



What is ergonomics?

Traditionally, the workplace was set up for the sake of the product. Industry took great strides to ensure the product was accommodated in every way to best meet production targets and quality goals. Most often, however, workplace design and layout did not account for the most versatile element of the workplace — the human operator.

Ignoring human limitations can result in increased occupational injury and illness, and lowered productivity levels. Effective job design must include balancing task demands with human operator capabilities.

Ergonomics is the application of engineering and scientific principles to design a work environment that accommodates the employee in relationship to the workplace, product, equipment, tools, workspace and organization of the work. The objective of ergonomics is to fit the task to the worker, rather than force the person to adapt to the work environment.

What does ergonomics do?

Ergonomics draws upon many disciplines, including psychology, physiology, anatomy, mathematics, statistics and engineering that contribute to designing safe and productive workplaces.

Ergonomic workplace applications include:

- Materials handling;
- Cumulative trauma disorders (CTDs);
- Video display terminal use and office workstations;
- Adverse environmental conditions;
- Shift work and occupational stress;
- Display and control placement, design or arrangement.

Work environments that allow workers to operate more comfortably without excess physical or mental stress improve productivity, work quality, vigilance, job satisfaction and attitude. Working without the distractions of aches, pains and premature fatigue can reduce or eliminate:

- Complaints, absenteeism, tardiness and high turnover rates;
- Injuries, work restrictions, disabilities, error or scrap rates and quality problems;
- Economic loss;
- Loss in expertise.

Maximizing efficiency and reducing medical and compensation costs are sound business reasons for using ergonomically well-designed work environments. These work environments improve competitiveness and raise operational quality. Ergonomics can help:

- Return injured employees to work;
- Reduce data entry error rates;
- Increase morale and job satisfaction;
- Improve customer service.

Risk factors

Certain physical elements of a job or a task are potentially stressful and are known to contribute to CTDs. Job stresses become harmful and may result in CTDs when workers exceed their capabilities and limitations.

Risk factors, which increase the risk of developing CTDs include:

- Repetitive motions;
- Awkward postures;
- Forceful exertions;
- Mechanical pressure on soft tissues;
- Inadequate rest.

Other contributing factors include adverse environmental conditions such as cold and vibration. It is important to note that humans are exposed to such risk factors off the job as well.

Just because one or more of these factors are present in a job does not necessarily mean that a CTD will develop. However, especially with exposure to multiple risk factors, the potential for CTD is higher. Conversely, if you reduce any or all of these risk factors, the potential for overexertion or injury decreases.

Cumulative trauma

Cumulative trauma is a term referring to wear and tear on the musculoskeletal system. Cumulative indicates that physical stresses add up gradually over a period of time and result from many repeated stresses on a particular body part. Trauma signifies a bodily injury that physicians can classify as a disorder because it refers to a physical ailment or abnormal condition. Hence the term CTD.

CTDs are not limited to any particular body part. Any link, element or joint of the musculoskeletal system — muscles, nerves, tendons, ligaments, joints, cartilage and spinal disks — are subject to cumulative trauma. For instance, most back injuries are a result of cumulative trauma; they are not necessarily always a result of acute traumatic incidences.

Examples of CTDs include:

- Carpal tunnel syndrome;
- Synovitis;
- Raynaud's phenomenon;
- Tendinitis;
- Trigger finger;
- Lower back pain;
- Rotator cuff tendinitis;
- Epicondylitis;
- Muscle strains;
- Sciatica;
- De Quervain's disease;
- Carpet layer's knee.

Repetitive motion disorders and overuse syndrome are other common terms that apply to the same class of injuries.

Problem identification

Preventive measures that you should institute include early physical evaluation of employees with musculoskeletal symptoms. When physical activities (e.g., work, sports, hobbies, etc.) become excessive, localized fatigue is usually the first sign our bodies communicate. Signs of localized fatigue are discomfort (e.g., aches, pain, soreness), loss of strength and possibly trembling in the affected body parts. These symptoms tend to increase as the activity performed is continued, and usually diminish or disappear after stopping the activity.

Work site analysis

A task analysis breaks a task into its various elements or actions, describes them, measures and quantifies risk factors inherent in the elements, and identifies conditions contributing to the risk factors.

Most task analyses have several common steps. You obtain a complete description of the task. Employees are often interviewed to determine if the way the task is done changes over time. During the task analysis, the job is divided into a number of discrete elements. Each element is then studied to determine the specific risk factors that occur during the task. Sometimes each risk factor is evaluated in terms of its magnitude, the number of times it occurs during the element and how long the risk factor lasts each time it occurs.

Solutions

Establishing a formal ergonomics program is one of the most effective means of reducing CTDs.

