Fitting the Job to the Worker

An ergonomics program guideline

May 2005

Department of LABOR AND INDUSTRIES

This voluntary guideline explains how your company can set up an ergonomics program to detect, correct, and prevent work-related musculoskeletal disorders among your employees.

The Department of Labor and Industries may be able to help you set up an ergonomics program. If you need more help after reading this booklet, write to:

Department of Labor and Industries
WISHA Services Division
Policy and Technical Services
PO Box 44610
Olympia, WA 98504-4610

You may also call the safety and health toll-free information line:

1-800-423-7233.

The Labor and Industries office in your area also has consultants who may be able to help you with your ergonomics program. Here are the regional office contacts:

Region 1 - Everett	206-290-1300 or 206-290-1431
Region 2 - Seattle	206-515-2800
Tukwila	206-835-1000
Region 3 - Tacoma	206-596-3800
Region 4 - Tumwater	360-902-5799
Region 5 - Yakima	509-454-3700
Region 6 - Spokane	509-324-2600

The following ergonomics-related publications are available from the Department of Labor and Industries:

Booklets

- Fitting the Job to the Worker: An ergonomics program guideline
- Lessons for Lifting and Moving Materials (378 KB PDF / >1 min)
- Office Ergonomics: Practical solutions for a safer workplace (PDF: 1,735 KB / 10 min. dial-up)
- Frequently Asked Questions about Sit-to-Stand Patient/Resident Lifts
- Frequently Asked Questions about Total Body Patient/Resident Lifts
- Work Related Musculoskeletal Disorders: Washington State Summary 1992-1994
- Cumulative Trauma Disorders and Your Job, Carpal Tunnel Syndrome: A Preventable Disease

[The following files are in PDF format. Downloading PDF files requires Adobe's Acrobat Reader, available for free from Adobe's website.]

- Work-related Musculoskeletal Disorders of the Neck, Back and Upper Extremity Washington State Worker's Compensation Claims, 1991-1999 (29 KB PDF file - summary only; please contact SHARP for the entire Technical Report)
- Employer Survey of Musculoskeletal Injuries and Illnesses, Risk Factors and Prevention Steps in Washington State Workplaces (42 KB PDF file - summary only; please contact SHARP for the entire Technical Report)
- Non-Traumatic Soft Tissue MSDs, 1990-1997 (PDF: 197 KB / 1 min. dial-up)
- Work-related Musculoskeletal Disorders of the Neck, Back and Upper Extremity in Washington State, 1994-2002 (73 KB PDF) - summary only; please contact SHARP for the entire technical report.
- Injured at Work. What workers' compensation data reveal about work-related musculoskeletal disorders (WMSDs) (653 KB PDF / 4 min). This document is a summary booklet of SHARP Report 40-8a-2004.

L&I's Safety & Health Assessment & Research for Prevention (SHARP) program has a number of additional research reports on ergonomics and musculoskeletal disorders available, along with a wealth of other safety and health topics.

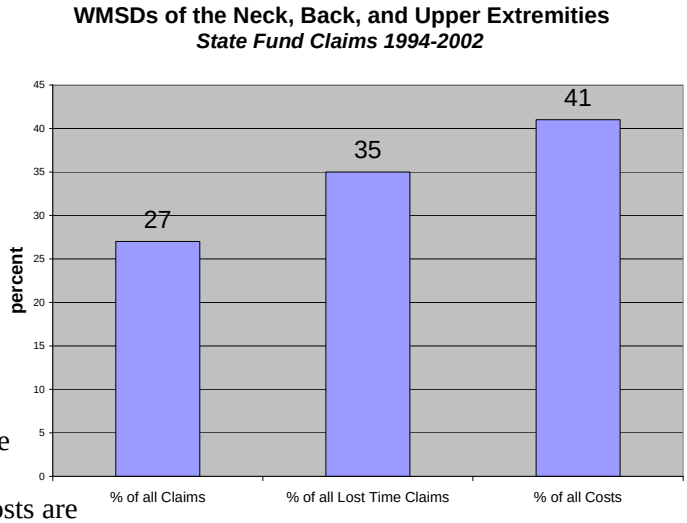
Fact Sheets

- Quick Tips for Lifting (PDF: 533KB / 3 min. dial-up)
- Read an article that talks about what ergonomics is, the importance of good ergonomic design and the ease of implementing good ergonomic practices.

Contents

Introduction

This guideline contains the basic information your company needs to set up an ergonomics program. The following sections describe each part of the program, how the parts work together, and why each is important. If you are interested in more in-depth information, we have included an appendix of technical information, a glossary of terms, and a list of reference materials.



From 1994 to 2002, more than one quarter of the Washington State Fund workers' compensation claims were attributable to work-related musculoskeletal disorders such as sprains, strains, nerve compression, and joint inflammation. More importantly, those claims were responsible for 35% of the compensable (costs incurred) claims and 41% of the all direct costs for the period.

Medical payments and time-loss for these injuries and illnesses cost State Fund employers more than $3.2 billion [1] In addition, the indirect costs of work-related musculoskeletal disorders can include investigation time, decreased production, training and hiring replacement workers. These indirect costs are difficult to measure, but are usually estimated to be anywhere from 2-5 times the direct claim costs.

This guideline holds the key to reversing that trend. It describes an ergonomics program that can help you prevent or reduce these kinds of injuries to your workers, and manage injuries if they occur. In the long run, this program can help save your company money, increase worker comfort and safety, decrease your workplace injuries and workers' compensation claims and, in some cases, increase productivity.

[1] Washington State Fund claims data, January 2005

SUCCESSFUL ERGONOMICS PROGRAMS

Businesses that have implemented ergonomics programs report significant decreases in accidents, injuries, illnesses and health-care costs over time, along with increases in productivity, product quality and worker morale.

In Professional Safety magazine, Jerome Foods Inc., a turkey hatching, growing and processing company, reports saving $3 for every $1 spent since instituting its ergonomics program.[2] Similar savings have been reported by the Grumman Corp., Ford Motor Co., and several large food retailers.[3]

Closer to home, a large Northwest aerospace company has reported successful projects in their ergonomics program.

- In a shop where aircraft interiors are installed, engineering controls and work practice changes increased productivity 10- 15 percent, which translated into a benefit of more than $200,000.
- Changes made to a work process at a wire installation shop reduced stressful body posture and lowered the assembly time from eight to six and a half hours.

In both instances, employee morale also appears to have improved.

This guideline outlines the program that can help lead you to similar success. The following are covered:

- Identifying musculoskeletal symptoms and their associated risk factors.
- Making changes to jobs to eliminate the risk factors.
- Preventing injuries and keeping those that occur from becoming disabling.
- Training employees on all of the above.

You will notice that each major section of the booklet begins with a scenario of a fictional company named Fiction Equipment Ltd. These scenarios will help to illustrate how the principles outlined in the booklet can be used.

[2]Henderson, Chris **J.** and Cemohous, C.: Ergonomics: A Business Approach," *Professional Safety*, January 1994, pp. 27-31.

[3]*BNA Daily News: "Special Report: Cumulative Trauma Disorders, Ergonomic Problems Dominate Sessions at This Year's Industrial Hygiene Conference," June 4, 1993.*

Fiction Equipment Ltd.

Fiction Equipment Ltd. is an industrial equipment manufacturing company of 75 employees with an in-house sales and installation staff.

After reading the ergonomic program guidelines, the company president calls a company-wide meeting to announce the beginning of the company's ergonomics program. At the meeting, the president reaffirms the company's commitment to workplace safety and health and asks for involvement from employees at all levels. She then outlines the ergonomics team approach she wants to follow and appoints three of eight members of the team. The employees elect the remaining five members.

Some members of the ergonomics team are also on the safety committee. At the meeting, these two groups agree to coordinate efforts and to meet periodically.

The ergonomics team arranges to get help from ACME Consulting, a local ergonomics consulting Firm. ACME trains the ergonomics team members in:

- *Ergonomic principles*
- R*isk factor identification*
- *Worksite analysis procedures*
  Hazard prevention and control

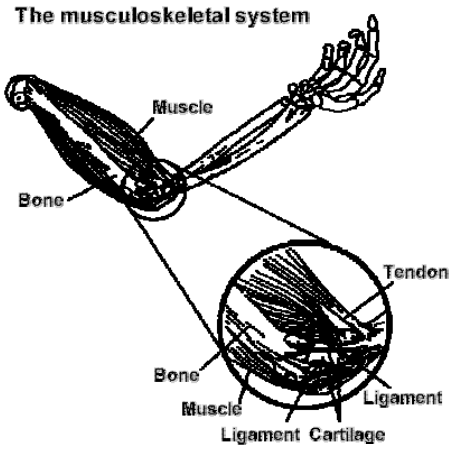
Getting Started

This section covers:

- Important terms.
- The ergonomics team.
- Elements of an ergonomics program.

IMPORTANT TERMS

Ergonomics is the scientific study of human work. Ergonomics considers the physical and mental capabilities and limits of the worker as he or she interacts with tools, equipment, work methods, tasks, and the working environment. A goal of ergonomics is to reduce work-related musculoskeletal disorders by adapting the work to fit the person, instead of forcing the person to adapt to the work..



The **musculoskeletal system** is made up of the soft tissue and bones in the body. These are the parts of the musculoskeletal system:

- Bones: the load-bearing structure of the body.
  Muscles: tissues that contract to create movement.
  Tendons: tissue that connects muscles to bones.
- Ligaments: tissue that connects bones to bones.
- Cartilage: tissue that provides cushioning and reduces friction between bones.
- Nerves: the communication system that links muscles, tendons and other tissue with the brain.
- Blood vessels: tubes that circulate nutrients throughout the body.

Musculoskeletal disorders include sprains, strains, inflammation, degeneration, tears, pinched nerves or blood vessels, bone splintering and stress fractures. Symptoms are discomfort, pain, fatigue, swelling, stiffness, or numbness and tingling.

Other terms for musculoskeletal disorders

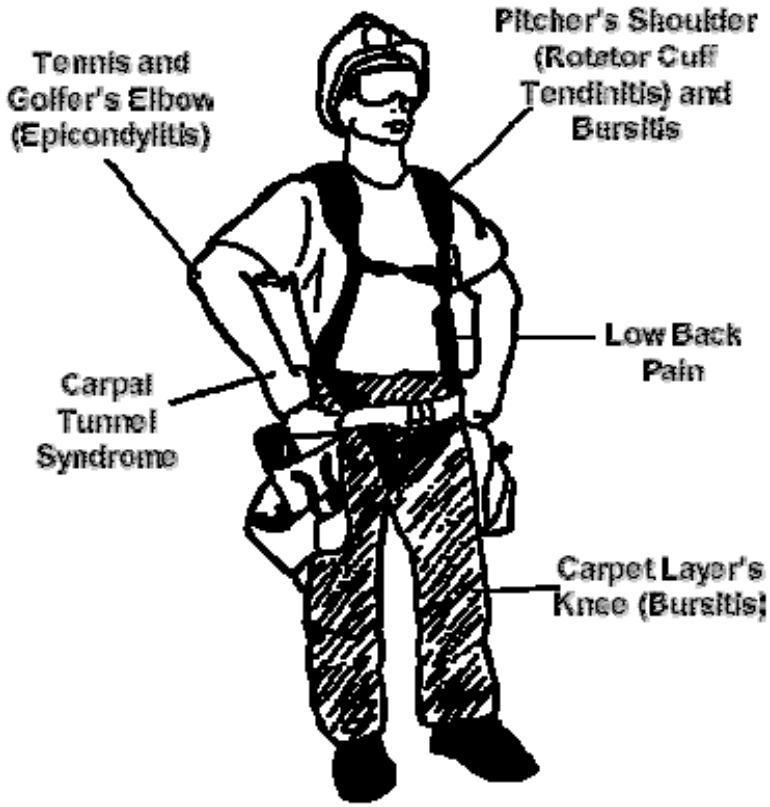
Cumulative trauma disorders **(CTDs)**

Repetitive trauma disorders

Repetitive strain injuries **(RSIs)**

Repetitive motion disorders

Occupational Overuse Syndrome (OOS)



4 elements of an ergonomics program

Worksite Analysis

Hazard Prevention and Control

Medical Management

Training and Education

Musculoskeletal disorders are illnesses and injuries that affect one or more parts of the musculoskeletal system. When caused by hazards in the workplace, they are work-related musculoskeletal disorders.

Risk factors are the elements of a job that increase the chance of work-related musculoskeletal disorders. The potential of a risk factor to cause injury is affected by the duration of the worker's exposure to it.

An **ergonomics program** is a systematic method of preventing, evaluating, and managing work-related musculoskeletal disorders. The four elements of the ergonomics program described in this guideline are:

- worksite analysis.
- hazard prevention and control.
- medical management.
- training and education.

ERGONOMICS TEAM MEMBERS

As with your accident prevention or quality-improvement program, an ergonomics program requires a strong commitment from management. It is also important for your company to provide the resources necessary for success and to involve workers in every stage of the program. As your workers and managers learn more about ergonomics, they will become more willing and able to be active in the program.

The size and style of your ergonomics program will vary, depending on the size of your business, but one person should have the authority to make decisions involving money and resources. However, one person should not be expected to solve all the problems. Finding an ergonomics team is a common and effective approach. This guideline recommends and describes the team approach.

An ergonomics team's makeup often is similar to that of a safety committee or quality-improvement team. Allowing employees to select the employee members of the team is one way to promote involvement. Your team may include some or all of the following:

Small business

- workers/union representatives
- managers/supervisors
- maintenance or facilities staff
- safety and health personnel
- purchasing personnel

Large business

- engineers
- human resources personnel
- health care providers
- ergonomist
- all listed under small business

Especially in smaller companies, one person may perform many of these functions. For instance, supervisors may be responsible for their own purchasing, and ergonomics awareness will help them choose ergonomically correct tools and equipment. You may also want to bring in an ergonomics specialist to provide training and consultations. Within larger companies, ergonomics team subgroups may represent different departments, production lines, work groups or work areas. After the ergonomics team is chosen, members should receive training on ergonomic principles.

