

Ergonomic Assessments

Designing for Minimal Risk of Injury & Reducing Physical Stress of the Employee

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ABSTRACT

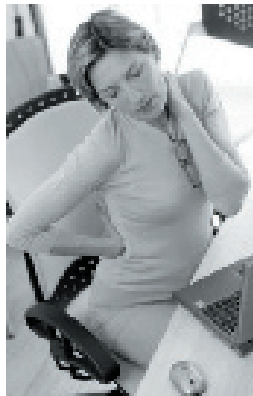
Ergonomics is the scientific study of people at work. The goal of ergonomics is to reduce stress and eliminate injuries and disorders associated with the overuse of muscles, bad posture, and repeated tasks. This is accomplished by designing tasks, work spaces, controls, displays, tools, lighting, and equipment to fit the employee's physical capabilities and limitations.

Historically, ergonomics was another name for Human Factors. Today, ergonomics commonly refers to designing work environments for maximizing safety and efficiency. Biometrics and Anthropometrics play a key role in this use of the word ergonomics. Engineering Psychology often has a specialty dealing with Workplace or Occupational Ergonomics. Companies once thought that there was a bottom-line tradeoff between safety and efficiency. Now they embrace ergonomics because they have learned that designing a safe work environment can also result in greater efficiency and productivity. Recently, U.S. laws requiring a safe work environment have stimulated great interest in ergonomics - from ergonomic furniture to ergonomic training. But it is in the design of the workplace as a whole where the greatest impact can be seen for both safety and efficiency.

"The easier it is to do a job, the more likely it is to see gains in productivity due to greater efficiency. Analogously, the safer it is to do a job, the more likely it is to see gains in productivity due to reduced time off for injury. Ergonomics addresses both of these issues by maximizing the workspace and equipment needed to do a job."

What Is Ergonomics?

Ergonomics is the practice of adapting a job to the person so work can be performed without harmful strain or injury. Effective ergonomics reduces discomfort and injuries and increases job satisfaction and productivity. Ergonomics is the applied science of equipment design and configuration that seeks to maximize productivity and reduce risks by adapting the work environment to meet the physical needs of the worker. An ergonomic assessment is an evaluation of the biomechanics of the work environment that includes recommendations for engineering and/or administrative modifications to the workplace. Ergonomically designed workplaces can help employees avoid pain and injuries that may arise from such risk factors such as repetitive tasks.



Ergonomic Principles

Ergonomics is about fitting the task to the person, and fitting the person to the task. When ergonomic principles are applied in a work environment, many workplace injuries are avoided and work performance can be improved. To have "good ergonomics", ergonomic risk factors with the work task and the individual must be identified and eliminated or reduced.

The Work Task

Some common ergonomic risk factors associated with the task include:

- Awkward postures
- Prolonged positions
- Repetitive movements
- Excessive force
- Contact stress
- Environmental conditions such as heat, cold, loud noise and poor visibility
- Vibration

Awkward postures:

These are body positions that are uncomfortable, or put the body parts in use in a mechanical disadvantage. Muscles and joints work most efficiently in specific positions, usually at the mid point of the joint's range of motion. When muscles are working at the same time as they are being stretched, they are more susceptible to injury.



Prolonged positions:

Positions held for long periods of time can cause fatigue to supporting muscles which results in discomfort and can lead to injury if fatigued muscles are required to work. Certain positions place increased pressure on body structures, and if held for long periods of time can cause damage to those

structures. A common example of this is the pressure exerted on discs in the lower back whenever the low back is in a flexed position such as driving or sitting in a chair.

Repetitive movements:

These can lead to overuse of muscles and tendons. Muscles and tendons may be subjected to micro trauma that causes pain. This is especially problematic if the repetitive movements are also performed in an awkward posture. In this case, muscles and tendons may actually rub against other bony structures causing wear or breakdown within the muscles and tendons.

Contact Stress:

This occurs when there is pressure exerted on a body part, for example, when kneeling on the floor for an extended period there is contact stress on the knees. Contact stress can cause irritation to the body, particularly when combined with awkward postures.



Environmental conditions:

Muscles fatigue faster in hot conditions and gripping objects or tools can become difficult to maintain with sweaty palms. Alternating between tasks, or taking more frequent breaks from the task may be required when working in hot weather or confined spaces. In cold conditions, blood flow to the extremities is reduced and consequently muscle performance is reduced. Wearing appropriate clothing and warming up the working muscles with light exercise before commencing the work duties may minimize the impact of cold weather. Loud noise can compromise attention to a task and can create tension within the body. Poor visibility may lead to poor hand-eye coordination during a task, or may place the body in an awkward position while straining to see properly.