Reducing worker exposure to risk factors is the key to controlling some upper extremity CTDs. Techniques for controlling CTDs include:

- Bend the tool, not the wrist. Select the proper tool design to eliminate poor posture. Reorient the tool, workpiece, container or workstation to achieve a straight wrist and reduce the stresses;
- Use powered instead of manual tools or equipment when work requires high forces or repetition. Keep frequently used tools and parts within easy reach;
- Working heights and reaches should allow the worker to keep the elbows close to the side of the body;
- Reduce excessive or unnecessary gripping and grasping forces. Design jigs or fixtures to hold workpieces, parts or tools. Also, power grips where all fingers can wrap around the object are preferable to using finger tips or pinch grips;
- If gloves are necessary for comfort, protection or cleanliness, take care in selecting the proper size, material and style. Poor-fitting gloves can prematurely tire the hand. Proper textures and thickness are often crucial to effective handling.

Engineering controls

You can control CTD hazards through proper engineering design of the job, workstation and equipment. Engineering controls attempt to reduce CTD risk factors, including extreme postures, excessive forces and repetitive motions.

Engineering control strategies to reduce ergonomic risk factors may include:

- Changing processes to reduce worker exposures to risk factors;
- Modifying containers such as height-adjustable material bins;
- Changing workstation layout such as using height-adjustable workbenches or locating tools and materials within short reaching distances;
- Changing tool designs;
- Automation or mechanization.

Simple measures

Recent statistics show that work-related musculoskeletal disorders (WMSDs) now account for 34 percent of all lost workday injuries and illnesses, costing tens of billions of dollars each year. The scientific basis for the relationship between work and development of WMSDs, and for addressing ergonomic problems in the workplace is well established.

Hand tools

Often, a key to eliminating risk factors is in the proper design and selection of hand tools.

Manual materials handling

First, it is important to recognize that materials handling is often one of the largest cost components of a product, operation or service. Unnecessary handling of materials costs time and money. Ergonomics focuses on job design, not on teaching how to lift.

The following is a basic list of materials handling principles designed to eliminate individual exposure to risk factors and overexertion. These principles include strategies concerning management operations, material flow, the task, the load, workplace and work space, and the worker and equipment.

Management operations

- Make purchasing agents part of the process so they can pay attention to details, such as size, weight, packaging and convenience for handling. Also, ship direct from supplier to customer to avoid freight costs and handling.
- Reduce overall work-in-process quantities to avoid overcrowding, extra handling and inventory problems.

Material flow

- Eliminate unnecessary materials handling by combining operations or shortening the distances that you must move the materials.
- Look for crossing paths, loops, backtracking and a general lack of direction as production of a material goes from start to finish. Short distances allow linking the workstations by conveyors, reducing carrying distances.
- Never work and/or store materials in aisles. Safe passage is necessary in the event of an emergency.

The job

- Be aware of the trade-off between frequency of lift and weight. Frequency challenges endurance; weight challenges strength.
- Allow the employee as much time as possible to complete the task.
- Minimize reach requirements. Design the operation for the smallest person's reach.
- Avoid needless material stacking, storing or placement of work-in-process materials such as neatly orienting parts in containers when they may be dumped out in the next operation.
- Simplify tasks by combining operations and steps.

The load

- Use large containers for high-flow volume and small containers for low volume.
- Plan for incoming materials to arrive in suitable containers so parts do not require unloading.
- Keep manually handled loads as small as possible, and keep load height less than 30 inches to avoid viewing obstruction.
- Ensure that loads are easy to grip by providing handles, cutouts, straps or textured containers.
- Stabilize contents in containers by using vertical baffles or dividers to balance the weight and avoid shifting.

Workplace — workspace

- Practice good housekeeping. Damaged floor surfaces, obstacles on the floor, damaged wheels, and dirty/slippery surfaces can complicate handling.
- Try to optimize lifting postures by storing materials between knuckle height and shoulder height.

- Provide adjustable chairs and work surfaces wherever possible to accommodate more of the working population.

Worker

For jobs with considerable manual materials handling, consider:

- Rotating employees from less-strenuous jobs;
- Splitting work among two or more employees;
- Instituting appropriate work/rest schedules.

Provide workers with specific training in:

- Mechanical handling aids;
- Recognizing materials-handling problems in the workplace;
- Procedures that can prevent excessive manual materials handling.

Remember, we do not specifically recommend requiring employees to use particular lifting techniques such as the squat lift.

Mechanical aids

Whenever practical, employees should use mechanical lifting aids to avoid lifting-related injuries.

