Workplace Strain and Sprain Injury Control Strategy – Approaches in Managing Repetitive Stress Injuries in the Sawmill Industry

Introduction

This document is a working tool developed in cooperation between the WSIB and OFSWA in consultation and collaboration with participant mills. The strategy was initiated in December of 2003 and launched in March 2004.

The purpose of the Workplace Strain and Sprain Injury Control Strategy is to assist workplace parties such as mill operators, managers, supervisors, health and safety personnel and workers to identify and find risk factors within occupations in the sawmill industry and take appropriate action to begin to control this risk. The risk factors (force, posture, and time variables) are the known contributors to work-related Strain and Sprain injuries.

The purpose of the strategy… to take action to control Workplace Strain and Sprain Injury Risk.

Secondly, the purpose of the Workplace Strain and Sprain Control Strategy was to determine the effectiveness of a Participatory Ergonomics Program facilitated by the WSIB's consulting Ergonomist and OFSWA's Consultant Trainer.

Effective Participatory Ergonomics Program facilitated by OFSWA Consultant Trainer Chris Serratore and WSIB Ergonomist Malcolm Sutherland.

In a recent issue of *The Log* [1] it was stated that Workplace Strain and Sprain injuries account for 27 percent of lost-time injuries in sawmills and 25 percent in veneer/plywood and other board mills.

Overexertion was reported as the top injury cause in sawmills and veneer/plywood mills.

It is estimated that 143,965 days were lost in the forestry industry in 2004. This represents an increase of 40 percent in days lost since 2001.

[1] The Log, Health And Safety News For Ontario's Forest Industry, Vol. No.8, Issue No. 2, Summer 2005

Workplace Strains and Sprains are an industry-wide problem… the stats

Lost time due to these injuries in sawmills decreased from 341 in 2003 to 328 in 2004. But workplace strain and sprain injuries remain the most common injury type. Sawmill labourers are the most prevalent group, suffering 39 percent of all sawmill lost-time injuries in 2004. This occurrence rate is followed by sawyers at 11 percent, mechanics at 8 percent and planers/turners accounting for 3 percent.

A similar picture is drawn for the labourers in veneer/plywood and other board mills. Labourers suffered 35 percent of lost-time injuries in veneer/plywood and other board mills in 2004, followed by planers/turners/shapers at 11 percent, wood processors at 6 percent and mechanics at 5 percent.

Workplace Strains and Sprains defined.

Workplace strain and sprains result in injuries to the soft tissue of the upper extremity, lower extremity or low back occurring over time due to highly repetitive motions, high force, or awkward postures. When force, posture and time factors occur in jobs in combination, the risk of development of these types of injuries increase.

This document will present case histories and the result of firms' participation in the program. A number of control measures will also be described. The reader is encouraged to implement the advocated ergonomics process and apply the appropriate control strategies. Upon review of this document, it is notable that many sawmills in Ontario use different names for similar occupations. This does not appear particularly problematic. Please note that the described interventions and processes advocated have "cross application". The reader should take into account the principle, the guidelines and the practices and apply those concepts to their similar jobs.

Ergonomic Controls

Regardless of the type of controls chosen, ergonomic interventions can be classified into three recognizable controls.

Engineering controls -- changes to the workstation, tools or equipment in order to reduce or eliminate exposures.

Administrative controls -- reorganization of work or adjustment to work process often chosen to reduce time-exposure factors. Administrative controls may also include re-organization of duties and job tasks in a manner considering human factors.

Work practice controls -- work methods training, employee work habits, and attention to judge the approach to work.

The participants in this initiative (the group are classified in the 033 sawmill rate group and the 036 veneer/plywood rate group) involved:

- 1 WSIB consulting Ergonomist
- 1 OFSWA consultant trainer
- 1 Administrative/ data consultant
- 5 participant firms made up of management, supervisory staff, and ergonomic subcommittee members.

The five voluntary participant firms were visited with an initial tour of their facility and various "problem" occupations reviewed. The voluntary participant firms were selected in a targeted approach based on injury rate, injury cost, and report of Strain and Sprain injuries and/or WSIB claim/rate group.

Essentially the volunteer mills acted as model sites, allowing for evaluation of a participative ergonomic model.

Participant Group for the Workplace Strains and Sprain Injury Sawmill Control, management, supervisors & staff in consultation with Safe Work/ Health & Safety Facilitators

Sawmill Participants

Atikokan Forest Products Ltd.

Domtar Sawmill (White River)
Great West Timber Ltd.
Northern Sawmills Inc.
Columbia Forest Products Ltd. (Hearst)

The authors of this document would like to thank former Director of Forestry WSIB, Robbin Lavoie, for his insight and vision; current Acting Director of Forestry WSIB, Paul Field; and OFSWA Management Cecil Demers, CEO OFSWA, and Tom Welton, Manager of Field and Program Development OFSWA, for their support.

We would also like to acknowledge the key participants of in the participant working group:

Health & Safety Professionals & Ergo Committee participants:

Tom Darechuk, Claudio Caratti and Jeff Cook of Great West Timber; Mike Adams, Geoff Farrow and Doris Blair of Northern Sawmills; Scott Manford, Maxine Mcallum and Dave Cryderman of Atikokan Forest Products; Roger LeBlanc, Richard Pitre, Carol Couture and Armando Prezares of Columbia Forest Products. Scott Needs of Domtar.

The Working Group…"Our Champions"

Thanks Mill Managers & Thanks Participants!

"We've all become more proactive in how to counteract and prevent these injuries by recognizing symptoms. The biggest thing is a little more education in how we can help employees help themselves before it becomes a problem. Rehabilitation is not the answer, because they're already hurt. The biggest thing that hit home with everybody is that we have to try to prevent these injuries in the first place. The employees grasping that is probably the biggest change. They're the ones that have to make the change and we're here to support them with whatever has to be done. It's the employees that have made the change -- they're the ones who deserve the credit."

Tom Darechuk, General Manager, Great West Timber

"These are types of injuries that you can't see what the problems are. You can see a crushed finger or a broken hand or foot, but now all of our injuries are sore back, sore neck, sore shoulder... This ergonomic process is not a godsend where all of a sudden all the problems are cured, but it's a beginning to make a change. Prior to this, the extent that we looked at anything ergonomically was if we hired someone to come in and do it. The way the industry is now, nobody can throw money around to bring in people to solve the problems. This process opens your own eyes up to what the problems are and what could be causing them. It's an education where you need the knowledge in order to start a process to change it. Hopefully a few years from now we'll see a change where these types of injuries are on a decline."