Vibration:

The blood supply to vibrating areas of the body is reduced, which reduces the ability of the muscles to contract and leads to more rapid fatigue. Whole body vibration is experienced by operators of vehicles, particularly heavy vehicles. Hand-arm vibration occurs in workers using vibrating or impact tools such as rattle guns, drills or hammers.

How to Reduce Ergonomic Risk Associated with the Task:

1. Eliminate the task.

This is the most effective way to reduce ergonomic risk, but is usually the most difficult, and is often not an option. For example, repairing a heavy piece of machinery (such as a pump or engine) on site, rather than removing it for repair, eliminates the task of moving the machinery.

2. Substitute the task.

For example, using a trolley to transport boxes from A to B, instead of a person carrying the boxes or a conveyor to transfer loads instead of carrying them.

3. Modify the task.

This includes changing tools or equipment, breaking up the task so that it is shared between people or is performed in shorter bursts of activity interchanged with different activities. An example would be the provision of pneumatic tools instead of manual based on a production line assembly.

4. Personal protective equipment.

This is the least effective method of managing ergonomic risk. It includes the use of knee pads, gloves and anti vibration mats for absorbing pressure, shock and vibration, reducing the impact on the body.

THE INDIVIDUAL

Common ergonomic risk factors associated with the individual may include:

1. Acquired postural changes:

Over time the body can develop poor posture from repeated tasks, even in a proper ergonomic environment. Without regular attention to posture, these changes have a risk of causing strain, nerve compression, muscle injury, and may lead to permanent changes.

2. Restricted range of motion:

If joints don't have full range of motion due to degenerative change or previous injury, the joint surfaces may be under increased or abnormal load. Muscles and tendons surrounding the affected joints may also be at risk of overuse or injury due to altered biomechanics.

3. Inadequate cardiovascular fitness:

Cardiovascular endurance is essential for many physical jobs. Without proper fitness, the individual will fatigue quickly and be unable complete job demands.

4. Inadequate physical strength:

If the individual does not possess enough strength to complete the job tasks such as lifting, carrying, pushing, pulling or tool use he or she will be at risk of physical injury.

5. Physical disabilities:

Individuals with permanent physical disabilities (i.e. altered visual acuity or hearing, amputation, spinal cord injury, physical trauma) may have increased risk of overuse in affected or other tissues due to altered perception, biomechanics, or strength.

How to Reduce Ergonomic Risk Associated with the Individual.

Employees in jobs prone to musculoskeletal and repetitive motion disorders need to prepare for each day and different tasks by stretching and warming up, just as an athlete would do before a game. This is the

primary foundation of the Industrial Athlete approach. Maintaining physical health and good posture is essential for preventing injury. A Functional Requirement Evaluation (FRE) can assess an individual's fitness to perform tasks associated with a job. Prolonged and repetitive work at any workstation can cause fatigue, muscle soreness, and even serious injury. Improper posture aggravates the situation further.

Description of 4 Levels of Ergonomic Assessments:

Level One: "Prevention"

Level One is a, concise and effective option when an individualized approach is necessary. Modifications are suggested to promote a better fit between the worker and their workstation. Designed for the low-risk and symptom free employee, this is a particularly effective way to evaluate individual employees. This will qualify as a "good faith effort" under OSHA.

Level Two: "Protective"

Level Two is a comprehensive individual workstation evaluation, with a detailed report. Level Two is appropriate for employees with complaints of work-related pain/discomfort or groups of individuals in ergonomic "red flag" areas (data entry, call centers, materials handling, etc.). "Protective" evaluations are designed to eliminate current complaints and prevent future incidents.

Level Three: "Post-Injury"

Level Three is a personalized assessment of the workspace performed during or after medical intervention (work or non-work related injuries) to ease return to work and maximize the employee's capability.

Level Four: "Follow-Up"

These visits are designed to ensure workstation recommendations and equipment modifications have been implemented properly. This is particularly important if the job functions, equipment or environment have changed. Individuals who received either a prevention or formal assessment in the past will be re-visited in person or by phone.

Description of Ergonomic Job Hazard Assessment

An ergonomic job assessment provides practical solutions to ergonomic concerns encountered in working conditions where cumulative trauma disorders / repetitive strain injuries, acute soft tissue injuries, or other ergonomic concerns are present.