The Elements of an Ergonomics Program

Ergonomics programs typically have these four elements. Your program should have all four to ensure success.

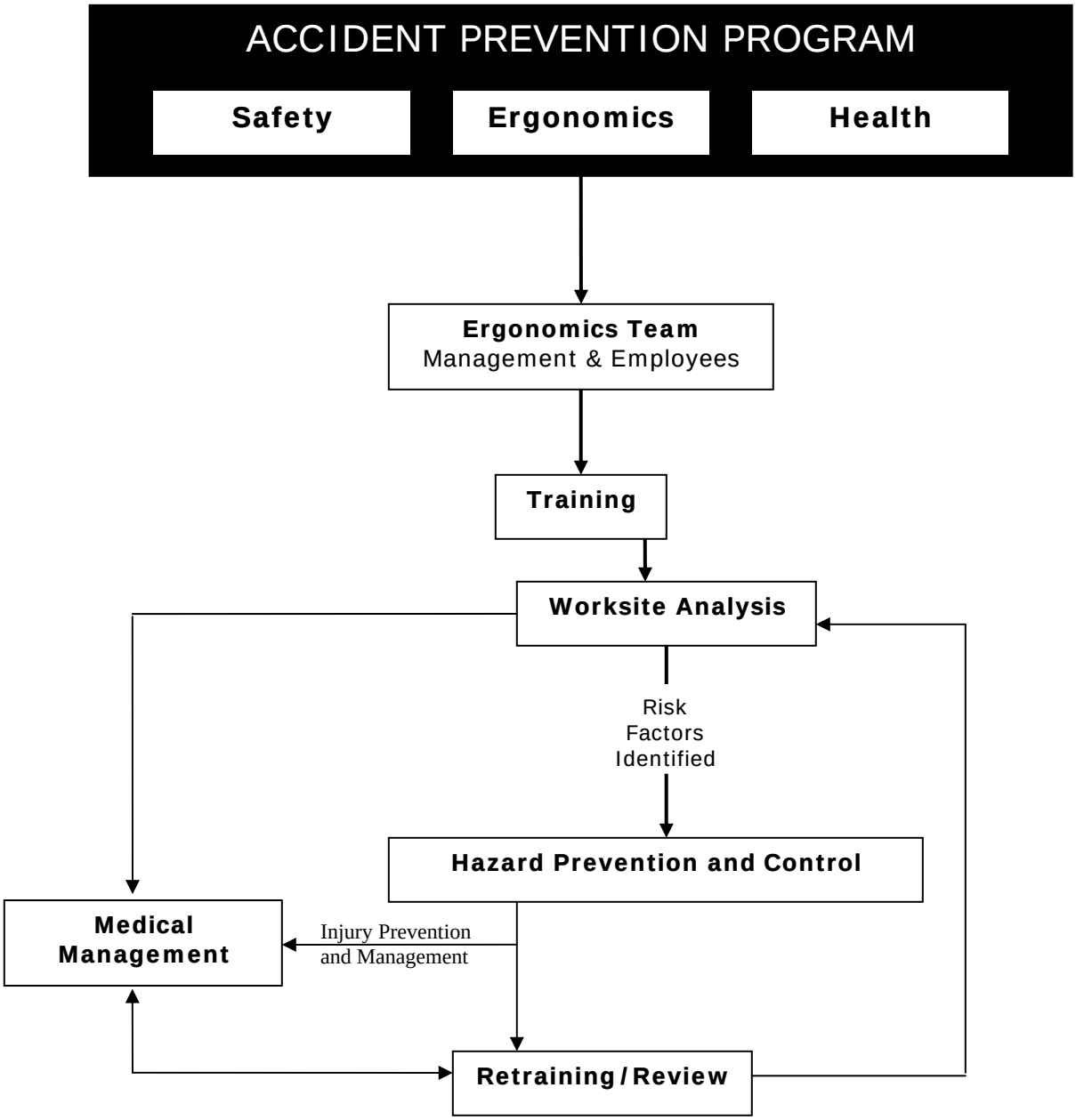
- **Worksite analysis:** a safety and health review that identifies jobs and workstations that may contain musculoskeletal hazards, the risk factors that pose the hazards, and the causes of the risk factors.

- **Hazard prevention and control:** eliminating or minimizing the hazards identified in the worksite analysis by changing the jobs, workstations, tools or environment to fit the worker.

- **Medical management:** the effective use of available health-care resources to prevent or manage work-related musculoskeletal disorders.

- **Training and education:** a method to give both workers and managers an understanding of the potential risk of injuries, their causes, symptoms, prevention and treatment.

At the beginning, a large part of your ergonomics program will be searching for ways to correct problems that have already caused injuries and illnesses. As your employees become familiar with ergonomics issues, claims for work-related musculoskeletal disorders may increase for a short time. Once you are able to focus more effort on prevention, fewer and less severe injuries probably will occur. As with any safety and health program, your target should be to prevent as many injuries as possible.


ACCIDENT PREVENTION PROGRAM
Safety
Ergonomics
Health
Ergonomics Team
Management & Employees
Training
Worksite Analysis
Risk
Factors
Identified
Hazard Prevention and Control
Medical
Management
Injury Prevention
and Management
Retraining / Review

Worksite analysis
Fiction Equipment Ltd.'s ergonomics team gathers records for their review. They also distribute a symptom survey to each employee. To maintain confidentiality, employees can choose to not include their names on the survey.

The records review indicates two major areas that should be investigated further These are knee problems for the equipment installers and wrist problems in one section of equipment manufacturing. The team decides that they are more confident in their ability to identify and correct the equipment installers 'knee problems. They will tackle the wrist problems after gaining more experience.

An ergonomics team member accompanies two equipment installers on the job with a worksite analysis checklist and a video camera. The team member identifies the following risk factors on the checklist as the installers work:
- Contact stress of the knee with a hard surface or edge.
- Knee flexed greater than 90 degrees.
- Static lifting posture.
- The use of the knee as a hammer

During the review of the video, the team notes the following potential causes for the installers' risk factors:
1. Installers kneel on a variety of floor surfaces, sometimes for more than 10 minutes.
2. The installers may have to lift and hold equipment (up to 40 lbs.) in these kneeling positions.
3. The installers stand and lift in a fully squatted position for up to eight minutes.
4. Installers use their knees as a brace to hold equipment in place.
5. Some installers bump equipment into place with their knees.

Worksite analysis

This section covers:
Records review.
- Signs of musculoskeletal disorders.
- Incidence and severity rates
- Selecting projects.
- Identifying risk factors.
- Worksite analysis tools.
- Identifying risk-factor causes.

The first part of your ergonomics program should be worksite analysis, which can be thought of as a safety and health review that addresses work-related musculoskeletal disorders. Worksite analysis is a structured process for identifying jobs and workstations that may contain musculoskeletal hazards, the risk factors that pose the hazards, and the causes of the risk factors. Worksite analysis sets the stage for the rest of your program.

RECORDS REVIEW

Worksite analysis begins with reviewing company records to identify patterns of injuries (or potential injuries) to help you find the jobs and workstations that may have musculoskeletal hazards.

When Should You Do a Records Review?

- You will want to conduct a records review at least once a year to measure progress and to see if new problem areas have developed. You should also consider conducting a records review whenever:
- the product line changes or new products are added.
- the workplace moves to a different location.
- workstation configurations change.
- the company purchases new equipment.
- work methods or procedures change.

You should conduct a records review both before and after these kinds of workplace changes are made. This will give you a better idea of whether the changes have created new problems.

Periodic reviews will help you keep your program focused and give you ways to measure success. The records available for review will depend on the record-keeping requirements and needs of your company. (Smaller companies typically have fewer record-keeping requirements but should find that some of these records are available to them.)

You should be aware that many of these records may contain confidential information. It is important that the ergonomics team maintain confidentiality. You may also need to remove employees' names and other identifying information from certain records to comply with the law.

Here are some of the records you may want to use when trying to determine where there are problems with work-related musculoskeletal disorders in your company:

- OSHA 300 log of injuries and illnesses* (required of most employers with 11 or more employees).
- Supplementary records for the OSHA 300 log* (OSHA 101).
- Workers' compensation claims*.
- First-aid room logs.
- Accident reports or incident reports.
- Safety meeting reports or minutes (required of all employers).
- Safety and/or workplace audits.
- Job titles and descriptions.
- Employee complaints.
- Symptom surveys (see Appendix E for sample).
- Equipment and tool evaluations.

SIGNS OF MUSCULOSKELETAL DISORDERS

Your ergonomics team should review available records for signs of potential work-related musculoskeletal disorders. Specifically, they should look for symptoms related to parts of the musculoskeletal system as described on page 7. These common symptoms may show up in your record's review:

- Painful joints.
- Pain in wrists, shoulders, forearms, knees, etc.
- Pain, tingling or numbness in hands or feet.
- Fingers or toes turning white.
- Shooting or stabbing pains in arms or legs.
- Back or neck pain.
- Swelling or inflammation.
- Stiffness.
- Burning sensations.
- Heaviness.
- Weakness or clumsiness in hands; dropping things.

(For medical terminology, see Appendix A.)

Record the types of musculoskeletal symptoms you find, along with information that will help lead you to the source of injuries and illnesses.
Specifically, you need:

- Description of injury or illness, including affected body parts.
- Job title or position title of the worker.
- Previous job title and job description of the worker.
- Department where worker works.
- Job at time of injury or illness.
- Time on the job or doing that type of work.
- Date of injury or illness.
- Description of equipment used on that job.

The more detailed information you collect at this stage, the easier it will be to pinpoint how your company's disorders occur.

***** Note: May contain confidential information

INCIDENCE AND SEVERITY RATES

Look at the data you have gathered and group together similar injury types, body parts, severity of injuries, etc. This will help the team find the areas that produce the greatest number of, or the most costly, injuries and illnesses. This is the first step toward finding the incidence rate and the severity rate.

Incidence rate: the number of new incidents of injuries and illnesses in a given time period.

Severity rate: the cost of injuries and illnesses, either in terms of dollars or physical severity, in a given time period.

To calculate rates, see Appendix B.

SELECTING PROJECTS

From the incidence and severity rate information, your team should rank the departments, jobs, or equipment in descending order, starting with highest injury rate and severity rate. This ranking is a way of focusing your team on the jobs that need to be worked on first.

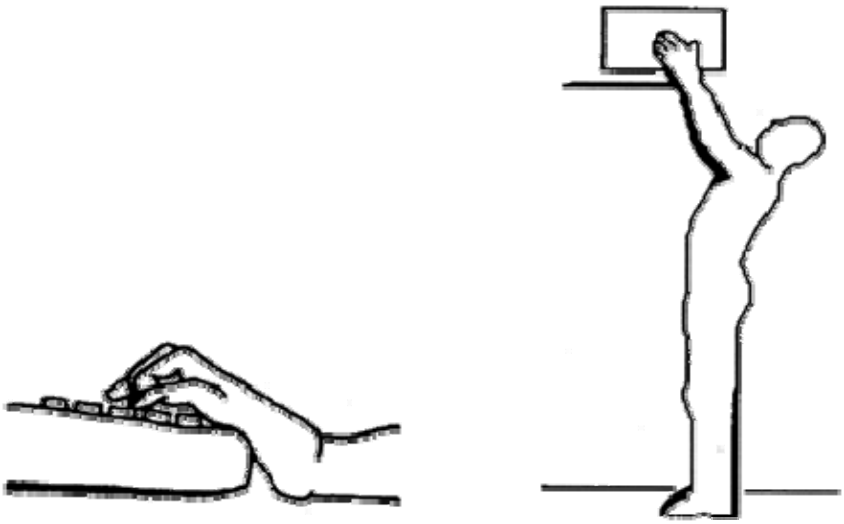
There may be some contradiction in the rankings. For example, one job or department may have the highest incidence rate while another may have the highest severity rate. In this case, the team needs to determine whether to (1) focus their efforts to reduce the greatest **number** of injuries, or to (2) concentrate on reducing the greatest associated **costs**.

No matter which area your team decides to focus on first, beginning with smaller projects will lead to early success. If the initial project is too large, the team may become overwhelmed and frustrated. Remember to also keep your goals realistic and well defined. Demonstrated improvement will help the ergonomics team gain experience and credibility. Once your team has completed a few projects successfully, it will be more confident to tackle bigger and more complex problem areas.

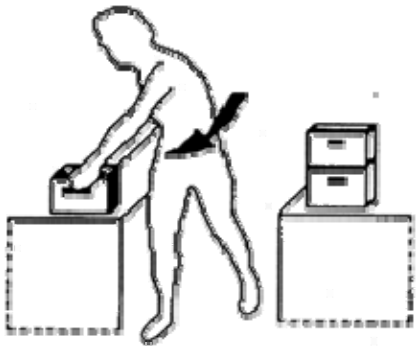
IDENTIFYING RISK FACTORS

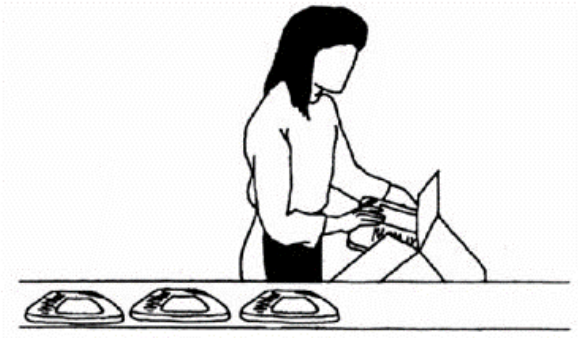
Once the records review is completed, you should have a short list of jobs that you want to investigate further. The first step in identifying risk factors is to study the jobs you have chosen so that you can identify the risk factors present. Your study of the jobs should be a team effort and should include input from the worker as well as observers from the ergonomics team. A team effort will help to confirm risk factors as well as ensure that as many are identified as possible. The following list of common risk factor types can serve as a general guide in this process.

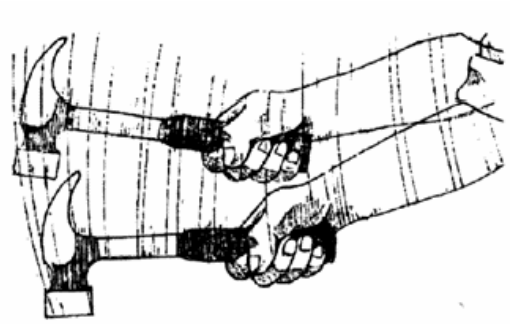
- **Forcefulness** is the amount of physical effort required by the person to do a task and/or maintain control of tools and equipment. The effort depends on the type of grip, object weight, object dimensions, body posture, type of activity, slipperiness of object, temperature, pinching, vibration, duration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



- **Awkward posture** is a deviation from the ideal working posture of arms at the side of the torso, elbows bent, with the wrists straight. Awkward postures typically include reaching behind, twisting, working overhead, kneeling, forward or backward bending, and squatting.

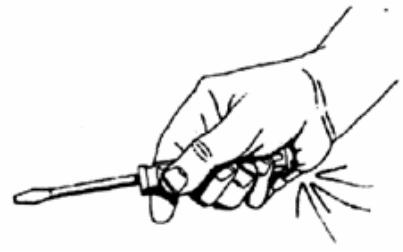






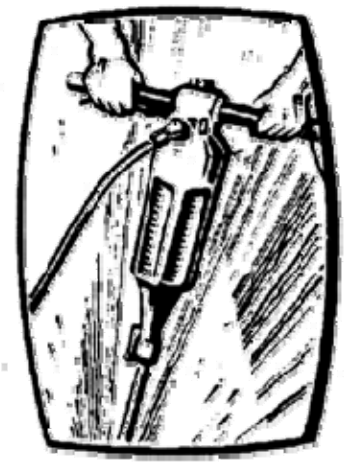
- **Repetitiveness** is performing the same motions repeatedly. The severity of risk depends on the frequency of repetition, speed of the movement or action, the number of muscle groups involved, and the required force. Repetitiveness is influenced by machine or lien pacing, incentive program, piece work and unrealistic deadlines.

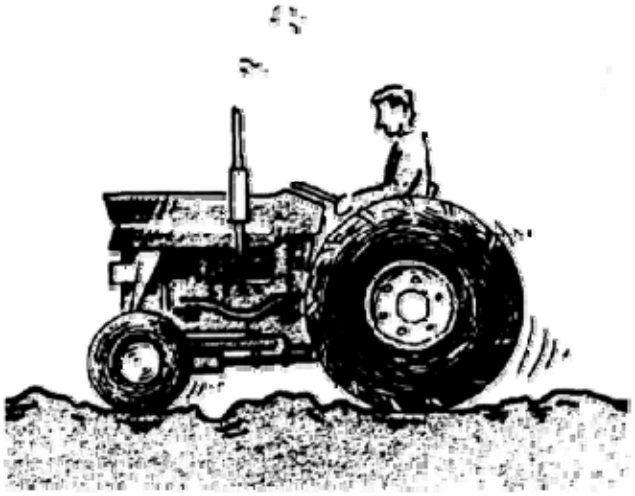
- **Static loading or sustained exertions** are physical effort or body postures that are held and require muscle contraction for more than a short time. As muscles remain contracted, the blood flow to the muscles is reduced.



- **Mechanical contact stress** is the contact of the body with a hard surface or edge that results in the pinching or crushing of tissue. Contact stress can also result when using a part of the body as a hammer or striking instrument.

- **Extreme temperatures:** Low temperatures reduce sensory feedback, dexterity, blood flow, muscle strength, and balance. High temperatures increase the rate at which the body fatigues.

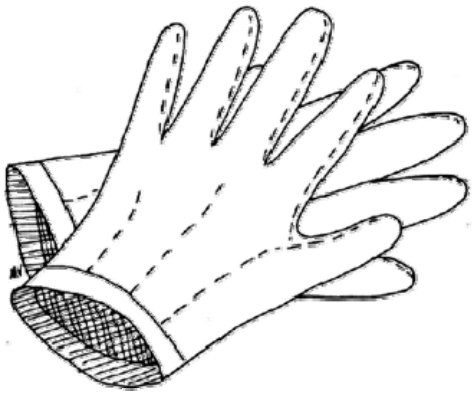




- **Hand-arm vibration** is vibration (generally from equipment or a hand tool) that goes through the hand and arm, then travels through the rest of the body. Vibration can also affect the lower back, especially when driving a vehicle. Vibration reduces blood flow and sensory response.

- **Poorly fitted gloves** reduce dexterity and feeling, resulting in a need to use stronger muscle force.

You will probably want to consult sources from the reference section of this guideline for more information on risk factors. Also, you may want to consult sources specific to your industry for more specialized information. (See Appendix F for information on psychosocial risk factors.)



Remember that for every risk factor, the duration of worker exposure affects the potential for it to cause injury. Any combination of the risk factors may further increase the likelihood of a work-related musculoskeletal disorder. As an employer, you have control over occupational risk factors and you can change them to decrease the likelihood of injuries.

Most likely, you will find connections between the risk factors you identify and the types of symptoms uncovered in your records review. You may, however, discover some hazards that have not caused problems yet. Incorporating the correction of these observed hazards into your program will help you to develop a more proactive approach.

WORKSITE ANALYSIS TOOLS

It is important that team members are properly trained in the use of the worksite analysis tools before worksite analysis begins. There are several tools that will help you to identify risk factors. Some of the more commonly used include:

- *Employee interview questionnaire:* Used to get the employee's opinion about the risk factors present in the job. Either a personal interview or a written questionnaire can be used. Anonymous written questionnaires are less threatening, especially when your program is beginning.
- *Checklist:* A list of risk factors commonly found in a specific job. Provides a quick method to identify the most obvious risk factors. Should most often be used along with at least one other analysis tool. (Sample checklists are included in Appendix C.)
- *Photographing:* Photographs allow you to have a still image that you can review in order to measure angles in jobs you think may have awkward postures associated with them.
- *Videotaping:* A team member videotapes the normal work from different angles for a period of time (typically 10-20 minutes or through at least three complete work cycles) and can then view the tape later. This method allows for slow motion viewing and gives observers the opportunity to study specific sections many times if necessary. (Washington Department of Labor and Industries can provide you with more information about using videotape successfully.)
- *Narrative review*: A team member watches the work for a period of time (typically 30-40 minutes or through five or 10 complete work cycles) and writes a detailed description of his/ her observations.
- *Symptoms Survey:* A symptoms survey can help you to find problem areas before workers' compensation claims are filed. There is a sample survey in Appendix D.
- *Workers' Compensation "Loss Run"*, This information can be requested from L&I, or if you are self-insured, retrieved from your internal data about injuries and claims.

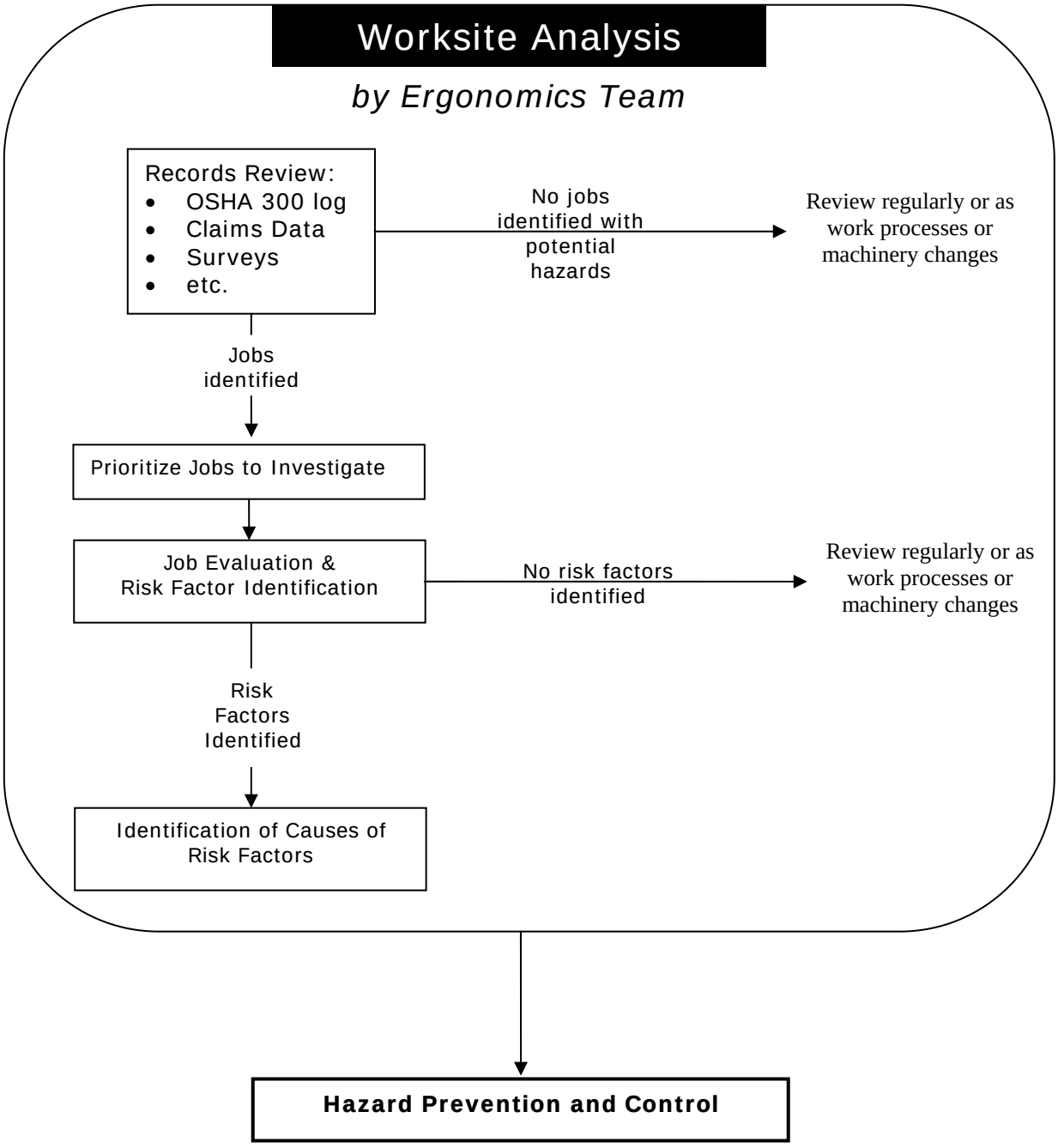
Using as many different tools as possible (at least two) will ensure a more thorough analysis that in turn will lead to more complete solutions. Team members then review the data to confirm the risk factors and determine the causes. Identifying the causes of the risk factors will help develop solutions. If the type of musculoskeletal disorders that are happening at this job do not correlate with the risk factors identified, then a further investigation is needed.

IDENTIFYING RISK-FACTOR CAUSES

Identifying the causes of risk factors is one of the primary goals of an ergonomics program. If the causes are not determined, then solutions to the problem cannot be developed effectively. The team needs to determine whether the risk factor is caused by:

- The method used or required to do the task.
- The effort or strength required to do the task.
- The location of the parts, equipment or tools.
- The position of parts, equipment, or tools.
- The speed or frequency of the work.
- The duration or repetition of the tasks.
- The design of the parts, equipment or tools.
- The environmental factors, such as light, noise, temperature and air quality.

Risk factors may create hazards individually or in combination with others. Videotaping the job will allow the ergonomics team to confirm the risk factors identified by other sources. A combined review that uses two or more tools will increase the chance of determining all the causes, and will also help in the development of solutions to the problems. The next section describes the types of solutions you may use.


Worksite Analysis
by Ergonomics Team
Records Review:
OSHA 300 log
Claims Data
Surveys
etc.
No jobs identified with potential hazards
Review regularly or as work processes or machinery changes
Jobs identified
Prioritize Jobs to Investigate
Job Evaluation & Risk Factor Identification
No risk factors identified
Review regularly or as work processes or machinery changes
Risk Factors Identified
Identification of Causes of Risk Factors
Hazard Prevention and Control

Hazard Prevention and Control

At Fiction Equipment Ltd., the ergonomics team meets with the equipment installers to discuss the results of the worksite analysis and to brainstorm ideas for correcting the problems. The group looks at each of the risk factor causes separately to determine possible solutions.

1. *Knee pads will relieve pressure for the times when kneeling is necessary. However, engineering controls should be put into place to eliminate kneeling and the need for personal protective equipment. These controls will redesign equipment and tools so that installation tasks are accessible without kneeling.*
2. *A lift or jack could both lift and hold equipment, thus eliminating the need to kneel.*
3. *A lift or jack could also eliminate the need to squat and lift.*
4. *A lift or jack would hold the equipment steadier than the installers can hold it using their knees to brace.*
5. *Provide levers, casters or other tools that can move the equipment into place more easily, resulting in less risk to the installer.*

The ergonomics team also works with the equipment installers to develop safe written procedures to be followed by all installers. After putting the controls into place, the team schedules another worksite analysis for six months later At that time, they will look at the old risk factors and their causes to see if they have been eliminated and to make sure that new ones have not been created.

Hazard prevention and control

This section covers three types of controls:

- Engineering controls.
- Work practice controls.
- Personal protective equipment.

Hazard prevention and control is the part of your ergonomics program in which changes are made so the jobs, workstations, tools and environment fit the worker. It is the active process of eliminating or reducing the risk of injury by changing the things that contribute to the risk factors.

After you evaluate the job and identify the specific problems, you can eliminate or reduce the risk of injury through the use of these controls. Personal characteristics of the workers, such as size, physical condition or medical history, may need to be accommodated to make the best fit.