Scott Manford, Safety Coordinator, Atikokan Forest Products

Method & Process (Summary)

When actioning ergonomic awareness, the effectiveness and the efficacy of ergonomic interventions are a relied-on measure of a program's value. However in a *participatory approach*, a more accurate yardstick is who is involved and what processes were created to deliver and re-deliver solutions.

The measure of effectiveness is the "process created".

Based on anecdotal reports, many attempts at ergonomic interventions in the sawmill industry (and in our participant group) have resulted in limited success. The purpose of our approach was therefore to explore ways that ergonomic interventions can be introduced and promoted in the sawmill industry to increase the likelihood of acceptance.

Acceptance of the participatory approach.

The initial stages of this project involved the identification of personnel within targeted participant mills (those with elevated injury rates). Once these individuals were determined, mill management acceptance and "buy-in" were determined either through direct meetings with the OFSWA consultant and Ergonomist or by indirect report from a Health & Safety Representative within the mill(s).

Next, leaders in mills were charged with the identification of problem jobs through their own analysis of internal data such as injury report, WSIB claims, or worker complaint. Many were in fact quite aware of problem jobs immediately.

"Problem jobs" were easy to find.

However participants were encouraged to collect and analyze information relating to Workplace Strain and Sprain injury occurrence more scientifically. Information specific to an occupational title, specific to duties and tasks that could be linked to injury report, and/or opinions of health & safety personnel and/or supervisory staff and workers performing the "problem jobs" was advocated.

"Defining real problems through records and an information process…"

No specific criteria as to method of collection of the above noted data or accuracy of collection was however monitored. Furthermore, specific injury type or area was not specified. Yet each group was able to determine what jobs needed direct attention and began to shape a "priority of action."

"Priority of action"

Next, each participant mill was asked to:

- Define an ergonomic subcommittee or recruit a working group that reports to the Joint Health & Safety Committee and would begin to use ergonomic tools.

- Develop a detailed and ergonomic action plan - to address specific ergonomic concerns and prevent workplace strain and sprain injuries in problem jobs. Action plan timelines and resource requirements were defined and their program's key goals were set. The creation of the ergonomic subcommittee, an ergonomic policy statement and a plan to address concerns at selected workstations were the initial actions of all participants.

Small steps taken…resulting in knowledge transfer and independent practices.

- Training identification and a company-wide communication plan were to follow.

- Follow-up

The WSIB Ergonomist, OFSWA Consultant Trainer and Health & Safety Representative of the mill toured the "problem jobs" and performed some independent analysis as a control measure prior to the request for participants to begin quantifying and describing the physical work being performed.

Job Descriptions and a Physical Demands Analysis tool were provided to each Mill to complete for their defined occupation. This was vital and a tangible step for each group. Some of the groups already had Job Descriptions while others did not. Some participants had Physical Demands Analysis, most did not. All were asked to revisit their process of understanding work and the accuracy of their data.

Job demands & PDA…the roots

It became evident that there was difficulty in accurately defining occupational requirement in an organized manner. Participants required training and education.

Knowledge Transfer Workshop / Education and Training in simple ergonomic tools.

The participant mills were therefore asked to attend with their Ergonomic Subcommittee a one-day workshop to outline tool use and provide ergonomics training and education on principles and practices.

After the workshop, improved completion of basic ergonomic tools such as the Job Description and Physical Demands Analysis were noted. And the additional tools provided at the workshop were also better used (hazard checklists, symptom survey, etc.).

Solution development for the mill's particular Workplace Strain and Sprain Injury problems in the defined occupations were then generated in a framework also presented at the workshop. However each mill and the subcommittees were challenged to develop their own alternatives based on their resources available and priority of need.

Customized interventions

Each mill worked its own interventions into its management plan, to fit logistically, and into its own business priorities. In some cases the implementation of interventions was to fit into existing upgrade of production lines. In other cases implementation of interventions occurred as scheduled maintenance was performed. Finally some decided on low-cost work practice change.

Case Studies

Each of the participant mills faced challenges in their implementation of an Ergonomics Program. This was expected.

It is felt that these challenges were part of a normal "learning curve" and are characteristic to implementation of a muti-discplinary, process-driven approach to ergonomics. (Participatory Ergonomics)

The challenges faced are reflective of the working dynamic or the work culture in this industry. Furthermore, the issues faced mirror the economic turmoil and instability in Ontario in the lumber trade.

The issues will likely be faced by most sawmills when implementing a Participatory Ergonomics Program and are therefore highlighted below:

Understanding key principles assist in analysis of risk, defining priority of intervention and generating viable solutions to exposure.

These challenges are:

1. *Human resources* - availability, delegation and interest in the establishment of a multi-disciplinary group. An ergonomic subcommittee with membership and participation from management and union (supervisory level and front-line staff) is required. Without "complete" participation and buy-in from the ground up, ergonomic solutions are doomed to failure.

Shared learning

2. *Priority* - Ergonomics and programs of this kind are proactive by their nature and as such require a "champion" or advocate of the program within the mill. Outside the mill, health & safety groups and associations such as OFSWA have a role in support, facilitation and resource development. To a lesser extent, the future of injury prevention through ergonomics may have greater compliance and results with the adoption of either an incentive (financial, recognition or otherwise) or an enforcement measure. It remains unclear in the literature if enforcement has a positive or negative effect and as such will not be a recommendation coming from this report.

The Ergonomics Subcommittee must establish its own momentum through public relations and marketing of the program internally in the mill.

The subcommittee must also meet regularly and work to continually evaluate, measure and create positive change in defined occupations. It was found that reacting to problems after an injury has occurred is much more difficult. Proactive solutions in design stages are always easier.

Solutions before problems

3. *Economic climate*- Clearly the sawmill industry in Ontario is facing considerable challenges. Layoffs, shutdowns, mill closures and personnel change were common occurrences during the case studies described in this project report. Yet in the face of these challenges the most successful participants chose to remain focused on their individual programs and did in fact establish ergonomics as a priority. Each has therefore effected positive change and benefit to their workers and workplaces.

4. *Mechanization*- Automation, mechanization and specialization to meet the need of increased productivity and decreased production costs may have resulted in an increased prevalence of WMSDs in the sawmill industry. It remains unclear if mechanization has been appropriately implemented in this industry to reduce worker exposure to high-risk manual handling tasks (handling lumber).

5. *Anthropometric variability* - work design, work organization and layout of workstations typically followed wood processing requirements, not human factor design principles. Furthermore, in all the mills an extremely diverse workforce was noted with regard to stature and body size. This variation creates some reportable difficulty when generating ergonomic solutions.

