alternative tasks to allow the neck muscles time for a recovery break.

CONSEQUENCES

- When the head is held in a twisted posture, muscles and soft tissues of the neck and upper back may fatigue. Fatigue leads to an accumulation of waste products and a decrease in the ability to tolerate additional stress.
- Continual operation of a boat in poor posture can lead to over-stretched ligaments and stretch-weakened muscles in the neck and upper back. Eventually, if not repaired, this may lead to permanent postural changes.
- Signs and symptoms include pain, tenderness, muscle spasm in the neck and upper back area, and headaches.

SUGGESTED SOLUTIONS

- For specific solutions that may prevent injuries to the Neck/Upper Back, please see the column labelled “Neck/Upper Back” in the Summary of Solutions on pages 158 to 163.
- For exercises that can help to prevent ***neck*** injuries, see the ***Neck section of the Body Manual.***
- To help prevent ***upper back*** discomfort, see the posture check, external shoulder rotation, and isometric neck extension exercises in the ***Body Manual.***

NECK/SHOULDER

Direct Risk Factors:
Force
Repetition

A Boom Area Employee may pull on pike poles and boom chains in order to manoeuvre logs and boom sticks.

BACKGROUND INFORMATION

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

DIRECT RISK FACTORS

Force

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

Repetition

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

INDIRECT RISK FACTORS

Workstation Design

Working Reaches

- Loading on the neck and shoulder muscles is increased because the Boom Area Employee may need to reach beyond the dimensions of a slip or boat in order to manoeuvre logs, boom sticks, and chains or lines in the water.

Additional Workstation Design Options

- Loading on the neck and shoulder muscles is increased when certain mill infeed mechanisms are used. Side lifts, for example, may cause problems when only one side of the log catches on the chair.
- Loading on the neck and shoulder muscles is increased when the slip or raceway layout is not straight, as additional force may be required to guide logs and deal with cross-ups. Straight slips or raceways allow logs to flow easily, producing less jams and cross-ups.
- Loading on the neck and shoulder muscles is increased when log ponds have ineffective or no flow control devices to counteract the effects of currents and tides.

Environmental Conditions

- Loading on the neck and shoulder muscles is increased when high winds and/or strong currents are present because the employee must work harder to move the logs and boomsticks against the wind and currents.

Work Organisation

Task Variability

- Loading on the neck muscles is increased when a lack of task variety prevents the Boom Area Employee from performing alternative tasks to allow the neck muscles time for a recovery break.

CONSEQUENCES

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

SUGGESTED SOLUTIONS

- For specific solutions that may prevent injuries to the Neck/Shoulder, please see the column labelled “Neck/Shoulder” in the Summary of Solutions on pages 158 to 163.
- To help prevent ***neck*** discomfort, see the upper trapezius stretch in the ***Neck section of the Body Manual.***

SHOULDER

Direct Risk Factors:
Force
Repetition
Awkward Postures

A Boom Area Employee may push or pull on pike poles and boom chains in order to manoeuvre logs and boomsticks.

A Boom Area Employee may pull on boom chains, swifter lines, and bundle wires in order to form or release bags, booms, lockages, or bundles, unhook boom sticks, and coil lines and wires.

A Boom Area Employee may push down on logs when using a chainsaw to buck logs.

BACKGROUND INFORMATION

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

DIRECT RISK FACTORS

Force

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

Repetition

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

Awkward Postures

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

INDIRECT RISK FACTORS

Workstation Design

Working Reaches

- Loading on the rotator cuff is increased because the Boom Area Employee may need to reach beyond the dimensions of a slip or boat in order to manoeuvre logs, boom sticks, and chains or lines in the water.

Working Heights

- Loading on the rotator cuff is increased when bucking logs because the shoulder must be placed in an awkward posture in order to lift and hold the chainsaw over large logs.

Additional Workstation Design Options

- Loading on the rotator cuff is increased when certain mill infeed mechanisms are used. Side lifts, for example, may cause problems when only one side of the log catches on the chair.
- Loading on the rotator cuff is increased when the slip or raceway layout is not straight as additional force may be required to guide logs and deal with cross-ups. Straight slips or raceways allow logs to flow straighter, producing less jams and cross-ups.
- Loading on the rotator cuff is increased when log ponds have ineffective or no flow control devices to counteract the effects of currents/tides.
- Loading on the rotator cuff is increased when wires and lines are coiled manually, in positions requiring awkward arm movements.
- Loading on the rotator cuff is increased when Boom Area Employees must forcefully pull on cut bundle wires in order to free them from the logs.

Environmental Conditions

- Loading on the rotator cuff is increased when high winds and/or strong currents are present because the employee must work harder to move the logs and/or boom sticks against the wind and currents.

Work Organisation

Task Variability

- Loading on the rotator cuff is increased when a lack of task variety prevents the Boom Area Employee from performing alternative tasks to allow the shoulder muscles time for a recovery break.

CONSEQUENCES

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

SUGGESTED SOLUTIONS

- For specific solutions that may prevent injuries to the Shoulder, please see the column labelled “Shoulder” in the Summary of Solutions on pages 158 to 163.
- For exercises that can help to prevent ***shoulder*** injuries, see the ***Shoulder section of the Body Manual.***

SHOULDER

Direct Risk Factors:
Force
Awkward Postures

A Boom Area Employee may manipulate the boat steering wheel with a 'Suicide Knob' in order to guide the boat.

BACKGROUND INFORMATION

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

DIRECT RISK FACTORS

Force

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

Awkward Postures

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

INDIRECT RISK FACTORS

Characteristics of Objects Being Handled

Size and Shape

- Loading on the rotator cuff is increased because a relatively large force must be applied to the small 'Suicide Knob', often while the shoulder is in awkward positions, in order to steer the boat.

Environmental Conditions

Vibration (Jolting)

- Loading on the rotator cuff is increased because the operator must ram the boat into logs and/or bundles, often while the shoulder is in an awkward position, in order to push the logs and bundles.

Work Organisation

Task Variability

- Loading on the rotator cuff is increased when a lack of task variety prevents the Boom Area Employee from performing alternative tasks to allow the shoulder muscles time for a recovery break.

CONSEQUENCES

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

SUGGESTED SOLUTIONS

- For specific solutions that may prevent injuries to the Shoulder, please see the column labelled "Shoulder" in the Summary of Solutions on pages 158 to 163.
- For exercises that can help to prevent ***shoulder*** injuries, see the ***Shoulder section of the Body Manual.***

SHOULDER

Direct Risk Factors:
Repetition
Awkward Postures

A Boom Area Employee may work with the arms overhead in order to cut bundle wires and to perform boat maintenance tasks.

BACKGROUND INFORMATION

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

DIRECT RISK FACTORS

Repetition

- The rotator cuff tendon can fray from repeated rubbing against bone. If the repetitive stress is excessive, and recovery is not adequate, the tendon may fatigue to the point of injury.

Awkward Postures

- A rotator cuff tendon may rub up against bone (impingement) when the arms are lifted overhead. The friction between the tendon and the bone increases as the arm is lifted higher. In addition, the rotator cuff must stabilise the weight of the arms when working overhead, increasing the tension in the tendon. The combination of impingement and tension increases the stress on this tendon.

INDIRECT RISK FACTORS

Workstation Design

Working Heights

- Loading on the rotator cuff is increased because the bundle wires or parts/machinery are located above shoulder height.

Work Organisation

Task Variability

- Loading on the rotator cuff is increased when a lack of variety in tasks prevents the Boom Area Employee from performing alternative tasks that would allow the rotator cuff to have a recovery break.

CONSEQUENCES

- Repeatedly lifting the arms overhead may lead to fraying in the tendon, as a result of the friction between the tendon and the bone.
- Rotator cuff muscles may become weakened.
- Signs and symptoms include pain when lifting the arm to the side, above shoulder height.

SUGGESTED SOLUTIONS

- For specific solutions that may prevent injuries to the Shoulder, please see the column labelled “Shoulder” in the Summary of Solutions on pages 158 to 163.
- For exercises that can help to prevent ***shoulder*** injuries, see the ***Shoulder section of the Body Manual.***

ELBOW/WRIST

Direct Risk Factors:
Force
Awkward Postures
Static Postures

A Boom Area Employee may grip and hold the throttle in order to operate a Sidewinder.

A Boom Area Employee may grip a chainsaw in order to buck logs.

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 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., Sidewinder throttle) 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 forearm muscles work efficiently. This occurs when the wrist is in its natural relaxed 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.

Static Postures

- When the wrist and hand must maintain a forceful grip, the constant tension generated by muscles may lead to fatigue at the tendon/bone connection. If the duration of constant stress is excessive, and recovery is not adequate, the tissues may fatigue to the point of injury.

INDIRECT RISK FACTORS

Characteristics of Objects Being Handled

Size and Shape

- Loading on the tendon/bone connection is increased because the width of the throttle grip in the Sidewinder is large, requiring a wide grip in order to operate.

Environmental Conditions

Vibration

- Loading on the tendon/bone connection is increased because vibration transmitted to the hand can interfere with the sensory feedback pathways to the brain. This interference can result in over-gripping of the throttle or chainsaw.

Work Organisation

Task Variability

- Loading on the tendon/bone connection is increased when a lack in task variety prevents the Boom Area Employee from performing tasks that will allow the tendon/bone connection to have a recovery break.

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 158 to 163.
- For exercises that can help to prevent ***elbow*** injuries, see the ***Elbow section of the Body Manual.***

ELBOW/WRIST

Direct Risk Factors:
Force
Repetition
Awkward Postures

A Boom Area Employee may grip hand tools in order to guide logs and cut bundle wires.

A Boom Area Employee may grip the steering wheel of a boat in order to control the boat.

BACKGROUND INFORMATION

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

DIRECT RISK FACTORS

Force

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

Repetition

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

Awkward Postures

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

INDIRECT RISK FACTORS

Workstation Design

Additional Workstation Design Options

- Loading on the tendon/bone connection is increased when Boom Area Employees must forcefully grip and pull on cut bundle wires in order to free the wires from the logs.

Characteristics of Objects Being Handled

Size and Shape

- Loading on the tendon/bone connection is increased because the size of the controls and tools gripped may be larger or smaller than “optimal” grip size, contributing to awkward postures in the wrist.

Container, Tool, and Equipment Handles

- Loading on the tendon/bone connection is increased because the location of the handles may contribute to awkward postures at the wrist.
- Loading on the tendon/bone connection is increased because slippery tool handles increase the grip force required to maintain control of the tool.
- Loading on the tendon/bone connection is increased when bolt cutters requiring a large force are used to cut bundle wires. Some workplaces use pneumatic bolt cutters, or grinder saws, to reduce grip force.
- Loading on the tendon/bone connection is increased when gloves with slippery surfaces, or gloves that are too big or too small, are worn. These gloves will increase the effort required to grip.

Environmental Conditions

Cold Exposure

- Loading on the tendon/bone connection is increased in cold environments. There is a loss in tactile feel that occurs when hands get cold, and this can lead to an increase in the grip force used to handle objects.

