



# ERGONOMICS GUIDELINES FOR MANUAL HANDLING

2<sup>nd</sup> EDITION (2010)



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*“Ergonomics is the science of studying people at work and then designing tasks, jobs, information, tools, equipment, facilities and the working environment so people can be safe and healthy, effective, productive and comfortable.”*

(Ergonomics Design Guidelines, Auburn Engineers, Inc., 1998)

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## Acknowledgment

Special thanks to the Canadian Centre for Occupational Health and Safety and to WorkSafe Western Australia for granting permission to use their graphic images.

Also, we thank all the New Brunswick employers and employees who provided feedback during the pilot phase of this document.

## Disclaimer

This document represents best practices to prevent manual handling injuries and other business losses due to manual handling. Information contained in this document may change over time as new research and studies are done in the field of ergonomics. This document is not designed to replace a professional ergonomics analysis.

# INTRODUCTION

As part of its ergonomics strategy, WorkSafeNB has developed *Ergonomics Guidelines for Manual Handling*. This booklet is designed to be used by all industries, and to help Joint Health and Safety Committees, supervisors and management prevent musculoskeletal injury.

A musculoskeletal injury (MSI) is an injury or disorder of the muscles, tendons, ligaments, joints, nerves, blood vessels or related soft tissue arising from exposure to risk factors such as awkward postures, repetitive motions and forceful exertions. The injury can be acute or cumulative.

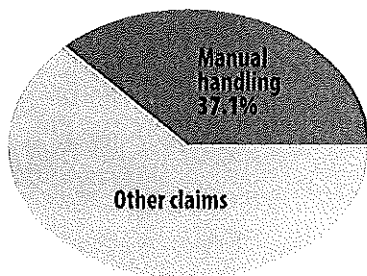
## Stages of cumulative MSIs:

- Stage 1: Mild discomfort, present while working, but disappears when not working. Does not affect work performance or daily living tasks. Completely reversible.
- Stage 2: Pain is present while working and continues when not working. Begins to affect daily living tasks. Employees sometimes take non-prescription pain medications. Completely reversible.
- Stage 3: Pain is present all the time. Employees seek medical attention. May not be able to complete simple daily tasks. May not be completely reversible to reach full recovery. Employee participates in the workplace accommodation process.

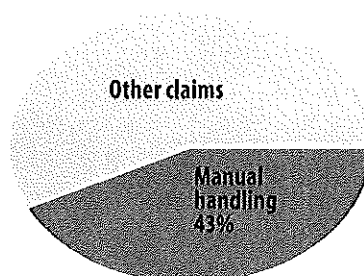
In the early stage, employees should communicate the increasing pain to their immediate supervisor. This is a great opportunity to prevent the MSI from occurring.

The *Discomfort Survey* found in Appendix A is a great tool to help employees report early signs and symptoms of MSI to their supervisor.

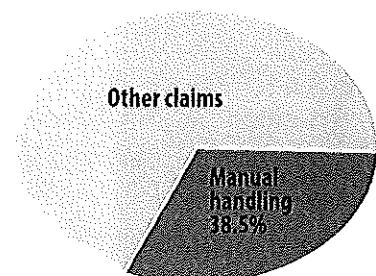
Percentage of Lost-time Claims



Percentage of Days Lost



Total Cost of Lost-time Claims



\* June 2007

## Why is manual handling a problem?

Across Canada, many workplaces are experiencing an increase in the number of MSIs. New Brunswick statistics for 2007 reveal that MSIs account for 38% of all long-term claim costs. Approximately 70% of all MSIs are injuries to the back and shoulders.