6. *Willingness to participate* - in all the groups targeted in the initial analysis of claims data by OFSWA and WSIB, a willingness to complete all aspects of this program was noted.

7. *Team composition, reporting structure, leadership* - the ergonomic team composition and leadership are extremely important in establishing a Participatory Ergonomic Program. Although inclusion of both top management and labor representatives is often difficult, it is a key link to success. Our participants had a mix of on-the- job experience, knowledge of work process and innovation, and professionals such as Engineers, Health & Safety Personnel and/or Occupational Health & Safety Nurses. Multidisciplinary teams had the best results. Involvement of maintenance staff and those involved in purchasing also suggests enhanced success with implementation and outcome. Smaller teams are better. Those with approximately five members or fewer allow for sufficient expertise and opinion, and in our participant group were most effective.

5-member teams

8. *Company-wide communication plan* - the broad-based involvement of employees is required in a participatory program. Therefore effective communication plans are required. The mills that had limited results may have failed in this regard.

Communication is vital

Participant Summaries

Please note the descriptions below will not include specific injury data, cost statements, or any other information that was deemed private or proprietary in nature. The OFSWA Consultant has retained much of this type of information. We encourage the reader to understand the example and compare it to their existing programs.

Case Studies

Great West Timber Ltd.

Pre-existing Level of Ergonomic Concern/Effort

- No job descriptions
- No physical demands analysis
- No ergonomic subcommittee
- Concerns regarding injury rates and prevalence rate of Workplace Strains and Sprains Injuries
- Miscellaneous solution development usually claim- specific
- Miscellaneous training with external experts
- Repetitive stress injury seminars and work methods training (infrequently).

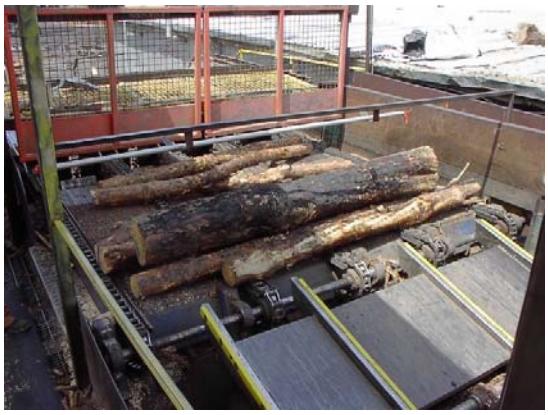
Team Training

- WSIB. Workplace Strain and Sprain Injuries control strategy seminar
- Ongoing mentoring, and facilitation from the WSIB. Ergonomist and the OFSWA Consultant.
- Internal consultation on "wood flow" for the 8- foot deck.

Individual results

Team Activities and Success in Defining/Implementing Solutions

- Two occupations defined with action taken in each resulting in significant change.
- 8 foot deck -- installation of oversized drop gates eliminating exposure to very heavy loading, forward bending and awkward postures with very heavy loads and high repetition rates of the above-noted movements for operators.
- Hot Ponds --review of occupational requirements identifying inconsistency in work technique and a cumulative fatigue/stress noted with work tasks. A compensatory stretching program was implemented with worker education and visual posting created. Work methods education and training with a mentorship component (matching experienced skilled workers with novice workers) was also described.



Overall Accomplishments

- Creation of ergonomic subcommittee.
- Education and training of ergonomic subcommittee members.
- Creation of an ergonomic action plan.
- Creation of the ergonomic policy.
- Defining problem occupations through job description and physical demands analysis.
- Adoption of basic ergonomic toolset.
- Implementation of solutions around problem jobs identified.
- Efficiency gains, process understanding and participation in all aspects of the ergonomic control strategy.
- A detailed stretching program was developed and printed up on large format posters. These posters are displayed throughout the mill and all workers are encouraged to utilize the basic stretches throughout their shift as an injury prevention measure.
- The stretching program was rolled out through a series of information sessions provided by an external specialist. The sessions highlighted the importance of injury prevention and how to follow the suggested guidelines from the stretching poster.

Submitted Documents

- Injury occurrence data/claim reports
- Workplace Strain and Sprain injury cost information
- Job descriptions and physical demands analysis for problem jobs
- Ergonomic action plan
- Ergonomic policy statement

Atikokan Forest Products

Pre-existing Level of Ergonomic Concern/Effort

- Limited and dated physical demands analysis reviewed and updated.
- No ergonomic subcommittee
- Concerns regarding injury rates and prevalence rate of Workplace Strains and Sprains; claim reactive
- Miscellaneous solution development, usually claim specific
- Miscellaneous consultations with experts
- Repetitive stress injury information but limited action items
- Informal job rotation in place in one department of the Mill.

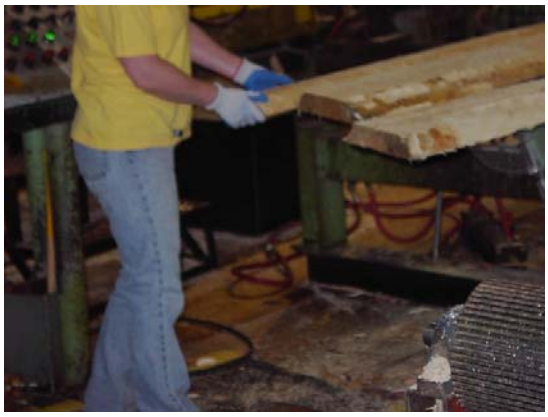
Team Training

- WSIB Workplace Strain and Sprain Injury control strategy seminar
- Ongoing mentoring, and facilitation from the
- WSIB Ergonomist and the OFSWA Consultant Trainer.

Atikokan Forest Products Ltd.

Team Activities and Success in Defining/Implementing Solutions

- Ergonomic consideration and review at the design stage underway with the installation of new line.
- Utilizing video capture techniques to analyze physical requirement can deal with urgent Workplace Strain and Sprain injury issues.
- Implementing simple devices and "ergonomic" items such as personal protective equipment, anti-fatigue footwear. (refer to OFSWA Log fall issue 2005)
- Full review of sticker position in planer mill, resulted in the installation of new equipment to reduce the amount of material handling required.
- Implemented use of specialized grip gloves to reduce the amount of force required while handling lumber.



Overall Accomplishments

- Creation of ergonomics subcommittee
- Education and training of ergonomic committee members
- Creation of an ergonomic action plan
- Creation of the ergonomic policy
- Defining problem occupations through job description and physical demands analysis
- Adoption of basic ergonomic tools
- Utilizing analysis technique and solution development method to address Workplace Strain and Sprain injury concerns.
- Efficiency gains, process understanding and participation in all aspects of the ergonomic control strategy.