Work Organisation

Task Variability

- Loading on the tendon/bone connection is increased when a lack in task variety prevents the Boom Area Employee from performing tasks that will allow the tendon/bone connection to have a recovery break.

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 158 to 163.
- For exercises that can help to prevent ***elbow*** injuries, see the ***Elbow section of the Body Manual.***

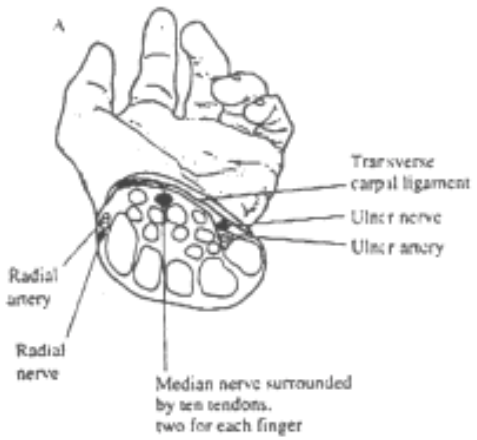
WRIST/HAND

Direct Risk Factors:
Repetition
Awkward Postures
Vibration

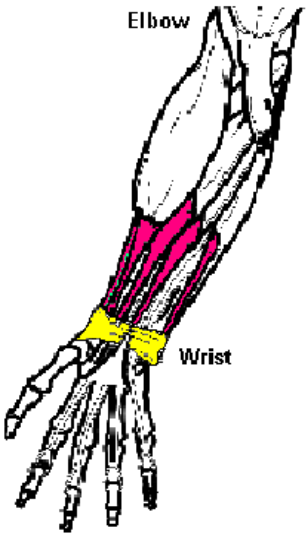
A Boom Area Employee may grip the steering wheel or jog steering lever of a boat with the wrist bent in order to operate the boat.

BACKGROUND INFORMATION

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



The Carpal Tunnel



DIRECT RISK FACTORS

Repetition

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

Awkward Postures

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

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 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

Size and Shape

- Loading on the tendon sheaths is increased because the size, shape, and orientation of the control handles may require awkward postures and large movements.

Work Organisation

Task Variability

- Loading on the tendon sheaths is increased when a lack in task variety prevents the Boom Area Employee from performing tasks that will allow the tendon sheaths to have a recovery break.

CONSEQUENCES

- Repeatedly gripping objects with the wrist bent may lead to irritation and damage in the tendon sheaths.
- Repeatedly gripping vibrating tools/controls may lead to degeneration of tissues in the hand.
- Signs and symptoms include pain, tenderness, inflammation, and/or a loss of sensation in the wrist and hand area.

SUGGESTED SOLUTIONS

- For specific solutions that may prevent injuries to the Wrist, please see the column labelled “Wrist” in the Summary of Solutions on pages 158 to 163.

WRIST/HAND

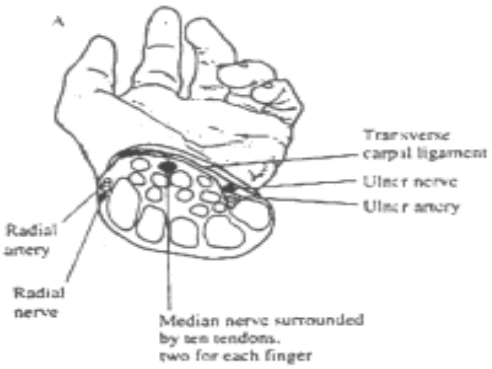
Direct Risk Factors:
Awkward Postures
Static Postures
Vibration

A Boom Area Employee may grip the steering wheel and throttle when operating a Sidewinder.

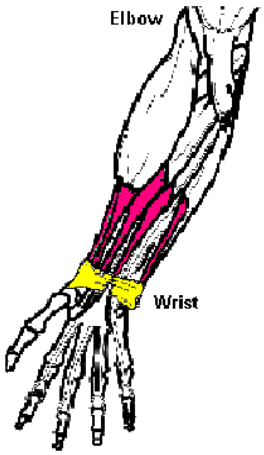
A Boom Area Employee may grip a vibrating chainsaw for long periods in order to buck logs.

BACKGROUND INFORMATION

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



The Carpal Tunnel



DIRECT RISK FACTORS

Awkward Postures

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

Static Postures

- When the wrist is held in a bent position, the tendon sheaths are under constant stress. If the duration of constant stress is excessive, and recovery is not adequate, tissues may fatigue to the point of 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

Size and Shape

- Loading on the tendon sheaths is increased because the width of the throttle grip in the Sidewinder is large, requiring a wide grip in order to operate it.

Container, Tool, and Equipment Handles

- Loading on the tendon sheaths and structures of the hand is increased because tool and control handles transmit vibration through the hand and wrist.
- Loading on the tendon sheaths is increased because the location of handles may contribute to awkward postures at the wrist.
- Loading on the tendon sheaths is increased because slippery tool handles increase the grip force required to maintain control of the tool.
- Loading on the tendon sheaths is increased when bolt cutters requiring large force are used to cut bundle wires. Some workplaces use pneumatic bolt cutters, or grinder saws, to reduce grip force.
- Loading on the tendon sheaths is increased when gloves with slippery surfaces, or gloves that are too big or too small, are worn. These gloves will increase the effort required to grip.

Environmental Conditions

Cold Exposure

- Loading on the tendon sheaths is increased in cold environments. There is a loss in tactile feel that occurs when hands get cold, and this decreased feel can lead to an increase in the grip force used to handle objects.

Work Organisation

Task Variability

- Loading on the tendon sheaths is increased when a lack in task variety prevents the Boom Area Employee from performing tasks that will allow the tendon sheaths to have a recovery break.

CONSEQUENCES

- Holding the wrist in a bent position may lead to irritation and damage in the tendon sheaths.
- Holding a vibrating tool/control for long periods may lead to degeneration of tissues in the hand.
- Signs and symptoms include pain, tenderness, inflammation, and/or a loss of sensation in the wrist and hand area.

SUGGESTED SOLUTIONS

- For specific solutions that may prevent injuries to the Wrist, please see the column labelled “Wrist” in the Summary of Solutions on pages 158 to 163.

LOW BACK

Direct Risk Factors:
Force
Repetition
Awkward Postures

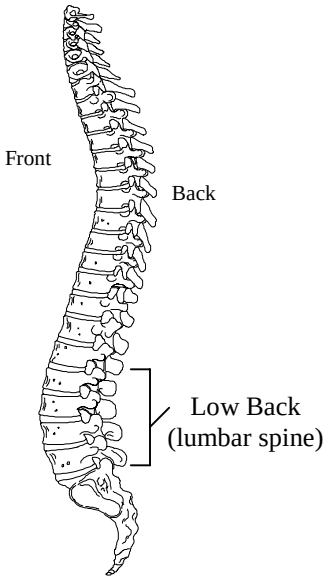
A Boom Area Employee may bend forward or squat in order to handle boom chains, swifter lines, and bundle wires.

A Boom Area Employee may bend forward and/or to the side in order to manoeuvre logs and boomsticks with pike poles.

A Boom Area Employee may bend forward and stabilise the weight of a chainsaw in order to buck logs.

BACKGROUND INFORMATION

Neutral Spine



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

DIRECT RISK FACTORS

Force

- Lifting increases the loading on the spine. Weight held in the hands is transmitted to the low back. The greater the weight, the greater the load on the structures of the low back.
- Pulling on pike poles to manoeuvre logs and boomsticks requires back muscles to stabilise the spine. The greater the pull, the greater the tension developed in the muscles.
- If the force placed on back muscles exceeds tissue tolerances, injury may occur.

Repetition

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

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 pressures on the walls of discs.

INDIRECT RISK FACTORS

Workstation Design

Working Reaches

- Loading on the structures of the low back is increased because the Boom Area Employee may need to reach beyond the dimensions of a slip or boat in order to manoeuvre logs, boom sticks, and chains or lines in the water.

Working Heights

- Loading on the structures of the low back is increased because the Boom Area Employee must bend down in order to reach objects in the water.

Floor Surfaces

- Loading on the structures of the low back is increased because the Boom Area Employee must lift and manoeuvre chains and wires while balancing on wet and slippery logs.

Additional Workstation Design Options

- Loading on the structures of the low back is increased when certain mill infeed mechanisms are used. Side lifts, for example, may cause problems when only one side of the log catches on the chair.
- Loading on the structures of the low back is increased when the slip or raceway layout is not straight, as additional force may be required to guide logs and deal with cross-ups. Straight slips or raceways allow logs to flow more easily, producing less jams and cross-ups.
- Loading on the structures of the low back is increased when log ponds have ineffective or no flow control devices to counteract the effects of currents/tides.
- Loading on the structures of the low back is increased when wires and lines are coiled manually, in positions requiring excessive trunk bending.
- Loading on the structures of the low back is increased when stubborn "U" bolts require workers to spend longer periods in a bent posture to release the bolt.
- Loading on the structures of the low back is increased when the time spent bent down manipulating boom chains into and out of boom sticks is increased due to mis-aligned toggles.
- Loading on the structures of the low back is increased when Boom Area Employees must forcefully pull on cut bundle wires in order to free them from the logs.

Environmental Conditions

- Loading on the structures of the low back is increased when high winds and/or strong currents are present because the employee must work harder to move the logs and/or boomsticks against the wind and currents.

Work Organisation

Task Variability

- Loading on the structures of the low back is increased when a lack of task variety prevents the Boom Area Employee from performing tasks that will allow the structures of the low back to have a recovery break.

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 158 to 163.
- For exercises that can help to prevent ***back*** injuries, see the ***Back section of the Body Manual.***

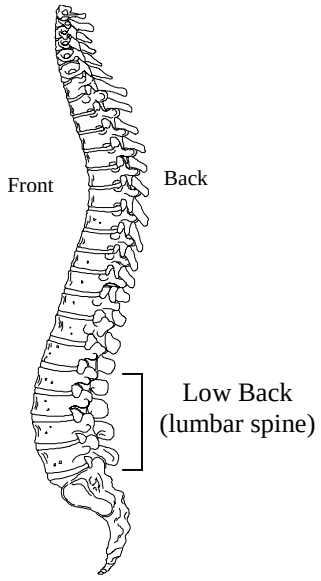
LOW BACK

Direct Risk Factors:
Repetition
Awkward Postures
Static Postures
Vibration

A Boom Area Employee may bend or twist in order to view around the boat and reach controls while operating a boat.

BACKGROUND INFORMATION

Neutral Spine



- 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

Repetition

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

Awkward Postures

Static Postures

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

Vibration

- Whole body vibration is usually transmitted through the seat to 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

Working Reaches

- Loading on the structures of the low back is increased because the orientation and lack of adjustability in the seating requires the boat operator to repeatedly turn the body in order to view the controls and the work area around the boat.

Working Heights

- Loading on the structures of the low back is increased because the height of steering wheel in certain boats may require the operator to bend over in order to use it.

Seating

- Loading on the structures of the low back is increased by a lack of supportive features in the boat chair (e.g., lumbar support).