In New Brunswick, the following section of *General Regulation 91-191* applies to handling an object or material:

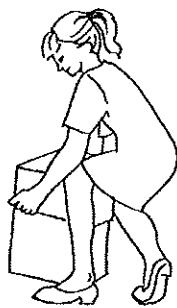
### *91-191 Section 52*

*“Where the health or safety of an employee handling an object or material may be endangered, an employer shall ensure that*

- (a) Adequate and appropriate equipment is provided to the employee and is used by the employee for lifting and moving the object or material, and*
- (b) The employee is instructed as to the appropriate method of lifting and moving objects and material.”*

## Definition

Manual material handling includes any tasks which require a person to lift, lower, push, pull, hold or carry any object or material.



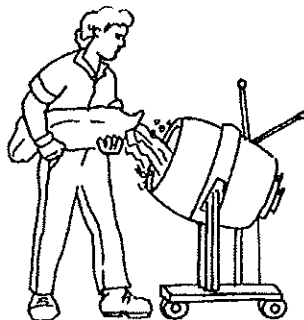
lift/lower



push



carry



hold



pull

## How to use this document

### Step 1

The first part of this document involves using a checklist to identify high-risk manual handling tasks. This identification process emphasizes lifting, lowering, pushing and pulling activities by assessing the following factors:

- Forceful exertion
- Awkward posture
- Repetitive motion

When quantifying the level of exposure for these primary risk factors you will need to consider measuring peak force, sustained force, weight of object, cumulative weight handled, various joints angles, duration of exposure, frequency, working height, workstation dimensions affecting body position, productivity, etc.

The process of identifying risk factors and quantifying the level of exposure will require intensive work upfront, but will provide tremendous benefits in terms of finding solutions that address the root cause of the problem.

If you are not sure where to start, simply select a task that has any of the following characteristics:

- Task requires high physical exertions while performing manual handling activities.
- Employee has a score greater than five on the *Discomfort Survey*.
- Employee has had an MSI in the past while performing the task in the past.

### Step 2

The second part involves using the potential solutions section to develop an action plan with detailed solutions to eliminate or reduce the high-risk manual handling tasks. For each “Yes” answer on the checklist, consult the potential solutions for examples of ways to reduce the risk of injury. Use these examples as a starting point for brainstorming and developing your own action plan.

Advise and involve the employee when completing the checklist for the task you have identified. To improve to improve the accuracy and consistency of your results, be sure to evaluate the most strenuous and physically-demanding portion of the task. Each “Yes” answer indicates a risk of an MSI or a sub-optimal condition. Include all meaningful comments for each item and answer “NA” if the question does not apply.

## MANUAL HANDLING CHECKLIST

Remember to check for a Physical Demands Analysis or Task Information Sheet. They can help you fill the checklist easily.

Initial pushing and pulling forces can be measured with a special gauge, which takes all the variables into account (weight, friction, acceleration).

	Task #1	Task #2	Task #3
<b>Forceful exertions</b>	<b>Check only if «Yes»</b>	<b>Yes</b>	<b>Yes</b>
1. Is the weight of the object lifted more than 25 kg male/ 15 kg female?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Is the initial pushing or pulling force exerted more than 320 N male/220 N female? (10 newtons ~ 1 kg)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Is the sustained pushing or pulling force exerted more than 230 N male/130 N female?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Does the worker handle a total cumulative weight exceeding 10,000 kg per day?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Posture</b>	<b>Check only if «Yes»</b>	<b>Yes</b>	<b>Yes</b>
5. Are objects handled below mid-thigh height forcing the worker to bend their back?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. Does the worker twist their trunk during the handling process?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. Are objects handled above shoulder height?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. Does the worker reach behind or fully across the body with their shoulders?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Repetition</b>	<b>Check only if «Yes»</b>	<b>Yes</b>	<b>Yes</b>
9. Does the worker perform the same task for more than one hour consecutively? (no job rotation and not using different muscle groups throughout the day)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Completed by: \_\_\_\_\_ Date: \_\_\_\_\_

# MSI PREVENTION: FINDING A SOLUTION

## The commitment

Over the years, we have learned that the commitment and involvement of the entire workplace, from top management to line employees, are essential elements of a successful health and safety program.