ENGINEERING CONTROLS

Engineering controls involve making changes to workstations, tools or equipment used on the job, or changing the way a job is done to avoid work-related musculoskeletal hazards. These controls are preferred over all others because they make permanent changes that eliminate hazards at the source. Although they can be more expensive to implement than other controls, their effect is often more significant.

Because of the importance of engineering controls, we include here a comprehensive list of types and examples. Engineering controls include workstation design, work methods design, tool and equipment design, controls and displays, connectors, fasteners and valves, and product design. Following are descriptions and examples of each.

Workstation design

Aspects of workstations you can change with engineering controls include workspace layout, work surfaces, standing and wailing surfaces, seating, storage, work fixtures, materials handling/ movement and work environment.

Computer workstations

Computer workstations have special considerations you should be aware of. The monitor and keyboard positions, lighting and seating are especially important in preventing work-related musculoskeletal disorders and eye discomfort. Shared workstations should be easily adjustable so the screen and keyboard can be at the proper level. These aspects should be taken into account to prevent discomfort and/or injury:

- Neutral posture at the keyboard and mouse - arms comfortably at the sides, elbows bent at approximately 90 degrees, forearms parallel to the floor, knees slightly below hips, and wrists straight.
- Chairs should meet the recommendations under "Seating," page 25.
- The work surface should be large enough to support the keyboard, mouse, monitor and documents.
- The top line of the screen should be just below eye level to keep the neck straight. (Adjustable arms, tables or platforms can help bring the screen to the proper height.) Screens that tilt vertically and swivel horizontally help the worker adjust the best viewing angle.
- Monitors should be placed 18-30 inches away from worker for viewing.
- Keyboards and monitors should be detachable so the angle and position can be adjusted.
- Keyboard and work-surface edges should be rounded.
- Documents should be at the same height and distance as the screen.

Document and monitor at same height

- The screen and document should be easily viewed so that the worker's head isn't turned to the side or tilted up or down regularly.
- To prevent glare, the monitor and keyboard should be perpendicular to windows and between (not directly under) overhead lights.
- Screen contrast and brightness should be easily adjustable.
- Screen characters should be clearly displayed, neither wavy nor flickering.

Wrist/palm rests may be used to protect wrists and palms from hard or sharp edges and to help keep the wrists in a neutral position. However, resting wrists on a wrist/palm rest during keying can put pressure on nerves. Wrist/palm rests should be made of soft but supporting material and be the same height as the front edge of the keyboard.

Workspace layout

Workspace layout and arrangement should allow:

- Adjustability to fit each worker's size.
- Worker to maintain neutral posture and avoid awkward or extended reaches and jerky movements while performing the tasks.
- A variety of working positions to avoid static postures.
- Full range of motion and adequate leg room.
- Adequate space for and access to all necessary tools and equipment.
- Frequently used work items within easy arm's reach.
- Un-obscured line of sight.

For example, in a packing operation, boxes being packed with parts could be placed at waist level in front of the worker, rather than behind, below or on an overhead shelf.

Neutral posture

Work surfaces

Work surfaces should be at the proper height and angle for the individual worker's size and tools and equipment used. They should permit neutral postures and be adjustable; especially where different kinds of tasks are performed or the workstation is shared. For example, where workers inspect or assemble small parts, or perform other visually intensive tasks, work surfaces could be tilted to reduce neck, shoulder and arm strain.

Walking and standing surfaces

Surfaces on which people stand for long periods should be designed to prevent slipping and provide adequate traction and comfort. Anti-fatigue floor mats, sit-stand stools, and footrests can help make workers more comfortable.

Seating

Seat-height adjustability and lower back support are important for work done for a long time while seated. Some workers may choose to sit part of the time and stand other times to reduce stress on the body from working in one position too long. Chairs or seating should:

- Adequately support the back and legs.
- Have padded seats.
- Have separately adjustable back and seat cushions.
- Permit feet to be supported either on the floor or with a footrest.
- Be easily adjustable while seated.
- Have swivel seats for most tasks.
- Isolate workers from whole-body vibration.
- Have adjustable arm support when appropriate.

Storage

Storage areas should be organized so that workers maintain good body positions, reduce muscular forces and avoid excessive reach. Store heavy items between knee and shoulder height and frequently used items closest to the worker.

Work fixtures

Workers should not have to use their hands or bodies as a vise to hold objects; mechanical devices do this much better. Tooling fixtures and jigs should be set up to avoid awkward postures and excessive forces.

Materials handling movement

Lifting, carrying, pushing or pulling objects can strain the back, arms and shoulders. Strength and lifting limits should not be exceeded; extreme muscular exertion can cause injury. The following steps will make materials handling/movement easier:

- Do not exceed the physical ability of the worker doing the lifting.
- Provide adequate recovery time for tasks that require frequent lifting.
- Provide easy access so the load is in front of the person lifting.
- Eliminate twisting by changing the start or end point of the lift.
- Put items to be lifted between knee and shoulder height.

- Provide handles or cutouts to make grasping easier, permit a closer lift, and allow items to be carried near the body
- Change an object's shape to make it easier to grasp.
- Decrease the weight of objects.
- Decrease the distance or height over which the object must be moved.
- Distribute a load evenly within a container.
- Use hand carts or hand trucks.
- Use a vacuum-assisted hoist or integrated conveyors.
- Use loaders, cranes and motorized material pallets to help move loads that are larger or heavier than one or two people can safely handle. (By handling materials mechanically in larger packages, you can enhance productivity and recover your initial investment.)

(See Appendix E for an evaluation flowchart for manual material handling tasks.)

NIOSH Work Practices Guide for Manual Lifting
Lifting tasks are one of the main contributors to work-related musculoskeletal disorders. Some of the many potential risk factors associated with lifts include excessive force, awkward postures, repetitiveness, and static loading.

The National Institute of Occupational Safety and Health (NIOSH) has developed the Work Practices Guide for Manual Lifting to help you determine which risk factors are a problem. The NIOSH lifting guidelines consist of a formula to find the recommended weight limit (RWL) for a lifting job. Although the formula is complex, you only need a tape measure and a stopwatch to gather the necessary data. If you have a computer with software designed to handle such formulas, it is easy to plug in the data you collect.

A copy of the lifting guidelines is available from the NIOSH Publications Office fax line (513) 533-8573. For more information call 1-800-35-NIOSH or 1-800-356-4674. You can access an on-line calculator at: http://hsc.usf.edu/~tbernard/ergotools/

Another simple to use tool is the Washington State Department of Labor and Industries Lifting Calculator. Here is a link to web page in which you can either download a paper copy of the calculator, use the calculator on-line or download the calculator files to your computer. http://www.lni.wa.gov/Safety/Topics/Ergonomics/ServicesResources/Tools/default.asp

Work environment
Here are some ways you can minimize work-environment hazards:

- Isolate equipment or operations that produce loud or distracting noise
- Make lighting bright enough without causing glare so workers can see clearly. (See special requirements for computer workstations as listed on pages 23-24.)
- Isolate hands and feet from cold
- Reduce whole-body vibration while riding in a vehicle or standing near equipment
- Isolate workers from excessive heat; provide adequate cooling and ventilation

Work methods design
Work methods should be designed so work can be completed safely and comfortably and factors contributing to work-related musculoskeletal disorders are minimized. Here are several risk factors and examples of how you can change work methods to reduce them:

Static or awkward postures
Prolonged static or awkward postures can rapidly cause fatigue. Work should be done so neutral postures are maintained, stoops and reaches are avoided, and time working overhead is minimized. For example, tasks should be organized so that workers at a conveyor belt don't have to lean over the belt.

Mechanical stress

Nerves, tendons and blood vessels can be damaged by exposure to hard or sharp edges, such as a table edge. Equipment should be moved so a worker doesn't touch the edge, or edges should be padded to minimize contact. For example, in packing boxes, the position of the box could be changed so a worker doesn't have to contact a sharp table edge to place the contents.

Repetitive-motion tasks

Tasks involving repetitive motion are major contributors to cumulative-trauma disorders. You can minimize repetition by:

- Using automation, such as in stapling, sorting, labeling or filling operations
- Changing the job to include tasks that don't use the same muscle groups

For example, in a check-sorting operation, instead of having one person open mail, another take checks out of envelopes, another stamp them and yet another record the figures, each worker could do each of those tasks.

Excessive force

Workers must use excessive force when objects are difficult to grasp or control, equipment and tools are poorly maintained, or tasks require awkward postures. You can eliminate the use of excessive force by:

- Improving friction on slippery objects
- Using mechanically assisted devices for awkward lifts.
- Choosing tools that better fit the hand.
- Keeping equipment properly maintained to prevent jamming and sticking.
- Providing adequate work room to perform tasks.

Work rates

The capacity of workers should be considered in establishing production goals. Increased work rates, excessive overtime and incentive programs for piece work can cause fatigue, increasing the chance for injury.

Tool and Equipment Design

Tools and equipment should fit the Individual user and be chosen for the specific demands of the task. Tools should be designed to maintain neutral body positions. Take extra care to avoid twisting, vibration, static muscle loading, and pressure on tissues and joints. Factors that can be modified to prevent risks include tool size, weight, and balance; handle size and position; and power control design.

Tool size, weight and balance

You should select tools just heavy enough to accomplish the task. You can do these things to minimize risks:

- Use counterweights or supports to minimize the weight of a tool; extra force should not be required to counteract the balancer.
- Select tools that can bend or are shaped to prevent awkward wrist or shoulder postures
- Select balanced tools that can be held at the center of gravity.

Handle size and position

The size of the handle influences the amount of force that can be exerted without straining the muscles and tendons. A handle that is too large or too small requires more force to accomplish the same amount of work as a tool with a correctly-sized handle. Handles should:

- Fit the individual user's hand and be long enough so they don't press into the palm or wrist.
- Have rounded (not sharp) edges, a positive stop or flanged end, and no fluting.
- Be made of material that is non-conductive, compressible, and doesn't feel slippery.
- Minimize vibration transferred to the hand. For example, some screwdrivers prevent repeated motion in an awkward position by means of a pistol grip, and a "Yankee drill" mechanism rotates the bit when the tool is pushed forward.

Power control

Workers should be able to turn a tool off and on or keep it running without using extra force. Auto-start/ stop tools are preferred. You can do these things to reduce hazards:

- Minimize rotational forces with variable torque settings.
- Avoid high-tension and one-finger triggers.

Controls and displays

The location of equipment/machinery controls and indicators should take into account their importance, frequency and sequence of use, and height of workers. Controls and displays need to be visible and accessible while in use, and easy to operate in relation to equipment functions. Spacing should be adequate to accommodate gloves or other protective equipment.

Connectors, fasteners and valves

Components, connectors, valves and fasteners should be located to allow neutral postures during work. The following can help reduce risks:

- Quick-release connectors and fasteners that require few turns with little force can reduce strain.
- Connectors should be positioned to allow easy access.
- Connectors should be labeled and set up to make connection easy and prevent cross-connection.

Product design

Product designers should take into account ergonomic considerations, not only for the people who use products, but also for those who fabricate, assemble and perform maintenance on them. Form, materials, means of assembly, packaging, disassembly and disposal should be considered. Designers should ask these questions to reduce hazards in product design:

- Does material handling or assembly require awkward postures, excessive repetitive movements or extreme force during assembly or manufacturing?
- If sharp edges are a hazard, can they be removed?
- Can materials be changed to help fabrication or assembly?
- Could assembling parts in a different order eliminate musculoskeletal hazards?
- Could the product's size or shape be changed to make manufacturing easier and make the product more acceptable to the user?

WORK PRACTICE CONTROLS

Work practice controls are procedures for safe and proper work that are used to reduce the duration, frequency or severity of exposure to a hazard. Standard operating procedures should allow for enough workers to complete the tasks and should be a regular part of the way you do business. When defining safe work practice controls, It is a good idea to ask workers for their ideas, since they have firsthand experience with the tasks. These controls should be understood and followed by managers, supervisors and workers.

Work methods training

Employees should be taught how to perform their jobs with the lowest physical stress and best posture, as well as how to handle materials, tools and equipment safely.

Gradual introduction to work

New and returning employees in Jobs involving risks, such as prolonged repetitive motion, should be introduced gradually to a full workload to improve work capacity and prevent injury. (See Medical Management section pages 34-39.)

Monitoring

Review all jobs regularly to see if specified safe work practices are being used. Work techniques should be reviewed periodically to ensure that they reduce risks.

Recovery pauses

Regular recovery pauses can help prevent eye strain, headache, neck, back, shoulder, arm or hand pain. Employees can perform activities that involve different muscle groups during these pauses.

Job rotation

If possible, job rotation should be used to prevent injury, not as a response to it. Also, job rotation should generally be used as an intermediate solution while you work on other solutions. Workers should be rotated into jobs using different muscle-tendon groups to prevent fatigue.

Job design

Your company should look at ways that jobs can be (re)designed to incorporate good ergonomic practices. These include providing relief from frequent repetitive motions, static or awkward postures, excessive forceful exertions, and mental and muscular fatigue.

Maintenance and housekeeping

Regular maintenance is critical to ensure that your employees have tools and equipment that are in proper working order and perform to expectations. Equipment that is not maintained and cleaned can make regular operations more difficult. Worn-out tools should be replaced; dull tools should be sharpened. Housekeeping should be done as often as necessary to reduce musculoskeletal hazards.

PERSONAL PROTECTIVE EQUIPMENT

Personal protective equipment (PPE) includes such things as gloves and knee pads that may help reduce hazards until other controls can be put into place, or to supplement existing controls. Be sure to choose PPE that fits the individual worker, is appropriate for the task being done, and does not contribute to extreme postures or excessive force. Remember, however, that eliminating a hazard is preferable to using PPE.

Gloves

Gloves can protect the hands from injury or cold, but they also may reduce dexterity and increase grip force. When choosing gloves, consider these factors:

- Gloves should be small enough to minimize wrinkling or slipping but large enough so they don't impede circulation.
- Padding or insulation can add protection.
- Texturing improves friction.
- If chemical resistance is not a concern, material should be breathable so perspiration is not trapped.

