How to identify, control, and reduce musculoskeletal disorders in your workplace!

Ergonomics for Everyone

DEPARTMENT OF CONSUMER & BUSINESS SERVICES

Presented by the Public Education Section
Oregon OSHA
Department of Consumer and Business Services

Oregon OSHA
PUBLIC EDUCATION

1003-04

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We provide knowledge and tools to advance
self-sufficiency in workplace safety and health

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Enforcement:

- Inspects places of employment for occupational safety and health rule violations and investigates complaints and accidents

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- Presents educational opportunities to employers and employees on a variety of safety and health topics throughout the state

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- Develops, interprets, and provides technical advice on safety and health standards
- Publishes booklets, pamphlets, and other materials to assist in the implementation of safety and health rules

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Introduction

The Problem: The Georgia Pacific wood I-beam production facility, a participant in OSHA's Voluntary Protection Program (VPP), had many jobs involving repetitive motion, and employees were complaining aches and pains.

The Solution: Employees were asked to evaluate their specific work stations. As a result, work tables were lowered or raised, matting was added, and work stations were automated and otherwise redesigned to reduce material handling and repetitive movements.

The Result: The facility's injury rate dropped from 4.2 to 2.1, and employee morale was greatly improved.

Welcome to OR-OSHA Course 201, Introduction to Ergonomics. In this workshop, we will explore engineering and management strategies that help you achieve the same kind of success Georgia Pacific experienced in reducing musculoskeletal disorders (MSDs). Our overall goal is to create greater understanding of the importance of basic ergonomics principles and how to successfully design and implement an effective ergonomics program.

Goals

At the end of this presentation you will be better able to:

1. Describe the concept and purpose of ergonomics.
3. Identify personal, job, and environmental ergonomic risk factors.
4. Discuss the importance of proper workstation design.
5. Describe the steps in establishing an ergonomics program.

Form Groups!

Introductions

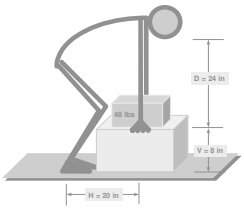
Elect a leader _____

Select a spokesperson _____

Everyone is a recorder _____

Please Note: This material or any other material used to inform employers of compliance requirements of Oregon OSHA standards through simplification of the regulation should not be considered a substitute for any provisions of the Oregon Safe Employment Act or for any standards issued by Oregon OSHA.

Basic concepts



Ergonomics: What is it?

- **Definition.** The scientific study (Greek - nomos) of human work (Greek - ergon).
- **Strategy.** 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.
- **Goal.** Reduce work-related musculoskeletal disorders (MSDs) by adapting the work to fit the person, instead of forcing the person to adapt to the work.
- **Principle.** Since everything is designed for human use or consumption, human characteristics should be considered at the beginning of the design process.
- ***What are Musculoskeletal Disorders (MSDs)?*** Don't let this term scare you! Illnesses and injuries that affect one or more parts of the musculoskeletal system. They 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.

Why is effective ergonomics so important?

- **Back injuries are the leading cause of disability** in the United States for people younger than 45 years and have been the most expensive health care problem for the 30- to 50-year-old age group.
- **Low back pain accounted for 23%** ($8.8 billion) of total workers' compensation payments in 1995.
- Statistics indicates that **in 1998 there were 279,507 back injuries** due to overexertion that resulted in lost work days (89% in material-handling).
- According to the Bureau of Labor Statistics, there were **582,300 MSDs that resulted in employees missing time from work in 1999**, the last year for which statistics are available.
- Successes. Jerome Foods Inc., a turkey hatching, growing and processing company, reports **saving $3 for every $1 spent since instituting its ergonomics program**. Similar savings have been reported by the Grumman Corp., Ford Motor Co., and several large food retailers.

2003 Average Cost For Disabling Claims By Event or Exposure

Total Claims: 22,569
Average Cost: $13,107

Event or Exposure Leading to Injury (Partial list)	CLAIMS CLOSED	AVERAGE COST($)
Lifting objects	2,763	11,611
Bodily reaction, other	2,364	11,369
Repetitive motion	2,134	13,519
Fall to floor, walkway	1,930	12,124
Overexertion, all other	1,179	13,029
Non-classifiable	1,170	10,372
Pulling, pushing objects	1,131	11,989
Caught in equipment or objects	949	14,808
Holding, carrying, wielding objects	879	14,651
Struck by falling object	863	14,249
Struck against stationary object	598	7,784
Loss of balance	549	12,288
Highway accidents, collisions, other	484	19,848
Struck by, other	475	16,616
Fall to lower level, all other	369	16,088
Fall from ladder	367	21,808
Fall from non-moving vehicle	323	18,617
Fall down stair or step	283	13,690
Assault or Violent Act by person	249	13,385
Struck against moving object	161	15,008
Struck by Vehicle	157	15,105
Exposure to noise	146	11,563
Jump to lower level	142	15,171
Fall from floor, dock, ground level	119	17,940
Fall to same level, other	95	20,381
Fall from roof	67	34,053
Vibration	66	15,447
Fall from scaffold	61	47,817
Highway noncollision accident, other	41	14,164
Explosion	23	27,453
Contact with electrical current	22	21,500
Fall from stacked material	21	19,798
Bodily reaction, exertion, other	13	50,636
Exposure to traumatic event	13	13,386
Caught in collapsing material	6	20,495

Notes: Table reflects estimated medical, timeloss, and partial permanent disability cost data for disabling claim closure activity. Costs exclude partial total disability and fatal indemnity, vocational assistance, medical-only claim costs, settlements, timeloss paid prior to claim denial and prior to settlement where claim was never closed, and compensation modified on appeal. Source: Research and Analysis Section, Information Management Division, Department of Consumer and Business Services

$ A F E T Y P A Y S ! OSHA Advisor @ www.osha.gov

A great tool you can use to show the bottom line benefits!

Estimated Costs of Ergonomics Injuries and Estimated Impact on a Company's Profitability

Report for Year: 2000
Employer: Ergonot Inc.
Prepared by: I. B. Safe, Safety Coordinator, on January 28, 2000

$AFETY PAYS is a tool developed by OSHA to assist employers in assessing the impact of occupational injuries and illnesses on their profitability. It uses a company's profit margin, the AVERAGE costs of an injury or illness, and an indirect cost multiplier to project the amount of sales a company would need to generate in order to cover those costs. Since AVERAGES are used, the actual costs may be higher or lower. Costs used here do not reflect the pain and suffering of injuries and illnesses.

The cost of injury and illness data were provided to OSHA by Argonaut Insurance Company and based on 53,000 claims for 1992-94.

The injury or illness selected: Strain

Average Direct Cost:	$5,945
Average Indirect Cost:	$7,134
Estimated Total Cost:	$13,079
The net profit margin for this company is	4 %
The ADDITIONAL sales necessary	
- to cover Indirect Costs are:	$178,350
- to cover Total Costs are:	$326,975

The injury or illness selected: Carpal Tunnel Syndrome

Average Direct Cost:	$8,305
Average Indirect Cost:	$9,966
Estimated Total Cost:	$18,271
The net profit margin for this company is	4%
The ADDITIONAL sales necessary	
- to cover Indirect Costs are:	$249,150
- to cover Total Costs are:	$456,775

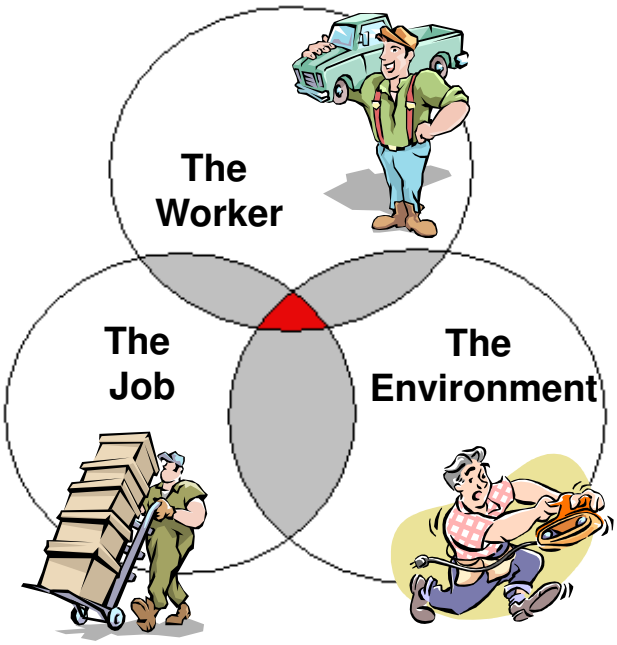
The injury or illness selected: Other Cumulative Trauma

Average Direct Cost:	$9,667
Average Indirect Cost:	$11,600
Estimated Total Cost:	$21,267
The net profit margin for this company is	4%
The ADDITIONAL sales necessary	
- to cover Indirect Costs are:	$290,000
- to cover Total Costs are:	$531,675

The TOTAL ADDITIONAL SALES required by these 3 incidents is estimated to be between:

$717,500 and **$1,315,425**

Ergonomic risk factors interact in three areas:



Risk factors inherent in the worker. Physical, psychological and non-work-related activities may present unique risk factors.

Risk factors inherent in the job. Work procedures, equipment, workstation design may introduce risk factors.

Risk factors inherent in the environment. Physical and psychosocial "climate" may introduce risk factors.

What risk factors might the worker bring to the job?

_____

_____

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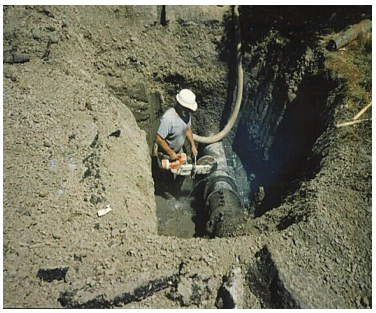
What risk factors does the job itself (equipment, tools, procedures) bring to work? What actions or movements are required to complete a task?



What are risk factors the environment imposes on the worker?

_____

_____

_____

_____

_____

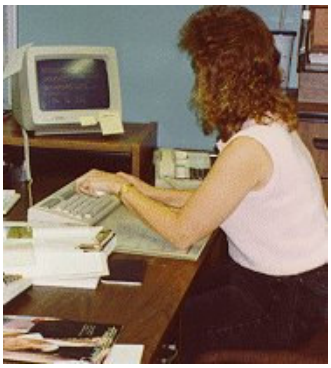
Physical Risk factors

Awkward postures. Body postures determine which joints and muscles are used in an activity and the amount of force or stresses that are generated or tolerated. For example, more stress is placed on the spinal discs when lifting, lowering, or handling objects with the back bent or twisted, compared with when the back is straight. Manipulative or other tasks requiring repeated or sustained bending or twisting of the wrists, knees, hips, or shoulders also impose increased stresses on these joints. Activities requiring frequent or prolonged work over shoulder height can be particularly stressful.

Forceful exertions (including lifting, pushing, and pulling). Tasks that require forceful exertions place higher loads on the muscles, tendons, ligaments, and joints. Increasing force means increasing body demands such as greater muscle exertion along with other physiological changes necessary to sustain an increased effort. Prolonged or recurrent experiences of this type can give rise to not only feelings of fatigue but may also lead to musculoskeletal problems when there is inadequate time for rest or recovery. Force requirements may increase with:

- **increased weight of a load** handled or lifted,
- **increased bulkiness** of the load handled or lifted,
- use of an **awkward posture**,
- the **speeding up of movements**,
- **increased slipperiness** of the objects handled (requiring increased grip force),
- the presence of **vibration** (e.g., localized vibration from power handtools leads to use of an increased grip force),
- forceful **pinch grip** compared with gripping the object with your whole hand), and
- use of **small or narrow tool handles** that lessen grip capacity.

Repetitive motions. If motions are repeated frequently (e.g., every few seconds) and for prolonged periods such as an 8-hour shift, fatigue and muscle-tendon strain can accumulate. Tendons and muscles can often recover from the effects of stretching or forceful exertions if sufficient time is allotted between exertions. Effects of repetitive motions from performing the same work activities are increased when awkward postures and forceful exertions are involved. Repetitive actions as a risk factor can also depend on the body area and specific act being performed.



Duration. Duration refers to the amount of time a person is continually exposed to a risk factor. Job tasks that require use of the same muscles or motions for long durations increase the likelihood of both localized and general fatigue. In general, the longer the period of continuous work (e.g., tasks requiring sustained muscle contraction), the longer the recovery or rest time required.

Frequency. Frequency refers to how many times a person repeats a given exertion within a given period of time. Of course, the more often the exertion is repeated, the greater the speed of movement of the body part being exerted. Also, recovery time decreases the more frequently an exertion is completed. And, as with duration, this increases the likelihood of both localized and general fatigue.

Contact stresses. Repeated or continuous contact with hard or sharp objects such as non-rounded desk edges or unpadded, narrow tool handles may create pressure over one area of the body (e.g., the forearm or sides of the fingers) that can inhibit nerve function and blood flow.

Vibration. Exposure to local vibration occurs when a specific part of the body comes in contact with a vibrating object, such as a power handtool. Exposure to whole-body vibration can occur while standing or sitting in vibrating environments or objects, such as when operating heavy-duty vehicles or large machinery.

Other conditions. Workplace conditions that can influence the presence and magnitude of the risk factors for MSDs can include:

- cold temperatures,
- insufficient pauses and rest breaks for recovery,
- machine paced work, and
- unfamiliar or unaccustomed work

Psychosocial Risk Factors

In addition to the above conditions, other aspects of work may not only contribute to physical stress but psychological stress as well. As long as we believe we have adequate control over all aspects of our job, we may experience normal (positive) stress. However, if we believe we have little control over job demands, we may suffer from abnormal (negative) **distress** with accompanying ill health and possible irrational behaviors. Under distress, the probability of an injury or illness increases.

I'm in control

I'm out of control!

Why does the probability of an injury or illness increase when stress becomes distress?

_____

_____

_____

What management policies/practices and employee behaviors might cause distress in the workplace?

Example: Unreasonable workload

_____

_____

_____

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_____

Five Activities Involved in Manual Materials Handling

Lifting/Lowering. Lifting is to raise from a lower to a higher level. Lowering is the opposite activity from lifting.

Try to lift from a position no lower than the _____ and no higher than the _____.

List ways to reduce risk factors associated with lifting and lowering.

_____

_____

_____

Pushing/Pulling. Pushing is to press against with force in order to move the object. The opposite is to pull.

If you have to choose, it's best to _____ an object.

List ways to reduce risk factors associated with pushing and pulling.

_____

_____

_____

Twisting. Moving the upper body to one side or the other while the lower body remains in a relatively fixed position. Twisting can take place while the entire body is in a state of motion.

List ways to reduce risk factors associated with twisting.

_____

_____

_____

Carrying. Having an object in ones grasp or attached while in the act of moving. The weight of the object becomes a part of the total weight of the person doing the work.

List ways to reduce risk factors associated with carrying.

_____

_____

_____

Holding. Having an object in ones grasp while in a static body position.

List ways to reduce risk factors associated with holding.

_____

_____

_____

Static vs Dynamic muscular effort

Resting

Blood needed Blood flow

Dynamic Effort

Blood needed Blood flow

Static Effort

Blood needed Blood flow

_____

_____

_____

_____

physical stresses imposed on the musculoskeletal system while working.

Compressive forces on L5 / S1 disc exceeding 550 lbs. (250 kg.) causes four times the injuries than forces of less than 550 lbs. *(The Joyce Institute, Principles and Applications of Ergonomics)*

What three factors increase compressive forces on L5 / S1 ?

1. _____

2. _____

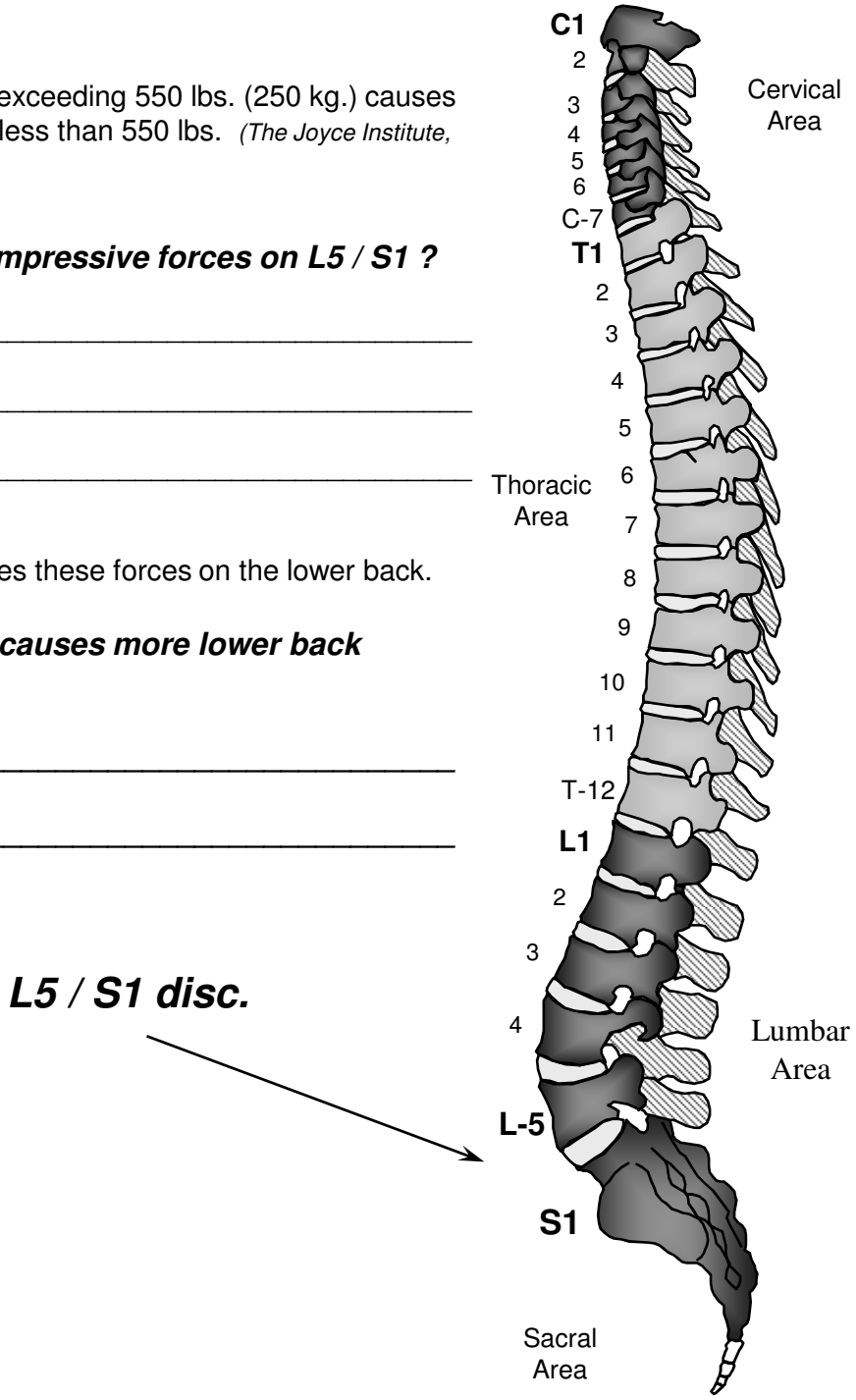
3. _____

Twisting in the middle of a lift amplifies these forces on the lower back.

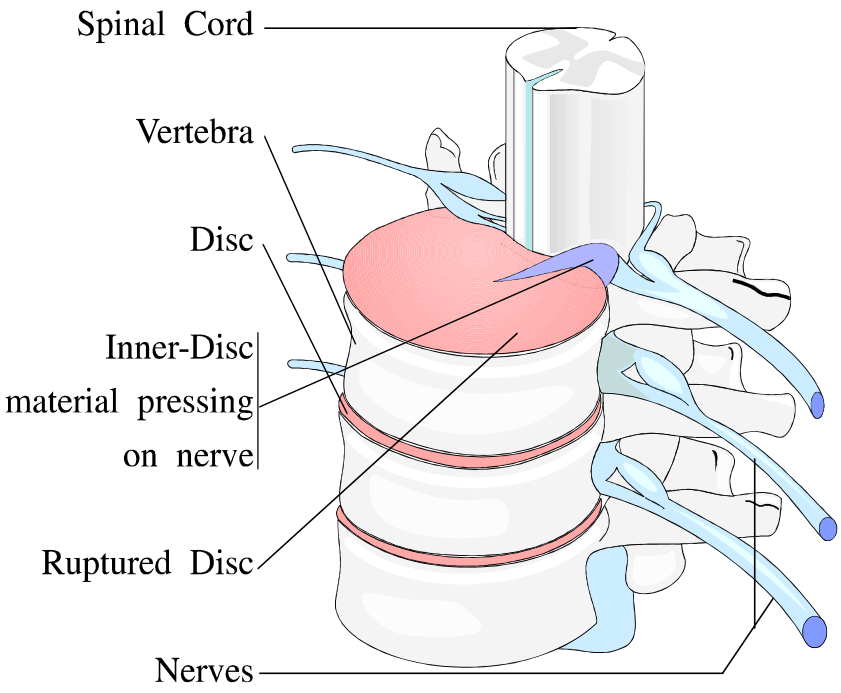
What job, more than any other causes more lower back injuries? Why?

_____

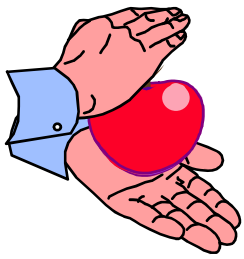
_____



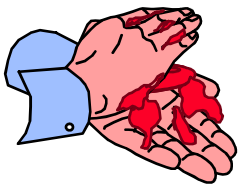
The discs allow flexibility in your spine and act as shock absorbers. The center of the disc is jelly-like. It is surrounded by tough rubber-like bands of tissue that are attached to the bones (vertebral bodies.)

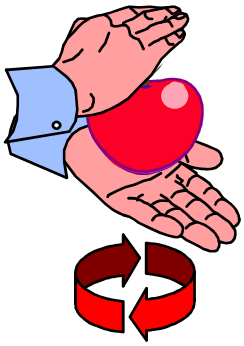


The Great Herniated Tomato Experiment



Imagine placing a tomato between the palms of your hands and applying direct pressure. You could apply enough force to cause the tomato to burst.



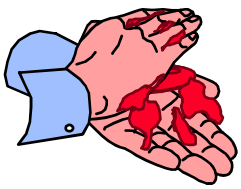


Now , imagine doing the same thing to another tomato, but this time you also twist your hands in opposite directions.

What happens?

_____

_____

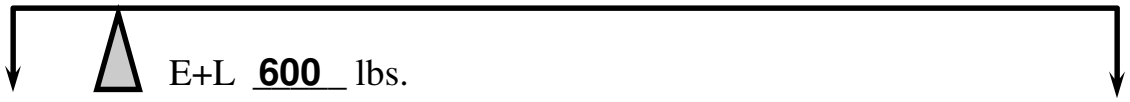


Body Mechanics: The Arm-Lever Equation

Load (L)
Load Distance (DL)

Effort (E)
Effort Distance (DE)

DE = **2** inches DL = **22** inches



E+L **600** lbs.

E **550** lbs. L **50** lbs.

$$E \times DE = L \times DL$$
$$E/L = DL/DE$$

Why is it important to decrease the distance of the load (DL)?

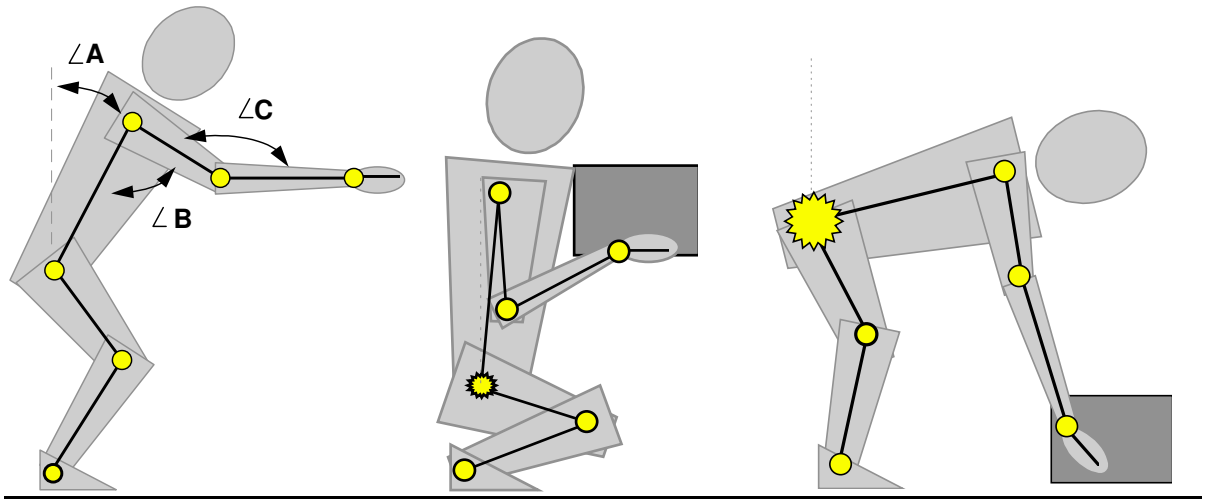
_____

_____

_____

The following illustration shows the sources of force on L5 / S1 disc. It does not address the impact of added forces during twist/bend lifting and backward bending situations. Force on the lower back increases as each angle increases.

- Angle from upper vertical of trunk . . . . . **A**
- Angle from lower vertical of upper arm . .**B**
- Angle from upper vertical of lower arm . .**C**



Lifting Safety: Tips To Help Prevent Back Injuries

Have you checked the object before you try to lift it?

- Test every load before you lift by pushing the object lightly with your hands or feet to see how easily it moves. This tells you about how heavy it is.
- Remember, a small size does not always mean a light load.

Is the load you want to lift packed right?

- Make sure the weight is balanced and packed so it won't move around.
- Loose pieces inside a box can cause accidents if the box becomes unbalanced.

Is it easy to grip this load?

- Be sure you have a tight grip on the object before you lift it.
- Handles applied to the object may help you lift it safely.

Is it easy to reach this load?

- You can be injured if you arch your back when lifting a load over your head.
- To avoid hurting your back, use a ladder when you're lifting something over your head.

What's the best way to pick up an object?

- Use slow and smooth movements. Hurried, jerky movements can strain the muscles in your back.
- Keep your body facing the object while you lift it. Twisting while lifting can hurt your back.
- Keep the load close to your body.
- "Lifting with your legs" should only be done when you can straddle the load. To lift with your legs, bend your knees to pick up the load, not your back. Keep your back straight.
- Try to carry the load in the space between your shoulder and your waist.

How can I avoid back injuries?

- Pace yourself. Take many small breaks between lifts if you are lifting a number of things.
- Don't overdo it--don't try to lift something too heavy for you. If you have to strain to carry the load, it's too heavy for you.
- Make sure you have enough room to lift safely. Clear a space around the object before lifting it.
- Look around before you lift and look around as you carry. Make sure you can see where you are walking. Know where you are going to put down the load.
- Avoid walking on slippery and uneven surfaces while carrying something.
- Get help before you try to lift a heavy load. Use a hand truck (dolly) or a forklift if you can.

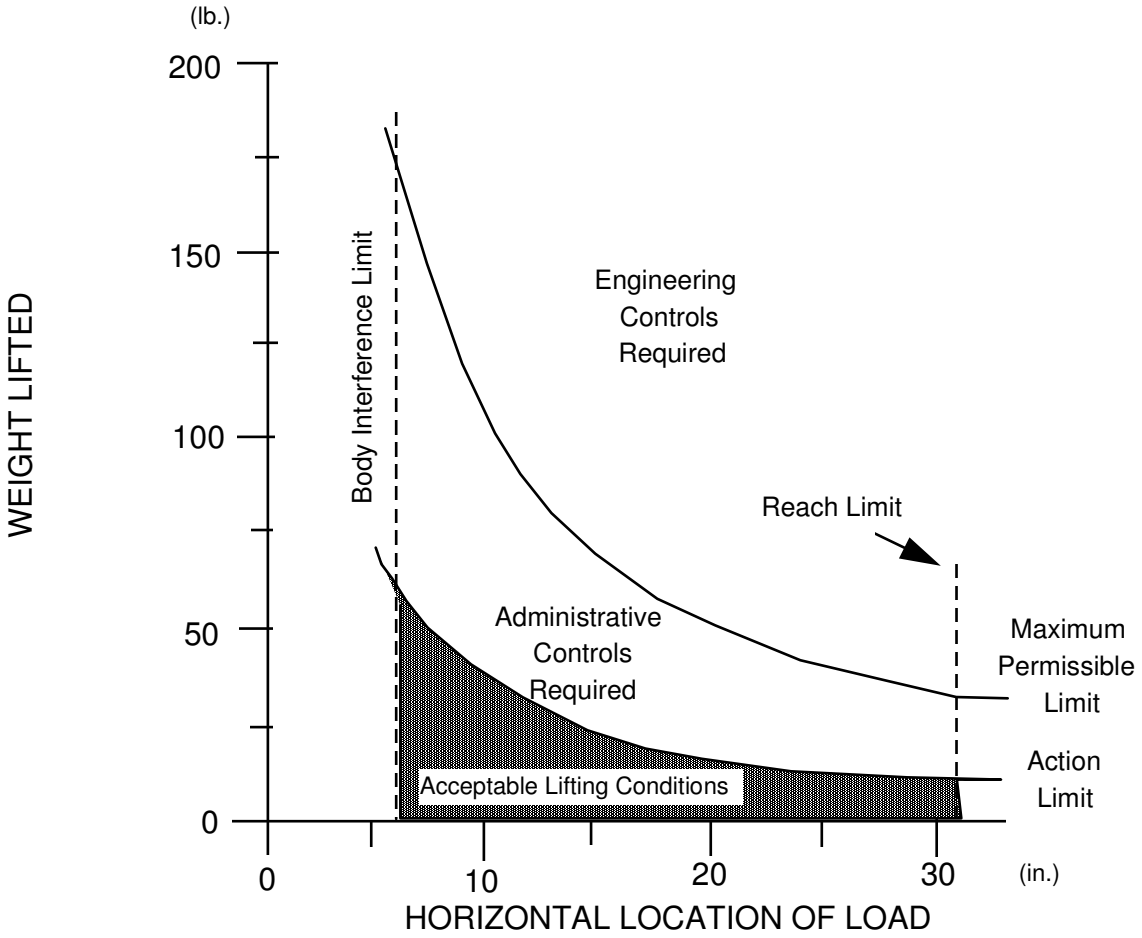
NIOSH Lifting Model (National Institute for Occupational Safety and Health)

This summary of the NIOSH Lifting Guidelines is adapted from the NIOSH Work Practices Guide for Manual Lifting 1982.

Determines what the maximum load should be, given the following characteristics:

- **Weight** of the object lifted.
- **Position** of load with respect to the body; starting and ending point of horizontal and vertical distances.
- **Frequency** of lift per minute.
- **Duration** of lift. Occasional = less than 1 hr/day. Continuous = greater than 1 hr/day.

NIOSH guidelines apply to infrequent lifts with loads which are symmetrically balanced in front of the body.



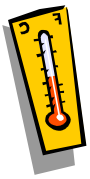
Ergonomics in the Office

Let's discuss some guidelines for each risk factor.

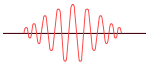
Color

Light

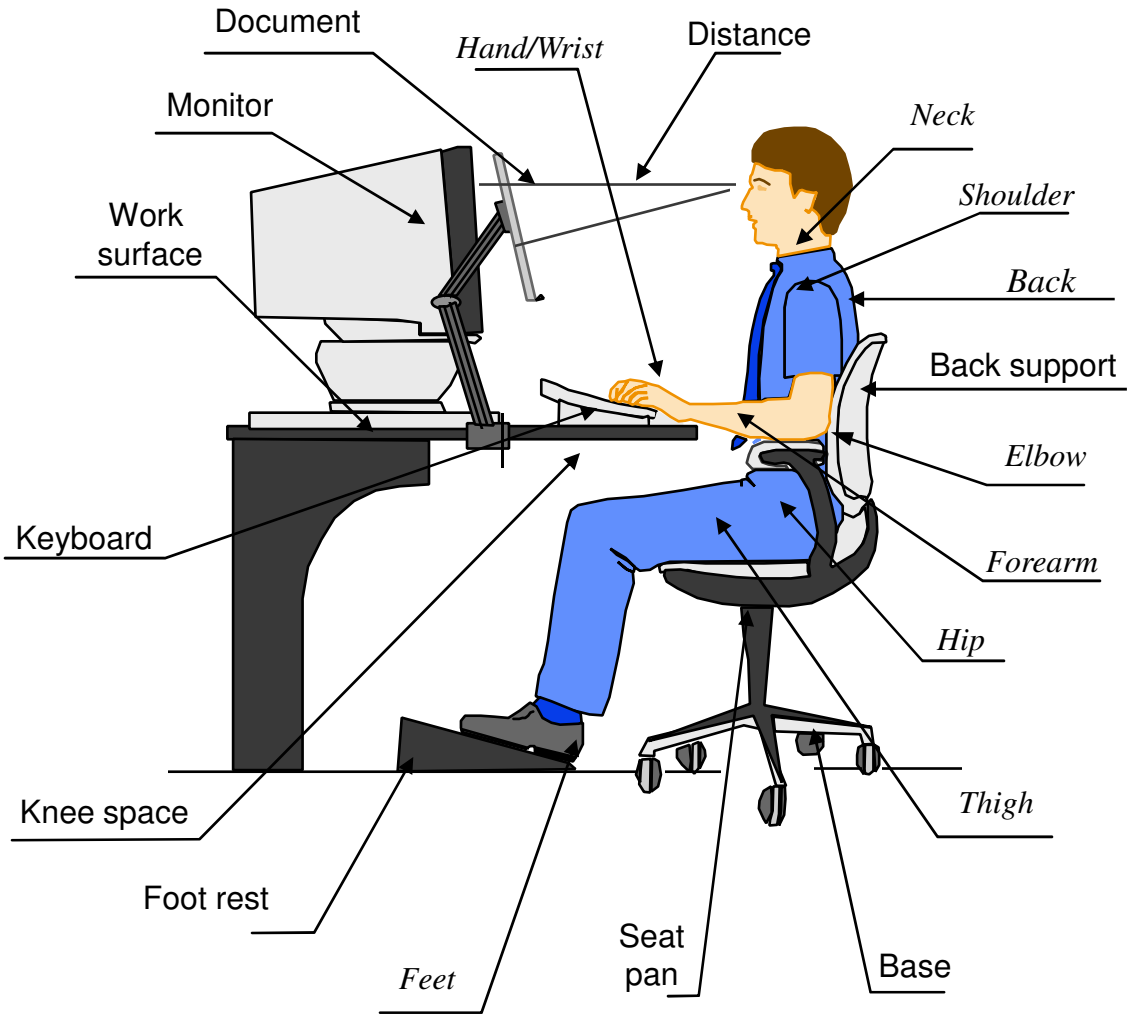
Temperature



Noise



Air Quality

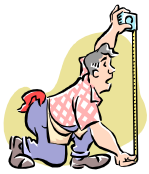


Controlling Risk Factors

It's important that identified risk factors be eliminated or reduced, if possible, and controlled so that they do not resurface.

Some important recommendations for controlling risk factors include:

- **Ask employees in the problem job for recommendations** about eliminating or materially reducing the MSD hazards;
- **Identify, assess and implement feasible controls** (interim and/or permanent) to eliminate or materially reduce the MSD hazards. This includes prioritizing the control of hazards, where necessary;
- **Track your progress** in eliminating or materially reducing the MSD hazards. This includes consulting with employees in problem jobs about whether the implemented controls have eliminated or materially reduced the hazards; and
- **Identify and evaluate MSD hazards** when you change processes or purchase equipment in problem jobs.



Hazard Control Strategies

Control strategies…to immediately correct hazardous conditions and unsafe behaviors.

- **Engineering controls.** Eliminates/reduces hazards that existed, through equipment redesign, replacement, or substitution. This is the most effective strategy. The preferred approach to prevent and control MSDs. Engineering control strategies to reduce ergonomic risk factors include the following:
  - ✓ **Changing the way materials, parts, and products can be transported** . For example, using mechanical assist devices to relieve heavy load lifting and carrying tasks or using handles or slotted hand holes in packages requiring manual handling
  - ✓ **Changing the process or product to reduce worker exposures to risk factors**. Examples include maintaining the fit of plastic molds to reduce the need for manual removal of flashing, or using easy-connect electrical terminals to reduce manual forces or modifying containers and parts presentation, such as height-adjustable material bins.

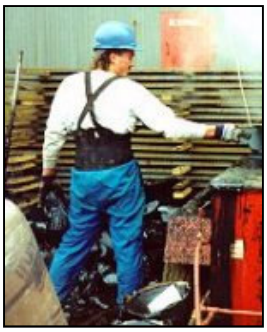
- ✓ **Changing workstation layout**. Examples might include using height-adjustable workbenches or locating tools and materials within short reaching distances.
- ✓ **Changing the way parts, tools, machinery and materials are to be manipulated**. Examples include using fixtures (clamps, vise-grips, etc.) to hold work pieces to relieve the need for awkward hand and arm positions or suspending tools to reduce weight and allow easier access.
- ✓ **Changing tool designs**. For example, pistol handle grips for knives to reduce wrist bending postures required by straight-handle knives or squeeze-grip-actuated screwdrivers to replace finger-trigger-actuated screwdrivers.
- ✓ **Changes in materials and fasteners**. For example, lighter-weight packaging materials to reduce lifting loads.
- ✓ **Changing assembly access and sequence**. For example, removing physical and visual obstructions when assembling components to reduce awkward postures or static exertions.

Management controls. If you can't eliminate or adequately reduce exposure through engineering controls (our first priority), then take a look at management controls. Reduce exposure to the hazard by controlling behaviors through design of safety rules and safe work practices and procedures. These control strategies work as long as employees comply with the controls. Examples include:

- ✓ **Broadening or varying the job content** to offset certain risk factors (e.g., repetitive motions, static and awkward postures)
- ✓ **Training in the recognition of risk factors** for MSDs and instruction in work practices that can ease the task demands or burden
- ✓ **Adjusting the work pace** to relieve repetitive motion risks and give the worker more control of the work process
- ✓ **Reducing shift length or curtailing the amount of overtime**
- ✓ **Rotating workers** through several jobs with different physical demands to reduce the stress on limbs and body regions
- ✓ **Scheduling more breaks** to allow for rest and recovery

Bottom-line, in making any ergonomic changes you'll most likely use both engineering and management controls to lower the risk of ergonomics-related injuries.

Personal Protective Equipment (PPE). In conjunction with engineering and management controls, consider personal protective equipment to reduce exposure to a hazard by placing a barrier between the hazard and employee. The object of the barrier is to reduce harmful levels of energy transfer (direct cause of injury).



- ✓ **Back belts/braces** and **wrist braces/splints** should not be considered PPE. In the field of occupational safety and health, PPE generally provides a barrier between the worker and the hazard source. Respirators, ear plugs, safety goggles, chemical aprons, safety shoes, and hard hats are all examples of PPE.

  Results based on these multiple NIOSH-sponsored analyses of data all converge to a common conclusion: back-belt use is not associated with reduced incidence of back injury claims or low back pain in material handlers.

  Whether braces, wrist splints, back belts, and similar devices can be regarded as offering personal protection against ergonomic hazards remains open to question. Bottom-line…the jury is still out.

- ✓ Less controversial types of personal equipment are vibration attenuation **gloves** and **knee pads** for carpet layers. But even here, there can be concerns. For example, do the design and fit of the gloves make it harder to grip tools?

What control measures might work to correct the hazard in the photo below?

Engineering controls

_____

_____

_____

_____

_____

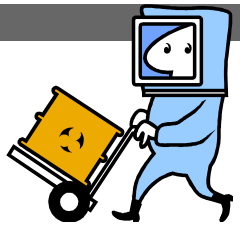
Management controls _____

_____

_____

PPE _____

_____



Implementing Control Strategies

To effectively implement control strategies:

- **Carefully plan the change - make small changes**
- **Conduct limited trials or tests of the selected solutions**
- **Study the effects of the change**
- **Adopt, abandon or revise as needed**
- **Once the change is adopted, implement full-scale**
- **Conduct follow-up evaluation of control strategies**

Testing and evaluation

Testing and evaluation verify that the proposed solution actually works and identifies any additional enhancements or modifications that may be needed. Employees who perform the job can provide valuable input into the testing and evaluation process. Worker acceptance of the changes put into place is important to the success of the intervention.

It's important that control strategies be implemented effectively to assure permanent improvement in conditions and behaviors. Use the following recommended strategies to help make sure your implementation process is effective.

- **Limit the variables.** Implement one control at a time, to minimize the number of variables in the change. Implementing many controls may result in new problems. How will you determine which control is the cause?
- **Abandon, revise, add controls.** If continued exposure to MSD hazards in the job prevents the injured employee's condition from improving or another covered MSD occurs in that job, you abandon the current control, revise the current control, or implement an additional control.

Making modifications or revisions

After the initial testing period, the proposed solution may need to be modified. If so, further testing should be conducted to ensure that the correct changes have been made, followed by full-scale implementation. Designating the personnel responsible, creating a timetable, and considering the logistics necessary for implementation are elements of the planning needed to ensure the timely implementation of controls.

The Ergonomics Program

An Ergonomics Plan may not be required, but it's smart management. Ergonomics injuries are real, and defining the best, comprehensive approach for ergonomic injuries is not necessarily a simple process. However, guiding principles will provide a vital starting point for effective design and implementation of an ergonomics program.

Foundation principles include:

- **Prevention** - Be proactive. Place emphasis on preventing injuries before they occur
- **Sound Science** - Any approach should be based on the best available science and research
- **Cooperation** - Cooperation between the employer and OR-OSHA/insurance provider
- **Flexibility** - Avoid a one-size-fits-all approach
- **Feasibility** - Solutions should be obtainable, cost-effective
- **Clarity** - Any approach must include short, simple and concise instructions

What is the purpose of an ergonomics program?

- **Design system compatible with physical/behavior needs of the individual employee.**

  Workplace layout — Work methods

  Machines and equipment design — Work environment

- **Inform employees** about musculoskeletal disorders and the risk factors that can cause or aggravate them.
- **Promote continuous improvement** in workplace ergonomic protection.
- **Encourage new technology and innovation** in ergonomic protection.
- **Identify design principles** that prevent exposure to risk factors.
- Ensure ongoing and consistent management **leadership** and employee **involvement**.

Program "Best Practices"

Demonstrate leadership

Leadership is critical to the successful implementation and operation of ergonomics programs. Management leadership provides the focus and direction of the program's effort as well as the needed resources in terms of both personnel commitment and funding.

- **Be involved** in developing, implementing and evaluating each element of your program;
- **Develop procedures** to report and respond to MSD signs and symptoms;
- **Develop clear policies** that detail management and employee responsibilities, and encourage employees to participate in the program and report MSD signs or symptoms.
- **Provide information** to employees that explains how to identify and report MSD signs and symptoms.

Encourage and reward employee participation

Employee participation is critically important. Employees are essential sources of information about MSDs, risk factors, and MSD hazards in their work areas. They have valuable insights into effective control measures that can be used to reduce risk factors inherent in their jobs.

Employee participation is demonstrated by the early reporting of MSDs. Active involvement by employees is demonstrated when they help implement, evaluate, and develop your program.

Design and conduct effective Job Hazard Analysis processes

Job hazard analysis helps identify ergonomic risk factors in the job. Analyze at-risk jobs to identify the ergonomic risk factors that could result in MSD hazards.

Design and conduct hazard reduction and control processes

Hazard reduction and control is the heart of the ergonomics program. Under this program element, employers control the risk factors in problem jobs identified during the job hazard analysis.

- **Eliminate or reduce the MSD hazards** using engineering and management controls.
- **Use Personal protective equipment** (PPE) to supplement engineering and administrative controls when necessary.

Implement effective education and training

Education and training provides employees with the information and understanding that they need to participate effectively in the ergonomics program. It describes the natural and system consequences of safety performance. In addition, it provides the more detailed information that supervisors, team leaders and other employees involved in setting up and managing ergonomics programs need to carry out their program-related responsibilities effectively.

Goals of ergonomics education and training

The goals for ergonomics awareness training include the following:

- **Provide initial training**, when exposure to hazards occurs, and periodically as necessary.
- **Train managers, supervisors and employees** in your ergonomics program and their role in it.
- **Improve skills on how to recognize workplace risk factors** for MSDs.
- **Improve knowledge and skills on how to identify the signs and symptoms** of MSDs that may result from exposure to such risk factors.
- **Understand control strategies**.
- **Know the procedures for reporting** risk factors and MSDs, including the names of designated persons who should receive the reports.
- **Be familiar with the company's health care procedures**.
- **Know the the employee's role and accountabilities** in the process.
- **Know the ways employees can actively participate** in the ergonomics program.

How do we know ergonomics education and training is successful?

_____

_____

_____

What methods can we use to measure the success of ergonomics education and training?

_____

_____

_____

Design and implement effective MSD management

MSD management should be prompt and appropriate when an employee has experienced an MSD incident. MSD management includes:

- access to a health care professional,
- work restrictions as needed,
- work restriction protection, and
- evaluation and follow-up of the MSD incident.

MSD management is important largely because it helps ensure that employees promptly report MSDs and signs and symptoms of MSDs. This, in turn, ensures that jobs that present MSD hazards will be included in the ergonomics program.

Design and implement an effective program evaluation process

Evaluation is the process employers use to ensure that the program they have established is functioning as intended. Employers should evaluate their programs if they have reason to believe that the program is not functioning properly.

- **Evaluate your ergonomics program periodically** to ensure effective design and implementation of processes.
- **Review measures to reduce the number and severity of MSDs** by increasing the number of jobs in which ergonomic hazards have been controlled, reducing the number of jobs posing MSD hazards, and correcting identified deficiencies in the program.

Let's review!

1. **Ergonomics is about fitting the work to the _____.**
    a. OSHA law
    b. worker
    c. groups
    d. Production schedule

2. **Risk factors exist in which of the following areas?**
    a. Person
    b. Job
    c. Environment
    d. All of the above

3. **Each of the following are examples of psychosocial risk factors except?**
    a. Lack of time
    b. Unreasonable workload
    c. Duration of the task
    d. Poor working relationships

4. **According to the text, ergonomic hazard control strategies include all of the following except?.**
    a. Engineering controls
    b. Management controls
    c. Education controls
    d. Personal Protective Equipment

5. **Give an example of a hazardous condition and an unsafe behavior related to ergonomics.**

_____

_____

Appendix

Sample Written Ergonomic Protection Plan

I. Purpose of the program

A. The Ergonomics Protection Program is established to prevent the occurrence of work-related musculoskeletal disorders, primarily those in the back, upper and lower extremities. To do this the program employs various strategies:

1. Informs employees about musculoskeletal disorders and the risk factors that can cause or aggravate them.
2. Promotes continuous improvement in workplace ergonomic protection.
3. Encourages new technology and innovation in ergonomic protection.
4. Identifies design principles that prevent exposure to risk factors.
5. Ensures ongoing and consistent management leadership and employee involvement.

B. _____ (person and position) is responsible for managing the Ergonomic Protection Plan. The ergonomic program health care provider, supervisors and the safety committee will assist in monitoring the effectiveness of the program.

II. Worksite analysis

A. Supervisor, with assistance from the program manager or a consultant, will conduct an ergonomic hazard analysis for each task in his or her area of responsibility. The purpose of worksite analysis is to recognize and identify existing ergonomic risk factors in the workplace. The analysis will include the use of an ergonomic checklist and employee questionnaire. Periodic surveys of the workplace will be conducted at appropriate intervals to evaluate changes in risk factors and effectiveness of work practices and engineering controls.

B. The OSHA 200 log will be reviewed to determine whether any musculoskeletal disorders have occurred during the last two years. If musculoskeletal disorders have occurred in the past two years, the supervisor will further analyze and evaluate the associated "at risk" work areas for ergonomic hazards

C. Each "at risk" task will be videotaped for the purpose of documenting work procedures, tools and materials used, and hazardous conditions encountered. The supervisor will analyze the task for ergonomic related hazard that could result in injury or illness. (See program description for instructions on videotaping)

1. The following risk factors should be considered in your analysis:

   a. Performance of the same motions or motion pattern every few seconds for more than two hours at a time. Questions to ask:

   - What is the task or cycle frequency per shift?
   - Is the task continuous or sporadic?
   - Does the worker perform the task for the entire shift or rotate with other workers?

b. Fixed or awkward work postures for more than a total of two hours: for example, overhead work, twisted or bent back, bent wrist, kneeling, stooping, or squatting. Questions to ask:

- What is the height of the workbench?
- What is the maximum reach to parts bins, etc.?
- What is the chair height?
- Is movement restricted due to confined workspace?

c. Use of hand tools. Questions to ask:

- What is the weight of tool being used?
- Are vibrating or impact tools or equipment used for more than a total of two hours?
- Is there air exhaust onto the worker's hand?

d. Manual handling of objects more than 25 pounds more than once each workshift.

e. The type of handwear being used. Questions to ask:

- Is handwear slippery?
- Do the gloves fit properly?

f. No worker control over work pace (e.g., work is mechanically or electronically paced) for more than four hours at a time (exclusive of regular breaks.)

g. Work performed in cold environment.

D. The use of outside ergonomics consultants to evaluate areas identified is encouraged. Their assistance may be extremely valuable in conducting the initial analysis. Coordinate with the program manager to request assistance.

III. Corrective Actions

A. The supervisor with assistance from the program manager will determine the surface and root causes for all hazards (ergonomic and general) related to a task being analyzed. The following control strategies will be used to reduce or eliminate those hazards:

1. Engineering controls should be designed by a qualified ergonomist and may include workstation redesign, tool and handle redesign, and change of work methods. The goal is to make the job fit the person.
2. Administrative/Work practice controls. Administrative controls try to reduce the duration, frequency, and severity of exposure to ergonomic stress. They include include job rotation, reduction of repetitions, preventive maintenance of related equipment, new employee conditioning, and monitoring and modifications as necessary to reduce ergonomic stressors.
4. Personal protective equipment (PPE) may be used if appropriate. However, in all cases, if employees are not properly trained, or are reluctant to accept change, reducing ergonomic injuries and illnesses may be difficult at best.

IV. Employee involvement and training

A. Management will be involved in all stages of identifying, assessing, and controlling ergonomics hazards. Managers and supervisors will work closely with employees to determine hazards. Training in ergonomic awareness and safe work practices will be key in ultimately reducing injuries and illnesses, and involving employees in this training will improve the interest and quality of the training.

B. All supervisors and employees will be educated on the early signs and symptoms of ergonomic injury and illness.

C. Further ergonomics training will be conducted for all "at risk" employees and supervisors, and will include specific information on the hazards associated with their jobs, reporting procedures, the risks of developing cumulative trauma disorders, symptoms of exposure, and how to prevent the occurrence of cumulative trauma disorders. The supervisor's training program will also be implemented to allow recognition of the signs of cumulative trauma disorders and to reinforce the ergonomics program. After training is completed, supervisors will provide regular feedback on work practices to their employees.

D. The training program will be conducted by a qualified health care provider.

V. Medical management

A. A medical management program will be established under the guidance of an appropriately qualified health professional. Appropriately trained health care providers will be available at all times, and on an ongoing basis as required. They will be knowledgeable in the prevention, early recognition, evaluation, treatment and rehabilitation of CTDs, and in the principles of ergonomics, physical assessment of employees, and OSHA recordkeeping requirements.

B. Program health care providers will conduct monthly, systematic workplace walk-throughs to remain knowledgeable about operations and work practices, identify risk factors for CTDs in the workplace, identify potential light duty jobs, and maintain close contact with employees. Findings and recommendations will be documented and reported to the safety committee as soon as possible after the walk-through is completed.

C. Program managers will develop a symptoms survey to measure the extent of symptoms of work-related disorders for each area of the plant, to determine which jobs are exhibiting problems and to measure progress of the ergonomic program. Body diagrams should be used to facilitate the gathering of this information. Employees identities and medical records, including surveys will remain confidential.

D. All employees who report pain or other symptoms possibly related to musculoskeletal disorders will be promptly evaluated by a health care provider, and appropriate treatment and follow-up will be provided.

E. Where an employee states that the injury or illness is work-related, and the case otherwise meets the criteria for recording, the case will be entered on the OSHA 300 log pending final determination of the cause.

E. The employee will be monitored until he or she is able to perform work without restrictions. The idea is to detect any problem as early as possible to reduce the severity of the injury and associated costs.

F. The program health care provider will compile a list of light duty jobs with the lowest ergonomic risk. For such jobs, ergonomic risk(s) will be described.

G. New and current employees who are assigned to at risk jobs or tasks will be given a baseline survey by the health care provider to establish a base against which changes in health status can be evaluated. The baseline survey is not for the purpose of precluding people from performing particular jobs.

VI. Program Evaluation

A. The Ergonomics Protection Program will be evaluated by the program manager and safety committee annually for its ability to identify, assess, and eliminate ergonomic hazards in the workplace. Reductions in ergonomics related injuries and illness should ideally be experienced soon after the program is implemented.

B. Findings of the evaluation will be reported directly to the CEO.

Certification

_____ _____

Reviewed by (Signature) Date

_____ _____

Approved by (Signature) Date

ENGINEERING CONTROLS

A. General. Alter the task to eliminate the hazardous motion and/or change the position of the object in relation to the employee's body -- such as adjusting the height of a pallet or shelf.

B. Manual Handling Tasks.

a. Material handling tasks should be designed to minimize the weight, range of motion, and frequency of the activity.

b. Work methods and stations should be designed to minimize the distance between the person and the object being handled.

c. Platforms and conveyors should be built at about waist height to minimize awkward postures. Conveyors or carts should be used for horizontal motion whenever possible. Reduce the size or weight of the object(s) lifted.

d. High-strength push-pull requirements are undesirable, but pushing is better than pulling. Material handling equipment should be easy to move, with handles that can be easily grasped in an upright posture.

e. Workbench or workstation configurations can force people to bend over. Corrections should emphasize adjustments necessary for the employee to remain in a relaxed upright stance or fully supported, seated posture. Bending the upper body and spine to reach into a bin or container is highly undesirable. The bins should be elevated, tilted or equipped with collapsible sides to improve access.

f. Repetitive or sustained twisting, stretching, or leaning to one side are undesirable. Corrections could include repositioning bins and moving employees closer to parts and conveyors.

g. Store heavy objects at waist level.

h. Provide lift-assist devices, and lift tables.

MANAGEMENT CONTROLS AND OTHER WORK PRACTICES

A.Engineering controls are preferred.

B.Worker training and education:

- Training should include general principles of ergonomics, recognition of hazards and injuries, procedures for reporting hazardous conditions, and methods and procedures for early reporting of injuries. Additionally, job specific training should be given on safe work practices, hazards, and controls.
- Strength and fitness training can reduce compensation costs.
- Rotating of employees, providing a short break every hour, or using a two-person lift may be helpful.
- Rotation is not simply a different job, but must be a job that utilizes a completely different muscle group from the ones that have been over-exerted.

OTHER WORK PRACTICES

A.Standing for extended periods places excessive stress on the back and legs. Solutions include a footrest or rail, resilient floor mats, height-adjustable chairs or stools, and opportunities for the employee to change position.

B.Where employees are seated the chairs or stools must be properly chosen.

C.Proper adjustable lumbar support may be provided.

D.Static seated postures with bending or reaching should be avoided.

Workstation Ergonomic Hazard Analysis

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 the floor surface flat?
10. ____ ____ Are cushioned floor mats provided when workers stand for long periods?
11. ____ ____ Is the chair or stool easily adjustable and suited to the task?
12. ____ ____ Are all task requirements visible from comfortable positions?
13. ____ ____ Is there a preventive maintenance program for tools and equipment?

Ergonomic Task Analysis Worksheet

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?
8. ____ ____ Are the materials easy to grasp?
9. ____ ____ Are the materials free from sharp edges or corners?
10. ____ ____ Do containers have good handholds?
11. ____ ____ Are jigs, fixtures and vises used where needed?
12. ____ ____ Do gloves fit properly, and are they made of the proper fabric?
13. ____ ____ Does the task avoid contact with sharp edges?
14. ____ ____ When needed, are push buttons designed properly?
15. ____ ____ Does personal protective equipment keep from getting in the way of the task?
16. 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?
17. Is the employee trained in:
    - ____ ____ Proper work practices?
    - ____ ____ When and how to make adjustments?
    - ____ ____ Signs and symptoms of potential physical problems?

Hand tool analysis checklist

Yes No

1. Are tools selected to avoid:
   - ____ ____ excessive vibration?
   - ____ ____ excessive force?
   - ____ ____ Bending or twisting the wrists?
   - ____ ____ finger pinch grip?
   - ____ ____ Raising elbows?
   - ____ ____ 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?

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?

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?

Symptoms Survey

Name _____ Date _____

(Optional)

Work Location _____ Job _____

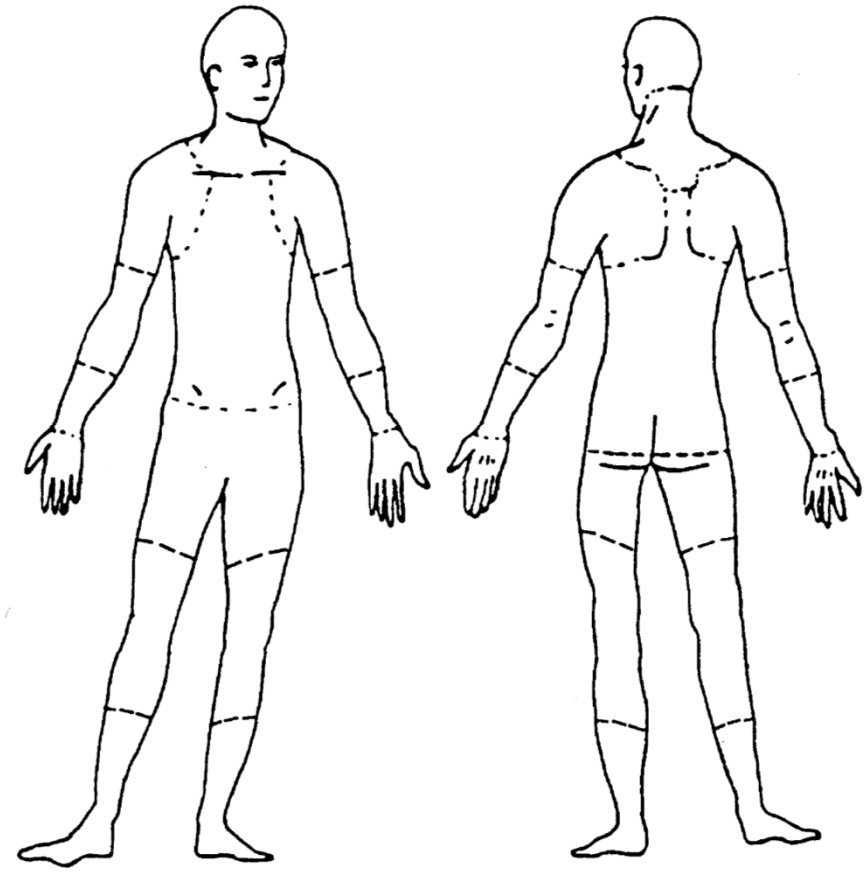
Shift _____ Supervisor _____

(Optional)

Time on this job: ____ Less than 3 months ____ 3 months to 1 year ____ 1 year to 5 years
____ 5 years to 10 years ____ Over 10 years

Have you had any pain or discomfort during the last year? ____ Yes ____ No

If you answered “Yes” to the above question, carefully shade in the area of the drawings below which indicate the location of the pain which bothers you the most.



Front **Back**

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.

   __ Aching __ Cramp __ Numbness __ Tingling

   __ Stiffness __ Burning __ Pain __ Weakness

   __ Swelling __ Color Loss __ Other (Specify) _____

2. When did you first notice the problem? __ recently ___ number of months ago __ years ago
3. How long does each episode last? _____
4. How many separate episodes have you had in the last year? _____
5. What do you think caused the problem? _____

_____

6. Have you had this problem in the last 7 days? __ Yes __ No
7. (optional) How would you rate the level of pain you experience related to 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 many days have you lost from work in the last year because of this problem? _____
10. How many days in the last year were you on modified duty because of this problem? _____
11. Have you changed jobs because of this problem? __ Yes __ No
12. Please comment on what you think would improve your symptoms:

_____

_____

_____

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