Management should have the knowledge to assume their leadership role. This includes:

- A visible involvement.
- A health and safety policy (signed by senior management).
- Well-defined roles and responsibilities for all parties (employees, supervisors, JHSC, human resources, etc.).
- A plan to provide the necessary education to all parties.
- A process that ensures all parties are accountable for their responsibilities.

## Engineering out of the problem

The design of the job itself (work and rest schedules, job rotation, production rate), the object being handled (weight, size, shape, handle) and the workstation (dimensions, layout, adjustability) have a direct impact on the primary risk factors. To prevent MSIs, you have to consider modifying all these aspects.

When implementing solutions to reduce the risk of injury, additional benefits can be measured to justify your investment, such as: productivity increase, improved quality, less rework, lower turnover rate, reduced training costs and improved morale.

## Providing education

Education is a key step to preventing MSIs. Employees should have a basic understanding of body mechanics, be able to recognize high-risk tasks and be able to identify the early signs and symptoms of an MSI. Employees should ensure that symptoms, near misses, hazards, incidents and accidents are reported to their supervisor so that necessary action can be taken. Management must document this information.

Please check  
[www.worksafenb.ca](http://www.worksafenb.ca)  
for more information

Some workplaces  
include some safety  
criteria in  
the performance  
appraisal process for  
their employees

Keep in mind that  
employees are a great  
source of creativity!

10 newtons ~ 1 kgf

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ISO 11228-1 and 11228-2 are not regulatory requirements.

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Pushing or pulling under non-ideal conditions reduces the safe pushing and pulling limit.

## Potential Solutions

The following sections provide examples of how to reduce or eliminate the risk of manual handling injuries, but they do not encompass all solutions. Any one solution may not eliminate all the risks of injury. Again, choose the solution that best applies to your situation and use it as a starting point to improve your work environment.

## Forceful exertion

One commonly used standard to determine a safe lifting limit is the ISO Standard 11228 Part 1: Lifting. This standard has a reference mass for two-handed lifting under ideal conditions of:

- 25 kg for 95% of males.
- 15 kg for 99% of females.

Ideal conditions are defined as:

- Standing symmetrically, unrestricted and upright.
- Trunk is upright and not rotated.
- Horizontal distance to object less than 25 cm.
- Height of grip less than 25 cm above knuckle height.
- Firm grip on the object (neutral wrist posture).
- Lifting duration of less than one hour per day.
- Frequency of lifting less than or equal to 0.2 lifts per minute.
- Favourable environmental conditions.

### Lifting under non-ideal conditions decreases the safe lifting limit.

The ISO Standard 11228 Part 2 is used to determine two-handed pushing and pulling limits (see following table):

	Recommend force for 90% male population	Recommend force for 90% female population
PUSHING: Two-handed initial	340 N	220 N
PUSHING: Two-handed sustained	230 N	130 N
PULLING: Two-handed initial	320 N	230 N
PULLING: Two-handed sustained	240 N	140 N

The above table is for a frequency of one-eighth hour, a handle height of 95 cm for males and of 89 cm for females, and a push distance of 2 m.



These ISO standards are based on well-recognized scientific research. While all the details and specifications are not listed in this booklet, do not hesitate to consult ISO ([www.iso.org](http://www.iso.org)) or your regional ergonomics consultant for more information. If you have any doubt while identifying the risk factors or measuring the level of exposure, you should consult or hire a professional ergonomist.

Another commonly used book to assess various manual handling tasks is “*A Guide to Manual Materials Handling*,” by A. Mital, A.S. Nicholson and M.M. Ayoub. This book covers lifting, pushing, pulling, carrying and other common tasks such as one-hand lifting, one-hand pushing, team lifting and manual handling in unusual postures.