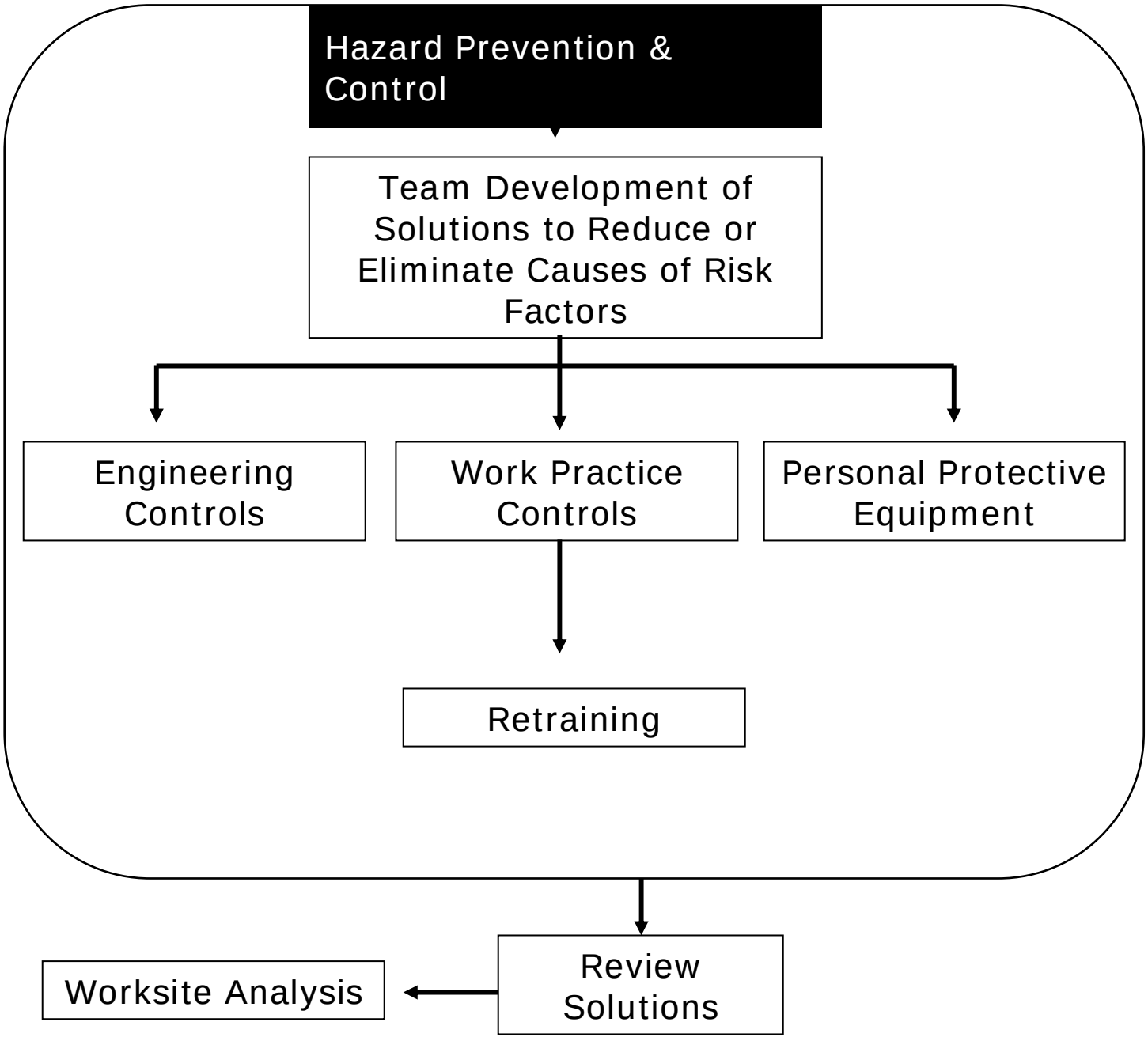
Footwear/anti-fatigue insoles

Anti-fatigue insoles can give relief from musculoskeletal fatigue that develops from prolonged standing and walking on hard floor surfaces. They are especially appropriate when anti-fatigue floor mats cannot be used because of housekeeping needs, the size of the area to be covered, or tripping hazards.

Knee pads

Knee pads can be used to avoid prolonged contact with hard or sharp surfaces. They should be comfortable, large enough to cover the entire knee, padded, and snug enough to fit well but not so tight that they impede circulation.

NOTE: Devices such as wrist splints and back belts are not considered PPE and should only be used as part of an injured worker's treatment on the advice of a qualified health-care practitioner.


Hazard Prevention & Control
Team Development of Solutions to Reduce or Eliminate Causes of Risk Factors
Engineering Controls
Work Practice Controls
Personal Protective Equipment
Retraining
Review Solutions
Worksite Analysis

Medical management

Fiction Equipment Ltd. hired ACME Consulting to help identify jobs that could potentially be used for modified duty if a worker becomes injured. For each department, they listed jobs that could be done by employees recovering from various types of musculoskeletal disorders.

Shortly after attending awareness training, the accountant reports to the safety officer some soreness and hot feeling in his wrists. He's had these kinds of symptoms before, mostly from working overtime to get the budget done before deadline. He takes ibuprofen, and his supervisor reminds him to take short recovery breaks frequently when keying for a long time. They also contact a member of the ergonomics team to review his workstation and to make a few adjustments.

The accountant's symptoms go away quickly, but a month later he feels them again. This time, the symptoms persist after three days and they are worse than usual. He reports to the safety officer and goes to the doctor for treatment. The doctor prescribes anti-inflammatory medication and rest. They discuss what to expect from recovery and plan to re-evaluate his progress at the next appointment. The doctor also speaks to the accountant's supervisor so that everyone understands the injury, its treatment and what to expect.

The accountant and his supervisor meet with the ergonomics team to find an appropriate modified job for him to do until his next doctor's appointment. They consult the list of potential modified duty jobs created when the ergonomics program began.

Medical management

This section covers the three phases of medical management:

- Phase one - injury prevention
- Phase two - injury management/early intervention
- Phase three - chronic injury

Medical management is making the best use of available healthcare resources to prevent and control work-related musculoskeletal disorders. It does not require limiting health care to specific treatments or providers, as long as an injured worker makes timely progress toward stated recovery goals.

Managers, workers, union representatives, claims representatives and health-care providers should work together to promote prevention of injury and illness, and to increase the probability of a positive outcome when injuries and illnesses do occur. To be successful, medical management requires regular communication and cooperation among everyone involved.

The goals of medical management are to:

- Promote prevention of injury and illness.
- Identify signs and symptoms as soon as they occur.
- Ensure proper evaluation and treatment of injured workers.
- Ensure safe and timely return to work for injured workers.
- Reduce the direct costs of injury and illness by decreasing time-loss and disability payments.
- Reduce the indirect costs of injury and illness by retaining workers and maintaining productivity.

PHASE ONE - INJURY PREVENTION

The prevention phase of medical management may already be a part of your company's accident prevention plan. Good ergonomic work practices will fit in well with your other safety measures. By focusing your efforts on prevention, you will help to ensure worker safety and reduce claims costs. The more effort spent on prevention in phase one, the less chance that injuries will occur and become disabling.

The methods discussed in the Worksite Analysis and Hazard Prevention and Control sections are important in this phase of medical management. Specifically, identifying the risk factors in your workplace and implementing controls to eliminate them forms the basis of your prevention efforts. Health-care professionals, occupational nurse consultants, ergonomists, or consultants from Labor and Industries may be able to help you in this area. In addition, written job descriptions, a baseline symptom survey and employee suggestions as described below will make your prevention efforts easier.

Detailed written job descriptions

You may already have job descriptions on file to meet Americans with Disabilities Act (ADA) requirements. If not, start by writing detailed job descriptions for each job category within your company. These descriptions should clearly define the qualifications, essential functions, and physical requirements of the jobs. Clearly defined job descriptions are a good first step in identifying risk factors and learning to avoid or eliminate them. They also help to ensure that workers, supervisors, and managers all have a similar understanding of the jobs.

Employee injury and symptom survey

You may also find that performing a baseline survey of employee injuries and symptoms is helpful. (A sample symptom survey is included in Appendix D.) To ensure the validity and confidentiality of the survey, responses should be anonymous. You also may want to include the survey data as part of your worksite analysis. Periodic updates of the survey will help you measure the success of your program.

Employee job improvement suggestions

Encouraging employees to make job improvement suggestions also will help your prevention efforts. In the daily performance of their jobs, your employees will readily discover ways to improve ergonomic safety. Their familiarity with the job's equipment, tools, processes and methods is the most direct source of ideas about prevention.

PHASE TWO - INJURY MANAGEMENT/EARLY INTERVENTION

Phase two of medical management begins when a work-related musculoskeletal injury occurs. The focus of injury management should be on early diagnosis and treatment of the injury, whether the employee continues working, begins modified duty, or is off work. Your goals at this stage should be to minimize time lost from work and to ensure safe return to work.

Seeking appropriate treatment

Employees and managers should be trained to recognize the signs and symptoms of musculoskeletal disorders, and what to do if disorders are discovered. Encourage your employees to report symptoms or potential injuries as soon as they are discovered and to seek prompt treatment. It is important to assure workers that when they report injuries, they will not be discriminated against. The sooner injuries are treated, the better chance you have to prevent a more serious problem.

Discrimination and retaliation are illegal

Your employees have the legal right to report injuries and raise safety and health concerns without fear of retaliation or discrimination. For example, an employer cannot terminate an employee because he or she files a claim for worker's compensation or complains about safety or health hazards. If an employee becomes disabled, an employer must still comply with the Americans with Disabilities Act (ADA) and the Washington state law against discrimination. For ADA information, contact the federal Department of Labor at 1-800-949-4232 or the Northwest Disability Business Technical Assistance Center at 1-800-HELP-ADA, or here: http://www.nwada.org/

Employers are not expected to be experts in health care and injury treatment and should not try to diagnose musculoskeletal disorders. However, you should be generally aware of treatments for common injuries. With a basic understanding, you will be better able to ask questions about an injured worker's recovery and to be confident that your employees are getting appropriate treatment.

You should have guidelines for determining whether the severity of symptoms requires immediate medical attention. For instance, get medical help if symptoms get worse or last more than three days. The first-aid certified supervisors in your company[4] should be able to help set up these guidelines. You may also consult a first-aid reference.

Throughout an injured worker's recovery you should maintain regular communication with the worker and the health-care provider. This communication will allow you to follow the recovery progress so that problems may be dealt with quickly. Safe return to work should be your primary consideration. When treatment begins, you should talk about setting specific time frames to accomplish recovery goals.

Questions for injured workers to ask their health-care providers

Many employers and employees are not yet familiar with musculoskeletal disorders, their causes and their treatments. This unfamiliarity makes it difficult for an injured worker to know what questions to ask the health-care provider about treatment. Asking the following questions can help give a thorough understanding of the injury/illness and what to expect from recovery:

- What is your diagnosis of my condition? Can you explain in non-medical language what that means?
- In your opinion, is this a work-related musculoskeletal injury/illness?
- How long does it usually take for this type of injury/illness to heal?
- What kinds of potential complications should I be aware of and watch for?
- What are my treatment options? What are the pros and cons of each?
- When should I expect to be back to full-duty work?
- What, if any, are the long-term implications of this injury/illness?
- What precautions should I take to avoid further injury?

[4] WAC 296-24-060 (2): There shall be present or available at all times, a person or persons holding a valid certificate of first aid training.

Be sure that the worker, employer and health-care provider all have the same understanding of the treatment plan. Encourage the injured worker to be an active participant in his or her recovery and to follow through on all treatment instructions. Show support and give encouragement throughout treatment. Coordinate return-to-work plans with the health-care provider and the worker to ensure that the plan is appropriate.

Modified duty and Job Modifications

Meaningful modified-duty jobs are often a part of safe return-to-work plans. Before injuries occur, your ergonomics team should make a list of these jobs. Then, when a worker is released for return to modified duty, you are already aware of potential positions. Modified-duty jobs should have the least ergonomic risk. You may want an ergonomist or trained occupational health-care provider to help identify these positions.

Coordinate with the injured worker and the health-care provider to be sure you follow the legal requirements[5] for returning the worker to a modified duty position that is appropriate to the injury. Also, work with the healthcare provider to set reasonable time limits for modified duty with a plan for transition back to full duty. Transition time is an important part of safe return to work, especially if the worker has been off work or on modified duty for more than six weeks.

To assist employers in modifying jobs where hazards have resulted in an accepted workers compensation claim, the Department of Labor & Industries provides job modification assistance.[6] Up to $5,000.00 per worker per job modification may be provided by the department. However, this assistance is intended to be a cooperative effort with the employer, so employers are encouraged to assist with their own contribution.

PHASE THREE - CHRONIC INJURY

The best way to keep injuries from moving into phase three is to focus your efforts on prevention and injury management. However, some workers' injuries may become chronic. In these cases, your goals should be to ensure return to work without further complications and to prevent disability. Chronic injury intervention should begin under one or more of the following conditions:

- Employee has not returned to work and the claim remains unresolved.
- Employee has not returned to work and does not show demonstrated improvement from phase two.
- Employee has returned to work with limited duties, but without resolution of the claim.
- Employee has been released for work, but non-physical barriers have prevented return to work.

Cases that move into this phase are often complex and confusing to both the worker and the employer. At this point, the worker may have seen several health-care providers and undergone several types of treatments. Because of this potential for complexity, communication and cooperation among the worker, employer, claims manager, and health-care providers are especially important in dealing with chronic injury.

[5] RCW 51.32.090(4): Temporary total disability; Return to available work
[6] WAC 296-18A-520: Job Modification Assistance

Sometimes injuries occur that are too severe to allow return to work in the worker's previous job. Even in this case, it is important to work toward claim resolution. The best possible solution is to return the worker to a job that meets his or her reduced capacity. No matter what course of action you take, it is important that you follow the requirements of the ADA as mentioned above.