The ergonomic job assessment consists of three phases: review of process, on-site assessment, and final documentation. The process assessment consists of a review of process design, equipment, previous analyses, and incident reports. The on-site analysis may consist of video recording and/or digital pictures, measurement gathering (force, weights, reach / carry distances, lifting heights, etc). The documentation phase addresses all employee and management comments and concerns. Identifying and measuring work risk factors in an industrial environment can be complicated and time consuming tasks; especially when there are many different jobs and job tasks that workers may perform every day. Only reacting to injury claims does not allow a company to work towards preventing injuries.

"It is important to take into account job rotation and subsequent associated essential duties and high risk factors."

Ergonomic Assessments Are Good For Business

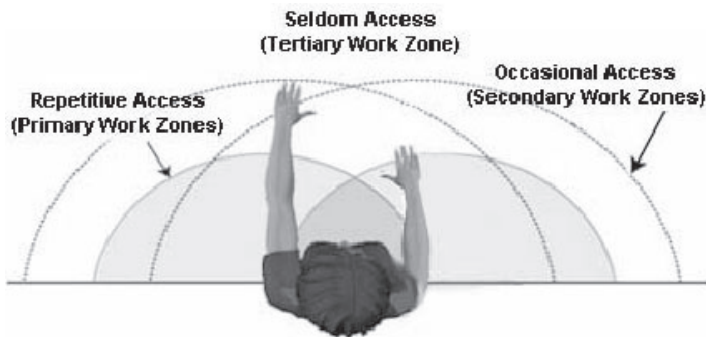
There are countless reasons why thousands of businesses have already chosen to incorporate the use of ergonomics in their workplace. Most companies adopt ergonomics to increase worker productivity, improve attendance, and protect the health of their employees; while others utilize the practice to simply fulfill regulatory requirements or to meet the individual needs of some workers. No matter what the circumstance is for its incorporation, every business can benefit from the use of ergonomics and undergoing an ergonomic assessment should be the first step taken in the process.

Industrial Ergonomic Evaluation Example:

Ergonomic Assessment of a Standard Workstation

An ergonomic assessment involves analyzing how the individual interacts with workstation, their job tasks / requirements and the products they are using. Basically it looks at the person and their working environment. This assessment involves assessing the need to adjust and make recommendations regarding the employee's workstation including, but not limited to:

- Chair/seating
- Desk
- Monitor/laptop
- Mouse
- Footrest
- Document solutions
- Keyboard
- Lighting



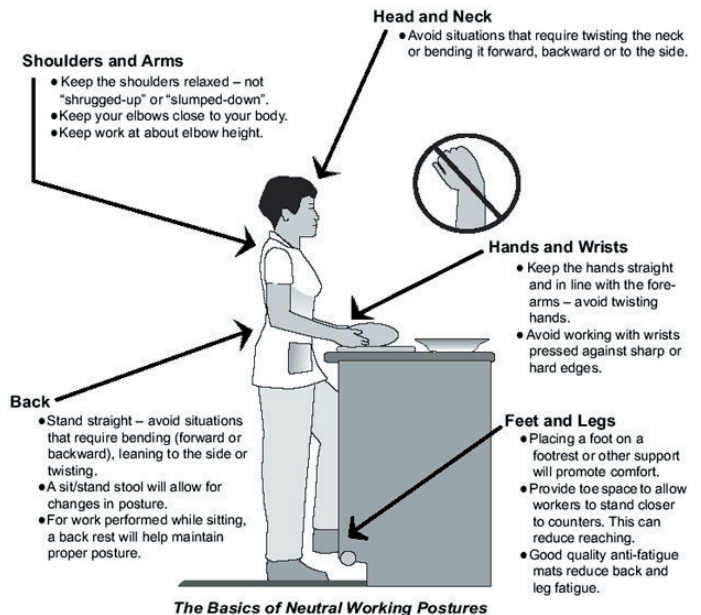
The assessment must also consider the individual's

- Posture
- Work habits
- Work speed
- Individual limitations
- Repetitious movements

Following an ergonomic assessment there are usually recommendations made to the employee about the posture, having rest and stretch breaks, etc. The employer is notified if there is a requirement for any pieces of equipment. The aim of this assessment is to recognize potential risk factors for the individual using the workstation and provide them with strategies to maximize their ergonomic workstation and minimize the risk of injury. To understand the best way to set up a computer workstation, it is helpful to understand the concept of neutral body positioning. This is a comfortable working posture in which your joints are naturally aligned. Working with the body in a neutral position reduces stress and strain on the muscles, tendons, and skeletal system and reduces your risk of developing a musculoskeletal disorder (MSD).

The following are important considerations when attempting to maintain neutral body postures while working at the computer workstation:

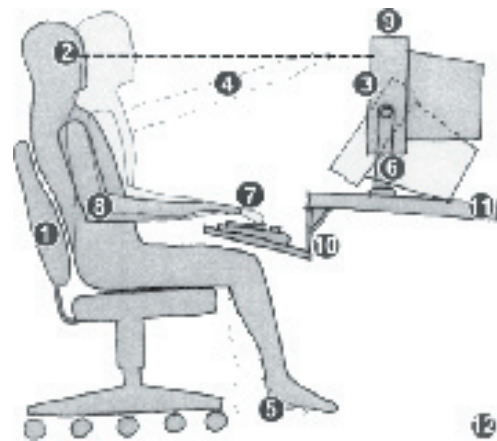
- Hands, wrists, and forearms are straight, in-line and roughly parallel to the floor.
- Head is level, or bent slightly forward, forward facing, and balanced. Generally it is in-line with the torso.
- Shoulders are relaxed and upper arms hang normally at the side of the body.
- Elbows stay in close to the body and are bent between 90 and 120 degrees.
- Feet are fully supported by the floor or a footrest may be used if the desk height is not adjustable.
- Back is fully supported with appropriate lumbar support when sitting vertical or leaning back slightly.
- Thighs and hips are supported by a well-padded seat and generally parallel to the floor.
- Knees are about the same height as the hips with the feet slightly forward.



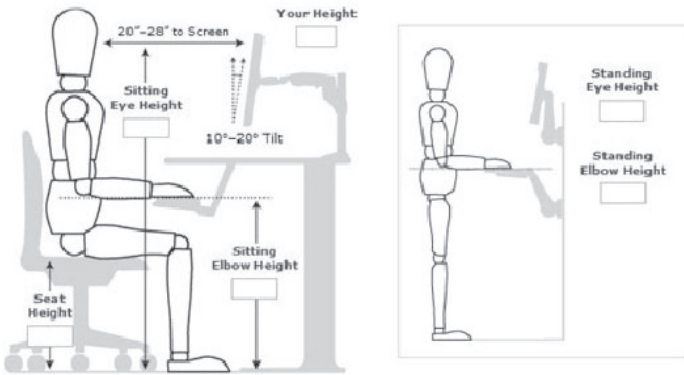
Regardless of how good your working posture is, working in the same posture or sitting still for prolonged periods is not healthy. You should change your working position frequently throughout the day in the following ways:

- Make small adjustments to your chair or backrest.
- Stretch your fingers, hands, arms, and torso.
- Stand up and walk around for a few minutes periodically

Example of a WorkStation Analysis:



1. Use a good chair with a dynamic chair back and sit back
2. Top of monitor casing 2-3" (5-8 cm) above eye level and 20 to 28" from the screen
3. No glare on screen, use an optical glass anti-glare filter where needed w/ 10 to 20 degree tilt
4. Sit at arms length from the monitor
5. Feet on floor or stable footrest
6. Use a document holder, preferably in-line with the computer screen
7. Wrists flat and straight in relation to forearms to use keyboard/mouse/ input device/wrist support
8. Arms and elbows relaxed close to body
9. Center monitor and keyboard in front of you
10. Use a negative tilt keyboard tray with an upper mouse platform or downward tilttable platform adjacent to keyboard



11. Use a stable work surface and stable (no bounce) keyboard tray
12. Take frequent short breaks (micro breaks) and perform stretches of extremities and total spine

**Note: For standing position workstations the measurements noted above are identical.*

Ergonomic Injuries: The Facts

- Overexertion is the number one cause of workplace injury.
- The direct cost of overexertion injuries for the U.S. economy was \$12.7 billion in 2005 and the cost of workers' compensation (WC) claims has risen 8% annually.
- The average cost of a WC claim for cumulative trauma disorders (such as carpal tunnel syndrome) is \$17,757 and musculoskeletal disorders comprise one-third of all lost work time injuries and illnesses.
- Ergonomic hazards are estimated to account for about 40% of the Workers' Compensation claims paid in 2006 and 2007.
- Overexertion and Repetitive Motion resulted in the highest median days away from work (34 days) for major disabling injuries.

The Business Case

There are many business reasons to support an ergonomics initiative. Three typical primary justification drivers for ergonomic programs include regulatory compliance, health and safety performance, and production enhancement.

Regulatory Compliance

Although there is currently no federal ergonomics standard, ergonomics still falls under OSHA's General Duty Clause, which states that every employer must provide "a safe working environment for their employees." There are also some states that have state plans specific to ergonomics, such as California. In addition, other states are currently in the process of looking to establish state plans, like the Michigan Ergonomics Standard. Still others have taken voluntary action, such as Minnesota's Ergonomics Task Force and Oregon's Ergonomics Stakeholder Group. OSHA has also issued guidelines for certain industries (e.g., poultry processing and patient handling), but these are voluntary guidelines, not regulatory guidelines. Outside of the U.S., there are European and Non-European Union guidelines and standards, such as the EN ISO 12100, an ergonomic design standard for machinery, and the ISO standards 5349: 1:2001 and 2:2001, which address vibration exposure.

Health and Safety Performance

Business managers know that health and safety performance is an important element in maintaining a well trained, motivated workforce. The financial benefit of reduced workers' compensation costs related to Work Related Musculoskeletal Disorders (WMSDs) can be substantial.

Production Enhancement

Productivity and value-added improvements have proven to be the most straightforward means of cost justifying ergonomic improvements. Productivity is measured at the workstation level, so it fits easily into typical

cost justification processes. Also, it is simple to predict and quantify the productivity impact of ergonomic improvements that leads to cost savings in many areas including: quality, delivery and work station production.

Cost versus Value:

In today's business climate, any initiative that does not deliver short to mid term measurable value is considered an option, rather than a requirement. Ergonomic improvements are more likely to be supported and accelerated if they fit into a cost justification process. Cost justification is a normal business process used by managers and executives to weigh the costs and benefits of various improvement initiatives. Managers are challenged every day to do more with less and are often measured on how quickly they can improve productivity and quality.

Cost justification:

- Enables communication with safety, engineering, or management
- Takes the focus away from injuries (reactive)
- Focuses on taking action before an injury occurs (proactive)
- Enables you to prioritize countermeasures (compare payback periods)
- Makes good business sense and affects the bottom line

Management must often weigh the merits of ergonomic improvements against other potential projects. Ergonomic projects that result in return on investment (ROI) are both effective and efficient in reducing hazard exposures.

Return on Investment

In the manufacturing environment, time is the dominant component, and we all know that awkward and or sustained postures, high forces, and repetitive movements take more time to complete. The challenge is quantifying the financial benefits of reducing force, frequency, and posture. Motion time can be converted to money. Ergonomics can affect productivity in two main ways: elimination of non-value-added tasks and reduction in motion waste. Cost justification is based on the ability to choose the best ergonomic improvements for the available resources. For each ergonomic improvement, the benefit should outweigh the cost (this is the "benefit-to-cost ratio"). The easiest and most effective way to estimate benefits of ergonomic improvements is to focus on productivity impact. Time savings from eliminating non value-added tasks and reducing motion times can be used to project effects on productivity.

Summary



According to OSHA, finding solutions to the problems posed by ergonomics hazard may be the most significant workplace safety and health issue of the 1990's. Dr. J. Donald Miller, recently retired Director of NIOSH (National Institute for Occupational Safety and Health), is quoted as saying, "that by any epidemiological criteria, occupational musculoskeletal injuries represent a pandemic problem in the United States with gigantic effects on the quality of millions of peoples' lives every year." Ergonomic disorders including CTS, various tendon disorders and lower back injuries, are the most rapidly growing category of OSHA recordable injuries and illnesses. The Bureau of Labor Statistics reports that of all occupational illnesses, musculoskeletal disorders rose from 18% in 1985 to 52% in 1989 and 56% in 1991. Though cost estimates vary greatly, it is believed that medical and workers' compensation costs of these disorders are estimated to exceed \$100 billion annually.

The identification and review of ergonomic hazards in the workplace benefits the employer, the employee and the overall long term profitability and sustainability of the workforce. Increased production, a safer work environment and a healthier employee base results in lower medical costs (direct and indirect) and a reduction in lost time. It behooves the employer to review their high risk jobs where they presently see their highest incidence of injuries. Contact a professional to review opportunities for enhancement of their existing risk management model through the incorporation of ergonomics.

The program noted above is a component of the Fit2WRK model by USPh. This integrated model is available through USPh in close to 400 facilities and 44 states nationally. For additional information on how the Fit2WRK Model could help your organization visit: www.Fit2WRK.com or call 1-877-Fit-2WRK.

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