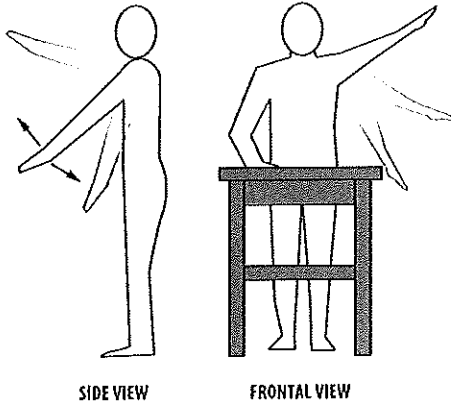
Consider implementing the following solutions to reduce the risk of injury:

- Provide mechanical aids such as conveyors, floor cranes, carts, balancing mechanisms, vacuum hoists, turntables, tilt tables, hooks, automatic pushers, wheels, etc.
- Minimize the total cumulative weight handled each day.
- Change from lifting to pushing or from pushing to rolling.
- Introduce team lifting.
- Modify the object (change the shape, change the size, use lighter containers, divide into smaller units, move the centre of gravity closer to the employee, create handles, improve casters, etc.).
- Provide education in proper body mechanics, in proper selection of clothing and footwear, in use of personal protective equipment, etc.
- Develop a work procedure, provide training and have everyone sign off.

As an approximate guide, the capability of a two-person team is two-thirds the sum of their individual capabilities.

## Posture

### AWKWARD POSTURES



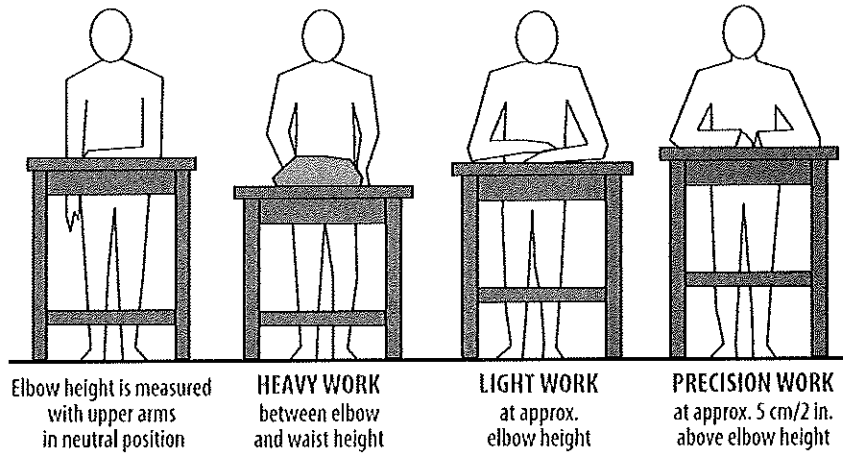
Awkward posture when shoulder abduction is > 45 degrees.

In general, tasks should be designed to allow employees to work close to their neutral joint posture. For the back, when possible, you should avoid frequently flexing and avoid twisting while performing manual handling activities.

For the shoulder, when possible, you should avoid reaching frequently above shoulder height and avoid reaching behind or fully across your body.

The workstation design will have a major effect on the working postures. Ideally, a workstation should be designed to fit a wide range of employees (smallest, tallest, average). Increasing the workstation adjustability is a great way to fit everyone.

### OPTIMAL WORKING HEIGHTS



Elbow height is measured with upper arms in neutral position

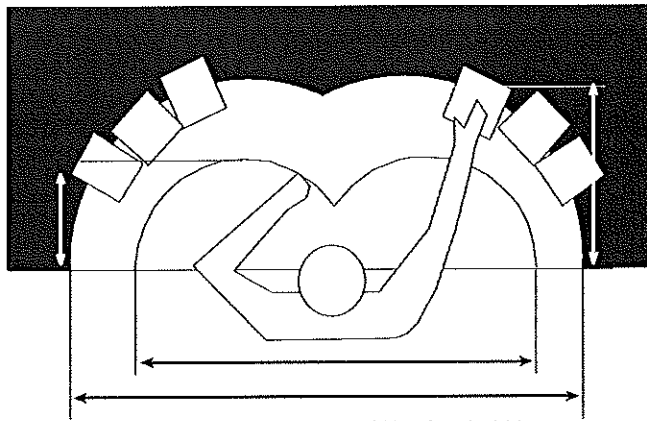
HEAVY WORK between elbow and waist height

LIGHT WORK at approx. elbow height

PRECISION WORK at approx. 5 cm/2 in. above elbow height

Optimal working height is based on worker's body dimensions.

### OPTIMAL WORKING AREA



Frequently used objects should be placed within easy reach in the usual work area.

Object characteristics (size, shape, handle) can also affect posture during the handling process. Handles should be designed to keep wrists in a neutral posture, to provide a power grip, and to minimize contact stresses. Consider implementing the following solutions to reduce the risk of injury:

- Use proper body mechanics – turn by moving the feet rather than twisting the upper body.
- Use storage techniques – wall brackets, shelving, gravity feed – to reduce holding, carrying, lifting, etc.
- Minimize the number of times the load is lifted below mid-thigh height or above shoulder height.
- Add posture variety by introducing job rotation or job enlargement.
- Add posture variety by using a footrest or a sit-stand device.
- Provide anti-fatigue matting or shoe inserts for workers who stand for long periods.
- Adjust the height of the workstation to the worker's optimal working height.
- Add lighting to improve the employee's ability to see objects.
- Use mirrors and other visual aids to help an employee manoeuvre safely around corners and other obstacles.
- Implement a warm-up and stretch program.

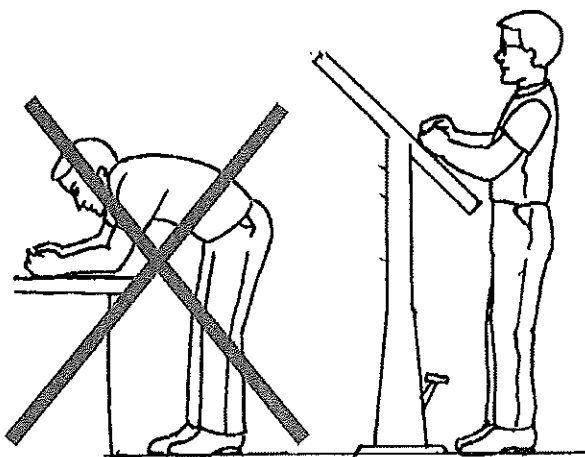
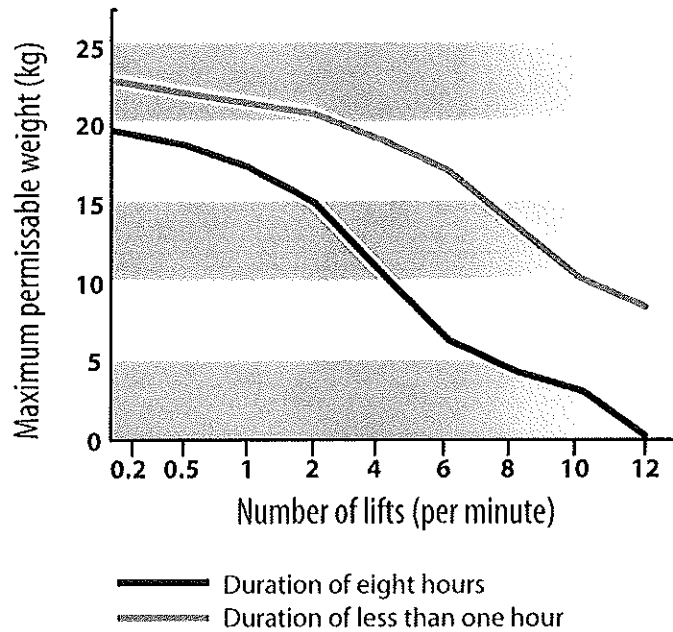


A turntable can help bring the load closer to the body.