- Pallet jack
- Chute
- Four-wheeled cart
- Dumper
- Conveyor
- Lift table
- Winch
- Positioner
- Two-wheeled hand cart
- Motorized hand truck
- Hoist
- Crane
- Power industrial vehicle
- Lift and tilt table
- Manipulator
- Upender

Try to incorporate concepts that fit the job to the worker. Consider maintenance and setup needs when planning, designing, purchasing and installing equipment. Build equipment around materials handling requirements.

Administrative controls

Administrative controls are work practices and policies established to reduce or prevent exposure to ergonomic risk factors. Engineering controls are preferred. However, administrative controls can serve as a temporary or supplemental measure until you implement engineering controls or when

engineering controls are not technically feasible. Since administrative controls do not eliminate hazards, management must ensure employees follow the practices and policies. Common examples of administrative control strategies for reducing the risk of WMSDs are:

- 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;
- Broadening or varying the job content to offset certain risk factors (e.g., repetitive motions, static and awkward postures);
- Adjusting the work pace to relieve repetitive motion risks and giving the worker more control of the work process;
- Training in the recognition of risk factors for WMSDs and instruction in work practices that can ease the task demands or burden.

Ergonomics team

An ergonomics team can be a driving force behind an ergonomics process. Ideally, an ergonomics team is composed of associates that represent the various departments throughout a company. It also is preferred to have an equal number of management and employee representatives on the team.

Consider soliciting prospective team members from:

- Management — to provide support with communication, finances and facility goals;
- Labor representatives — to ensure that the goals of the program focus on reducing injuries;
- Supervisors — to allow them to play a key role in the recognition of risk factors and the development of practical solutions;
- Associates/affected employees — to get input from the people performing the job and to promote ergonomics on the floor;
- Human resources — to provide valuable information about injury type, frequency, severity and cost;
- Engineers, facilities planning and maintenance personnel — to get expertise in machine and process design;

- Health-care provider — to provide information about injuries and illnesses;
- Plant safety representative — to provide guidance on safety management and applicable state and federal guidelines;
- Purchasing/accounting/finance — to ensure that tools and equipment purchased have desirable ergonomic characteristics.

The ergonomics team members should receive ergonomics training as soon as you form the team and as new members join the team. The team members must receive training to have a comprehensive understanding of ergonomic principles, theories and applications. The training should ensure the team members can identify ergonomic hazards and provide recommendations to reduce/eliminate the identified hazards.

Medical management

Medical-management responsibilities fall on employers, employees and health-care providers. Employers create environments that encourage early evaluation by health-care providers, employees' early reporting of symptoms and prompt evaluation by those providers. In addition, employers provide education and training to employees in recognizing symptoms and signs of WMSDs and procedures for reporting WMSDs.

Employees must abide by company work rules and follow established work processes as their part of the commitment to the medical-management team.

Health-care providers who evaluate employees, determine employees' functional capabilities and prepare opinions regarding work relatedness should be familiar with employee jobs and job tasks; this requires employer cooperation. With specific knowledge of the physical demands involved in various jobs and the physical capabilities or limitations of employees, the health-care provider can match the employees' capabilities with appropriate jobs. Being familiar with employee jobs not only assists the health-care provider in making informed case-management decisions but also assists with the identification of ergonomic hazards and alternative job tasks.

Training

Training is recognized as an essential element for any effective safety and health program. For ergonomics, the overall goal of training is to enable managers, supervisors and employees to identify aspects of job tasks that may increase a worker's risk of developing WMSDs, recognize the signs and symptoms of the disorders, and participate in the development of strategies to control or prevent them. Training of employees ensures that they are well informed about the hazards so they can actively participate in identifying and controlling exposures.

The target audience should understand the training. Use materials that consider the participants' educational levels, literacy abilities and language skills.

Open and frank interactions between trainers and trainees, especially those in affected jobs, are especially important. Employees know their own jobs better than anyone else. They often are the source of good ideas for ways to improve them. At a minimum, give employees an opportunity to discuss ergonomic processes in their jobs as they see them and engage in relevant problem-solving exercises during the training.

Recommend, review and implement change

Once workers, staff and line personnel are aware of ergonomics, they must act upon any problems they identify. An ideal ergonomically designed workplace is not accomplished until exposure to the hazards and risk factors are eliminated.

A follow-up evaluation ensures the implemented controls have reduced or eliminated the risk factors, and that no new risk factors were introduced. Use the same method of job analysis that first documented risk factors. If the hazards are not significantly reduced or eliminated, you have not finished the process.

The ergonomics process is ongoing; its purpose is to show continuous improvement. To accomplish this, set priorities for the projects according to risk factors. As you complete projects with higher risk factors, move on to the next project. Document and follow up to achieve reduction in: the incidence rate of musculoskeletal disorders; job turnover and absenteeism; and an increase in productivity or the quality of products and services.