Submitted Documents

- Injury occurrence data/claim reports
- Workplace Strain and Sprain injury cost information
- Job descriptions and physical demands analysis for problem jobs
- Ergonomic action plan
- Ergonomic policy statement

Information & Tools package

During the implementation stages of this project, mills and members of the ergonomic subcommittees became concerned with effectively determining whether work-related strain and sprain injury problems are significant.

One advocated method cited in NIOSH has been presented as an objective measure for data gathering. The measures may be compared with those from other departments and the industry as a whole when making judgments concerning injury report.

Incident rate -- number of cases per 100 worker years (equivalent to 200,000 workhours). Incident rate can further be defined by computing for all musculoskeletal disorders by disorder type or body part.)

$$IR = \frac{\text{no. of new cases during a time period X 200,000 hr}}{\text{Total hrs worked by all workers for that time period}}$$

The prevalence rate (PR) calculation is similar however all existing numbers of cases for given time are used for the formula.

$$PR = \frac{\text{number of all cases during a time period X200,000 hr}}{\text{Total hrs work by all workers for that time period}}$$

Evidence that excessive numbers of cases of Workplace Strain and Sprain injuries are due to workplace factors will require other forms of data collection. Interviews, questionnaire surveys, symptom surveys, and other tools described in this report should be included in the analysis.

Companies are encouraged to act on the results of all data collection. Shortfalls in compliance have been noted when professionals do not act on responses from data gathering.

Calculations

Baseline Ergonomic Assessment Survey

Survey participation should be voluntary in nature with forms remaining anonymous. Comparison of work surveys before and after ergonomic changes is one advocated method of measuring benefit.

See attached form

Job Description Form

See attached form

General Physical Demands Analysis
Physical Demands Analysis detailed description

See attached forms

Ergonomic Intervention review

See attached form

Upper Limb Assessment Tool

www.ergonomics.co.uk/Rula/Ergo/

Your tool kit

General Ergonomic Principles

1. Take into account the human factor first – adapt work space, working configuration and heights (layout) to the operator. Consider the work being done, stature(s) of workers and optimal body postures.
2. Understand the physical capacity of your particular workforce.
3. Provide space for body movements, reaching safely within optimal or preferred zones.
4. Ensure lifting, pushing and pulling requirements meet acceptable capacities for your workforce.
5. Provide variety in all physical tasks, avoiding static requirements and highly awkward bodily positions.
6. Use mechanization to assist with highly repetitive tasks, leaving more variable tasks to humans.
7. Place user-friendly controls and monitors (VDTs) within functional reach and idealized sightlines.
8. Use mechanization to handle extreme loads or loads that require poor postures with awkward coupling.
9. Use large muscles to handle large loads and small muscles to deal with precision work.
10. Review PPE and tool use with your workers. Notice adaptation to tools, such as taping handles, etc.
11. Change tasks that require high gripping requirements and forces with poor postures.
12. Provide adaptable equipment, ergo tools, and adjustable workstations.
13. Review need for quotas and performance incentives.

Your rules

WORKSTATION DESIGN PRINCIPLES [2]

1. Make the workstation adjustable, enabling both large and small persons to fit comfortably and reach materials easily.
2. Place materials and tools in front of the worker to reduce twisting motions. Provide sufficient workspace for the whole body to turn without obstruction.
3. Avoid static loads, fixed work postures, and job requirements in which operators must frequently or for long periods either lean to the front or the side, holding them in a bent or extended positions.
4. Set work surface above elbow height for tasks involving fine visual detail and below elbow height for tasks requiring downward forces and heavy physical effort.
5. Provide properly designed chairs with adjustable seat height, backrests and lumbar support. Padding that is durable and suitable for the environment in which it is placed is required.
6. Provide anti-fatigue mats for long-term standing.
7. Support with the upper extremity, providing elbow, wrist, arm and foot rest as needed.
8. Design workstations so movements follow a curved path. Arm movements pivot at the elbows rather than around the shoulders.
9. Provide controls, displays and dials that are simple, logical and easy to read and reach.

To reduce stress from repetitive hand and wrist actions

1. Reduced number of repetitions per shift through worker rotation, worker substitution or automated or semi-automated systems.
2. Maintain neutral wrist positions by designing jobs to reduce extreme flexion or extension/deviation of the wrist. Avoid inward and outward rotation of forearm when the wrist is bent.

[2] Bernard, B.P. (Ed.) (1997). Musculoskeletal Disorders and Workplace Factors: A Critical Review of Epidemiologic Evidence for Work-Related Musculoskeletal Disorders of the Neck, Upper Extremity and Low Back. Cincinnati, OH, National Institute for Occupational Safety and Health. (Tool Kits)

3. Reduce force and pressure on wrists and hands.
4. Wherever possible reduce the weight and size of objects handled.
5. Avoid tools that create pressure on the base of the palm.
6. Avoid pounding with hand by using appropriate tools.
7. Avoid repetitive and forceful pressing of fingertips.
8. Reduce requirements for pinch gripping.
9. Design work methods to reduce time or need to hold vibrating tools. Personal protective equipment can dampen hand contact vibration (Hcv).
10. Provide protection for the hand when working in cold environments. Provide a selection of glove sizes and types.
11. Select and use properly designed handtools.
12. Reduced extended reaching and reaching above shoulder height, waist level and behind the body.

HAND TOOLS USE SELECTION PRINCIPLES

1. Avoid bent wrists - "bend the tool, not the wrists".
2. Reduce weight and size of the tool. Provide a counterbalance support device for larger, heavier tools.
3. Investigate compressible gripping surfaces rather than hard plastic surfaces on tools.
4. Whenever possible use power grip rather than a precision finger grip.
5. Reduce trigger finger actions by selecting tools with large switches.
6. Protect or isolate hands from heat, cold, and vibration.
7. Wear gloves that fit and that meet the function of the task.

DESIGN PRINCIPLES FOR LIFTING AND LOWERING TASKS

1. Optimize material flow through the sawmill/mill to reduce manual handling and lifting of material.
2. Review and establish efficient receiving, storage, and supply or shipping facilities.
3. Establish acceptable clearance on the walkways, aisles and access areas.

More ideas

4. Reduce or eliminate the need to lift and lower manually by increasing the weight to a point where it must be mechanically handled.
5. Reduce weight of objects that are lifted and handled, such as raw materials.
6. Reduce hand distance from the body.
7. Convert load (lifting, carrying, and lowering movements) to a push or pull through the use of conveyors, carting, lift tables, mechanization such as come-along, winches, etc.
8. Review acceptable loads/lifting in carrying requirements.