Re-evaluation of the injured worker

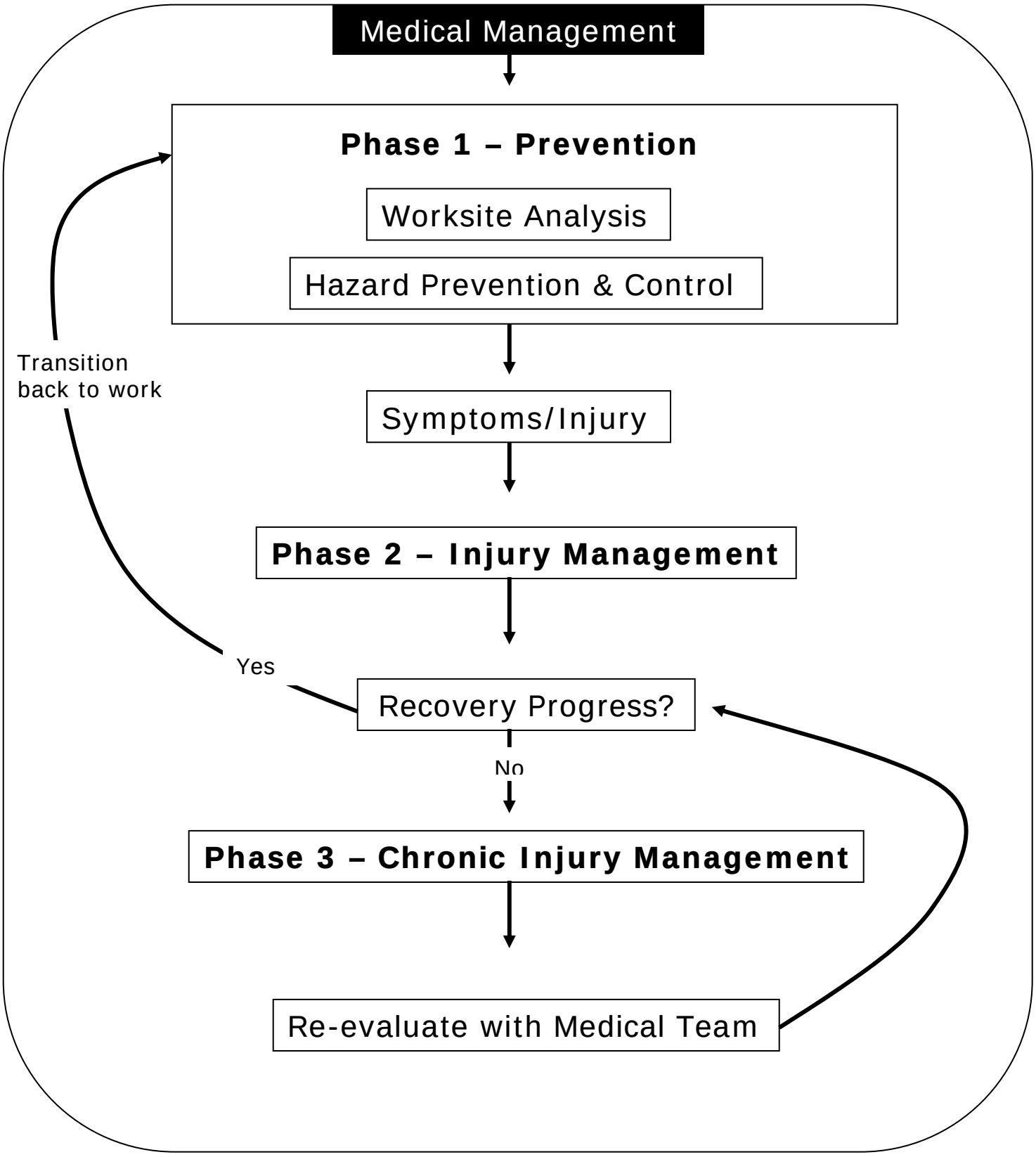
The first step in chronic-injury management should be a re-evaluation of the injured worker. Bring together everyone involved in the worker's treatment to evaluate the worker's recovery status. This will help minimize confusion and ensure that all barriers to return to work are discussed. The re-evaluation group should include:

- worker.
- health-care providers.
- claims manager.
- employer.
- occupational/physical therapist.
- psychologist (if applicable).

It is important for the re-evaluation to address all factors that prevent return to work. Non-physical barriers, such as emotional or social (psychosocial) factors, may also contribute to an employee's not returning to work. These non-physical barriers are often more difficult to detect and address (see Appendix F for more information on psychosocial risk factors). Some of the following tools may help to resolve these issues in discussions with a claims manager:

- Independent medical examination.
- Functional/physical capacities evaluation.
- Vocational rehabilitation assessment.
- Psychological evaluation.
- Work-hardening program.
- Pain clinic program.

Use the information gathered from these sources to help resolve the claim. This information should also be used to update and improve your safety and ergonomic programs. Try to figure out how you might have prevented the injury from getting to the chronic phase. The knowledge you gain in dealing with difficult injuries will help improve training and education of managers, employees and health-care providers.


Medical Management
Phase 1 – Prevention
Worksite Analysis
Hazard Prevention & Control
Transition back to work
Symptoms/Injury
Phase 2 – Injury Management
Yes
Recovery Progress?
No
Phase 3 – Chronic Injury Management
Re-evaluate with Medical Team

Training and education

With the help of ACME Consulting, the ergonomics team develops the training plans. The first part of the plan is to provide awareness training to all employees. This training covers:

- symptoms of musculoskeletal disorders.
- *where to report symptoms.*
- r*isk factors and potential causes.*
- *how to report risk factors to the ergonomics team.*

The team develops a training record that will be used to ensure that each employee has received all required training. The types of required training are determined by what job the employee holds. In addition to awareness training, each employee will be trained on the specific risk factors inherent in their jobs and how to correct or avoid them. They are also trained on the safe procedures they must follow in performing their jobs. Everyone in the company, from the president to the maintenance crew, is trained.

The ergonomics team reviews the training plan annually to see if it is effective in helping the company meet its ergonomics goals. They also review the results of the worksite analyses to see if new training is required or if old training is no longer effective or necessary.

Training and education

This section covers:

- When and whom to train.
- Contents of training.
- Ensuring that training is effective.
- Evaluating training.

Training and educating your company's employees on work-related musculoskeletal disorders is critical to the success of your ergonomics program. Training and education should give both workers and managers an understanding of the potential risk of injuries, their causes, symptoms, prevention and treatment. The more aware workers are of the musculoskeletal hazards in their workplace, the more likely they are to work toward reducing injuries.

WHEN AND WHOM TO TRAIN

Training should involve all employees, including support personnel. These people should all receive training on musculoskeletal risk factors:

- Workers/union representatives.
- Managers/supervisors.
- Engineers.
- Maintenance personnel.
- Purchasing personnel.
- Safety and risk control managers.
- Health-care providers.
- Insurance administrators.

All new employees or current employees in new jobs should be trained. Other times when training is advisable include:

- When new processes, equipment or procedures are introduced into the workplace.
- When an employee has been off work for more than 30 days.
- When accident rates go up, injuries become more severe, or performance drops.

CONTENTS OF TRAINING

Training can either be for general awareness or specific to the particular job or task. You should determine what type of ergonomics training your employees need according to:

- The nature of the task performed.
- The type of tools, equipment or processes involved.
- The length of time the task is to be performed.

General training involves providing instructions to employees about the hazards involved with their jobs and should include:

- Types of musculoskeletal disorders often associated with the job.
- Risk factors that may contribute to or cause these disorders.
- How to prevent these disorders from occurring.
- Recognition and reporting of symptoms associated with these disorders.

Job-specific training should involve the following:

- Hands-on training before beginning a regular production job.
- Care and proper use of all tools and equipment.
- Proper lifting techniques and devices.
- The correct way to stand, sit, bend, turn, reach, grasp, push/pull, and climb.
- Identification of hazards in the area, such as slippery surfaces, sharp edges, moving machinery or vehicles.
- Use of proper personal protective equipment, if any.

It is important for supervisors to get training similar to that of their employees, as they are responsible for ensuring that their employees use work practices that are ergonomically correct and safe. Supervisors should get additional training that will allow them to:

- Recognize early signs and symptoms of work-related musculoskeletal disorders and inform health-care providers about them.
- Recognize and correct hazardous work practices.
- Understand and emphasize the importance of the ergonomics program.

Managers should get training to ensure they have a general understanding of workplace ergonomic principles and how to implement them. Training for managers should also include information about their safety and health responsibilities and the specific ergonomic issues of your workplace.

Training for engineers and maintenance personnel should include how to correct musculoskeletal hazards through job and workstation design and maintenance. These personnel should be able to recognize hazards and modify workstations to eliminate or reduce hazards. Purchasing personnel should be trained to understand basic ergonomic concepts of tool, equipment and furniture design. This will help them make more informed choices in their purchasing decisions.

Once your employees have received general and job-specific training, you should review it with them to determine what can be done to eliminate hazards and reduce the risk of injury or illness.

Ensuring That Training is Effective

At first you probably will need help from consultants or trainers from outside the company. Once managers and members of the ergonomics team become comfortable with ergonomic principles, they will be able to train other employees.

For training to be effective, employees should be convinced that it is important to them. This can be done by:

- Explaining the goals of the training.
- Giving awareness training that explains the importance of ergonomics.
- Giving training that is relevant to your workplace.
- Keeping the training simple yet thorough.
- Frequently summarizing the main points and goals of the training.

Employee involvement is essential in any training program. Employers should encourage participation by:

- Establishing a one-on-one relationship with all who participate in the training.
- Encouraging discussion and questions.
- Providing an environment that encourages participation.
- Asking employees for their comments and suggestions on training issues.
- Repeating key points and asking employees to explain or restate what has been presented. (This helps to reinforce the information as well to help the trainer spot gaps in understanding.)

If the training is effective, employees will be able to demonstrate they have the skill and knowledge to perform their tasks with minimum risk of injury or illness.

Training methods and materials
When choosing training methods and materials, keep in mind the type of job, the learning capacity of the employee, the duration of the task or job, and the type and severity of risks involved. You may want to use one or more of the following training methods:

- Videotape
- Operations manual
- Lecture
- Magazine articles
- Slides and photographs
- Practice run
- Training models
- Film
- Instructional manual
- Demonstration
- Books
- Outlines and diagrams
- Hands-on demonstration
- Job-safety analysis

EVALUATING TRAINING

For an ergonomics training program to be successful, periodic evaluation of the training is necessary. You should evaluate the training to see if problem areas are developing and to determine what type of training is needed and when training should be given. Evaluations should consider:

- The complexity of the job for which the training is given (highly complex jobs may require more frequent training).
- The time that has elapsed since the last evaluation (evaluation of training effectiveness should be done at least annually).

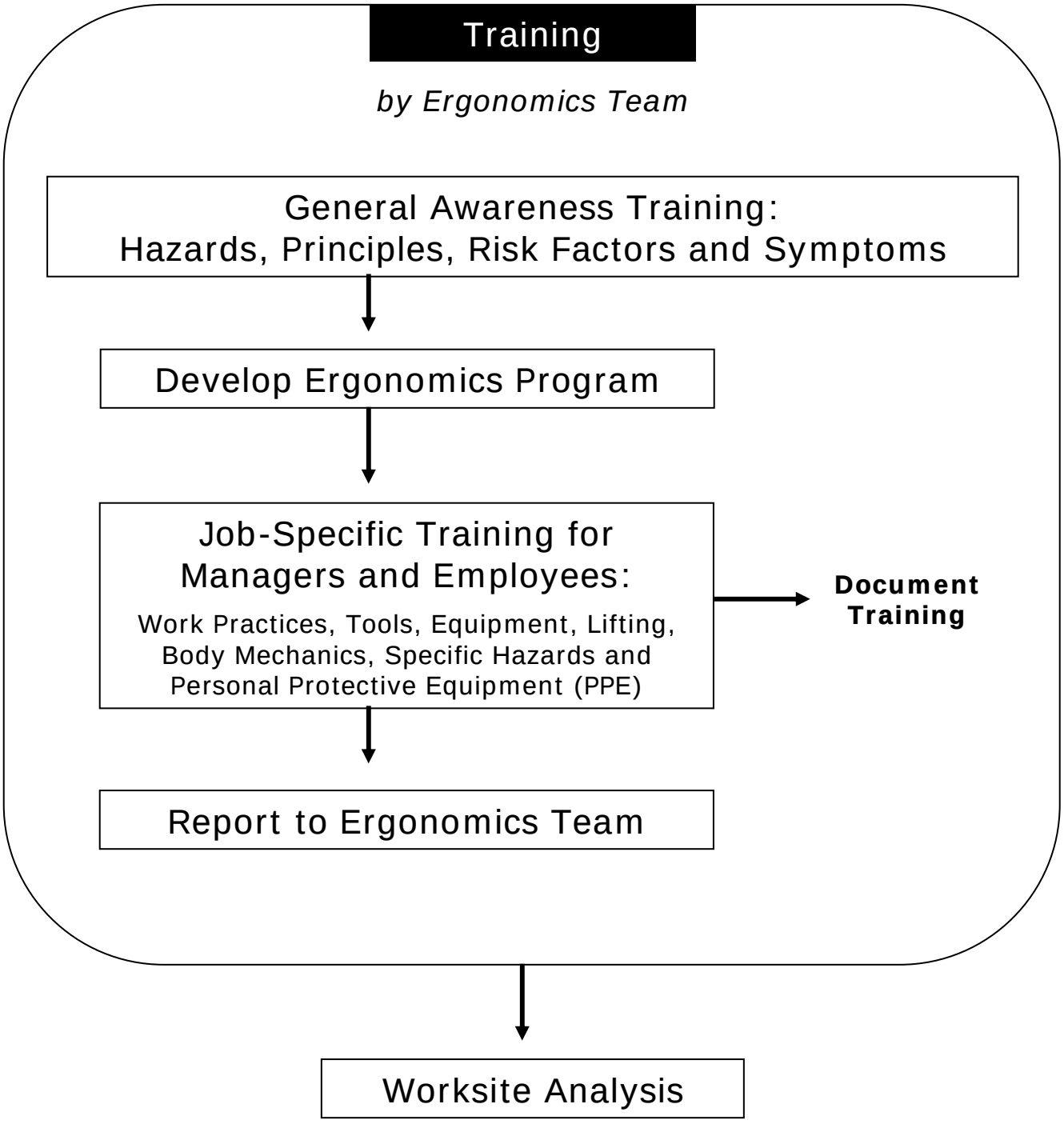
You should re-evaluate training whenever:

- New equipment, tools or techniques are introduced into the workplace.
- New employees join the company or employees are assigned to different jobs.
- The number of work-related musculoskeletal disorders in the workplace increases.