## Repetition

Ideally, workers should use different muscle groups and vary their posture (sitting, standing, walking) as often as possible. The physical intensity of the work should also vary, especially for lifting tasks.

In general, increasing the frequency of the task (the number of times the task is performed per minute) or the duration of the task increases the risk of injury.



A tilt work surface can eliminate reaching and bending.

Consider implementing the following solutions to reduce the risk of injury:

- Introduce proper task rotation or job enlargement.
- Introduce short and frequent work-rest cycles.
- Introduce task-specific exercises.
- Reduce the pace of the task or the pace of the machine or feeder.
- If frequency is very high, provide mechanical aids or automate the task.

# BIBLIOGRAPHY

This document is based on information collected from the following sources:

Auburn Engineers Inc. *Design For Ergonomics*. Auburn, 1997.

Bridger, R.S. *Introduction to Ergonomics*. McGraw-Hill, 1995.

International Organization for Standardization. International Standard ISO 11228-1. *Ergonomics - Part 1: Lifting and Carrying*. 1<sup>st</sup> ed. Geneva, 2003.

International Organization for Standardization. International Standard ISO 11228-2. *Ergonomics - Manual Handling - Part 2: Pushing and Pulling*. 1<sup>st</sup> ed. Geneva, 2005.

Kroemer, K.H.E., and E. Granjean. *Fitting the Task to the Human*. 5<sup>th</sup> ed. Bristol: Taylor & Francis Inc., 1997.

Kroemer, Karl, et al. *Ergonomics - How to Design for Ease and Efficiency*. Englewood Cliffs, N.J.: Prentice-Hall, 1994.

Mital, A., A.S. Nicholson, and M.M. Ayoub. *A Guide to Manual Materials Handling*. 2<sup>nd</sup> ed. Washington: Taylor & Francis Inc., 1997.

Occupational Health and Safety Authority. *Code of Practice for Manual Handling (Occupational Overuse Syndrome)*. Melbourne: Law Press, 1995.

Victorian WorkCover Authority. *Regulations and Code of Practice: Manual Handling*. Australian Government Publishing Service, 1996.

# APPENDIX A

## DISCOMFORT SURVEY

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

Job title: \_\_\_\_\_ Male  Female

Job description: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

1. How many years or months have you been working in this particular job or set of tasks?

\_\_\_\_\_ years \_\_\_\_\_ months

2. Please indicate all the body part(s) where discomfort occurred during the last six months:

Body part	Rate your physical discomfort using the scale below: 0 = no discomfort 10 = worst imaginable discomfort	Tasks that usually cause discomfort
Neck	0 1 2 3 4 5 6 7 8 9 10	
Left shoulder	0 1 2 3 4 5 6 7 8 9 10	
Right shoulder	0 1 2 3 4 5 6 7 8 9 10	
Left elbow	0 1 2 3 4 5 6 7 8 9 10	
Right elbow	0 1 2 3 4 5 6 7 8 9 10	
Left wrist/hand	0 1 2 3 4 5 6 7 8 9 10	
Right wrist/hand	0 1 2 3 4 5 6 7 8 9 10	
Back	0 1 2 3 4 5 6 7 8 9 10	
Left knee	0 1 2 3 4 5 6 7 8 9 10	
Right knee	0 1 2 3 4 5 6 7 8 9 10	
Legs	0 1 2 3 4 5 6 7 8 9 10	

3. Which body part rated on the previous page represents the one in which you feel the most discomfort?

---

4. For the body part in which you feel the most discomfort, check all the words that best describe your discomfort:

- |   |  |                                     |
|---|--|-------------------------------------|
| <input type="checkbox"/> Aching         | <input type="checkbox"/> Numbness (asleep) | <input type="checkbox"/> Stiffness  |
| <input type="checkbox"/> Burning        | <input type="checkbox"/> Pain              | <input type="checkbox"/> Tenderness |
| <input type="checkbox"/> Cramping       | <input type="checkbox"/> Redness           | <input type="checkbox"/> Tingling   |
| <input type="checkbox"/> Loss of Colour | <input type="checkbox"/> Swelling          | <input type="checkbox"/> Weakness   |

5. Have you sought or received medical assistance, treatment (chiropractor, physiotherapy, family doctor, etc.) or other for this specific body part?

Yes \_\_\_ No \_\_\_ If yes, please specify:

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6. Have there been any changes made to your job, workstation or activities that you must perform to do your work?

If yes, please specify:

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What do you think could improve your job?

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# APPENDIX B

## CASE STUDY



### Case Study: Back injury while pushing carts

- John, a new employee at the grocery store, hurt his back in the parking lot on March 2 at 8 p.m.
- John had worked outside all day.
- He was pushing and turning 12 empty carts out of the corral when he felt pain in his lower back.
- It was noted that the snow was very slushy that day, especially in and around the corral.
- When asked, John wasn't aware of any procedure for handling empty carts. John had previously reported to his supervisor that it was difficult to push carts in the snow, even worse with damaged casters.

### Investigation

- Always involve the worker while completing the checklist (interview).
- Complete your accident causation analysis sheet as usual.
- For an MSI, proceed with this booklet by completing the checklist, brainstorming potential solutions and creating a detailed action plan based on all the information gathered.

See example below:

Action items	Time Frames	Person Responsible
Order and test a mechanical cart pusher (build business case)	One month	Store manager
Repair damaged carts	One month	Maintenance
Contact head office to see if they can alter cart design to improve how they fit together, which would improve the overall manoeuvrability	Two weeks	Store manager
Develop a policy and procedure on the maximum number of carts to be handled by one person	Two weeks	Supervisor
Train employees on new procedure and have them sign off on it	One month	Supervisor
Improve snow removal and develop acceptable guidelines for next year's contractor	One month	Store manager
Educate employees on proper warm-up and stretches (contact local physiotherapy clinic)	One month	Supervisor
Discomfort Survey yearly to get feedback from employees and identify future problems	Done	Supervisor
Add an MSI education component to the employee orientation session	One month	Human resources



## REGIONAL OFFICES

## APPENDIX C

For more information, contact the ergonomics consultant in your region:

**NORTHWEST**

Phone: 506 475-2550

Fax: 506 475-2568

**SOUTHWEST**

Phone: 506 632-2200

Fax: 506 738-4206

**NORTHEAST**

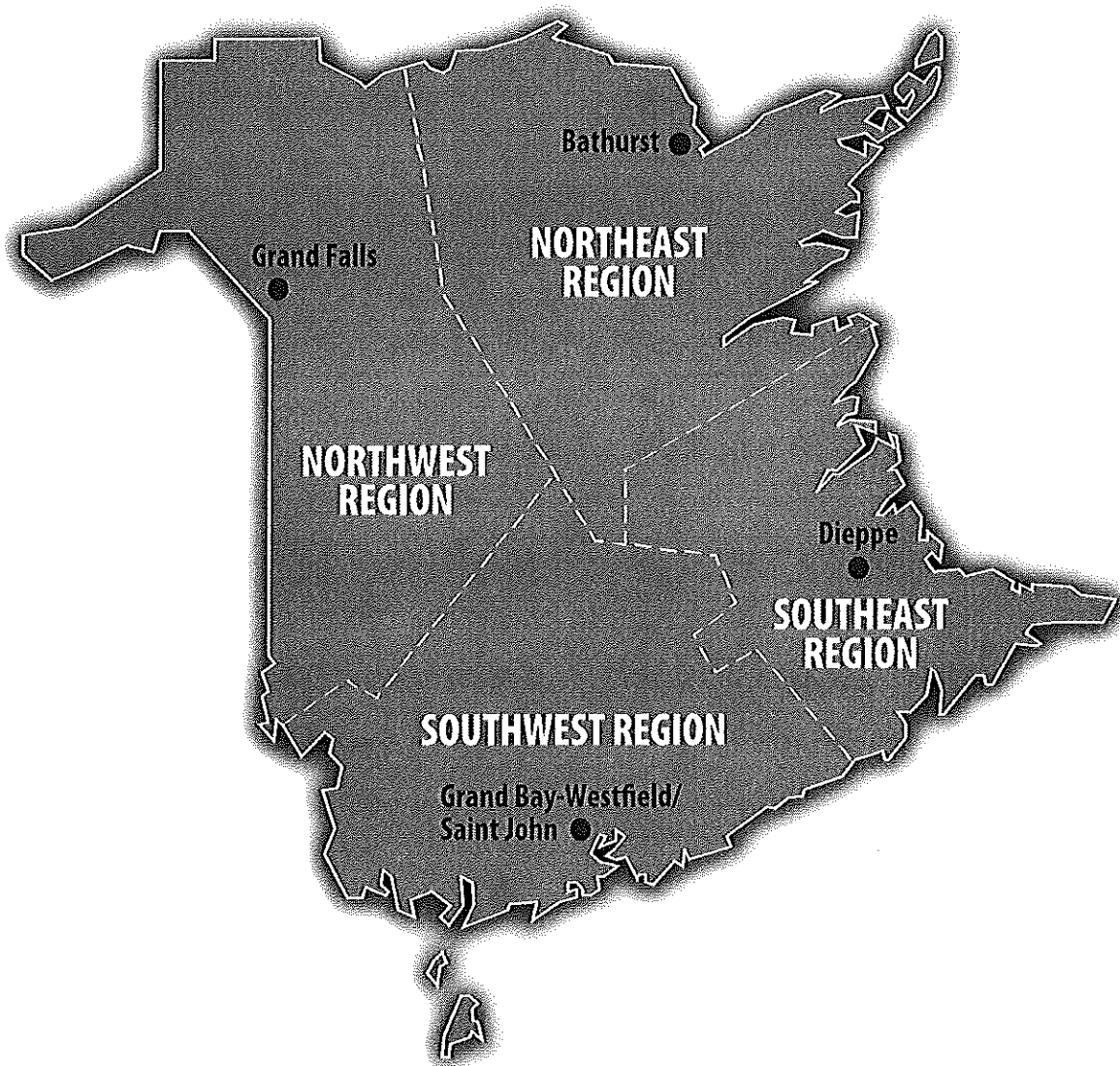
Phone: 506 547-7300

Fax: 506 547-7311

**SOUTHEAST**

Phone: 506 867-0525

Fax: 506 859-6911



## MANUAL HANDLING CHECKLIST

	Task #1	Task #2	Task #3
<b>Forceful exertions</b>	<b>Check only if «Yes»</b>	<b>Yes</b>	<b>Yes</b>
1. Is the weight of the object lifted more than 25 kg male/ 15 kg female?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Is the initial pushing or pulling force exerted more than 320 N male/220 N female? (10 newtons ~ 1 kg)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Is the sustained pushing or pulling force exerted more than 230 N male/130 N female?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Does the worker handle a total cumulative weight exceeding 10,000 kg per day?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Posture</b>	<b>Check only if «Yes»</b>	<b>Yes</b>	<b>Yes</b>
5. Are objects handled below mid-thigh height forcing the worker to bend their back?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. Does the worker twist their trunk during the handling process?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. Are objects handled above shoulder height?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. Does the worker reach behind or fully across the body with their shoulders?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Repetition</b>	<b>Check only if «Yes»</b>	<b>Yes</b>	<b>Yes</b>
9. Does the worker perform the same task for more than one hour consecutively? (no job rotation and not using different muscle groups throughout the day)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Completed by: \_\_\_\_\_ Date: \_\_\_\_\_