DESIGN PRINCIPLES FOR PUSHING AND PULLING TASKS

1. Eliminate the need to push or pull by using the following mechanical aids, when applicable:

- Conveyers and carts
- Lift trucks
- Lift tables, graduated work heights
- Non-powered conveyors
- Review wheels and casters on carts, dollies, etc; proper sizing for application and terrain.
- Perform regular maintenance

2. Reduce the force required to push and pull by reducing size or weight of load, used trucks or dollies, conveyers etc. Maintain floors to eliminate holes and bumps and apply surface treatment to reduce friction.
3. Reduce the distance of the push and pull by optimizing space in receiving, storage, production or placement of shipping areas closer to production areas.
4. Optimize technique of pusher by providing variable handles, replace a pull with a push whenever possible.
5. Use ramps with a slope of less than 10 percent when possible.

DESIGN PRINCIPLES FOR CARRYING TASKS

1. Rearrange the workplace to eliminate unnecessary material movement. Use the following mechanical aids when possible:

- Conveyors
- Lift trucks and hand trucks
- Tables or slides
- Four-wheel carts or dollies
- Air or gravity lifts/ejection systems

2. Reduce weight carried by reducing weight of container, size of object, amount carried.
3. When possible reduce the size or shape of the object or container of raw materials.
4. Provide handles or grips to allow materials to be held close to body. Utilize team lift technique.
5. Carefully mark material being lifted with weight and type of lift recommended (diagram).
6. Change carried to push or pull.
7. Train staff on lifting techniques recommended.

Recommendations

1. OFSWA Ergonomist - The newly created Ergonomist position for OFSWA should remain committed to the identification of participant mills for future delivery of Ergonomics programs in forestry mills within Ontario. As more and more participants are gathered and as they complete the program, an impact on Workplace Strain and Sprain injury claim rate and occurrence is expected for the entire rate group. Monitoring, facilitation and measurement of the results and pitfalls should continue.
2. Safe Work Ontario (SWO) - The Control Strategy and this document should be placed into the above-noted program. This will allow OFSWA Consultant Trainers to explain and facilitate participation. In addition, firms will receive materials and tools in a useable, accessible format.
3. Ergonomic Education - The created Ergonomics workshop (1 day) training course should be delivered and perhaps upgraded to add a competency measure and recognition of completion.
4. Length of training/recert. requirement defined - The ergo subcommittee group should receive ongoing education/information and updates with new members trained. As such, a timeline of yearly education should be provided. A database of key participants should be gathered.
5. Review of onsite education needs - Monthly, quarterly education and training of supervisors, front-line staff must be defined by participant firms and by delivery organization.
6. Education resources better defined- Links to information and Toolkit should be placed on the OFSWA website. In addition, information resources, expert contacts, safe work groups, and regular updates must be created and defined for user groups.
7. Scientific review - This study did not follow a scientific method, but the findings or method certainly could be adapted to create a proper study. Groups such as Cre-MSD may be consulted in the future.

Other Resources

Work stretches

Long working shifts and heavy and laborious work often present only minor opportunities for work design or engineering controls. Economic considerations in the increased need for productivity may also seemingly eliminate administrative solutions to address workplace strain and sprain injury risk factors.

In these cases the solution often lies in returning back to the productivity unit, that is the worker. The worker's physical ability and tolerance to deal with sustained and demanding work is a result of his physical capacity and endurance.

Micro stretch breaks, work pause

Interruption of physically demanding work to incorporate variation and reduce cumulative stress and muscular fatigue is recommended as a work practice control. Micro stretch breaks introduced during work pauses or scheduled at regular intervals throughout the day have been advocated to reduce exposure to risk.

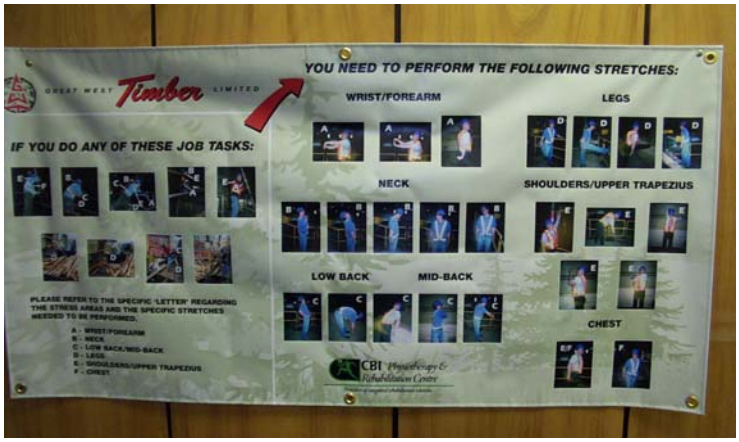
Warm-up and cool-down stretching has also been advocated prior to and after working periods. Workplace parties are encouraged to create systems that support these positive working habits.

Why stretch

Stretching increases the range of motion at a particular joint. It reduces muscular tension and is known to prevent injury and promote proper circulation.

How to stretch

Stretching is held for 10-15 seconds using gentle pain-free controlled motions. Breath should be natural and not held.



Stretching of the upper extremity such as hand, thumb and finger, wrist and arm, shoulder and neck are important for occupations that require frequent upper extremity work.

Stretching of the lower extremity, including the low back, hip flexors, hamstrings and extensors is important for occupations that require frequent whole body pushing and pulling, lifting and lowering, carrying, sitting, standing and walking.

Excellent resources for stretching are the Anderson series of stretching books. Please also speak with a competent health professional, your company's health & safety representative, and/or a kinesiologist/ exercise therapist or ergonomist for advice on work-specific routines.

Resources

Glossary of Terms

Abductions - movement away from the mid-line or axis of the body.

Adduction - the opposite of Abduction; movement towards midline of the body.

Acute -- sudden onset: having severe symptoms occurring abruptly. The opposite of chronic.

Awkward Postures – deviation from the neutral positions of bodily segments. Awkward postures may involve reaching above shoulders, twisting of low back, forward or backward bending of the neck or low back, pinching grips of the fingers, or combination movements involving lateral bending.

Biomechanics – the study of the effect of internal and external forces on the human body in movement and at rest.

Cervical -- pertaining to the upper spine or neck region; includes the C1 to C7 vertebrae. Involved in neck flexion, neck extension and rotation of the head.

Chronic -- progressive or cumulative effect, with symptoms persisting for long periods of time (beyond the normally expected healing time).