Although there are many methods for evaluating the effectiveness of an ergonomics program, you should use the following points in your evaluation:

- Involve employees in the evaluation. Don't just watch to see if they are using the training. There may be reasons why employees don't use the training. Those reasons must be addressed and incorporated into future training sessions.
- Have supervisors make formal evaluations to see how effective the training is.
- Find a way to measure whether the goals and objectives of the training have been reached.

Training is essential to the success of your ergonomics program. Honest and thorough evaluations will help you provide meaningful and productive training.


Training
by Ergonomics Team
General Awareness Training:
Hazards, Principles, Risk Factors and Symptoms
Develop Ergonomics Program
Job-Specific Training for
Managers and Employees:
Work Practices, Tools, Equipment, Lifting,
Body Mechanics, Specific Hazards and
Personal Protective Equipment (PPE)
Document
Training
Report to Ergonomics Team
Worksite Analysis

Appendix A
Medical terms for musculoskeletal disorders

Arthritis: inflammation of a joint or joints.

Carpal tunnel syndrome: a compression of the median nerve as it passes through the carpal tunnel in the heel of the hand.

Chronic low back pain: general soreness and fatigue of the low back; pain is usually constant, and it accompanies most activities.

Constriction: binding, squeezing, or shrinking blood vessels so that circulation is reduced.

Cubital tunnel syndrome: compression of the ulnar nerve as it passes through the notch of the elbow.

Cumulative trauma disorder: damage to body tissue by outside forces that has built up over time.

Degenerative disc disease: a breakdown of the discs that separate the vertebrae of the spine.

DeQuervain's Disease: an inflammation of the tendon and/or its sheath at the base of the thumb.

Digital neuritis: compression of the nerves along the sides of the fingers or thumbs.

Epicondylitis: an inflammation of the tendons at the elbow. Also called tennis elbow (lateral or outside part of the elbow), or golfer's elbow (medial or inside part of the elbow).

Ganglionic cyst: swelling of the tendon and sheath due to the build-up of synovial fluid inside the sheath. The cyst usually causes a bump under the skin.

Non-specific backache: general soreness and fatigue of the low back.

Raynaud's Phenomenon: a constriction of the blood vessels in the hands and fingers. Also called "white finger."

Rotator cuff tendinitis: inflammation of one or more tendons at the shoulder. Also called "Pitcher's Shoulder."

Sprain: overstretching of overexertion of a *ligament* that results in a tear or rupture of the *ligament.*

Strain: overstretching or overexertion of a *muscle or tendon.*

Tendinitis: inflammation of the tendon inside the sheath.

Tenosynovitis: inflammation of the sheath around the tendon.

Thoracic outlet syndrome: compression of the nerves and blood vessels between the neck and shoulder often associated with prolonged overhead work.

Trigger ringer: a common term for tendinitis or tenosynovitis that causes painful locking of the finger(s) while flexing.

Ulnar nerve entrapment: compression of the ulnar nerve as it passes through the wrist, often associated with prolonged flexion and extension of the wrist and pressure on the palm.

Appendix B
Incidence and Severity Rates

Incidence rate: the rate at which new injuries and illnesses occur for a given job, production line, work area, department or the company. Incidence rates express the number of new work-related musculoskeletal disorders occurring per year or other specified time period. They allow comparison of the numbers of injuries or illnesses between and within jobs, production lines, work areas, departments and the company from year to year.

Often, a business-wide incidence rate for musculoskeletal disorders is used as a baseline to evaluate specific jobs or departments. A baseline would be an incidence of work-related musculoskeletal disorders that may be expected to occur without a significant contribution from work-related causes. In some cases, a baseline incidence rate is determined from research published in the scientific literature.

The incidence rate is usually expressed as the number of cases per 100 workers per year The incidence rate assumes each worker works 2,000 hours per year (8 hours a day, 5 days a week, 50 weeks a year).

The incidence rate is calculated as:

$$\text{Incidence rate} = \frac{\text{Number of new cases/yr. x 200,000 work hours}}{\text{Number of workers in job (or department) x 2,000 hours}}$$

Note: 200,000 work hours is used to express the incidence rate on the basis of 100 workers per year (2,000 hours per worker per year x 100 workers).

If the actual number of hours worked by job or department is known, the formula below may be used:

$$\text{Incidence Rate} = \frac{\text{Number of new cases/yr. x 200,000 work hours}}{\text{Total hours worked (per job or department)}}$$

Severity rate: the cost (in terms of lost workdays) of new injuries and illnesses occurring in a given job, production line, work area, department or company.

The severity rate gives indications of the associated cost to the employer. The severity rate calculation used in this guideline is similar to the one for incidence rates. The main difference is that total lost work days per year is substituted for the number of new cases per year.

The severity rate is calculated using the following formula:

$$\text{Severity Rate} = \frac{\text{Total lost workdays/year x 200,000 work hours}}{\text{Number of workers in job (or dept.) x 2,000 hours}}$$

or

$$\text{Severity Rate} = \frac{\text{Total lost workdays/year x 200,000 work hours}}{\text{Total hours worked (per job or department)}}$$

Calculating the incidence rate and severity rate for each job where work-related musculoskeletal disorders occur allows targeting of specific jobs for worksite analysis. If information is not available on a specific job basis, then incidence rates should be calculated on a department-by-department basis, if possible.

The incidence rate and severity rate can also be used to identify long-ten-n trends (3+ years). Looking at trends can help measure the effect of changes to equipment, process, methods, training, workstations, and production rates. This information can also be used to measure the success of a company's ergonomic program and help determine the cost effectiveness of the program.

Appendix C

Worksite analysis sample checklists

Following are sample checklists that you may wish to use as a guide in developing your own worksite analysis checklists. These five checklists are included:

a) Workstation
b) Task Analysis
c) Hand Tool Analysis
d) Material Handling
e) Computer Workstation

The checklists are written so that "no" responses indicate potential problem areas that should receive further investigation.

Appendix C(a)

Workstation checklist

	Yes	No	
1.	( )	( )	Does the working space allow for a full range of movement?
2.	( )	( )	Are mechanical aids and equipment available?
3.	( )	( )	Is the height of the work surface adjustable?
4.	( )	( )	Can the work surface be tilted or angled?
5.			Is the workstation designed to reduce or eliminate:
	( )	( )	· bending or twisting at the waist?
	( )	( )	· reaching above the shoulder?
	( )	( )	· static muscle loading?
	( )	( )	· extending the arms?
	( )	( )	· bending or twisting the wrists?
	( )	( )	· raised elbows?
6.	( )	( )	Is the employee able to vary posture?
7.	( )	( )	Are hands and arms free from pressure from sharp edges on work surfaces?
8.	( )	( )	Is an armrest provided where needed?
9.	( )	( )	Is a footrest provided where needed?
10.	( )	( )	Is the floor surface flat?
11.	( )	( )	Are cushioned floor mats provided for employees who are required to stand for long periods?
12.	( )	( )	Is the chair or stool easily adjustable and suited to the task?
13.	( )	( )	Are all task requirements visible from comfortable positions?
14.	( )	( )	Is there a preventive maintenance program for mechanical aids, tools, and other equipment?

Note: A "no" response indicates potential problem areas that should receive further investigation

Appendix C(b)

Task analysis checklist

	Yes	No	
1.			Does the design of the task reduce or eliminate:
	( )	( )	bending or twisting?
	( )	( )	crouching?
	( )	( )	bending or twisting the wrists?
	( )	( )	extending the arms?
	( )	( )	raising elbows?
	( )	( )	static muscle loading?
	( )	( )	clothes-wringing motions?
	( )	( )	finger pinch grip?
2.	( )	( )	Are mechanical devices used when necessary?
3.	( )	( )	Can the task be done with either hand?
4.	( )	( )	Can the task be done with two hands?
5.	( )	( )	Are pushing and pulling forces reduced or eliminated?
6.	( )	( )	Are the required forces acceptable?
7.			Are the materials:
	( )	( )	* able to be held without slipping?
	( )	( )	* easy to grasp?
	( )	( )	* free from sharp edges or comers?
8.	( )	( )	Do containers have good handholds?
9.	( )	( )	Are jigs, fixtures and vises used where needed?
10.	( )	( )	If gloves are needed, do they fit properly, and are they made of the proper fabric?
11.	( )	( )	Does the task avoid contact with sharp edges?
12.	( )	( )	When needed, are push buttons designed properly?
13.	( )	( )	Does personal protective equipment keep from getting in the way of the task?
14.			Are high rates of repetitive motion avoided by:
	( )	( )	* job rotation?
	( )	( )	* self pacing?
	( )	( )	* sufficient rest pauses?
	( )	( )	* adjusting the job to the skill level of the worker?
15.			Is the employee trained in:
	( )	( )	* proper work practices?
	( )	( )	* when and how to make adjustments?
	( )	( )	* signs and symptoms of potential physical problems?

Note: A "no" response indicates potential problem areas that should receive further investigation.

Appendix C (c)

Hand tool analysis checklist

	Yes	No	
1.			Are tools selected to avoid:
	( )	( )	excessive vibration?
	( )	( )	excessive force?
	( )	( )	bending or twisting the wrist?
	( )	( )	finger pinch grip?
	( )	( )	problems associated with trigger finger?
2.	( )	( )	Are tools powered where necessary and feasible?
3.	( )	( )	Are tools evenly balanced?
4.	( )	( )	Are heavy tools counterbalanced?
5.	( )	( )	Does the tool allow adequate visibility of the work?
6.	( )	( )	Does the tool grip/handle prevent slipping during use?
7.	( )	( )	Are tools equipped with handles: of proper diameter? that do not end in the palm area? of textured non-conductive material?
8.	( )	( )	Are different handle sizes available to fit a wide range of hand sizes?
9.	( )	( )	Is the tool handle designed to not dig into the palm of the hand?
10.	( )	( )	Can the tool be used safely with gloves?
11.	( )	( )	Can the tool be used by either hand?
12.	( )	( )	Is there a preventive maintenance program to keep tools operating as designed?
13.	( )	( )	Have employees been trained: in the proper use of tools? when and how to report problems with tools? in proper tool maintenance?

Note: A "no" response indicates potential problem areas that should receive further investigation.

Appendix C(d)
Materials handling checklist

	Yes	No	
1.	( )	( )	Has excessive weight lifting been reduced?
2.	( )	( )	Are materials moved over minimum distances?
3.	( )	( )	Is the distance between the object and the body minimized?
4.			Are walking surfaces:
	( )	( )	level?
	( )	( )	wide enough?
	( )	( )	clean and dry?
	( )	( )	well lit?
5.			Are objects:
	( )	( )	easy to grasp?
	( )	( )	stable?
	( )	( )	able to be held without slipping?
6.	( )	( )	Are there handholds on these objects?
7.	( )	( )	When required, do gloves fit properly?
8.	( )	( )	Is the proper footwear worn?
9.	( )	( )	Is there enough room to maneuver?
10.	( )	( )	Are mechanical aids easily available and used whenever possible?
11.	( )	( )	Are working surfaces adjustable to the best handling heights?
12.	( )	( )	Does material handling avoid: movements below knuckle height and above shoulder height? static muscle loading? sudden movements during handling? twisting at the waist? excessive reaching?
13.	( )	( )	Is help available for heavy or awkward lifts?
14.	( )	( )	Are high rates of repetition avoided by: * job rotation? * self pacing? * sufficient rest pauses?
15.	( )	( )	Are pushing and pulling forces reduced or eliminated?
16.	( )	( )	Does the employee have an unobstructed view of the handling task?
17.	( )	( )	Is there a preventive maintenance program for equipment?
18.	( )	( )	Are workers trained in correct handling and lifting procedures?

Note: A *"no" response indicates potential problem areas that should receive further investigation.*

Appendix C(e)
Computer workstation checklist

	Yes	No	
1.			Is the chair adjusted to ensure proper posture, such as:
	( )	( )	* knees and hips bent at approximately 90 degrees?
	( )	( )	* feet flat on floor or footrest?
	( )	( )	* arms comfortably at sides with elbows at 90-degree angle?
	( )	( )	* straight wrists at keyboard?
2.			Does the chair:
	( )	( )	* adjust easily from the seated position?
	( )	( )	* have a padded seat that is adjustable for height and angle?
	( )	( )	* have an adjustable backrest?
	( )	( )	* provide lumbar support?
	( )	( )	* have a stable caster base?
3.	( )	( )	Is there sufficient space for knees and feet?
4.	( )	( )	Are the height and tilt of the keyboard work surface adjustable?
5.	( )	( )	Is the keyboard prevented from slipping when in use?
6.	( )	( )	Is the mouse or pointing device at the same level as the keyboard?
7.	( )	( )	Does keying require minimal force?
8.	( )	( )	Is there an adjustable document holder?
9.	( )	( )	Are arm rests provided where needed?
10.	( )	( )	Is the screen clean and free of flickering?
11.	( )	( )	Is the top line of the screen slightly below eye level?
12.	( )	( )	Does the monitor have brightness and contrast controls?
13.	( )	( )	Is the monitor 18-30 inches from the worker for viewing?
14.	( )	( )	Is there sufficient lighting without causing glare?
15.	( )	( )	Is an anti-glare screen used if necessary?
16.	( )	( )	Are adequate rest breaks provided for task demands?
17.	( )	( )	Are high stroke rates avoided by:
	( )	( )	* job rotation?
	( )	( )	* self pacing?
	( )	( )	* adjusting the job to the skill of the worker?
	( )	( )	* adequate rest pauses?
18.	( )	( )	Are employees trained in:
	( )	( )	* proper postures?
	( )	( )	* proper work methods?
	( )	( )	* when and how to adjust their workstations?
	( )	( )	* how to seek assistance with concerns?

Note: A *"no" response indicates potential problem areas that should receive further investigation.*

Appendix D

Symptoms Survey

Date _____/_____/_____

Last Name _____ (optional) First Name _____ (optional)

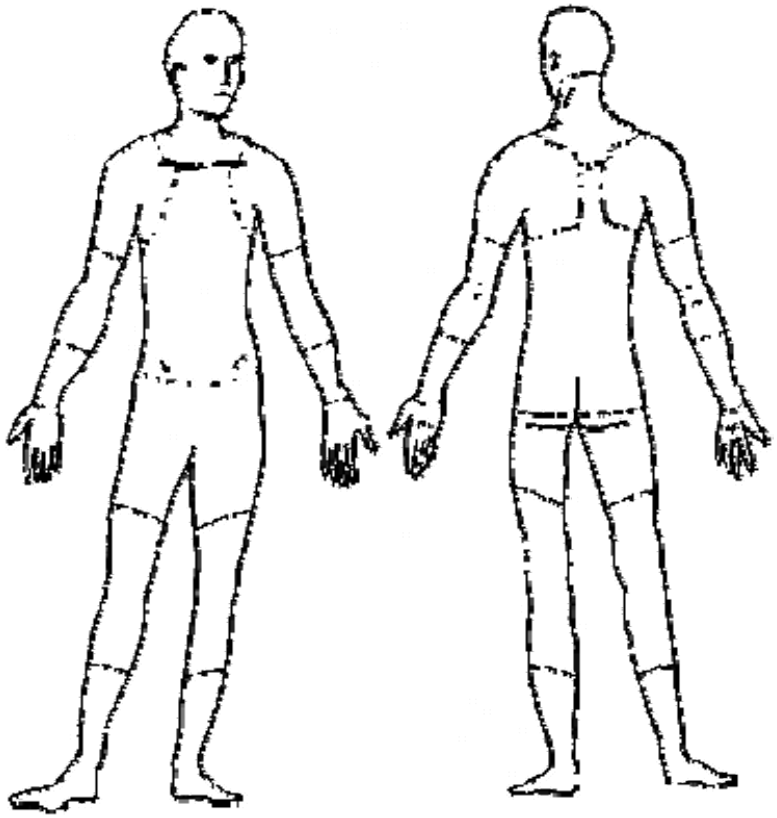
Work Location _____ Supervisor _____ (optional)

Time on THIS Job: ☐ Less than 3 months ☐ 3 months to 1 year ☐ Greater than 1 year to 5 years ☐ Greater than 5 years to 10 years ☐ Greater than 10 years

Have you had any pain or discomfort during the last year?

☐ Yes ☐ No (If NO, stop here)

If YES, carefully shade in the area of the drawings below which bothers you the MOST.



Front Back

Appendix D

Symptoms Survey

NAME (optional) _____

Please complete a separate page for each area that bothers you.

Check area ☐ Neck ☐ Shoulder ☐ Elbow/Forearm ☐ Hand/Wrist ☐ Fingers
☐ Upper Back ☐ Low Back ☐ Thigh/Knee ☐ Low Leg ☐ Ankle/Foot

1. Please put a check by the word(s) that best describes your problem:

_____1) Aching/Cramp	_____4) Numbness/Tingling (asleep)	_____7) Stiffness
_____2) Burning	_____5) Pain	_____8) Weakness
_____3) Loss of Color	_____6) Swelling	_____9) Other

2. When did you first notice the problem? _____ number of months – or – _____ years ago

3. How long does each episode last? (please check)

_____1) Less than 1 hour	_____3) 24 hours – 1 week	_____5) 1 month to 6 months
_____2) 1 hour – 24 hours	_____4) 1 week – 1 month	_____6) more than 6 months

4. How many separate episodes have you had in the last year? _____

5. What do you think caused the problem _____
_____

6. Have you had the problem in the last 7 days? ☐ Yes ☐ No

OPTIONAL

7. How would you rate this problem? Mark an X on the line.

RIGHT NOW: None_____Unbearable

AT ITS WORST: None_____Unbearable

8. Have you had medical treatment for this problem? ☐ Yes ☐ No

If YES, what was the diagnosis?_____

9. How much time have you lost from work in the last year because of this problem?
_____ days

10. How many days in the last year were you on modified duty because of this problem?
_____ days

11. Have you changed jobs because of this problem? ☐ Yes ☐ No

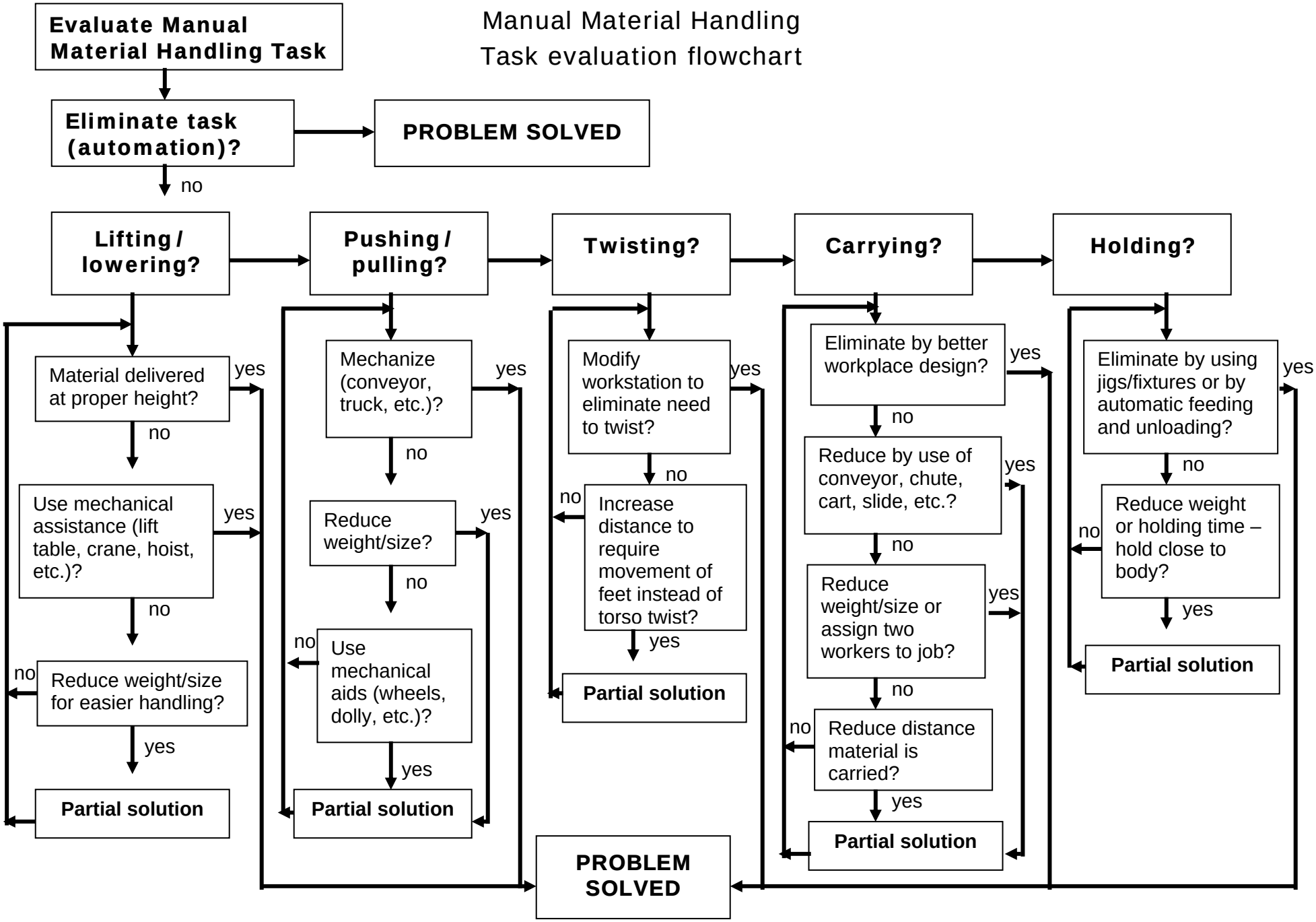
12. Please comment on what you think would improve your symptoms: _____

_____

Appendix E

Manual Material Handling

Task evaluation flowchart



Appendix F

Psychosocial risk factors

Psychosocial risk factors arise from the interaction of the individual (psychological) and the business' culture and attitudes toward employees (sociological).

The psychosocial aspects of the work environment are often the most difficult to incorporate into an ergonomics program. Not including them, however, can be serious and costly in terms of employee discomfort, increased absenteeism, and loss of productivity.

Symptoms that show evidence of psychosocial issues can be both emotional, such as depression, frustration, anxiety and insecurity, as well as physical, including fatigue, increased heart rate and loss or increase of sleep or appetite.

NIOSH predicts that by the year 2000, work-related stress will be a leading occupational injury/illness as measured by costs and disruption to business and personal lives.

What can you do to address psychosocial risk factors in your ergonomics program? It is important to identify emotional/social factors that may pose hazards as part of the worksite analysis, just as you identify potential physical hazards. Controls for reducing the effects of psychosocial factors may include:

- Implementing procedural changes.
- Listening to employees and acknowledging their accomplishments regularly.
- Seeking employee input on changes that affect their work.
- Ensuring adequate staffing and resources or reducing expectations.

You can use the following types of training to help reduce psychosocial risk factors in the workplace:

- Workplace modification and job design aspects of ergonomics.
- Stress reduction and fitness to use on the job and at home.
- Communication and interaction skills.

Glossary

Awkward posture: deviation from the ideal working posture of elbows at the side of the torso, with the wrists neutral. Awkward postures typically include reaching behind, twisting, forward or backward bending, pinching, and squatting.

Engineering controls: a method of controlling worker exposure to risk factors by redesigning equipment, tools, and work stations. Engineering controls are part of hazard prevention and control.

Ergonomics: the scientific study of human work. The term comes from the Greek words "ergos" meaning work, and "nomos," meaning natural laws of. Ergonomics considers the physical and mental capabilities and limits of the worker as he or she interacts with tools, equipment, work methods, tasks, and the working environment.

Ergonomics program: a systematic method (similar to an accident prevention or quality improvement program) used to evaluate, prevent and manage work-related musculoskeletal disorders. The four elements of a typical ergonomics program are worksite analysis, hazard prevention and control, medical management, and training and education.

Ergonomics team: those responsible for the identifying and correcting of musculoskeletal hazards in the workplace ergonomics program.

Fatigue: a condition that results when the body cannot provide enough energy for the muscles to perform a task..

Forcefulness: the amount of physical effort a person uses to do a task.

Hand-arm vibration: vibration (generally from a hand tool) that goes through the hand, then travels through the rest of the body.

Hazard prevention and control: eliminating or minimizing the hazards identified in the worksite analysis. It is changing the jobs, workstations, tools or environment to fit the worker. Hazard prevention and control is an element of the ergonomics program.

Incidence rate: the rate at which new injuries and illnesses occur for a given job, production line, work area, department or the company.

Mechanical contact stress: the contact of the body with a hard surface or edge that results in the compression of tissue. Can also result when using a part of the body as a hammer or striking instrument.

Medical management: the effective use of available health-care resources to prevent or manage work-related musculoskeletal disorders. Medical management is an element of the ergonomics program.

Glossary

Musculoskeletal disorders: illnesses and injuries that affect one or more parts of the musculoskeletal system.

Musculoskeletal system: the soft tissue and bones in the body. The parts of the musculoskeletal system are bones, muscles, tendons, ligaments, cartilage, nerves, and blood vessels.

Neutral posture: comfortable working posture that reduces the risk of musculoskeletal disorders. The joints are naturally aligned with elbows at the side of the body and wrists straight.

Personal protective equipment: gloves, kneepads and other equipment that may help reduce hazards until other controls can be implemented, or to supplement existing controls.

PPE: (See personal protective equipment.)

Records review: reviewing company records to identify patterns of injuries (or potential injuries) to help you find the jobs and workstations that may contain musculoskeletal hazards.

Repetitiveness: performing the same motions 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.

Risk factors: an aspect of a job that increases the worker's chance of getting a work-related musculoskeletal disorder.

Severity rate: the cost in terms of lost workdays (or dollars) of new injuries and illnesses occurring in a given job, production line, work area, department or company.

Static loading: physical effort or posture that is held and requires muscle contraction for more than a short time. As muscles remain contracted, the blood flow to the muscles is reduced. (Also su*stained exertions.)*

Sustained exertions: physical effort or posture that is held and requires muscle contraction for more than a short time. As muscles remain contracted, the blood flow to the muscles is reduced. Also *static loading.)*

Work practice controls: procedures for safe and proper work that are used to reduce the duration, frequency or severity of exposure to a hazard. They include work methods training, job rotation, and gradual introduction to work. Work practice controls are part of hazard prevention and control.

Worksite analysis: a safety and health review that addresses work-related musculoskeletal disorders. It is a structured way of identifying jobs and workstations that may contain musculoskeletal hazards, the risk factors that pose the hazards, and the causes of the risk factors. Worksite analysis is an element of the ergonomics program.

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