Additional Workstation Design Options

- Loading on the structures of the low back is increased because the orientation of the employee in the boat, with respect to the towed loads and/or the positioning of additional boat employees, requires the operator to repeatedly twist in order to monitor the work area.

Work Organisation

Task Variability

- Loading on the structures of the low back is increased when a lack in task variety prevents the Boom Area Employee from performing tasks that will allow the structures of the low back to have a recovery break.

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 158 to 163.
- For exercises that could help to prevent ***back*** injuries, see the ***Back section of the Body Manual.***

LOW BACK

Direct Risk Factors:
Force
Awkward Postures

A Boom Area Employee may lift heavy saw parts in order to perform maintenance on them.

BACKGROUND INFORMATION

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

DIRECT RISK FACTORS

Force

- Lifting increases loading on the spine. The effect of weight held in the hands is transmitted to the low back. The greater the weight, the greater the loading on the structures of the low back.
- If the force placed on the back muscles exceeds tissue tolerances, injury may occur.

Awkward Postures

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

INDIRECT RISK FACTORS

Workstation Design

Working Reaches

- Loading on the back muscles is increased because the Boom Area Employee must reach beyond the deck in order to lift heavy saw parts.

Additional Workstation Design Options

- Loading on the back muscles is increased because no mechanical aids are available to help lift objects of excessive weight.

CONSEQUENCES

- Lifting heavy objects in awkward positions can strain the back muscles.
- Signs and symptoms include pain and stiffness. Muscle spasms may also be present.

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 158 to 163.
- For exercises that can help to prevent ***back*** injuries, see the ***Back section of the Body Manual.***

HIP

Direct Risk Factors:
Force
Repetition

A Boom Area Employee may spend long periods of time walking and balancing on logs.

A Boom Area Employee may push or pull on logs and boom sticks with a pike pole in order to guide them to appropriate areas.

BACKGROUND INFORMATION

- The hip is designed for stability, based on the architecture of the bones. Muscles also contribute to the stability of the hip joint. Range of motion in the hip joint is primarily determined by the flexibility of muscles and soft tissues in this region.

DIRECT RISK FACTORS

Force

- Balancing/walking on logs and pushing/pulling on logs loads the muscles in the hip. The greater the push or pull, the greater the loading on hip muscles.

Repetition

- When walking/balancing on logs, muscles of the hip are subjected to repeated stress with little time for recovery. If repetitive stress is excessive, and recovery is not adequate, tissues may fatigue to the point of injury.
- Repeated pushing or pulling on one side of the body can lead to muscle imbalance in the hips. The larger the muscle imbalance, the greater the loading on one hip.

INDIRECT RISK FACTORS

Workstation Design

Floor Surfaces

- Loading on the muscles of the hip is increased because the Boom Area Employee must balance on wet and slippery logs.

Additional Workstation Design Options

- Loading on the hip muscles is increased when certain mill infeed mechanisms are used. Side lifts, for example, may cause problems when only one side of the log catches on the chair.
- Loading on the hip muscles is increased when the slip or raceway layout is not straight as additional force may be required to guide logs and deal with cross-ups. Straight slips or raceways allow logs to flow more easily, producing less jams and cross-ups.
- Loading on the hip muscles is increased when log ponds have ineffective or no flow control devices to counteract the effects of currents/tides.

Work Organisation

Task Variability

- Loading on the muscles of the hip is increased when a lack in task variety prevents the Boom Area Employee from performing tasks that will allow the muscles of the hip to have a recovery break.

CONSEQUENCES

- When walking and balancing on logs, muscles of the hip may fatigue. Fatigue leads to an accumulation of waste products and/or a decrease in the ability to tolerate additional stress.
- Repeated pushing or pulling to one side of the body can lead to muscle imbalance at the hip. This muscle imbalance may lead to excessive loading, which in turn may cause degenerative changes in the hip, and possibly the knee and low back.
- Signs and symptoms include pain in the area around the hip joint and stiffness to one side. Muscle weakness in the affected side may also be noticed.

SUGGESTED SOLUTIONS

- For specific solutions that may prevent injuries to the Hip, please see the column labelled "Hip" in the Summary of Solutions on pages 158 to 163.
- To help prevent ***hip*** discomfort, see the gluteal and groin stretches in the ***Back section of the Body Manual.***

KNEE

Direct Risk Factors:
Repetition
Awkward Postures
Static Postures
Contact Stress

A Boom Area Employee may kneel or crouch when handling boom chains, bundle wires, and swifter lines.

BACKGROUND INFORMATION

- At the knee joint, the kneecap (patella) is held in place over the thighbone (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 kneecap can come into contact with the thighbone.

DIRECT RISK FACTORS

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 thighbone and increased contact stress between these bones.

Awkward Postures
Static Postures

- Bending the knee increases contact stress between the kneecap and the thighbone. Contact stress increases significantly when the knee is bent over 90 degrees.

Contact Stress

- Kneeling on a hard surface increases contact stress between the kneecap and the thighbone.

INDIRECT RISK FACTORS

Workstation Design

Floor Surfaces

- Loading on the knee is increased because the Boom Area Employee must kneel on hard logs, boat decks, and slips in order to reach the boom chains, bundle wires, or swifter lines in the water.

Additional Workstation Design Options

- Loading on the knee is increased when stubborn "U" bolts require longer periods in a crouched posture in order to release them.
- Loading on the knee is increased when the time spent crouched down manipulating boom chains into and out of boom sticks is increased due to mis-aligned toggles.

Work Organisation

Task Variability

- Loading on the knee is increased when a lack in task variety prevents the Boom Area Employee from performing tasks that will allow the knee to have a recovery break.

CONSEQUENCES

- Repeated squatting and kneeling could cause inflammation under the kneecap, which may cause pain and may change the mechanics of kneecap tracking. Changes in kneecap tracking may lead to premature wear of the kneecap and/or the thighbone.
- 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 158 to 163.
- For exercises that could help to prevent ***knee*** injuries, see the ***Knee section of the Body Manual.***

FOOT

Direct Risk Factors:
Repetition

A Boom Area Employee may walk over unstable logs and stand in cold water when working around the boom area.

BACKGROUND INFORMATION

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

DIRECT RISK FACTORS

Repetition

- During walking, impact between the ground and the feet loads the plantar fascia. If the duration of walking is excessive, and recovery is not adequate, the fascia may fatigue to the point of injury.

INDIRECT RISK FACTORS

Workstation Design

Floor Surfaces

- Loading on the foot is increased because uneven walking surfaces increase the amount of muscle activity required around the foot and ankle in order to maintain balance. This activity will increase loading on the plantar fascia and its underlying musculature as well as the musculature supporting the ankle.

Additional Workstation Design Options

- Loading on the foot is increased when Boom Area Employees that spend the majority of their time walking and balancing on uneven floor surfaces are given no opportunities to sit down and rest the feet.

Environmental Conditions

Cold Exposure

- Loading on the foot is increased because exposure of the feet to cold water will decrease the blood flow to the plantar fascia and underlying musculature, thus slowing the recovery rate of the tissues.

Work Organisation

Task Variability

- Loading on the foot is increased when a lack in task variety prevents the Boom Area Employee from performing tasks that will allow the foot to have a recovery break.

CONSEQUENCES

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

SUGGESTED SOLUTIONS

- For specific solutions that may prevent injuries to the Foot, please see the column labelled “Foot” in the Summary of Solutions on pages 158 to 163.
- For exercises that can help to prevent ***foot*** injuries, see the ***Foot section of the Body Manual.***

Summary of Body Parts at Risk

NECK

- A Boom Area Employee may hold the head forward or backward in order to guide logs and boomsticks with a pike pole, handle boom chains and swifter lines, and cut bundle wires with hand tools.

NECK/UPPER BACK

- A Boom Area Employee may turn the head to the side while operating a boat in order to view activities on the water and on shore. Some boat layouts lead to extremely poor postures.

NECK/SHOULDER

- A Boom Area Employee may pull on pike poles and boom chains in order to manoeuvre logs and boom sticks.

SHOULDER

- A Boom Area Employee may push or pull on pike poles and boom chains in order to manoeuvre logs and boomsticks.

- A Boom Area Employee may pull on boom chains, swifter lines, and bundle wires in order to form or release bags, booms, lockages, or bundles, unhook boom sticks, and coil lines and wires.

- A Boom Area Employee may push down on logs when using a chainsaw to buck logs.

SHOULDER

- A Boom Area Employee may manipulate the boat steering wheel with a 'Suicide Knob' in order to guide the boat.

- A Boom Area Employee may work with the arms overhead in order to cut bundle wires and to perform boat maintenance tasks.

ELBOW/WRIST

- A Boom Area Employee may grip and hold the throttle in order to operate a Sidewinder.

- A Boom Area Employee may grip a chainsaw in order to buck logs.

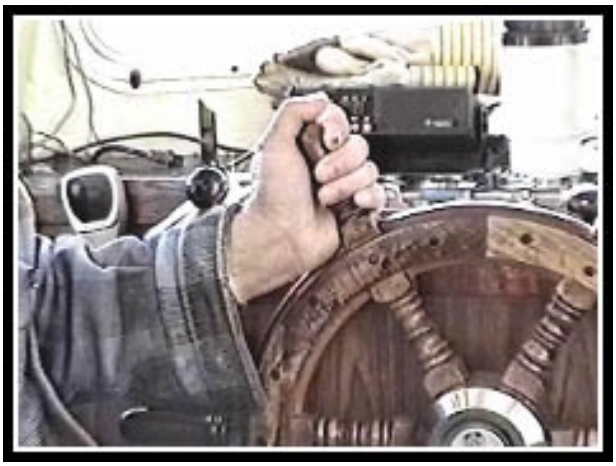
ELBOW/WRIST

- A Boom Area Employee may grip hand tools in order to guide logs and cut bundle wires.

- A Boom Area Employee may grip the steering wheel of a boat in order to control the boat.

WRIST/HAND

- A Boom Area Employee may grip the steering wheel or jog steering lever of a boat with the wrist bent in order to operate the boat.



- A Boom Area Employee may grip the steering wheel and throttle when operating a Sidewinder.

- A Boom Area Employee may grip a vibrating chainsaw for long periods in order to buck logs.

LOW BACK

- A Boom Area Employee may bend forward or squat in order to handle boom chains, swifter lines, and bundle wires.

- A Boom Area Employee may bend forward and/or to the side in order to manoeuvre logs and boomsticks with pike poles.

- A Boom Area Employee may bend forward and stabilise the weight of a chainsaw in order to buck logs.

LOW BACK

- A Boom Area Employee may bend or twist in order to view around the boat and reach controls while operating a boat.

- A Boom Area Employee may lift heavy saw parts in order to perform maintenance on them.

HIP

- A Boom Area Employee may spend long periods of time walking and balancing on logs.

- A Boom Area Employee may push or pull on logs and boom sticks with a pike pole in order to guide them to appropriate areas.

KNEE

- A Boom Area Employee may kneel or crouch when handling boom chains, bundle wires, and swifter lines.

FOOT

- A Boom Area Employee may walk over unstable logs and stand in cold water when working around the boom area.