Compression – loading which applies the squeezing force to structure that may result in distortion, flattening or thinning of the structure. Force normally associated with spinal loading.

Cycle – the time interval during which recurring sequences of tasks are completed. The time to complete a single operation or a single step in a repetitive task.

Controls – solutions applied to reduce worker exposure to known Workplace Strain and Sprain injury risk factors. Controls fall generally under three categories: engineering controls, administrative controls and work practice controls.

Caution/Hazard/Problem Jobs – jobs or occupations where workers perform activities with identifiable exposure to risk factors for Workplace Strain and Sprain injuries. These jobs have a sufficient degree of risk to require ergonomic awareness, education, and potential changes to eliminate, reduce or control exposure to risk.

Dynamic -- referring to movement or motion of a body part. Producing or involving activity or action. Opposite of static.

Ergonomics – the science or practice of designing jobs to the capabilities and limitations of the human body. Ergonomics includes physical, mental and work systems and their limits. The study of human factors; worker interaction with tools, machines, equipment, work methods and working environments.

Extension -- movement of a joint which increases the angle at that joint.

Fatigue – the condition that results in the body when it cannot provide sufficient energy for muscular work (activity, movement) to perform the task.

Havs – hand and arm vibration, generally from a power tool.

Flexion - bending of a joint whereby the angle between the bones decreases.

Gripping - power, hook, and pinch hand position applying pressure from the hand or fingers to stabilize a load or apply force.

Lateral -- pertaining to or proceeding from the side of the body.

Ligaments -- fibre structures connecting bones to bones, providing support and stability.

Load/Force/Magnitude – external weight of an object multiplied with distance held away from the body. Internal force requirements are often graded as high, medium, or low, such as isometric contraction of muscles while holding, pushing or pulling an object.

Lumbar -- lower back or lumbar spine corresponding to L1-L5 vertebrae.

Medial -- pertaining to or proceeding or directed towards the mid-line on the body.

PPE – personal protective equipment such as gloves, kneepads and other equipment designed to reduce the exposure to risk. In ergonomic solutions these devices are often implemented to supplement existing controls.

Range of motion -- ROM; the limit of movement of a joint.

Repetition -- performing an action or motion over and over again. Severity of risk depends on frequency of repetition, speed of movement, number of muscles involved, size and function of those muscles and the required force. Ergonomic research has not accurately defined repetition threshold for a specific body part or muscular segment, however repetition with the absence of recovery results in fatigue and reduced biomechanical efficiency. At the muscular and tendon level, high levels of repetition result in tissue degeneration.

Rest cycle – timeline for recovery from task: the pattern of work activity including regularly scheduled rest breaks or alteration of work to less demanding tasks.

Risk Factors – an aspect of work that may increase an exposed worker's chance of developing a work-related strain and sprain injury. These factors include force posture in time elements, usually in combination with adverse environmental or working conditions. Risk factors include awkward postures, high hand forces, highly repetitive action, repeated impact, heavy, frequent or awkward lifting, etc.

Rotation -- as in head neck or trunk rotation. Twisting turning the body part or body segment about its centre line access. Job rotation involves movement to known alternative work locations or an alternative duty resulting in variation and a change in risk exposure.

Static -- static posture involving muscular activity with body part held in a fixed position. Isometric contraction stressing the body.

Supination -- turning the palm facing up or out, for example. The opposite of pronation.

Task analysis -- systematic identification of all physical activity demands of the job or work process.

Thoracic -- pertaining to the mid-level of the spine. T1 -- T12 of the spinal vertebral discs.

VDT -- video display terminal or computer monitor.

Vertebral Disc – fibrous, gelatinous structures that separate the bones that make up the spinal column.

Workplace Strain and Sprain Injuries - involve soft tissue such as muscle, tendons, joints, ligaments, blood vessels and nerves. Workplace Strains and Sprains result from exposure to risk factors. Examples include muscular strain, tears, ligament dysfunction, pinched nerves, carpal tunnel syndrome, rotator cuff syndrome, etc. For the purpose of this guide, Workplace Strains and Sprains do not occur or include injuries with a traumatic origin such as slips, trips, motor vehicle accidents or being struck or caught in or by objects. Synonyms may include repetitive stress injury (RSI), musculoskeletal disorder (MSD), musculoskeletal injury (MSI). cumulative trauma disorder (CTD).

Workstation -- the entire area accessed by a worker when performing a specific task or job cycle.

Job Rotation Information

Create variation

A method of establishing greater variation in physical tasks and requirement is job rotation. Research on the effectiveness of job rotation remains inconclusive to date. Some studies advocate job rotation as a method to limit worker exposure to risk factors while other studies suggest either no result or alternatively spreading out the risk to a greater number of workers. Ultimately the goal of job rotation is to allow muscular recovery to bodily structures that would be overloaded by a set of tasks in one specific job.

Consider recovery

Recovery or active rest can be facilitated through job rotation if tasks completed are different enough to provide this recovery from one job to the next. Jobs that are not significantly different from one another in physical requirement and expose workers to more Workplace Strain and Sprain injury risk eliminate the effectiveness of job rotation.

Adequate training and an adequate trial period are important considerations for all workers in a job rotation program.

Number of jobs

The number of jobs included in a job rotation segment should generally be less than five to allow workers to become competent, comfortable and skilled at each workstation.

Job rotation does not change, reduce or eliminate the risk factor present in the occupation, but rather distributes it. The intent is a reduction of risk below a hazardous level.

Creating job rotation in three or more occupations manipulates the time factors of work. Reduction of duration of exposure to known risk factors is therefore seen as beneficial.

One case scenario would be rotating into jobs that require primarily upper extremity effort while standing from workstations that require primarily sedentary static seated postures while manipulating foot controls.

Caution should be observed in the design of your job rotation programs. Poorly designed job rotation has no set time values for rotation and is informally decided upon by workers. Job choice and clearly defined time requirements in each location of work are very important.

It should also be noted that job rotation does not improve the job itself, therefore efforts to control exposure in the job or at the workstations should continue.

Job rotation guidelines

1. Review job description and hazard checklists for jobs that have divergent physical requirements and follow a logical rotation (proximity & logistics).
2. Determine if the job rotation would be reasonably accomplished considering worker competency, seniority, union guidelines, and worker qualification.
3. Provide employees with upgraded training required for introduction of new duties, new equipment handled, and work process responsibilities.
4. Allow workers a period of adjustment in on-the-job training to become familiar with work processes and methods.
5. Monitor the new work locations, determining efficiency gains or performance decline.
6. Schedule follow-up meetings with supervisors and workers, utilizing their feedback in the performance of new tasks.
7. Track measures such as injury, symptom survey, turnover, employee satisfaction and injury report to determine the effectiveness of job rotation.

Job rotation frequency can be determined by the severity of risk factors identified in the original occupation. High-risk occupations with the greatest exposure in physical demand require a higher rate of rotation.

The following list contains some positive results reported as a result of job rotation, as well as negative experiences with rotating duties.

Positive results possible	Negatives results reported in literature
Reduced monotony and boredom	Experienced workers not wanting to be retrained
Reduced cognitive stress	Seniority with operators "earned status"
Increased understanding of work process	Requirement for greater workstation adjustability
Increased productivity	Worker movement and traffic, marking pathways and caution areas clearly is required
Increased free time	Increased education and training Requirements
Reduced exposure to Workplace Strains and Sprains	Challenge in finding similar jobs in close proximity
Increased job satisfaction	Inappropriate use of job rotation by either workers or management
Reduced absenteeism	
Reduced turnover	

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[3] An additional list of resources and references appear in this manual

Baseline ergonomic assessment survey

1) Does your company have a specific documented program to address ergonomic concerns in the workplace? ☐ Yes ☐ No

Comments: _____

_____

_____

_____

2) Does your Joint Health & Safety Committee evaluate ergonomic concerns during regular JHS committee meetings? ☐ Yes ☐ No

Comments: _____

_____

_____

_____

3) Does your JHSC have an Ergonomics Sub-committee? ☐ Yes ☐ No

Comments: _____

_____

_____

_____

4) If your JHSC does not have an Ergonomic Sub-committee, would you consider establishing one within the present structure of your JHS committee? ☐ Yes ☐ No

Comments: _____

_____

_____

_____

5) Does every job in your operation have a detailed job description? ☐ Yes ☐ No

Comments: _____

_____

_____

_____

6) Does your company have any employees who have received training on how to carry out a Physical Demands Analysis on a workstation? ☐ Yes ☐ No

Comments: _____

_____

_____

7) Does your company have a tool to conduct a Physical Demands Analysis in the workplace?
☐ Yes ☐ No

Comments: _____
_____
_____
_____

8) Has your company conducted any Physical Demands Analysis in the past 3 years? ☐ Yes ☐ No

Comments: _____
_____
_____
_____

9) Are there tasks that are carried out in your workplace that involve lifting or awkward movements?

☐ Yes ☐ No

Comments: _____
_____
_____
_____

10) Has your company experienced a lost time injury in the past 3 years that could be attributed to poor workstation or task design? ☐ Yes ☐ No

Comments: _____
_____
_____
_____

11) Does your company have an effective Early and Safety Return to Work program? ☐ Yes ☐ No

Comments: _____
_____
_____
_____

Job Description Form

☐ New ☐ Revised	
Position Number	Job Title
Department	Reports To
Location	Work Hours

Prepared By	Date (DD/MM/YYYY)	Approved By	Date (DD/MM/YYYY)

HR Approved	Date	Position Group
Union Approved	Date	Position Group

Grade	Position Class	Exempt ☐ Yes ☐ No	Security Sensitive ☐ Yes ☐ No

I. Purpose of the Job
(What are the end results or objectives of this position? Why does the job exist?)

II. Essential Functions and Responsibilities
(What duties are required for the position to exist? Estimate the percentage of time spent in each per day/week/month.)

III. Other duties and responsibilities
(Responsibilities/important duties performed occasionally or in addition to the essential duties of the position.)

IV. Duty Breakdown/detailed work activity
(Provide task statements which summarize what is involved in each duty.)

V. Equipment Operation
(Provide the type of equipment utilized and reason for use.)

VI. Supervisory Responsibilities

(Provide the number and type of employees supervised, level of authority to hire and fire or to make recommendations.)

VII. Knowledge and Skills
(Indicate which are required, preferred or desirable. Include licenses, registrations, certificates, degrees or formal education.)

VIII. Fiscal Responsibility
(Budgeting responsibilities, approval privileges on purchase orders and check requests, reporting and auditing functions.)

IX. Extent of Public Contact
(Within and outside the office.)

X. Working Conditions and Environment
(I.E. necessary travel, unusual work hours, unusual environmental conditions, etc.)

General Physical Demands Analysis

Occupational Title:											**Contact:**
Department:				**Date:**							**Phone:**
Physical Demands			Check if Performed	**Weight**		***Frequency**					**Comments**
				Maximum	Usual	0 Not Req.	1 Rare	2 Occasional	3 Frequent	4 Constant	
Strength	Lifting	Floor									
		Waist									
		Shoulder									
	Carrying	Bilateral									
		Unilateral									
	Pushing										
	Pulling										
	Fine Finger Movement										
	Handling										
	Gripping										
	Reaching	Above Shoulder									
		Below Shoulder									
	Foot Action	Right Foot									
		Left Foot									
Mobility	Sitting										
	Standing										
	Walking										
	Running										
	Climbing	Ladders									
		Stairs									
	Bending/Stooping										
	Crouching/Kneeling										
	Crawling										
	Twisting										
	Balancing										
Sensory/ Perceptual	Hearing	Conversation									
		Other Sounds									
	Vision										
	Feeling										
	Reading										
	Writing										
	Speech										
Work Environment	Inside Work										
	Outside Work										
	Thermal Stress										
	Cold Stress										
	Noise										
	Vibration	Whole Body									
		Hand-arm									
	Dust/Vapours/Fumes										
	Congested Worksite										
	Slippery										
Conditions of Work	Travelling/Driving										
	Work Alone										
	Operate Equipment/Machinery										
	Deadline Pressures										

*** Frequency: 0 – not required, 1 – rare (1-5%), 2 – occasional (6-33%), 3 – frequent (34-66%), 4 – constant (67-100%)**

Worker Representative _____ Date (DD/MM/YY) _____ Management Representative _____ Date (DD/MM/YY) _____

Physical Demands Analysis detailed description

Provide details regarding strength, mobility, sensory, work environment and work condition requirements. In some cases you may wish to include a picture of the work task.