Risk Factors by Body Part

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

Indirect Risk Factors		Neck	Neck/ Upper Back	Neck/ Shoulder	Shoulder	Elbow/ 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	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦

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

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

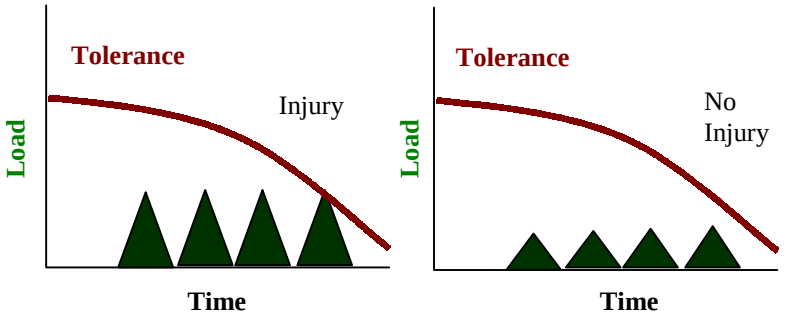
= Indicates that the risk factor was assessed and was not found to be a contributor to the body part problem.

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

✓ = Indicates that the risk factor was assessed as a contributor to the body part problem. Please see the Summary of Solutions Table on pages 158 to 163 for specific problem/solution information. Additional information on some risk factors can be found in the General Risk Factor Solutions Manual.

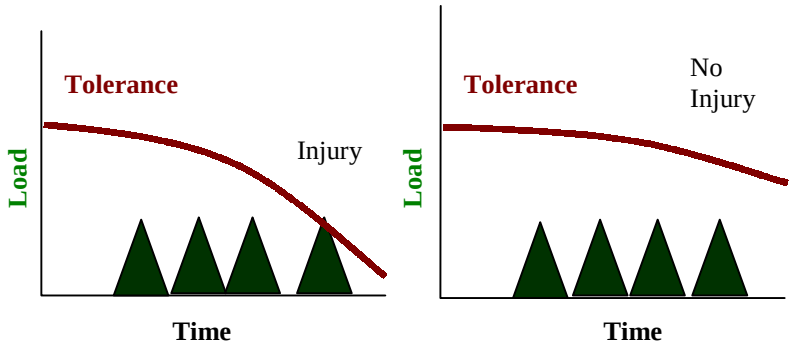
Injury Prevention

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 Boom Area Employees. 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

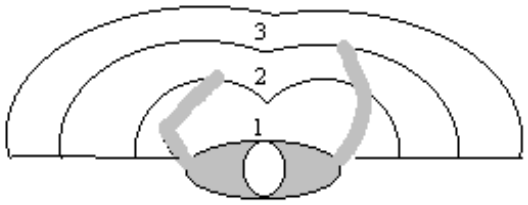
These are devices worn by a worker to reduce the risk of injury, including gloves, kneepads, hearing protection, and leather aprons.

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.

Reduce reaching

E
WP

In order to reduce loading on the shoulders and low back, use a lightweight, long pike pole or picaroon to reach logs, boom chains, etc. Provide various lengths of pike poles for different tasks or situations.

Standing work

WP

In order to minimise loading on the shoulders and low back, pulling and pushing of logs should be performed while standing. With both feet planted, the Boom Area Employee has more stability and can recruit the larger muscle groups from the legs to assist with the physical demands. Sitting will increase the amount of reaching necessary and place increased stress on the muscle groups of the upper body. These factors increase the risk of injury.

BOOM BOAT/TUG BOAT

Tug and Boom Boat Operators are often required to operate controls located in front of them while twisting to view towed loads and conditions around the boat. This motion can increase the loading on the neck/upper back, shoulders, and low back. The following solutions are geared towards reducing the strain associated with continued twisting and reaching for controls.

Swivel chair

E

In order to reduce loading on the neck/upper back and low back the operator's chair can be mounted on a swivel base. This change would allow the Operator to turn the whole chair while maintaining the neck, upper back, and low back in neutral postures to view areas around the boat. It is important to understand that this solution may increase reaching with the arms to operate controls located on the front control panel.

Integrated swivel chair/control unit

E

In order to reduce loading on the neck, upper back, shoulder, and low back the operator chair and controls can be mounted on a swivel base that allows the operator to turn in either direction while having the chair and controls turn together with the user. This layout would reduce the twisting and reaching required in operating the boat. For safety purposes, the swivel unit should have a locking mechanism that is within easy reach for the operator.

Chair orientation

E
WP

In order to reduce loading on the neck, upper back, shoulder, and low back, evaluate the Boat Operator's orientation in relation to the necessary controls. Many of the operators observed attempted to alleviate the strain associated with constant twisting and reaching by placing their chairs on a 45 to 90 degree angle to the front controls (sitting sideways). Ensure that the seating available in the boats has the ability to be repositioned in this way, and encourage the operators to find the orientation most comfortable for them. Operators should also be encouraged to reposition their chair periodically.

WORKING HEIGHTS

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

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

To determine the appropriate work height specific for the Boom Area Employee, 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.

Ear plugs

PPE

In order to reduce loading on the neck, use earplugs or custom-fitted earpieces instead of earmuffs. This change will decrease the load on the head that must be supported by the neck muscles when the head is bent forward.

Look down with eyes

WP

In order to reduce awkward postures of the neck; look down with the eyes, not just the neck, to view logs and bundles in the water. If neck bending cannot be avoided, keep the chin tucked in and the ears in alignment with the shoulders.

Brace upper body

WP In order to reduce loading on the low back when leaning over to handle objects, avoid overextending to reach the objects and brace the upper body with the free arm when possible.

When leaning over to handle objects, brace the upper body by resting the free arm on the legs, or other secure point. This posture will reduce strain on the low back.

SLIPMAN

Deck height

E In order to reduce loading on the neck, keep deck heights as low as possible. This setup will reduce the amount of neck bending required to view logs and bundles in the water.

BOOM BOAT/TUG BOAT

Height of steering wheel

E In order to reduce loading on the low back, tug and boom boat steering wheels should be raised to eliminate the need to bend forward while steering. Care should be taken to not raise the steering wheel too high, as this may introduce awkward postures of the shoulder.

Arm supports

E
WP

In order to reduce awkward and static postures of the neck/shoulder and wrist when operating controls while seated, consider the height of the controls and arm supports. An operator's elbows and forearms should sit comfortably on the arm supports with the shoulders relaxed and the wrists free for using controls. Arm supports that are well padded are preferred. Resting the arms on arm supports reduces muscle tension and fatigue in the neck and shoulder.

Boom Area Employees should be encouraged to use arm supports to relax the muscles in the neck/shoulder region when there is a break in the workload when in a seated position. Placing elbows and forearms on arm supports while taking these microbreaks will allow working muscles to recover and repair.

LOG MARKER

Bucking logs

WP

In order to reduce loading on the shoulder, Log Markers should position themselves on or around logs so that the chainsaw need not be lifted and supported at or above shoulder height (when possible).

BUNDLE CRANE SWAMPER

Cutting wires

WP

In order to reduce loading on the shoulder Bundle Crane Swampers should aim to cut wires at or below shoulder height, where possible. The Swamper often raises the grinder to cut wires above shoulder height in order to increase recycling. When this motion is done repeatedly, the Swamper should lower the arms between cuts and allow the musculature a small recovery break.

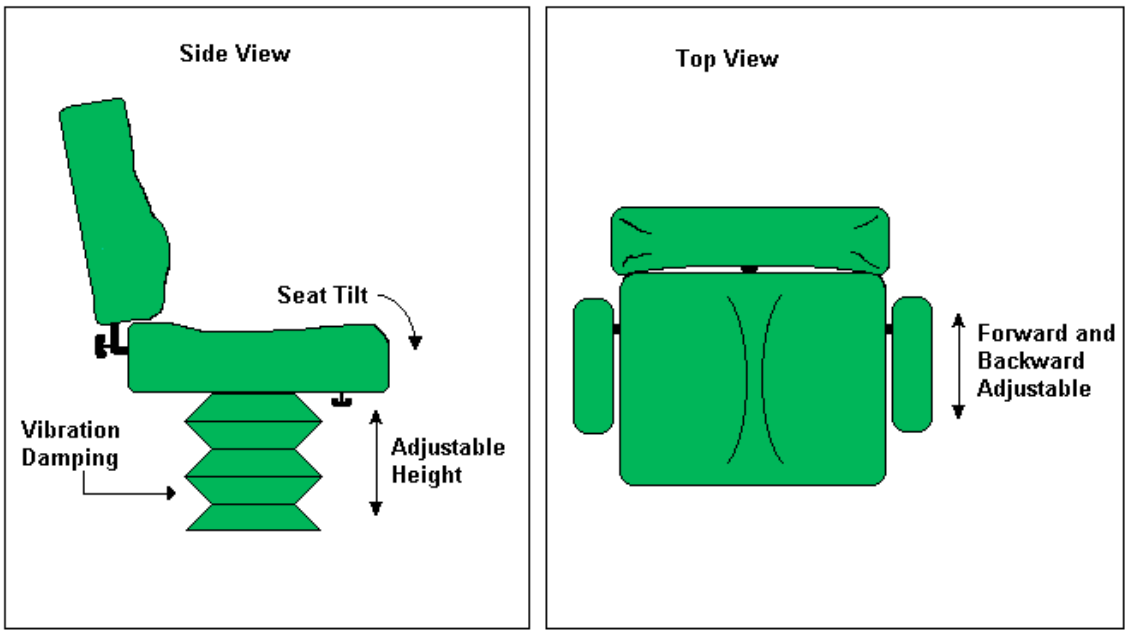
SEATING

Many Boom Area Employees are required to sit when operating a boat. Sitting for long periods increases the load on the spine, which stresses the ligaments and discs of the low back. The load is increased when the Boom Area Employee does not maintain a neutral spine (see Injury Education for the Low Back on page 102).

Adjustable seating

E

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



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

Moveable chair

E

In order to reduce awkward and static postures in the low back, operators should be able to move the chair out of the way and work from a standing position where space permits. This setup can be done by ensuring that the chair has a wide, sturdy base and can be picked up and moved, or that the chair is mounted on slide tracks, allowing it to be pushed back.

Lumbar support

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

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.

Vary body posture

WP — In order to reduce awkward and static postures in the low back, encourage Boom Area Employees to get up from the seated posture throughout the day. This posture change alleviates the load on the spine, allows the discs to equalise, and allows ligaments to regain their stiffness after being stretched out from sitting.

Seat maintenance

E
A
WP

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

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

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

Regular seat maintenance

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

Daily inspection of seat

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

FLOOR SURFACES

Anti-slip material on high traffic areas

E

In order to prevent soft tissue injuries resulting from slips and falls, cover high traffic areas such as slips and manual handling areas such as the backs of boats with an anti-slip material. The anti-slip material may help to prevent strains and sprains of the low back, knee, and ankle whenever Boom Area Employees perform tasks in these areas.

Appropriate footwear

PPE

In order to ensure healthy foot alignment, purchase appropriate footwear. Caulk boots will help to improve traction when walking on slippery logs and decks. Ensure that boots have good heel and arch support. See the guidelines for footwear in the Foot section of the Body Manual.

Replace worn spikes

WP

In order to ensure maximum traction on slippery logs and decks, Boom Area Employees should inspect the condition of spikes on their caulk boots regularly. Old or worn spikes should be changed immediately.

Anti-fatigue insoles

WP
PPE

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

Anti-fatigue insoles may be a more practical option for Boom Area Employees than anti-fatigue matting as the tendency is to work in a variety of unprotected work environments, where matting would not be feasible, cost effective, or practical.

Remove loose bark

WP In order to improve traction and lifting conditions, kick loose bark off logs before trying to lift heavy boom chains or manoeuvre around with hand tools while standing on the log.

Boom Area Employees should get in the habit of kicking loose bark off logs before lifting boom chains or swifter lines. This will allow for greater traction during lifting tasks.

ADDITIONAL WORKSTATION DESIGN OPTIONS

Wire coiling device

E In order to reduce loading on the shoulders and low back, upright wire coiling devices that turn freely should be used to coil bundle wires and swifter lines. By using an upright, freely rotating device the Boom Area Employee will not need to bend forward and/or repeatedly circle the arms to wind the bundle wires and swifter lines.

A freely rotating, upright device to coil wires on will help to reduce awkward postures and excessive force placed on the shoulders and low back.

Staple

E

In order to reduce loading on the low back and knees, Boom Area Employees should carry a staple to help undo "U" bolts. This will minimise the amount of time spent in a bent position while tying up logs.

A staple can be used to increase leverage when undoing "U" bolts. This will allow the Boom Area Employee to undo the bolts faster, spending less time with the low back and knees in awkward postures.

String

E

In order to reduce loading on the low back and knees, attach a string to the toggle of the boom chain to feed the chain through the hole in the boom stick. This will minimise the amount of time the Boom Area Employee must bend or crouch in order to perform this task. The string should attach to one end of the toggle so that the toggle will be vertical (parallel to the chain) when the string is pulled.

The string it used to hold the toggle parallel to the chain. This will minimise the time spent bent over or crouched down to feed boom chains through holes in boom sticks.

Pin driver

E

In order to reduce loading on the low back, use a bolt welded onto a long metal rod ("pin driver") to aid in releasing swifter lines. The pin driver should be held in place over the swifter line attachment while the butt end of an axe is used to drive the pin driver through the swifter line attachment, releasing the swifter line. This will eliminate the need to bend down during this task.

An appropriate sized bolt welded to the end of a long rod can be used to help in releasing swifter lines. This tool will eliminate the need to bend over to accomplish this task.

Knee pads

PPE

In order to reduce contact stress on the knees, provide kneepads to Boom Area Employees. Kneepads can be worn underneath the clothing, or can be sewn into the clothing. Kneepads should be kept as dry as possible.

SLIPMAN

Log infeed device

E

In order to reduce the force required to feed logs into the mill, one solution might be to install a new log infeed device. Side lifts appear to require more force to load logs than jackladders. Another alternative may be to use a peco crane to mechanically feed logs. Some mills use a grapple operator to mechanically feed jackladders. Be aware that changes in the process can lead to the introduction of new ergonomic risk factors. Moving towards a more mechanical process for feeding logs into the mill may lead to an increase in static work postures.

Slip layout

E

To reduce the force required to guide and feed logs, design the slip to allow logs to flow straight down. Straight slips or raceways cause less cross-ups and jams than slips with bends.

Flow control device

E

In order to reduce the force required to guide and feed logs, use a flow control device to counteract the effects of current. A number of mills have designed unique solutions to this problem. Some mills use a pump to generate current. Other mills use lines to pull logs towards the Slipman. Of the systems observed, lines with boom chains appeared to work the best. The flexibility in placing the boom chain allows the worker to turn logs if desired. Lines that attach to bundle wires can pull logs off line, increasing cross-ups.

Note that using a boom chain attached to lines requires workers to carry heavy (16 kg) chains over unstable logs.

SIDEWINDER

Wire pulling attachment

E

In order to reduce loading on the shoulders, elbow/wrists, and low back, an attachment should be installed onto Sidewinders for pulling cut bundle wires. This design will eliminate the need to forcefully pull wires.

A metal block with holes slightly larger than the bundle wires.

Cut bundle wires are inserted into the holes and the boat is used to drag wires from bundles. Once wires are free of bundles, the wires are removed from the block and placed in a designated area.

BOOM BOAT/TUG BOAT

Mirrors

E

Boom Area Employees responsible for operating tug and boom boats must monitor towed loads and other employees on the boat in order to ensure safety. To do this, repetitive neck and back twisting is required, placing strain on the neck and upper back muscles and putting the worker at risk for an injury. To decrease the frequency of this motion, install mirrors on the boat to give an overall view of the areas that need to be viewed on a regular basis.

DECK HAND

Chairs for deck hands

E

In order to relieve stress on the feet, a chair should be provided for the deck hand to sit on. This is important during long towing trips.

SPLITTING SAW

Mechanical aids

E

In order to reduce loading on the low back, mechanical aids should be provided to aid in lifting objects of excessive weight, such as the saw bar. An overhead hoist system would eliminate the need to lift the saw bar in an awkward, extended posture.

A pulley system extending over top of the saw would assist the operator in removing the saw bar. The pulley should swing back over the deck so that the saw bar can be safely lowered to the deck.

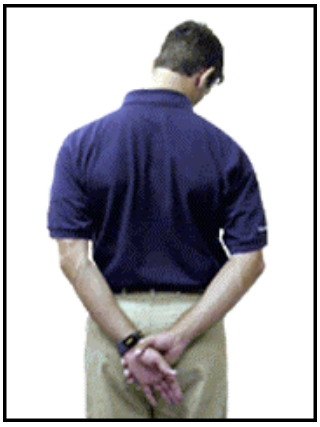
Additional Work Practices

Stretches

WP In order to minimise awkward and static posture of the neck, wrist and, low back, stretch these body parts throughout the day to enhance tissue tolerance for those muscle groups. See additional stretches in the Body Manual.

Neck Stretch

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

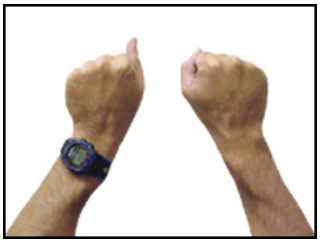


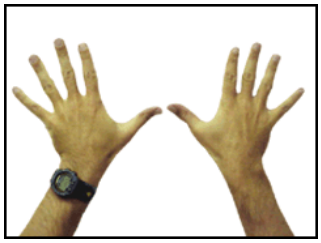
Upper Back & Chest Stretch

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

Hands and Fingers Stretch

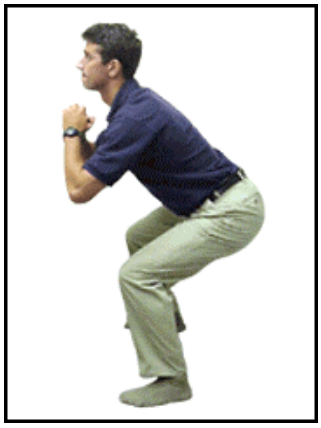
Clench both fists and hold for 3 seconds. Then open your hands and spread fingers apart. Hold for 3 seconds. Repeat.





Squats

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

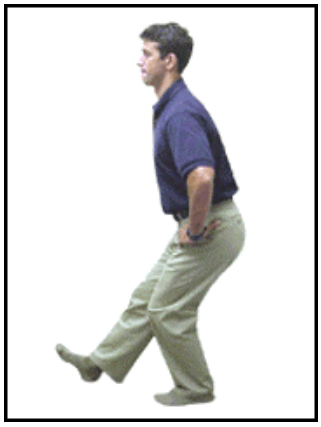


Hip Flexor Stretch

Place one foot in front of the other and lower the body, keeping your pelvis tilted. Hold for 5 seconds. Repeat 3 times with each leg.

Hamstring Stretch

Place one foot in front of the other and squat down. Hold for 5 seconds. Repeat 3 times with each leg.



View with eyes

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

Push instead of pull

WP In order to reduce the force experienced at the shoulder, push on pike poles when manoeuvring logs and bundles. Pushing is a safer and stronger motion than pulling.

Pushing logs/bundles from the hip. This work practice allows the larger muscle groups of the legs to perform the work rather than the shoulder and back musculature.

Keep back straight

WP In order to reduce awkward postures of the low back, keep the back straight when pushing/pulling on pike poles or when bending down to cut wires or handle objects.

Bend at hips

WP In order to reduce stress on the low back bend at the hips and knees, rather than the back, when bending down to handle objects. Maintain the 3 curves in the spine.

Boat positioning

WP In order to avoid over-reaching, and reduce stress on the shoulders and low back, ensure that the boat is in good position, as close as possible to the log to be worked on. Pull the log tight to the boat before attempting to lift chains out of the water.

Log pond organisation

WP In order to reduce loading on the elbow/wrist and low back, the log pond should be kept organised. Arrange boom sticks in the log pond so that all toggles and eyes face upward in the water. This setup will eliminate the need to forcefully turn the boom sticks in order to gain access to the chains.

Dynamic activity

WP In order to reduce loading on the body, perform dynamic movements after every period of "static" work (e.g., holding a posture for an extended period). For example, after sitting for a long period, get up and walk around for a minute or so. After holding onto controls for an extended period, circle the shoulders and alternate spreading out the fingers with making a fist. These dynamic movements will promote blood flow and allow the tissues to recover faster. It is especially important to perform dynamic work before lifting or manoeuvring heavy objects.

SLIPMAN

Alternate sides

WP In order to reduce loading on the preferred hip, Slipmen should be encouraged to alternate sides to which they push/pull logs. This will help to avoid muscle imbalance in the hips.

Use the whole body

WP In order to reduce loading on the shoulders when guiding logs along the slip, keep hands in line with the shoulder joint when pulling. Place the butt-end of the pike pole at the top of the hip and use the legs to generate force when pushing. Encourage the use of both sides of the body to support the pike pole.

SIDEWINDER

Ramming bundles

WP In order to reduce loading on the shoulder when ramming the boat into bundles to move them, ensure the arms are kept close to the body. Many operators ram bundles while holding onto the suicide knob, with the arm away from the body. It is safer to hold the steering wheel with both hands, at the closest point to the body, during impact with the bundle.

BOOM BOAT/TUG BOAT

Jog steering

WP In order to reduce loading on the thumb, use the whole hand to activate the jog steering lever rather than just the thumb.

Stand sideways

WP In order to reduce loading on the neck and low back, tug and boom boat operators should stand sideways when operating the boat. This position will reduce the amount of neck and back twisting required to view around the boat. In addition, tug and boom boat operators should alternate sides to which they stand.

Alternate sitting/standing

WP In order to reduce loading on the low back, boat operators should be encouraged to alternate between a seated and a standing posture throughout the day.

DECK HAND

Safe lifting area

WP In order to improve lifting conditions, remove loose boom chains from the lifting area at the back of the boat. This organisation will minimise injuries from slips and falls while lifting heavy boom chains.

Boom chains lying loosely at the back of the boat may interfere with secure footing. This obstruction will be of particular concern during lifting tasks.

Use tools to lift

WP In order to reduce loading on the shoulders and low back use a pike pole to lift boom chains out of the water. Keep the pike pole close to the body while lifting.

Stress on the shoulders and low back can be reduced by using pike poles to lift boom chains out of the water. A neutral posture (3 curves of the spine) should be maintained as much as possible while lifting.

LOG MARKER

Centre upper body weight

WP In order to reduce loading on the low back when bending over to buck logs, centre the upper body weight over one leg rather than leaning forward and away from the lower extremities.

Poor Posture
The operator's back is rounded (awkward posture) and the saw is held away from the operator's lower extremities. This posture will increase the loading on the structures of the low back.

Good Posture
The operators back is straight (neutral posture) and the saw is held over one leg. This posture will minimise the loading on the structures of the low back.

BUNDLE CRANE SWAMPER

Pulling stubborn wires

WP

In order to reduce loading on the shoulders use the front end loader to remove wires that are stuck in the logs. This will eliminate the need to forcefully pull on the cables.

When wires are stuck on the bundles, the front end loader can be used to pull the wires from the bundle. Ensure that the Bundle Crane Swamper is standing in a safe location when the loader is pulling on the wire.

Characteristics of Objects Being Handled

Power positions

WP

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

Manual material handling

WP

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

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

Two person lift

WP In order to reduce loading on the low back, two people should work together to lift heavy or awkward loads such as "hangers" (boom chains hanging off boom chains) and coiled bundle wires or swifter lines.

Two people working together should lift heavy and awkward objects. This will reduce the risk of injury to the low back.

SIZE AND SHAPE

SIDEWINDER

Throttle mechanism

E In order to reduce loading on the elbow/wrist and wrist/hand, install a mechanism that can be used to hold the throttle in the "on" position. This will eliminate the need to hold the throttle in this position.

A metal clip can be used to hold the throttle in the "on" position. String that slid along the length of the throttle was also used for this purpose. Whatever mechanism is used, it should be fast and easy for the boat operator to remove, in case of emergency.

Foot controlled throttle

E
WP

In order to eliminate the need to hold the throttle of the Sidewinder, use a foot pedal to control the throttle instead of a hand activated control. Some boats had a foot pedal for this purpose. If this is the case, boat operators should be encouraged to use the foot pedal over the hand-activated throttle. This option would also reduce force and awkward postures of the right shoulder by freeing up the left arm to aid in steering the boat. The suicide knob could be used less, and both hands could be used to guide the boat while ramming bundles.

Range of motion in throttle

E

In order to reduce loading on the elbow/wrist and wrist/hand reduce the grip span required to activate the throttle. This will decrease the severity of the awkward posture required to activate the throttle.

BOOM BOAT/TUG BOAT

Alternate hands

WP

In order to reduce loading on elbow/wrist and wrist/hand when grasping the boat steering wheel, alternate the hand used to grip the steering wheel when possible and maintain a neutral wrist position as much as possible.

LOAD CONDITION AND WEIGHT DISTRIBUTION

Lightweight, sharp tools

A
WP

In order to decrease the force required by a Boom Area Employee to manoeuvre logs in the water, ensure that the tools used to manipulate the logs (e.g., pike poles, picaroons) are lightweight and sharp.

CONTAINER, TOOL AND EQUIPMENT HANDLES

Modify tool handle friction

E

In order to reduce the force required to grip hand tools, increase the friction between tool handles and the operator's glove. Due to the smooth, slippery surface of metal or wooden tool handles (e.g., pike pole, picaroon) a Boom Area Employee 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 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 Boom Area Employees glove, and decrease the grip forces required.

Anti-vibration wrap

E

In order to reduce/attenuate vibration transmitted to the hands through tool handles and controls, vibrating handles and controls can be wrapped with a vibration damping handle wrap. Wrapping tool handles or controls with an anti-vibration wrap may be more appropriate in situations where one vibrating tool or control is used for long duration.

Anti-vibration gloves

PPE

In order to reduce/attenuate vibration transmitted to the hands through tool handles and controls, Boom Area Employees can wear anti-vibration gloves. Anti-vibration gloves may be more appropriate in situations where a number of vibrating tools and controls are handled by the worker.

Sticky palm gloves

PPE

In order to reduce grip forces required by the Boom Area Employee, the operator should wear thin, close fitting gloves with a "sticky" palm surface to increase the friction between the gloves and the tool handles.

Bolt cutters

E

In order to reduce the force required by the shoulders and elbow/wrist to cut bundle wires, manual bolt cutters should be replaced with pneumatic bolt cutters or grinder saws. Replacement tools should be as light as possible and should encourage neutral working postures at the wrist.

Grinder saws or pneumatic bolt cutters will reduce the force required in the shoulders and elbow/wrist to cut bundle wires.

SIDEWINDER/BOOM BOAT/TUG BOAT

Wheel friction

E

In order to reduce loading on the shoulder; decrease the resistance in boat steering wheels. By reducing friction or resistance, less force will be needed to accurately steer the boat.

Neutral wrist postures

WP

In order to reduce loading on the elbow/wrist and wrist/hand, a neutral (straight) wrist posture should be maintained when operating controls.

While operating controls the wrists should be kept in a neutral (straight) posture as much as possible.

LOG MARKER

Spray can extension

E

In order to reduce loading on the low back, attach an extension handle to spray paint canisters. This modification will reduce the amount of bending required to mark logs.

The handle extension shown on the left will allow the Log Marker to mark the logs while keeping the low back in a more neutral posture.

Environmental Conditions

COLD EXPOSURE

Proper fitting gloves

PPE

In order to reduce cold exposure at the hands, workers should be provided with a good supply of proper fitting dry gloves for wet, cold weather. Glove liners may be useful in keeping the hands warm.

LIGHTING

Reduce glare

PPE

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

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

Work Organisation

The tasks associated with Boom Area work are often performed in varying climates and locations. Rarely was a fixed workstation found where the majority of work was performed. More often, workers were found to have tasks requiring work within boats, on logs, on slips/decks, and on land. Due to this variation in task environments and the inability to provide aids and tools for all environments, work techniques and practices adopted by workers will have a significant impact on the risk of injury. For this reason, it would be wise to provide specific training to Boom Area Employees regarding body mechanics. The training should provide the workers with an understanding of how their bodies operate, how they may become injured, and problem-solving strategies to allow Boom Area Employees to determine what appropriate work techniques and practices may look like in varying situations. In addition, education regarding ergonomic risk factors and the importance of decreasing the exposure to these risk factors can be communicated to employees. This education may aid in gaining acceptance for the following task variability and/or job rotation recommendations.

Job rotation

A

To reduce loading on the body parts of concern listed in this Work Manual, Boom Area Employees can be rotated to other job positions that require different physical and mental demands. By rotating to jobs that require different physical demands, working muscles get a chance to recover and repair, decreasing the risk of injury. Job rotation is more effective if it occurs intermittently throughout the shift, for example, every hour or every two hours. The duration of exposure to risk has a large effect on the amount of time required for the tissue to recover.

There are a large variety of tasks found within the Boom Area. A job rotation schedule could easily be designed using only Boom jobs, in order to reduce any potential disruptions elsewhere. The key is to vary physical demands that workers are exposed to. Some suggestions on rotations with positive ergonomic benefits (and likely the least disruption to the process):

- Sidewinder Operators rotate with Slipman and/or Boomman positions
- Tug Boat Operators rotate with Deck Hands

Many Boom Area Employees were observed rotating positions/tasks on an informal basis.

Task variability

A
WP

In order to reduce exposure to risk factors associated with Boom Area Employee jobs, workers should vary tasks throughout their shift. When possible Boom Area Employees should minimise the amount of time they spend steadily performing one task. Instead, they should be encouraged to move between tasks that require different physical demands, on a regular basis.

TUG BOAT/DECK HAND

Communication radios

A
WP

In order to promote better communication between the Tug Boat Operator/Deck Hand team, provide small 2-way radios for the team to communicate through. This would allow for more verbal communication (rather than relying on non-verbal) and it would also allow the boat operator to close the cab of the boat during harsh weather conditions.

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/ Upper Back	Neck/ Shoulder	Shoulder	Elbow/Wrist	Wrist/ Hand	Low Back	Hip	Knee	Ankle	Foot
Reduce reaching	**129**				**F A**			**F A**				
Standing work	**129**			**F**	**F**			**F**				
Swivel chair	**130**		**A**					**A**				
Integrated swivel chair/control unit	**130**		**A**		**A**			**A**				
Chair orientation	**130**		**A**		**A**			**A**				
Ear plugs	**131**	**A**										
Look down with eyes	**131**	**A**										
Brace upper body	**132**							**F**				
Deck height	**132**	**A**										
Height of steering wheel	**132**							**A**				
Arm supports	**133**			**A S**		**A S**	**A S**					
Bucking logs	**133**				**F A**							
Cutting wires	**133**				**F A**							
Adjustable seating	**134**							**A S**				

Direct Risk Factors

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

Summary of Solutions

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

		Injury Prevention Potential										
SOLUTIONS	**Page**	Neck	Neck/ Upper Back	Neck/ Shoulder	Shoulder	Elbow/Wrist	Wrist/ Hand	Low Back	Hip	Knee	Ankle	Foot
Moveable chair	**134**							**A S**				
Lumbar support	**135**							**A**				
Vary body posture	**135**							**A S**				
Seat maintenance	**136**							**A V**				
Anti-slip material on high traffic areas	**137**	indirectly reduces risk of injury to the body										
Appropriate footwear	**137**											**R**
Replace worn spikes	**137**	indirectly reduces risk of injury to the body										
Anti-fatigue insoles	**137**											**R**
Remove loose bark	**138**	indirectly reduces risk of injury to the body										
Wire coiling device	**138**				**F A**			**F A**				
Staple	**139**							**A R**		**A C**		
String	**139**							**A R**		**A C**		
Pin driver	**140**							**A R**		**A C**		
Knee pads	**140**									**C**		
Log infeed device	**140**			**F A**	**F A**	**F**		**F A R**				

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SOLUTIONS	**Page**	Neck	Neck/ Upper Back	Neck/ Shoulder	Shoulder	Elbow/Wrist	Wrist/ Hand	Low Back	Hip	Knee	Ankle	Foot
Slip layout	**140**			**F R**	**F A R**	**F**		**F A R**				
Flow control device	**141**			**F R**	**F A R**	**F**		**F A R**				
Wire pulling attachment	**141**			**F R**	**F A R**	**F**		**F A R**				
Mirrors	**142**	**R A**	**R A**					**R A**				
Chairs for deck hands	**142**											**S**
Mechanical aids	**142**							**F A**				**R**
Stretches	**143**	directly reduces risk of injury to the body										
View with eyes	**145**	**A**										
Push instead of pull	**145**			**F**	**F**							
Keep back straight	**145**							**A**				
Bend at hips	**145**							**A**				
Boat positioning	**145**				**F A**			**F A**				
Log pond organisation	**146**					**F**		**F A R**				

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		Injury Prevention Potential										
SOLUTIONS	**Page**	Neck	Neck/ Upper Back	Neck/ Shoulder	Shoulder	Elbow/Wrist	Wrist/ Hand	Low Back	Hip	Knee	Ankle	Foot
Dynamic activity	**146**	directly reduces risk of injury to the body										
Alternate sides	**146**								**F R**			
Use the whole body	**146**				**F A**							
Ramming bundles	**146**				**F A**							
Jog steering	**147**						**A**					
Stand sideways	**147**	**A**	**A**					**A**				
Alternate sitting/standing	**147**							**A S**				
Safe lifting area	**147**	indirectly reduces risk of injury to the body										
Use tools to lift	**148**				**F A**			**F A**				
Centre upper body weight	**148**							**F A**				
Pulling stubborn wires	**149**				**F A**							
Power positions	**150**							**F A**				
Manual material handling	**150**							**F A**				
Two person lift	**151**							**F A**				

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SOLUTIONS	**Page**	Neck	Neck/ Upper Back	Neck/ Shoulder	Shoulder	Elbow/Wrist	Wrist/ Hand	Low Back	Hip	Knee	Ankle	Foot
Throttle mechanism	**151**					**F A S**	**A S**					
Foot controlled throttle	**152**					**F A S**	**A S V**					
Range of motion in throttle	**152**					**A**	**A**					
Alternate hands	**152**					**A R**	**A R**					
Lightweight, sharp tools	**152**				**F**	**F**		**F**				
Modify tool handle friction	**153**					**F**						
Anti-vibration wrap	**153**						**V**					
Anti-vibration gloves	**153**						**V**					
Sticky palm gloves	**153**					**F**						
Bolt cutters	**154**				**F**	**F**						
Wheel friction	**154**				**F**							
Neutral wrist postures	**154**					**A**	**A**					
Spray can extension	**155**							**A**				
Proper fitting gloves	**155**					**F**	**S**					

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		Injury Prevention Potential										
SOLUTIONS	**Page**	Neck	Neck/ Upper Back	Neck/ Shoulder	Shoulder	Elbow/ Wrist	Wrist/ Hand	Low Back	Hip	Knee	Ankle	Foot
Reduce glare	**155**	**A**										
Job rotation	**156** ◆	indirectly reduces risk of injury to the body										
Task variability	**157** ◆	indirectly reduces risk of injury to the body										
Communication radios	**157**	indirectly reduces risk of injury to the body										
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										
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*

BOOM AREA EMPLOYEE MSI SAFETY GUIDE

OBJECTIVE:
To identify ergonomic risks involved in Boom Area Employee jobs and to reduce the potential for musculoskeletal injuries.
More detailed information about risk reducing recommendations can be found in the Work Manual for the Boom Area Employee.

CHECK IF THIS APPLIES	ACTIVITY OF RISK	DIRECT RISK FACTOR(S)	POTENTIAL HAZARDS	SUGGESTED SOLUTIONS
	Neck A Boom Area Employee may hold the head forward or backward in order to guide logs and boomsticks with a pike pole, handle boom chains and swifter lines, and cut bundle wires with hand tools.	**Repetition** **Awkward Postures** **Static Postures**	• When the head is repeatedly bent forward or backward, the muscles of the neck are subjected to repeated stress with little time for recovery. If the repetitive stress is excessive, and recovery is not adequate, the tissues can fatigue to the point of injury. • Neck muscles must support the weight of the head while in a forward or backward bent 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 or backward bent 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.	• Look down with the eyes, not just the neck, to view logs and bundles in the water. • Perform dynamic activity after holding the head in a certain posture for any length of time. For example, roll the head in forward half circles after holding the head backward for a length of time. • Vary work tasks as much as possible. Intersperse activities requiring holding the head in awkward postures with activities that do not. • For exercises that can help prevent **Neck** injuries, **see the Neck section of the Body Manual**.

CHECK IF THIS APPLIES	ACTIVITY OF RISK	DIRECT RISK FACTOR(S)	POTENTIAL HAZARDS	SUGGESTED SOLUTIONS
	Neck/Upper Back A Boom Area Employee may turn the head to the side while operating a boat in order to view activities on the water and on shore. Some boat layouts lead to extremely poor postures.	**Repetition** **Awkward Postures** **Static Postures**	• When the head is repeatedly turned to the side, muscles of the neck and upper back are subjected to repeated stress with little time for recovery. If the repetitive stress is excessive, and recovery is not adequate, the tissues can fatigue to the point of injury. • When sitting with a head-forward posture (head is not aligned over the spine), the muscles of the neck and upper back can become over-stretched and fatigued. The result is what is called "stretch-weakened" muscles. • Neck and upper back 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.	• Place the chair on a 45 to 90 degree angle from the controls in order to minimise neck twisting. Periodically change the direction that the chair is facing. • Vary your seated posture as much as possible throughout the shift. • Vary between sitting and standing when operating a boat. • Stand sideways when operating the boat. Periodically change the direction that you face. • Rotate the eyes and neck, not just the neck, to view the work area. • Perform dynamic activity after sitting with a poor posture for any length of time. For example, alternate stretching the arms out in front and behind the chest. • Vary work tasks as much as possible. Intersperse activities requiring sitting and twisting with activities that do not. • In order to prevent ***Neck/Upper Back*** discomfort, ***perform the Posture Check exercise in the Back section of the Body Manual***.

CHECK IF THIS APPLIES	ACTIVITY OF RISK	DIRECT RISK FACTOR(S)	POTENTIAL HAZARDS	SUGGESTED SOLUTIONS
	Neck/Shoulder A Boom Area Employee may pull on pike poles and boom chains in order to manoeuvre logs and boom sticks.	**Force** **Repetition**	• Neck and shoulder muscles support the weight of objects held in the hands. The heavier the object, the greater the load on the muscles and tendons. • When workers repeatedly pull on logs, muscles of the neck and shoulder are subjected to repeated stress with little time for recovery. If the repetitive stress is excessive, and recovery is not adequate, the tissues can fatigue to the point of injury.	• Push on pike poles when manoeuvring logs and bundles. This is a stronger and safer motion than pulling. • Vary work tasks as much as possible. Intersperse activities requiring pulling on pike poles and boom chains with activities that do not. • For exercises that can help prevent ***Neck*** and ***Shoulder*** discomfort, ***see the Neck and Shoulder sections of the Body Manual***.

CHECK IF THIS APPLIES	ACTIVITY OF RISK	DIRECT RISK FACTOR(S)	POTENTIAL HAZARDS	SUGGESTED SOLUTIONS
	Shoulder A Boom Area Employee may push or pull on pike poles and boom chains in order to manoeuvre logs and boomsticks. A Boom Area Employee may pull on boom chains, swifter lines, and bundle wires in order to form or release bags, booms, lockages, or bundles, unhook boom sticks, and coil lines and wires. A Boom Area Employee may push down on logs when using a chainsaw to buck logs.	**Force** **Repetition** **Awkward Postures**	• The rotator cuff stabilises the shoulder joint when objects are pushed/pulled/manipulated. The heavier the object, or the larger the force required, the greater the load on the rotator cuff. • If the force placed on the rotator cuff exceeds tissue tolerances, injury may occur. • When the arms are repeatedly placed in an awkward posture, the rotator cuff is subjected to repeated stress with little time for recovery. If the repetitive stress is excessive, and recovery is not adequate, the tissues may fatigue to the point of injury. • The rotator cuff stabilises the shoulder joint when the arms are away from the body. The farther away the arms are from the body, the greater the load on the rotator cuff.	• When bucking logs, avoid lifting and supporting the chainsaw above shoulder height. • Push on pike poles when manoeuvring logs and bundles. This is a stronger and safer motion than pulling. • Ensure the boat is in good position, close to the log being worked on, before lifting chains out of the water. • Keep the hands in line with the shoulder when pulling logs. • Use pike poles to lift boom chains out of the water. • Vary work tasks as much as possible. Intersperse activities requiring forceful and repeated exertions at the shoulder with activities that do not. • For exercises that can help prevent ***Shoulder*** injuries, ***see the Shoulder section of the Body Manual***.

CHECK IF THIS APPLIES	ACTIVITY OF RISK	DIRECT RISK FACTOR(S)	POTENTIAL HAZARDS	SUGGESTED SOLUTIONS
	Shoulder A Boom Area Employee may manipulate the boat steering wheel with a 'Suicide Knob' in order to guide the boat.	**Force** **Awkward Postures**	• The rotator cuff stabilises the shoulder joint when objects are manipulated. The larger the force required, the greater the load on the rotator cuff. • If the force placed on the rotator cuff exceeds the tissue tolerances, injury may occur. • The rotator cuff stabilises the shoulder joint when the arms are away from the body. The farther away the arms are from the body, the greater the load on the rotator cuff.	• Keep the arms close to the body and grip the wheel with both hands when ramming bundles. • Vary work tasks as much as possible. Intersperse activities requiring the operation of a Sidewinder with activities that do not. • For exercises that can help prevent ***Shoulder*** injuries, ***see the Shoulder section of the Body Manual***.
	Shoulder A Boom Area Employee may work with the arms overhead in order to cut bundle wires and to perform boat maintenance tasks.	**Repetition** **Awkward Postures**	• The rotator cuff tendon can fray from repeated rubbing against bone. If the repetitive stress is excessive, and recovery is not adequate, the tendon may fatigue to the point of injury. • A rotator cuff tendon may rub up against bone (impingement) when the arms are lifted overhead. The friction between the tendon and the bone increases as the arm is lifted higher. In addition, the rotator cuff must stabilise the weight of the arms when working overhead, increasing the tension in the tendon. The combination of impingement and tension increases the stress on this tendon.	• When cutting bundle wires, avoid lifting hand tools above shoulder height. • Use the Front End Loader to remove stubborn wires that are stuck in the logs. • Vary work tasks as much as possible. Intersperse activities that require working with the arms overhead with activities that do not. • For exercises that can help prevent ***Shoulder*** injuries, ***see the Shoulder section of the Body Manual***.

CHECK IF THIS APPLIES	ACTIVITY OF RISK	DIRECT RISK FACTOR(S)	POTENTIAL HAZARDS	SUGGESTED SOLUTIONS
	Elbow/Wrist A Boom Area Employee may grip and hold the throttle in order to operate a Sidewinder.. A Boom Area Employee may grip a chainsaw in order to buck logs.	**Force** **Awkward Postures** **Static Postures**	• Gripping an object requires activation of the forearm muscles, which generates tension at the tendon/bone connection of the elbow. The harder 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. 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., Sidewinder throttle) 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 forearm muscles work efficiently. This occurs when the wrist is in its natural relaxed 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. • When the wrist and hand must maintain a forceful grip, the constant tension generated by muscles may lead to fatigue at the tendon/bone connection. If the duration of constant stress is excessive, and recovery is not adequate, the tissues may fatigue to the point of injury.	• Perform dynamic activity after gripping a hand tool for a length of time. For example, alternate making a fist and spreading out the fingers. • If a foot-controlled throttle is available, use it as much as possible. As a minimum, alternate between using the hand and foot throttles. • Vary work tasks as much as possible. Intersperse activities requiring the operation of a Sidewinder or chainsaw with activities that do not. • For exercises that can help prevent ***Elbow*** and ***Wrist*** injuries, ***see the Elbow and Wrist sections of the Body Manual***.

CHECK IF THIS APPLIES	ACTIVITY OF RISK	DIRECT RISK FACTOR(S)	POTENTIAL HAZARDS	SUGGESTED SOLUTIONS
	Elbow/Wrist A Boom Area Employee may grip hand tools in order to guide logs and cut bundle wires. A Boom Area Employee may grip the steering wheel of a boat in order to control the boat.	**Force** **Repetition** **Awkward Postures**	• Gripping an object requires activation of the forearm muscles, which generates tension at the tendon/bone connection of the elbow. The harder that an object must be gripped, the greater the load on the tendon/bone connection. • Repeated stress to the elbow without adequate rest could slowly fatigue tissues to the point of injury. • The width of an object 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 controls) 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 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.	• Arrange boomsticks in the log pond so that all toggles and eyes are facing upwards in the water. • Alternate the hand used to grip the steering wheel or hand tool. • Vary work tasks as much as possible. Intersperse activities requiring continual gripping of hand tools and/or controls with activities that do not. • For exercises that can help prevent ***Elbow*** and ***Wrist*** injuries, ***see the Elbow section of the Body Manual***.

CHECK IF THIS APPLIES	ACTIVITY OF RISK	DIRECT RISK FACTOR(S)	POTENTIAL HAZARDS	SUGGESTED SOLUTIONS
	Wrist/Hand A Boom Area Employee may grip the steering wheel or jog steering lever of a boat with the wrist bent in order to operate the boat.	**Repetition** **Awkward Postures** **Vibration**	• Repeated gripping and/or repeated bending of the wrist causes stress to the tendon sheaths. If the repetitive stress is excessive, and recovery is not adequate, the tendon sheaths may fatigue to the point of injury. • As the wrist is bent, the tendon sheaths rub up against the walls of the carpal tunnel. The further the wrist is bent, the more friction experienced in the tendon sheaths. • Exposure to vibration, through the use of power tools or through contact with other vibrating objects, places a unique form of mechanical stress on 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.	• Use the whole hand, not just the thumb, to operate the jog steering lever. • Keep the wrist in a neutral (straight) posture while operating boat controls. • Vary work tasks as much as possible. Intersperse activities requiring the operation of boat controls with activities that do not. • For exercises that can help prevent ***Wrist*** and ***Hand*** injuries, ***see the Wrist section of the Body Manual***.

CHECK IF THIS APPLIES	ACTIVITY OF RISK	DIRECT RISK FACTOR(S)	POTENTIAL HAZARDS	SUGGESTED SOLUTIONS
	Wrist/Hand A Boom Area Employee may grip the steering wheel and throttle when operating a Sidewinder. A Boom Area Employee may grip a vibrating chainsaw for long periods in order to buck logs.	**Awkward Postures** **Static Postures** **Vibration**	• As the wrist is bent, the tendon sheaths rub up against the walls of the carpal tunnel. The further the wrist is bent, the more friction experienced in the tendon sheaths. • When the wrist is held in a bent position, the tendon sheaths are under constant stress. If the duration of constant stress is excessive, and recovery is not adequate, tissues may fatigue to the point of 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.	• Perform dynamic activity after gripping a control or hand tool for a length of time. For example, alternate making a fist and spreading out the fingers. • Vary work tasks as much as possible. Intersperse activities requiring the continual gripping of controls and hand tools with activities that do not. • For exercises that can help prevent ***Wrist*** and ***Hand*** injuries, ***see the Wrist section of the Body Manual***.

CHECK IF THIS APPLIES	ACTIVITY OF RISK	DIRECT RISK FACTOR(S)	POTENTIAL HAZARDS	SUGGESTED SOLUTIONS
	Low Back A Boom Area Employee may bend forward or squat in order to handle boom chains, swifter lines, and bundle wires. A Boom Area Employee may bend forward and/or to the side in order to manoeuvre logs and boomsticks with pike poles. A Boom Area Employee may bend forward and stabilise the weight of a chainsaw in order to buck logs.	**Force** **Repetition** **Awkward Postures**	• Lifting increases the loading on the spine. Weight held in the hands is transmitted to the low back. The greater the weight, the greater the load on the structures of the low back. • Pulling on pike poles to manoeuvre logs and boomsticks requires back muscles to stabilise the spine. The greater the pull, the greater the tension developed in the muscles. • If the force placed on back muscles exceeds tissue tolerances, injury may occur. • Repeated forward and/or side bending and/or lifting can gradually fatigue the structures of the low back. If the repetitive stress is excessive, and recovery is not adequate, disc walls may fatigue to the point of injury. • Back muscles must support the weight of the upper body when leaning forward or to the side. Increased bending of the back increases the loading on the spine and increases pressures on the walls of discs.	• Avoid overextending to reach objects and brace the upper body with the free arm when possible. • Kick loose bark off logs before lifting boom chains or manoeuvring around with hand tools. • Keep the low back straight (3 curves) when pushing/pulling on pike poles or when bending down to cut bundle wires. • Bend at the hips and knees, rather than the back, when bending down to handle objects. • Ensure the boat is in good position, close to log, before lifting chains out of water. • Arrange boomsticks in the log pond so that all toggles and eyes are facing upwards in the water. • Remove loose boom chains from the lifting area at the back of the boat. • Use pike poles to lift boom chains out of water. • Centre the upper body weight over one leg when bending forward to buck logs. • Use power positions and leverage when possible to manoeuvre and handle objects. • Ask for help when lifting heavy objects (hangers). • Vary work tasks as much as possible. Intersperse activities requiring forceful and repeated exertions of the low back with activities that do not. • For exercises that can help prevent ***Low Back*** injuries, ***see the Back section of the Body Manual***.

CHECK IF THIS APPLIES	ACTIVITY OF RISK	DIRECT RISK FACTOR(S)	POTENTIAL HAZARDS	SUGGESTED SOLUTIONS
	Low Back A Boom Area Employee may bend or twist in order to view around the boat and reach controls while operating a boat.	**Repetition** **Awkward Postures** **Static Postures** **Vibration**	• Repeated twisting can gradually fatigue the structures of the low back. If repetitive stress is excessive, and recovery is not adequate, disc walls may fatigue to the point of injury. • Sitting increases the loading on the walls of the discs. If the duration of sitting is excessive, and recovery is not adequate (e.g., spine not returned to neutral posture), tissues may deform to the point of injury. • Whole body vibration is usually transmitted through the seat to 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.	• Adjust available lumbar supports to maintain the curve of the low back while sitting. • Vary your seated posture as much as possible throughout the shift. • Vary between sitting and standing when operating a boat. • Stand sideways when operating the boat. Periodically change the direction that you face. • Inspect boat seats on a regular basis and report excessive wear and inoperable features. • Perform dynamic activity after sitting for any length of time. For example, stand up and walk around for a minute or so. • Vary work tasks as much as possible. Intersperse activities requiring sitting and twisting with activities that do not. • For exercises that can help prevent ***Low Back*** injuries, ***see the Back section of the Body Manual.***

CHECK IF THIS APPLIES	ACTIVITY OF RISK	DIRECT RISK FACTOR(S)	POTENTIAL HAZARDS	SUGGESTED SOLUTIONS
	Low Back A Boom Area Employee may lift heavy saw parts in order to perform maintenance on them.	**Force** **Awkward Postures**	• Lifting increases loading on the spine. The effect of weight held in the hands is transmitted to the low back. The greater the weight, the greater the loading on the structures of the low back. • If the force placed on the back muscles exceeds tissue tolerances, injury may occur. • Back muscles must support the weight of the upper body when leaning forward or to the side. Increased bending of the back increases loading on the spine and increases pressures on the walls of discs.	• Try to keep the back in its neutral, 3-curve posture when lifting objects. • Do not twist while holding or moving objects. • Carry and hold objects as close to the body as possible. • Ask for help when lifting excessively heavy objects such as saw bars. • Vary work tasks as much as possible. Intersperse activities requiring heavy manual handling with activities that do not. • For exercises that can help prevent ***Low Back*** injuries, ***see the Back section of the Body Manual***.

CHECK IF THIS APPLIES	ACTIVITY OF RISK	DIRECT RISK FACTOR(S)	POTENTIAL HAZARDS	SUGGESTED SOLUTIONS
	Hip A Boom Area Employee may spend long periods of time walking and balancing on logs. A Boom Area Employee may push or pull on logs and boom sticks with a pike pole in order to guide them to appropriate areas.	**Force** **Repetition**	• Balancing/walking on logs and pushing/pulling on logs loads the muscles in the hip. The greater the push or pull, the greater the loading on hip muscles. • When walking/balancing on logs, muscles of the hip are subjected to repeated stress with little time for recovery. If repetitive stress is excessive, and recovery is not adequate, tissues may fatigue to the point of injury. • Repeated pushing or pulling on one side of the body can lead to muscle imbalance in the hips. The larger the muscle imbalance, the greater the loading on one hip.	• Inspect caulk boots regularly and replace old or worn spikes. • Alternate the side of the body to which logs are pushed/pulled. • Vary work tasks as much as possible. Intersperse activities requiring long periods of walking/balancing on logs and/or pushing/pulling on logs and boom chains with activities that do not. • For exercises that can help prevent ***Hip*** discomfort, ***perform the hip and leg flexibility stretches in the Back section of the Body Manual.***

CHECK IF THIS APPLIES	ACTIVITY OF RISK	DIRECT RISK FACTOR(S)	POTENTIAL HAZARDS	SUGGESTED SOLUTIONS
	Knee A Boom Area Employee may kneel or crouch when handling boom chains, bundle wires, and swifter lines.	**Repetition** **Awkward Postures** **Static Postures** **Contact Stress**	• 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 thighbone and increased contact stress between these bones. • Bending the knee increases 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 contact stress between the kneecap and the thighbone.	• Vary work tasks as much as possible. Intersperse activities requiring kneeling or crouching with activities that do not. • For exercises that can help prevent ***Knee*** injuries, ***see the Knee section of the Body Manual***.

CHECK IF THIS APPLIES	ACTIVITY OF RISK	DIRECT RISK FACTOR(S)	POTENTIAL HAZARDS	SUGGESTED SOLUTIONS
	Foot A Boom Area Employee may walk over unstable logs and stand in cold water when working around the boom area.	**Repetition**	• During walking, impact between the ground and the feet loads the plantar fascia. If the duration of walking is excessive, and recovery is not adequate, the fascia may fatigue to the point of injury.	• Inspect caulk boots regularly and replace old or worn spikes. • Wear anti-fatigue insoles in caulk boots. • Kick loose bark off logs before lifting boom chains or manoeuvring around with hand tools. • Seal leather boots with a good water sealant. • Vary work tasks as much as possible. Intersperse activities requiring walking over unstable logs or standing in cold water with activities that do not. • For exercises that can help prevent ***Foot*** injuries, ***see the Foot section of the Body Manual.***