Strength Requirements *(Comment on any one of the following if applicable)*
Lifting:
Carrying:
Pushing:
Pulling:
Fine finger movement:
Handling:
Gripping:
Reaching:
Foot action:

Mobility Requirements *(Comment on any one of the following if applicable)*
Sitting:
Standing:
Walking:
Running:
Climbing:
Bending/Stooping:
Crouching/Kneeling:
Crawling:
Twisting:
Balancing:

Sensory/Perceptual Requirements *(Comment on any one of the following if applicable)*
Hearing:
Vision:
Perception:
Feeling:
Reading:
Writing:
Speech:

Work Environment Requirements *(Comment on any one of the following if applicable)*
Inside Work:
Outside Work:
Thermal Stress:
Cold Stress:
Vibration:
Dust:
Slippery:

Work Conditions Requirements *(Comment on any one of the following if applicable)*
Travelling:
Work Alone:
Operate Equip/Machinery:
Deadline Pressures:

Overall Impression *(Indicate if the job would be considered "light", "moderate" or "heavy" based on the physical demands. Provide any other information you feel is important to capture the essence of the job.)*

(when complete ensure this section is also signed and dated to verify it is complete and correct)

Worker Representative	Date (DD/MM/YY)	Management Representative	Date (DD/MM/YY)

Ergonomic Intervention Review

Occupational Title: _____
(Attach PDA, Hazard Checklist, Symptom Survey, Work Order)

Date of Accommodation/Modification *(dd/mm/yy)*: _____

Type of Modification (Check one):
☐ Workpractice ☐ Administrative ☐ Design ☐ Upgrade/Device

Risk Factors to which Body Area:

☐ Neck	☐ Mid Back	☐ Hips
☐ Shoulders	☐ Low Back	☐ Knees
☐ Elbows		☐ Ankles
☐ Wrist		☐ Feet
☐ Hands		

Risk Factors Description (Force, Posture, Time elements):
Identify the risk factors that you have identified by using the "ergonomic tool package". *(I.E. use of awkward working postures, repetitive motions, use of excessive force.)*

_____
_____
_____
_____

Recommendations:

Worksite Picture (Before)

Worksite Picture (After)

MSI Prevention Guidance Sheet
Workers' Compensation Board of B.C.

Risk Factor: Pushing/Pulling/Carrying

Purpose
This guidance sheet can be used to identify and assess the risks of musculoskeletal injuries (MSI) associated with pushing, pulling, and carrying forces.

Description and general concepts
Forces from **pushing** and **pulling** are usually associated with a risk of injury to the arms, shoulders, or back. The risk of injury may come from a single traumatic event, such as pulling a heavy cart with poorly maintained wheels, or from repetitive exertions over a long period of time, such as pulling lumber from a green chain.

Push/pull forces are affected by:
- Worker's body weight and strength
- Height of force application (for example, height of handles)
- Distance from the worker's body at which the force is applied
- Direction of force application
- Size, shape, and weight of the load
- Amount of friction or grip between the floor and the worker's shoes
- Distance over which the object is pushed or pulled
- Frequency of the push/pull task
- Grade of the floor or surface the object is being moved across

The initial force needed to get the object moving is usually much greater than the continuous (sustained) force required to keep that object moving.

Carrying a heavy load is mechanically stressful and energetically demanding. Prolonged carrying of a heavy load will subject the muscles of the arms and back to loading. Moving the whole body and the load (carrying) consumes energy.
Carrying forces are affected by:

- Holding time (determined mainly by the distance the object is carried)
- Type of grip
- Size, weight, and shape of the object (wide objects are more awkward to carry)
- Grade of the floor

Examples
Some occupations that have potential exposure to pushing, pulling, and carrying are hospital workers (pushing or pulling laundry or medical carts), workers in manufacturing jobs (where goods are pushed along rollers or conveyors), workers who pull cables, warehouse workers, and restaurant workers.
When assessing the risk for pushing, pulling, or carrying, you need to determine the weakest link in the task. The weakest link is usually the grasping forces and shoulder muscle strength, not the strength of the legs or back. Direct measurement of forces using a push/pull dynamometer (a strain or force gauge) is the preferred method for assessing the risk of MSI. These values are *not* the same as the actual weight of the object being pushed or pulled.

You can compare the forces you measure with published research data to determine if the pushing/pulling task presents a high, moderate, or low risk of MSI. A number of such guidelines are available and can be used – for example, S.H. Rodgers, 1985; the Snook tables, 1991 (Snook and Cieriello, 1991); or the Mital, Nicholson, and Ayoub tables, 1993. For ease of assessment, a link to a push/pull/carry calculator – based on the Snook tables – is provided:
http://ergonomics.healthandsafetycentre.org/calculator/ergo/PPCC/intro.htm

Controls
The employer is required to eliminate or minimize the risk of MSI to workers. Possible solutions include the following options:

1. Eliminate the need to push/pull/carry:
- Automate pushing, pulling and carrying tasks (examples include using mechanical rollers/conveyors and gravity feed systems).
- Use mechanical aids such as carts, dollies, or lift trucks or pallet jacks.
- Avoid carrying wide or tall (bulky) loads.

2. Reduce the forces required to push/pull/carry:
- Reduce the weight or size of load.
- Maintain the wheels on carts in good working order .
- Where practicable, provide handles.
- Ensure that friction between the floor and the cart wheels is low.
- Keep the floor clean and free of debris.
- Wear appropriate footwear to enhance friction and minimize slippage between floor and shoes.
- Minimize the distances over which objects are to be pushed, pulled, or carried (change the layout of the workplace if necessary).
- Train workers in the use of correct body mechanics for pushing, pulling, and carrying.

WMSD Final Evaluation

1.) Has your firm developed a policy statement outlining the importance of preventing strain and sprain injuries and described a strategy or plan to deal with these issues company wide? Please attach copy of policy statement. Yes No
Comments:

2.) Has your firm developed an ergonomic team/committee or sub-committee of JHSC? This team should have an identified project or team leader and the names of all involved should be posted at information locations throughout the operations. Yes No
Comments:

3.) Has your ergonomic team established set meeting dates and kept minutes of meetings? Yes No
Comments:

4.) Has your ergonomic team conducted a review of injury statistics to determine areas of the operations or specific workstations that have experienced strain & sprain injuries? Yes No
Comments:

5.) 7.) Has your ergonomic team completed detailed job descriptions for selected workstations? Yes No
Comments:

6.) Has your ergonomic team completed Physical Demands Analysis for selected workstations? Yes No
Comments:

7.) Has your ergonomic team completed a hazard checklist for selected workstations? Yes No
Comments:

8.) Has management demonstrated commitment to this initiative and participated in the process or reducing strain & sprain injuries? Yes No
Comments:

9.) Are there tasks that are carried out in your workplace that involve lifting or awkward movements? Yes No
Comments:

10) Has your company experienced a lost-time injury in the last 3 years that could be attributed to poor workstation or task design? Yes No
Comments:

11) Does your company have an effective Early and Safe Return to Work Program? Yes No
Comments: