UNIT-17 Injury prevention through Safety

Learning Outcomes

By the end of this unit the learner will be able to:

- ✓ Define ergonomics and its related terms
- ✓ Identify where to get ergonomics information for your region
- ✓ Identify how ergonomics can be incorporated into your workplace
- ✓ Assess your environment for ergonomic hazards, create ways to resolve those issues, and plan for implementation
- ✓ Review and evaluate your ergonomic efforts
- ✓ Use change management techniques effectively
- ✓ Describe the basic principles of ergonomics
- ✓ Outline ergonomic practices for sitting, standing, lifting, carrying, pushing, and pulling
- ✓ Design an ergonomic workstation

Unit 17
Injury prevention through Safety

Getting Started

What is Ergonomics?

The **International Ergonomics Association** defines ergonomics like this:

Ergonomics (or **human factors**) is the scientific discipline concerned with the understanding of the interactions among humans and other elements of a system, and the profession that applies theoretical principles, data, and methods to design in order to optimize human well-being and overall system performance.

(Source: http://www.iea.cc/01_what/What%20is%20Ergonomics.html)

Ergonomics is designed to help minimize and/or prevent **musculoskeletal disorders (MSD's)**, also known as **repetitive strain injuries (RSI's)**. These conditions involve the nerves, tendons, muscles, ligaments, and other supporting structures in our bodies. Some examples include:

- Carpal tunnel syndrome
- Tennis elbow
- Carpet layer's knee
- Pitcher's shoulder
- Humidifier's lung

These injuries develop over months or even years of the same type of work, in contrast to a sudden workplace injury (like a fall or amputation).

There are four key **risk factors** for these types of injuries:

- Frequent and/or heavy lifting, pushing, and/or pulling
- Extended time spent in awkward postures (such as holding a piece of ceiling drywall up for several hours of the day)
- Exposure to excessive noise and/or vibration (commonly through hand tools or machinery)
- Frequent, forceful, and/or lengthy exertion

These risks are increased when:

- Multiple factors are present
- People are exposed for lengthy periods of time (i.e. eight hours a day, or a career of a constant stressor being present)
- Temperatures are extreme

A 2009 survey by the United States Bureau of Labor Statistics showed that in 2008, of the just over one million

workplace injuries reported, 317,440 of them were musculoskeletal disorders. 75% of these injuries were caused by an overexertion, 40% were caused by over-lifting, and 9% were caused by repetitive motion. (The remaining percentage was caused by miscellaneous events.)

(Source: http://www.bls.gov/iif/oshfaq1.htm#q09)

It is clear that companies can save money; be more productive; and create a happier, healthier workforce by making their workplace more ergonomic.

Legislation and Regulatory Bodies

Before beginning any kind of ergonomic assessment or changes in your workplace, you must be aware of the legislation and/or regulatory bodies in your areas. In the United States, for example, the Occupational Safety & Health Administration has guidelines on developing programs, as well as recommendations for specific industries. Additional guidelines are in place in 27 states.

Governing Agencies

If you are not sure where to look, we recommend consulting the safety division of your government. Here is a brief list of some governing agencies.

Area	Organization(s)	Web Site
Asia	Asia Pacific Occupational Safety and Health Organization	http://www.aposho.org
Canada	Canadian Centre for Occupational Health and Safety	http://www.ccohs.ca
European Union	European Agency for Safety and Health at Work	http://osha.europa.eu
Great Britain	Health and Safety Executive	http://www.hse.gov.uk
Mexico	Secretaría del Trabajo y Prevision Social	http://www.stps.gob.mx
United States of America	Occupational Safety and Health Administration (OSHA)	http://www.osha.gov

NOTE: These organizations and links were accurate at the time of printing. Velsoft takes no responsibility for the content of these sites, whether by inclusion or omission.

International Ergonomics Association and Affiliates

Another excellent resource is the International Ergonomics Association (http://www.iea.cc), an umbrella organization for global ergonomics and human factors groups. Their website provides a list of recognized ergonomic associations. We have reprinted it here for your convenience.

However, note that although these organizations and links were accurate at the time of printing, Velsoft takes no responsibility for the content of these sites, whether by inclusion or omission.

Area	Organization	Web Site
Argentina	Asociación de Ergonomía Argentina	http://www.adeargentina.org.ar
Australia	Human Factors and Ergonomics Society of Australia	http://www.ergonomics.org.au
Belgium	Belgian Ergonomics Society	http://www.besweb.be
Brazil	Associação Brasileira De Ergonomia	http://www.abergo.org.br
Canada	Association Of Canadian Ergonomists	http://www.ace-ergocanada.ca
France	French Language Ergonomic Society	http://www.ergonomie-self.org
Germany	Gesellschaft Für Arbeitswissenschaft	http://www.gfa-online.de
Greece	Hellenic Ergonomics Society	http://www.ergonomics.gr
Hong Kong	Hong Kong Ergonomics Society	http://www.ergonomics.org.hk
Hungary	Hungarian Ergonomics Society	http://www.met.ergonomiavilaga.hu/subsites/index_eng.htm
India	Indian Society of Ergonomics	http://www.ise.org.in
Ireland	Irish Ergonomics Society	http://www.irishergonomics.com
Israel	Israeli Ergonomics and Human Factors Society	http://www.ergonomicsisrael.org/joomla
Italy	Societa Italiana Di Ergonomia	http://www.societadiergonomia.it
Japan	Japan Ergonomics Society	http://www.ergonomics.jp

Area	Organization	Web Site
Latvia	Latvian Ergonomics Society	http://www.ergonomika.lv
Mexico	Sociedad de Ergonomistas de Mexico	http://www.semac.org.mx
Netherlands	Nederlandse Vereniging Voor Ergonomie	http://www.ergonoom.nl
New Zealand	New Zealand Ergonomics Society	http://www.ergonomics.org.nz
Nordic Countries: o Denmark o Iceland o Finland o Norway o Sweden	Nordic Ergonomics Society	http://www.nordicergonomics.org
Poland	Polskie Towarzystwo Ergonomiczne	http://ergonomia-polska.com
Russia	Inter-Regional Ergonomics Association	http://www.ergo-org.ru
Singapore	Ergonomics Society of Singapore	http://www.ergoss.org
South Africa	Ergonomics Society of South Africa	http://www.ergonomicssa.com
Spain	Asociación Española de Ergonomía	http://www.ergonomos.es
Switzerland	Swiss Ergonomics Association	http://www.swissergo.ch
Taiwan	Ergonomics Society of Taiwan	http://www.est.org.tw
Thailand	Ergonomics Society of Thailand	http://www.est.or.th
Tunisia	Société Tunisienne d'Ergonomie	http://www.st-ergonomie.org
Ukraine	All-Ukrainian Ergonomics Association	http://www.ergotech.org.ua
United Kingdom	Institute of Ergonomics and Human Factors	http://www.ergonomics.org.uk
United States of America	Human Factors & Ergonomics Society	http://hfes.org

The Role of Ergonomics in Your Workplace

A Plan for Everyone

The way in which ergonomics is handled in the workplace will differ depending on the industry, size of the workplace, and legislation in the region. Here are a few of the most common scenarios that we have seen.

Integration with Workplace Safety Committee

In many organizations, ergonomic projects are included in workplace safety plans. The advantage to this approach is that efforts can be synchronized and re-work can be prevented. However, the downside is that ergonomics can be overshadowed by more pressing concerns about workplace injuries.

To help prevent this, ergonomics should be included as a special item on all agendas and an ergonomics representative should be appointed. This approach works well for small companies.

Special Committee

In larger organizations, a special ergonomics committee may be appointed. This group works in conjunction with the safety committee, company executives, department managers, and employees to identify and assess ergonomic hazards. They also help to develop and implement plans to reduce those hazards.

This approach works best for with large organizations that have a high ergonomic risk, such as moving companies, warehouses, and production facilities.

Ergonomics Coordinator

Another approach is to have a qualified ergonomist act as consultant and coordinator. They work with individual teams and departments to identify, assess, and resolve ergonomics hazards. In order for this to work, the coordinator must have the funds, ability, and authority to implement changes. This is an excellent approach for small organizations that have a high ergonomic risk.

Case Studies

Sunshine Cleaners

Description
A centralized company that offers residential and small business cleaning within four metropolitan areas.

Company Size

- One general manager
- Four office managers
- Eight dispatchers, two for each office
- 36 cleaners

Employee Tasks

- Office managers split time between office and field
- Dedicated safety manager who works under the general manager
- Dispatchers spend 12 hour shift at call station
- Cleaners perform wide range of tasks; some involve lifting and reaching

Recommended Ergonomic Plan

Super Service Customer Care Group

Description
A large call center that provides outsourced customer care services to nine major retailers.

Company Size

- One CEO, one CFO, and one COO
- Ten operations managers
- 50 team leaders
- 500 full-time and 100 part-time customer care representatives

Employee Tasks

- All work involves sitting for eight to ten hours
- Customer care representatives sit in a 6 foot by 6 foot cubicle and use a computer and headset
- COO leads a safety committee with two operations managers, five team leads, and five employees

Recommended Ergonomic Plan

Smith Moving

Description
A large moving company that focuses on large businesses.

Company Size

- One CEO/CFO
- 5 fleet leaders
- 50 drivers
- 250 movers

Employee Tasks

- Fleet leaders and CEO/CFO spend a lot of time in the office (on computer and telephone)
- Movers sometimes pack items beforehand

- Moving, carrying, and lifting comprise most of the movers' workday
- Drivers and movers can spend a lot of time in vehicles
- Outsourced safety coordinator currently works with fleet leaders to plan for safety measures

Recommended Ergonomic Plan

Armadillo Security

Description
A small company that provides security for a local shopping mall, including visible patrols and secret shoppers.

Company Size

- One general manager
- Six security people

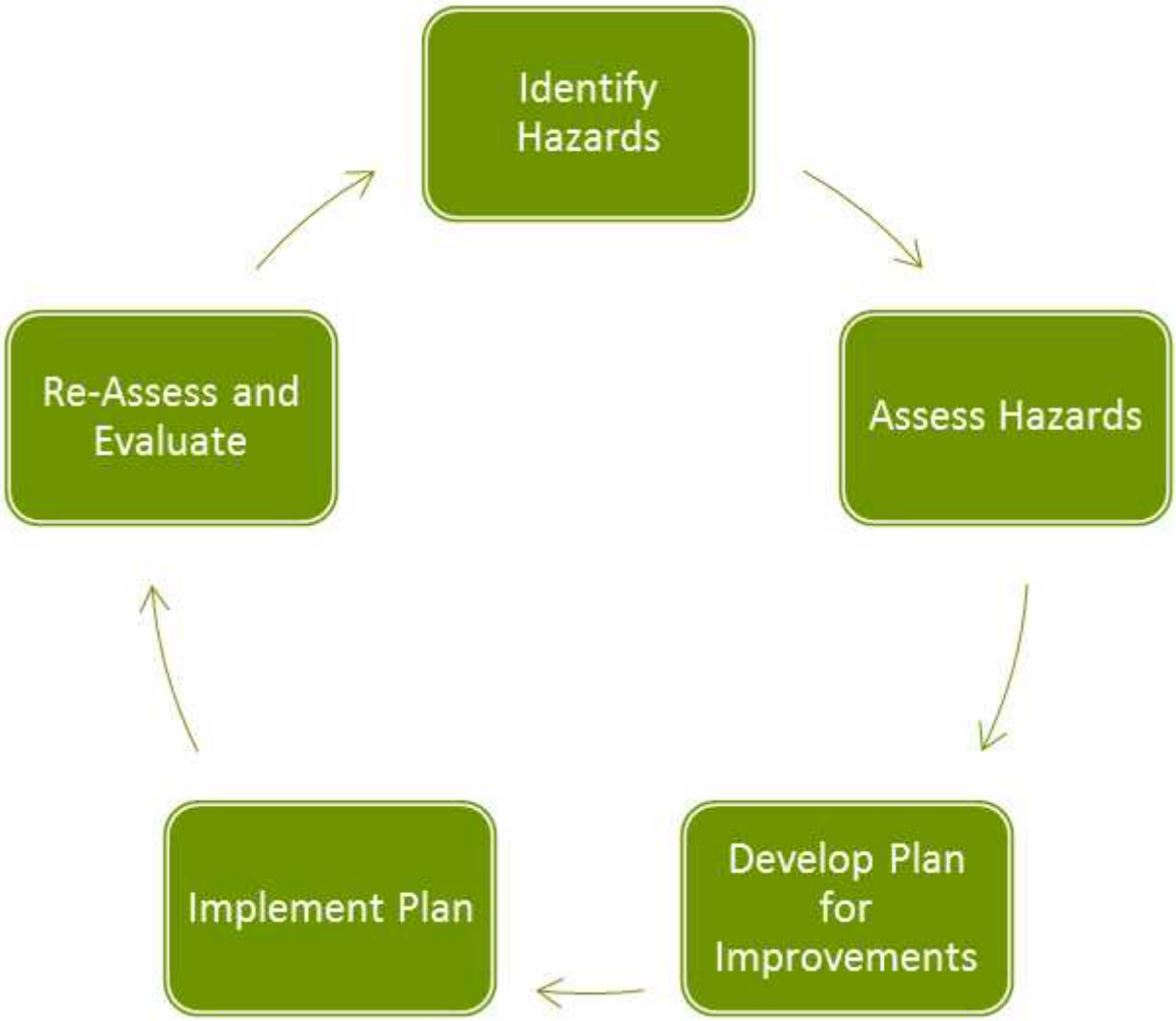
Employee Tasks

- Security people spend 10 to 12 hours a day on their feet
- General manager spends eight hours per day performing general office tasks
- No safety plan in place

Recommended Ergonomic Plan

The Ergonomic Assessment Cycle

Like any effort, ergonomic improvement should be structured and scheduled. The typical cycle looks like this:



It is important that re-assessment and evaluation is done periodically, typically once a year. This will enable the company to stay on top of any new trends and nip problems in the bud.

Let's start by looking at how to identify and assess ergonomic hazards.

Identifying and Assessing Ergonomic Hazards

How to Identify Ergonomic Hazards

Identifying possible hazards is the first step in making the workplace more ergonomic. This is a task that the ergonomics team can take on, with the assistance of all employees in the workforce. The purpose of this step is to identify areas that appear to have ergonomic issues. The next step will be to assess the severity and impact of these issues.

Because there are so many variables to consider from workplace to workplace, hazards will differ depending on where you are. However, here are some of the most common types of hazards.

Area	Description
Biomechanical	Hazards posed by person's posture, movement, and actions
Operative	Hazards caused by human interaction with systems and machines
Environmental	Hazards caused by environmental factors, such as noise, light, and air quality

Now, let's look at how to identify where hazards may exist.

Look at safety data.

Review safety and injury data and look for patterns that might point to an ergonomic hazard. You are looking for non-specific complaints like headaches, back pain, hand and wrist pain, etc. Also be on the lookout for specific disorders like carpal tunnel syndrome, carpet-layer's knee, and other industry-specific ailments. (If you are not sure what to look for, look at worker's compensation data for your industry and region.)

Perform a job analysis for each position.

Although this can be time-consuming, it is the best way to identify ergonomic hazards. With this method, you review each job thoroughly, looking at each task that the job entails and the methods used. Ideally, this analysis will be performed with the employee. You can also use pictures and/or videos if available.

Remember, you are looking for:

- Frequent and/or heavy lifting, pushing, and/or pulling
- Extended time spent in awkward postures (such as holding a piece of ceiling drywall up for several hours of the day)
- Exposure to excessive noise and/or vibration (commonly through hand tools)
- Frequent, forceful, and/or lengthy exertion

Also be aware of exacerbating factors like:

- Multiple factors present
- People being exposed to a risk for lengthy periods of time
- Extreme temperatures

Look at production data.

Production problems can also point to ergonomic issues. Look for quality problems, bottlenecks, and/or recent slowdowns. See if there is a documented solution to these issues; if not, include these areas in your assessment for further evaluation.

Ask about complaints.

Are the typists always complaining about sore necks? Does the warehouse team grouch about the super-bright light? Does the packaging team grumble about the hard plastic chairs? Although objective, these are all signs that an ergonomics problem exist. Take them seriously and perform a further assessment.

Use software.

There are many software packages out there that can analyze common workplace scenarios, identify possible ergonomic hazards, and offer tips for improvement.

An Assessment Toolkit

Once you have identified possible hazards, you need to perform a more thorough assessment.

Use a checklist.

A checklist can help organize the analysis and ensure that nothing is missed. It can also help identify common industry hazards. However, it may be too comprehensive or it could exclude aspects particular to your workplace. If you're going to use a checklist, have the ergonomics or safety committee review it first to ensure that it is applicable and appropriate.

Use lifting calculators.

Take the guesswork out of whether a lifting task is safe or not by using calculators to determine how much strain the worker is putting on their body. There are many formulas out there; consult with your regulatory organization to find the best one to use.

Have employees complete a symptom survey.

Symptom surveys ask employees to identify areas of discomfort and check off terms to describe that discomfort, like aching, burning, swelling, stiffness, weakness, etc. Or, they are asked to rate the level of pain that they feel in that area. Ensure that these surveys are legal in your jurisdiction. As well, be sure to have them approved by your human resources and legal teams before using them. Confidentiality policies and limits of data gathering should also be clearly outlined and adhered to.

Complete employee interviews.

Another method of assessing the severity of an ergonomic hazard is to interview employees. Questions to ask include:

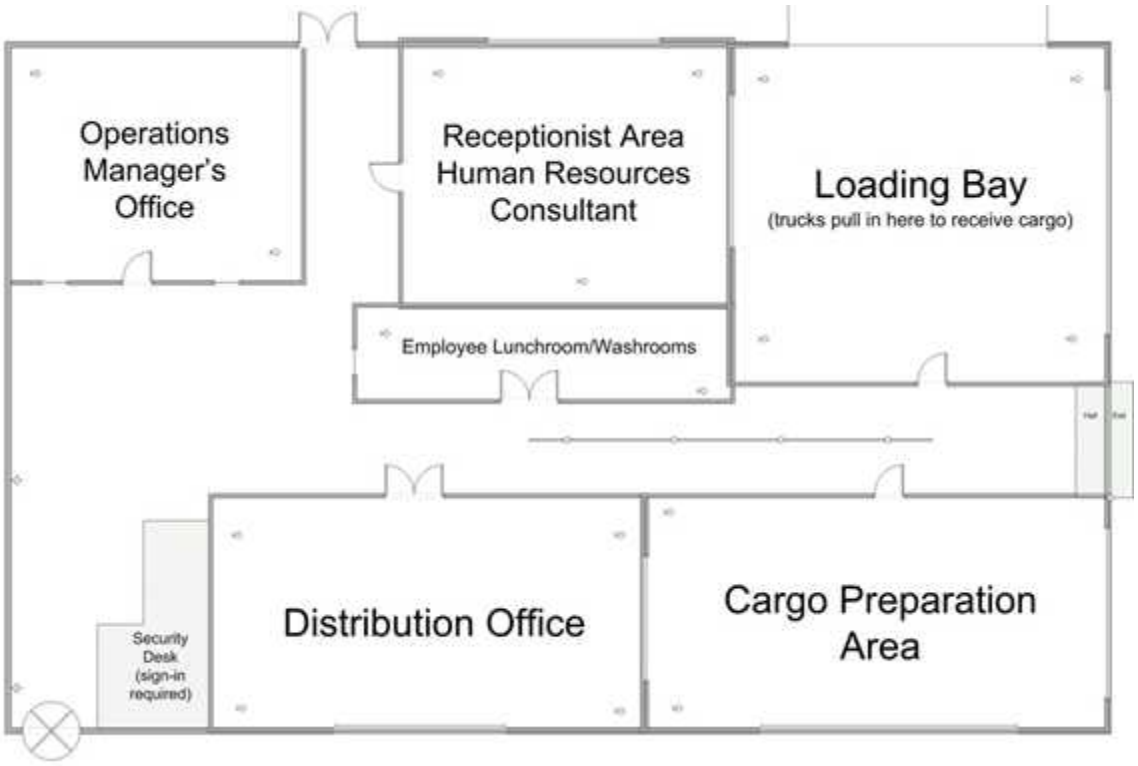
- What kind of work do you do?
- What lifting, pushing, or pulling is involved in your work?
- How many hours a day do you spend at a computer or other machine?
- What repetitive tasks do you perform?
- How long does each task take?
- Do you feel tired during a particular task?
- Do you feel pain or discomfort during a particular task?
- What health problems do you have (diagnosed or undiagnosed)?
- How do you sleep at night?
- What concerns do you have?
- What ideas do you have for improvement? What else would you like to share?

Remember, have questions approved by your human resources and legal teams before using them. Confidentiality policies and limits of data gathering should also be clearly outlined and adhered to.

Case Study: The Acme Widget Company

Part One: Background Information

The Acme Widget Company manufactures and distributes widgets. It occupies the main floor of a warehouse. The floor plan looks like this:



SITE MANAGEMENT

The staff and their hours are outlined below.

Staff Member	Responsibility	# of Staff	Hours Worked
Security guards	o Patrol building and grounds every half hour o Monitor security desk and cameras	2	7 am to 7 pm (Sun-Wed)
		2	7 am to 7 pm (Thu-Sat)
		2	7 pm to 7 am (Sun-Wed)
		2	7 pm to 7 am (Thu-Sat)
		1	Backup; varies
Operations manager	o Oversee all staff	1	8 am to 4 pm
Distribution clerks	o Check invoices and prepare cargo o Transport cargo to loading bay	2	7 am to 7 pm (Sun-Wed)
		1	7 am to 7 pm (Thu-Sat)
		2	7 pm to 7 am (Sun-Wed)
		1	7 pm to 7 am (Thu-Sat)
		1	Backup; varies
HR consultant	o Manage all human resource issues	1	8 am to 4 pm, although can be called in off-hours
Receptionist	o Respond to incoming phone calls, e-mails, faxes o Prepare invoices and send to distribution clerks	3	8 am to 4 pm
		2	4 pm to midnight
		1	Midnight to 6 a.m.
Warehouse Workers	o Let trucks into loading bay o Place cargo onto trucks o Ensure paperwork is signed/cash received	4	8 am to 4 pm
		4	4 pm to midnight
		4	Midnight to 6 a.m.

Log of Safety Incidents		
Incident	**Date and Time**	**Action(s) Taken**
Truck driver backed into boxes in warehouse; boxes fell onto employee	Saturday, January 7, 2012, 7:19 p.m.	o Employee taken to hospital o Off work for 17 days
Tape dispenser fell off top shelf of cargo preparation area; hit employee on head	Tuesday, February 14, 2012, approximately 10 p.m.	o None
Senior receptionist diagnosed with carpal tunnel syndrome	February 2012	o Employee on short term disability until August 2012
Distribution clerk pulled back muscle moving box onto truck	Monday, April 9, 2012, 7:12 a.m.	o Clerk off work permanently o Purchased forklift to assist with moving boxes
Warehouse worker dislocated shoulder opening garage door	Thursday, May 24, 2012, approximately 3:30 p.m.	o Worker taken to hospital o Off work for 7 days; continued pain and weakness o Investigating automatic garage door opener

Part Two: Discussion Questions

How might you identify possible ergonomic issues for this company?

How would you do further assessment and evaluation?

What issues do you think you might find?

Developing a Plan to Address Ergonomic Issues

Three Key Methods

There are three main ways to reduce or prevent ergonomic issues. Let's discuss them in the order of preference.

Engineering

The best way to reduce ergonomic hazards is to change the hazard itself. Here are some examples:

- Purchase new tools that have ergonomic handles
- Improve flooring so that it is level (to reduce lifting strain)
- Install muffling panels to reduce noise
- Install air filters to improve air quality

Methods like these solve the problem at the root and don't require the user to do anything, removing the possibility of human error.

Organizational

Another method to reduce hazards is to implement organizational strategies and policies. Some examples:

- Requiring that individuals complete training on safe lifting procedures
- Restricting shift length
- Changing work tasks and/or pace to reduce repetitive motions
- Adjusting production goals to reduce the risk of over-exertion

Although these measures are often necessary, they do rely on people to implement them.

Individual

You can also ask the individual to change the way they do certain things in order to reduce the ergonomic hazard. Some examples might include:

- Wear earmuffs
- Improve their posture
- Report ergonomic issues early
- Take frequent rest breaks

Categorizing

Hazard	Type of Resolution

Identifying and Implementing Solutions

Where to Find Ideas?

At this point in the cycle, you know what the major ergonomic hazards are and you know that there are three main categories of solutions. But where do you find concrete, practical ideas to resolve ergonomic hazards? Here are a few starting points.

Ask the person doing the job.

The best place to start is to talk to the person doing the job. What would make their job more comfortable? Getting their input on options (and their buy-in on the choices made) will make it easier for employees to adopt the recommended changes and more likely that your efforts will succeed.

Use company resources.

Involve everyone in the company in the solution-gathering process. Have brainstorming meetings to come up with ideas to resolve various hazards. Encourage creativity; don't let people get bogged down in practical details like cost and implementation at this point.

Use ergonomic software.

There are many software applications that can assess situations for ergonomic hazards and recommend possible solutions. Just make sure that the solutions it suggests work for your organization.

Read ergonomic books and industry journals.

Other materials, such as ergonomic literature and industry journals, can also provide a good starting point for ideas.

Use the Ergonomics Ideas Bank.

The Internet can be a great resource, but it can be hard to know what information you can trust. One excellent resource is the Washington State Department of Labor & Industries' Ergonomics Ideas Bank (http://www.lni.wa.gov/Safety/Topics/ReduceHazards/ErgoBank). Here, you can search for specific problems based on your industry and see what has worked for other people. You can also submit ideas that have worked for you.

Making Connections

What hazards did you identify in your pre-assignment?

Where might you find resources to resolve these hazards?

What specific solutions do you have in mind?

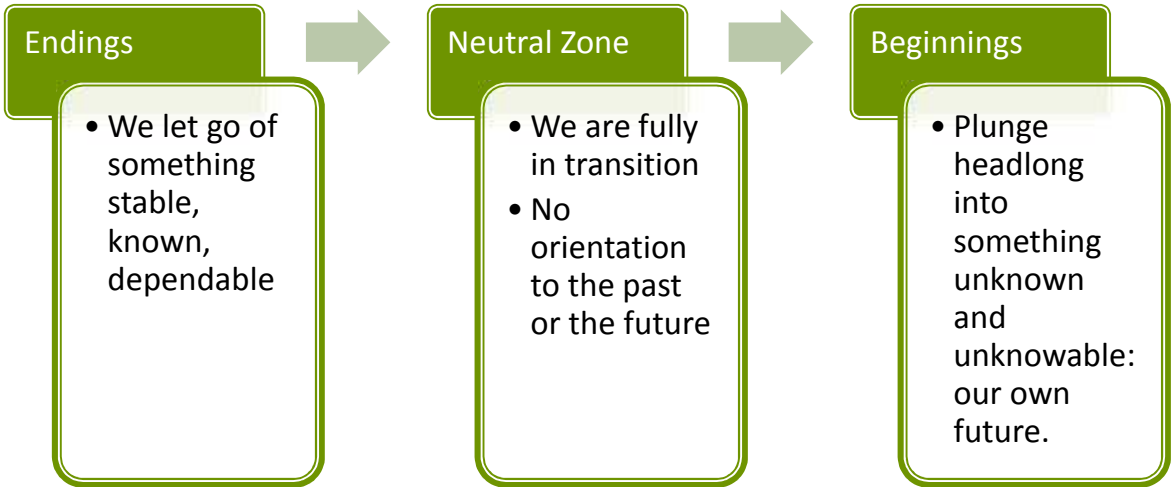
Obtaining Employee Buy-In

Change Management 101

So far, we have covered a plan to identify, evaluate, and address ergonomic hazards in the workplace. However, all of your organization's ergonomic efforts will not succeed without the cooperation of the employees who will be affected by the changes. It is important to involve all company employees in this process whenever possible.

Dr. William Bridges has contributed significantly to research about how change affects us. He believes it isn't the change that is the problem; the change is a situation. People have difficulty with the transition, which can be described as a three-part process. The transition isn't optional, and we must all go through those three stages if we want to make the change stick.

The three stages each of us goes through in accommodating ourselves to any change are:



Endings

All change begins with an ending. We may try hard to intellectualize it, thinking that if we understand it, we can deal with it. However, we don't always have the skills to deal with emotional reservations. Like the organ reject theory, our minds may know that the change is good for us, but the body still rejects it. Intellectually, we may accept a change, but emotionally, we may still resist it.

Change is sometimes perceived as exciting, stimulating, and motivating. Jack Welch, the former CEO of GE and a popular consultant, talks about change with excitement. He believes in seizing the opportunity and being open to what's ahead.

Change is often viewed as loss. An ending can be a loss, but a loss can be celebrated. It simply means that we are letting go of one thing to grasp on to another. Failing to identify and get ready for loss is the biggest difficulty for people in transition.

Transitions/Neutral Zone

This is a time to complete endings and begin new patterns. People in this stage may have a strong need for support from others. Major transitions can unleash powerful conflicting forces in people.

Western culture often tries to avoid this phase of the experience and jump to new beginnings. The neutral zone is treated like a busy street to be crossed as quickly as possible. However, it is important to take the time to complete endings and integrate new patterns effectively.

Beginnings

Organizations think about beginnings long before people do. There is often conflict between the organization's motivation and the critical mass to make it happen, so it is essential to get people involved, especially those who are leaders and have influence.

At this stage, people need drawing leadership (with a vision and purpose) rather than pushing management (focusing on goals and plans). Explain why ergonomic changes are being made and what benefits people can hope to see.

Insights

Think of a change you have experienced.

Did you feel threatened at the time? Did it open up new insights, opportunities, or possibilities?

What did you do that helped you accept the change and move on? What things did other people do that helped?

Do you remember feeling like you were confused or angry?

Did you have moments of anticipation and energy?

Do you have some success stories to share, some times that change brought better things than you had expected?

Tips for Successful Implementation

When it comes time to make changes to improve the ergonomics of your workplace, there are a few other things that you can do to make the adjustment as easy as possible.

Give people as much input and control as possible.

People will be more likely to accept changes and make them work if they have helped design those changes, and if they have a say in how the changes are implemented.

For example, let's say that one of the ergonomic hazards identified is excessive noise in a particular area of the workplace. Workers have said that they feel ear protection will help resolve the hazard, as the noise is from a machine and cannot be reduced. Ear protection is then implemented, with the choice of a few different methods (ear plugs and ear muffs in different designs).

Implement changes gradually.

If possible, implement changes over a period of time, rather than making many changes at once. As well, try to break changes down into small phases. This is especially important when making job design or policy changes.

Make the changes easy.

Make it as easy as possible for employees to implement and adapt to the change. Make sure that managers and other support resources are hands-on and monitoring the changes. Training, coaching, and other education efforts may also be necessary.

Be clear.

Be absolutely clear about what changes will be made and what you expect from employees. If changes are being made to job procedures, for example, checklists and manuals may need to be updated. If new equipment is being used, new signs should also be installed.

Continue following up with employees.

After changes are made, organizational leaders need to make sure that the changes are sticking. If people are reverting back to their old methods, find out why this is happening so that real changes can be made. Sometimes, it may take several tries to get it right!

Reviewing Your Ergonomics Program

Another important part of successful implementation and ergonomic hazard management is review and evaluation. This will help you verify that the changes made were the right ones and that they are sticking.

We suggest a follow-up schedule like this:

- Check in by managers and supervisors immediately after a change is made
- Close supervision over the first few weeks of a change, gradually tapering off
- Check in by ergonomics team and/or managers three months after a change is made
- Yearly review of all ergonomic efforts

However, unscheduled ergonomic reviews may need to take place if:

- New equipment is added
- There is a change in job responsibilities that causes a new hazard
- There is a new pattern of incidents
- An issue is raised by a staff member

Things that you want to look for include:

- Were the original hazards resolved or mitigated?
- If not, why not?
- Were new hazards created?

- What caused this? How will they be addressed?
- How do employees feel overall?
- Has anything changed in the industry that may impact our efforts? If so, what has happened and what might be the causes?

You can use the same tools that you used for assessments, including:

- Checklists
- Lifting calculators
- Symptom surveys
- Employee interviews

This will help you ensure that you are being thorough. It will also ensure that you are comparing relevant data.

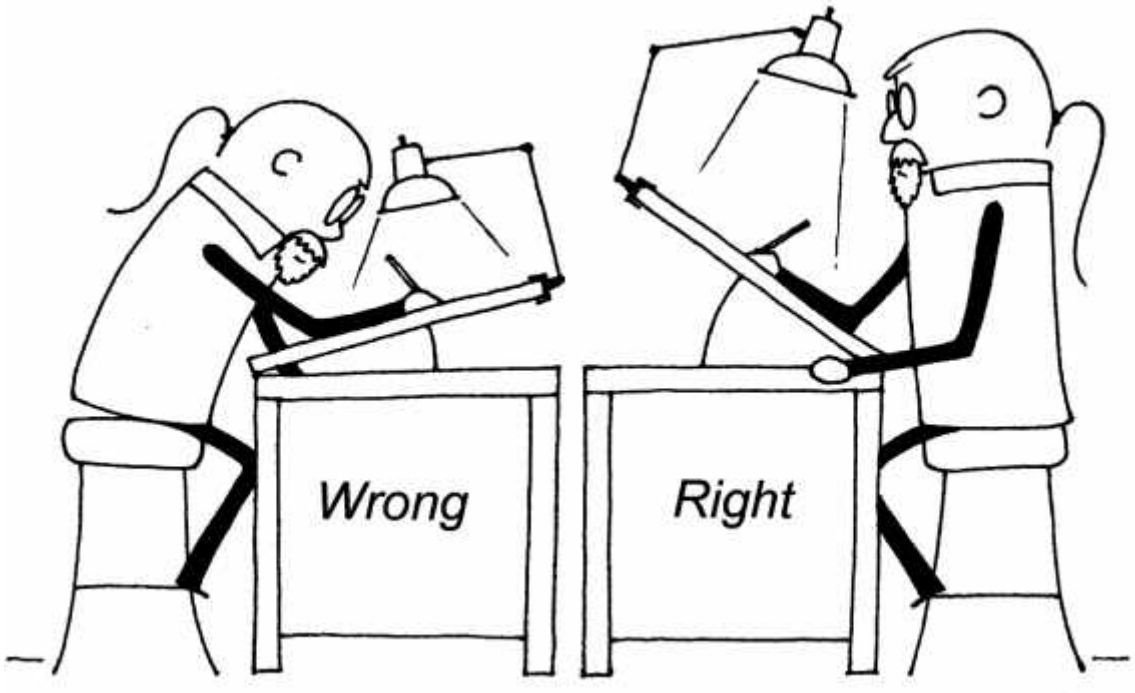
Basic Ergonomic Principles

Today, we will explore some ways to make various tasks more ergonomic. To begin, let's explore some basic principles of ergonomics to help you understand the reasoning behind our suggestions.

The Human Body is Part Machine...

The science of ergonomics tries to help you adjust other factors (like the environment or the task) so that your body does the least work possible. Remember that the human body is designed to work in a particular way. **Joints are their strongest when in a neutral position.**

Notice how the slope of the reading surface makes a big difference in the artist's posture here:



To help keep your joints in a neutral position, try to:

- Avoid bending, reaching, and twisting whenever possible.
- Remember that sudden forces put far more pressure on the body than slow, steady movements.
- Change position when possible. Take a break and stretch!
- Don't do too much at once.
- Listen to your body and put your health first.

...And Part Human!

People are unique. Height, weight, hand size, arm span, foot size, stride, head circumference, dominant side, and many other factors can all differ between individuals. Make sure that your ergonomic efforts (such as hand grips, ear protectors, goggles, etc.) are designed with the appropriate target population in mind. One size may fit 95% of the population, but the other 5% may need special accommodation.

Optimal Sitting and Standing

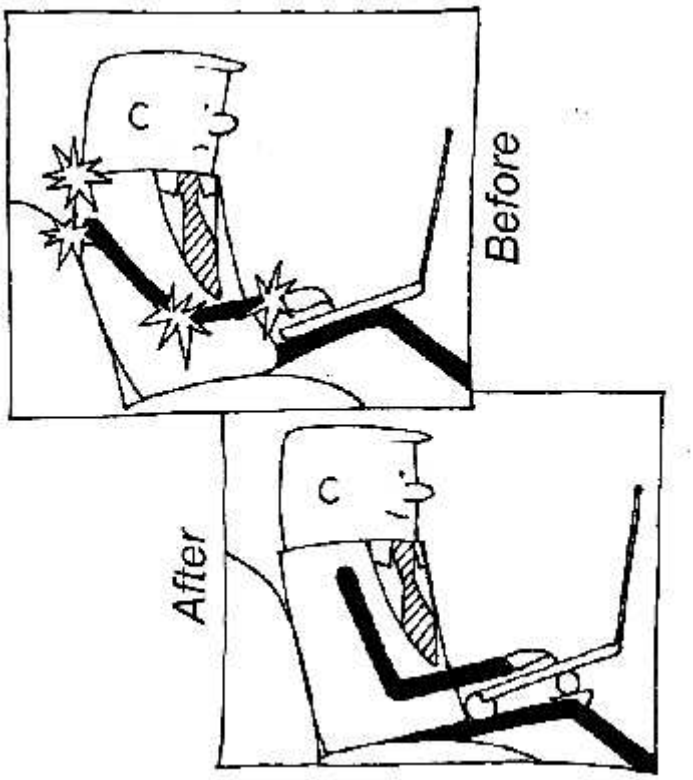
Best Practices for Sitting

Many of us spend long hours sitting in vehicles, at desks, and in front of the television. Our bodies were not designed for this – we were once an active population of farmers and hunters!

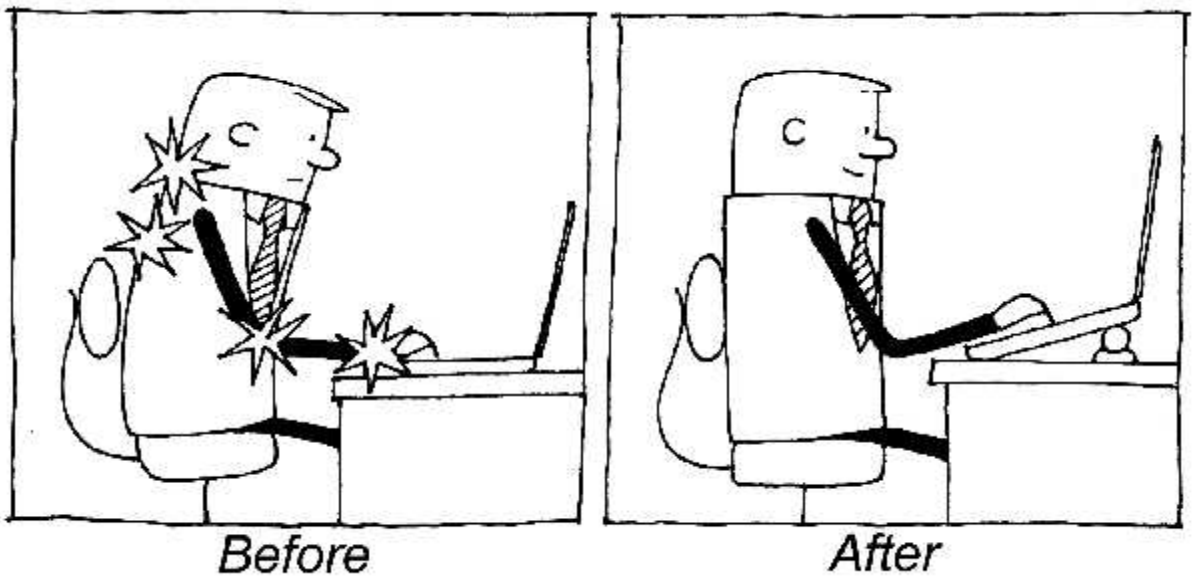
Sitting does have its advantages; most importantly, our bodies are supported by what we are sitting on. Therefore, it's important to ensure that your furniture supports your body in the right way. (More on that later!) However, sitting for long periods of time can make muscles tense. It can also cause problems if you must bend or twist.

To help mitigate this, vary sitting and standing activities, and be sure to take breaks to stretch frequently. Be aware of the position that your joints are in. Here are two examples.

Example One

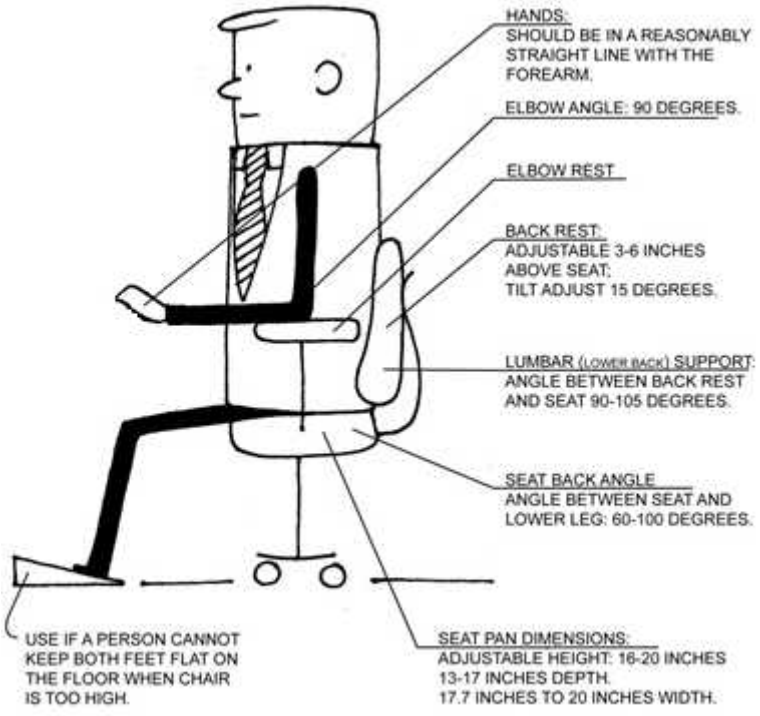


Example Two



Ergonomic Chairs

As well, ensure your chair meets these ergonomic guidelines:



Ideally, chairs should also have wheels, so that the person can turn easily without bending their body.

Other factors to consider:

- Have your work surface sloped so that you do not have to bend your neck very much.
- Make sure you have plenty of legroom to stretch.
- Design your workspace so that frequently used items are closest to you (called the reach envelope).
- Ensure that the task you are working on is at the correct height, as shown below.

Eye Use	Hand and Arm Use	Recommended Height of Work Material
Frequent	Frequent	0 to six inches above elbow height
Infrequent	Frequent	Six to 12 inches below elbow height
Frequent	Infrequent	4 to 12 inches below eye height

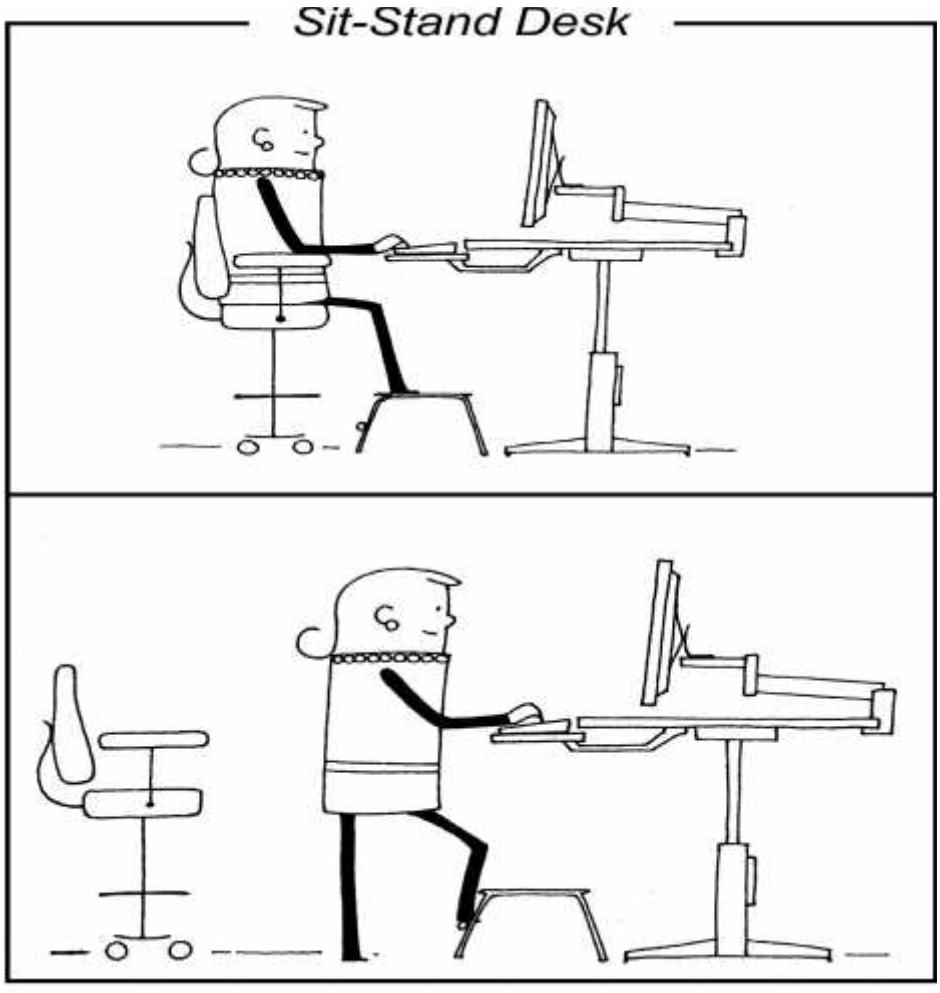
Best Practices for Standing

While standing can tire leg, back, and neck muscles, it is the ideal position if the worker must move around frequently or perform heavy manual labor. Like sitting, the worker should take breaks to sit or walk and give the sitting muscle groups a break. As well, keep these tips in mind:

- Ensure that the task you are working on is at the correct height, as shown in the table on the previous page.
- Try to avoid standing in confined spaces; make sure you have plenty of room to stretch.
- Try to avoid using platforms. They often pose a trip hazard and create a safety issue.
- Design the workspace so that reaching, twisting, and bending is minimized.
- Use a pedestal stool or a custom chair to make breaks easy.

The Best of Both Worlds

Sit-stand workstations are becoming an increasingly popular ergonomic choice. These adjustable workstations can easily be configured so that the user can sit or stand while working.



Identifying Areas for Improvement

Advantages	Disadvantages

How can we increase the effect of the advantages?

How can we reduce the impact of the disadvantages?

Safe Lifting and Transporting

Lifting Safely

According to the United States Bureau of Labor Statistics, a large percentage of workplace injuries result from improper heavy lifting. *(Source: http://www.bls.gov/iif/oshfaq1.htm#q09)* Understanding and using proper lifting techniques can make the exertion a lot more ergonomic and easier on your body in the short-term, and prevent injuries in the long-term.

Guidelines for Safe Lifting

Some basic guidelines:

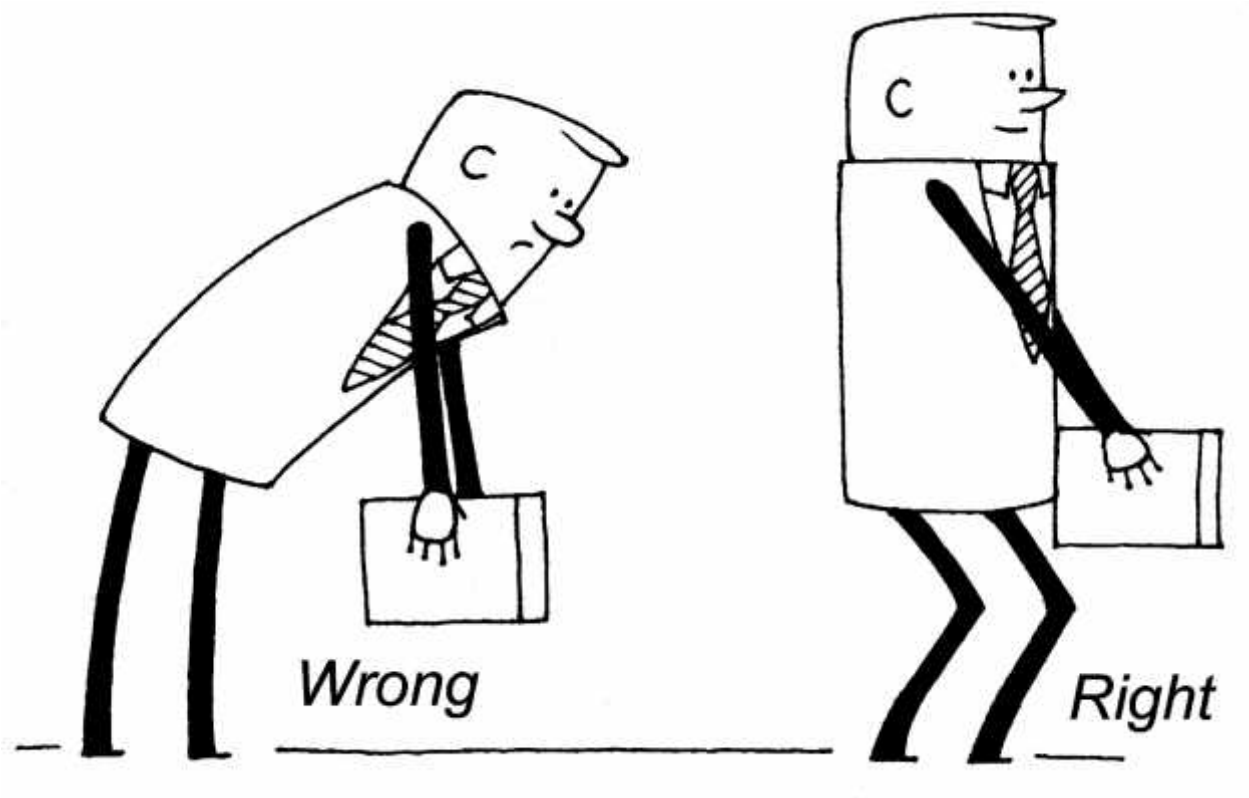
- Avoid lifting awkwardly shaped and/or tall loads.
- Keep the load close to you.
- Use both hands and lift with your body.
- Ensure the load has proper handles.
- Get help or use transporting tools (such as a forklift) when necessary.
- Do not twist when lifting.
- Take frequent breaks to rest and stretch.
- Alternate lifting with light tasks.

Here are some guidelines for specific lifting tasks, as provided by the Washington State Department of Labor & Industries.

Description	Amount	Recommended Max. Frequency	Other Notes
Heavy Lift	75 pounds	Once per day	
	55 pounds	10 times per day	
Awkward Lift	25 pounds	25 times per day	With load above shoulders, below knees, or at arm's length
Frequent Lift	10 pounds	2 hours per day	Twice per minute

(Source: http://www.lni.wa.gov/Safety/TrainTools/Online/Courses/courseinfo.asp?P_ID=102)

Example



Transporting Materials Safely

Ideally, we want to design workplaces so that a minimum of lifting, carrying, pushing, and pulling is necessary. However, that isn't always reasonable! Let's look at some other safe methods of transporting materials.

Carrying Materials

Only carry materials when they are fairly light and the distance is short. Otherwise, use a device like a trolley to transport them. As well, observe good lifting practices:

- Avoid carrying awkwardly shaped and/or tall loads.
- Keep the load close to you.
- Use both hands.
- Ensure that the load has proper handles.
- Do not twist when carrying.
- Take frequent breaks to rest and stretch.
- Alternate carrying with light tasks.

Pushing and Pulling

Pushing and pulling materials can exert a tremendous force on the body. Always limit pushing and pulling activities and be sure to take breaks. When pushing or pulling, use your body to perform the task. This means leaning forward and propelling yourself with your feet when pushing, and the opposite when pulling.

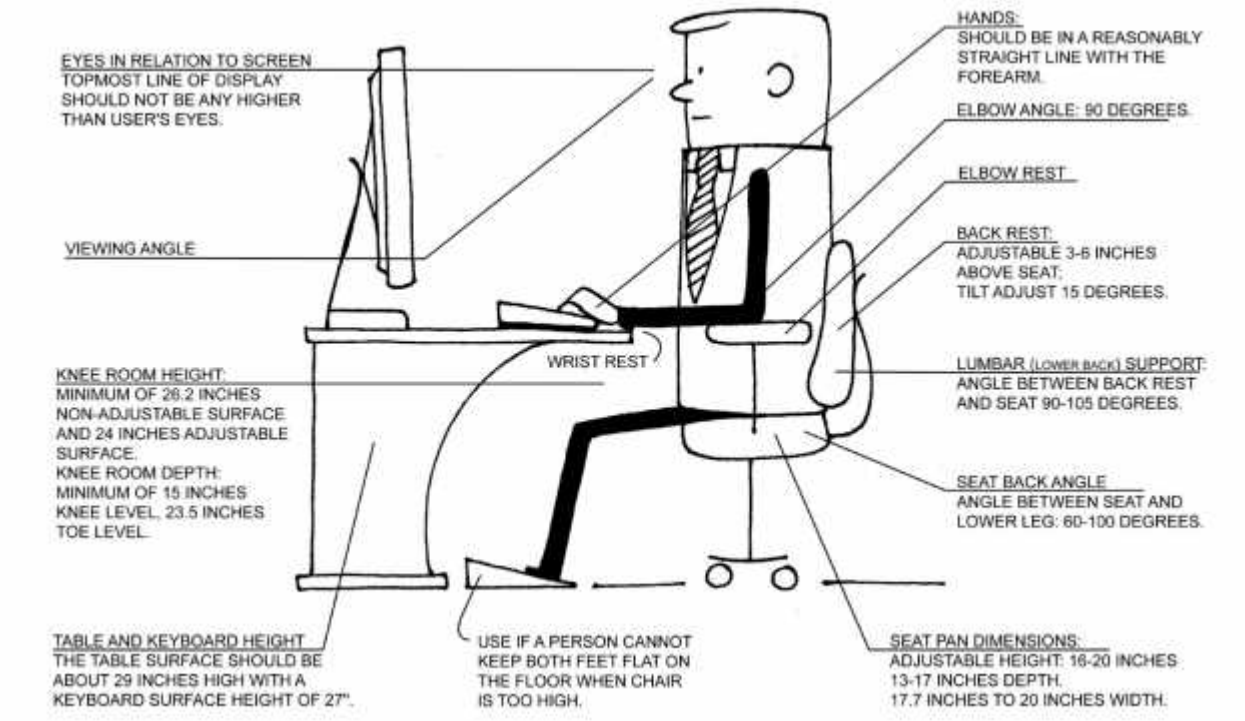
In addition, the workplace should be designed to minimize these activities and to make the activities as easy as possible. This includes:

- Keeping equipment well maintained
- Having a variety of tools available (motorized and non-motorized) so that the best tool for the job can be chosen
- Ensuring that all tools have proper handgrips and safety devices
- Ensuring that floors are clean and even with proper surfaces

Ergonomic Workstations

Overview

When you say “ergonomics,” most people think of computers. Indeed, many people suffer from neck, back, and wrist pain that is caused by improperly configured workstations and/or too much time spent at the keyboard. Even if you don’t use a computer, your workstation should be configured to make things as easy as possible on your body. Here are some recommended guidelines.



Note that even with an ergonomic workstation, the Washington State Department of Labor & Industries recommends a limit of four hours of typing per day.

(Source: http://www.lni.wa.gov/Safety/TrainTools/Online/Courses/courseinfo.asp?P_ID=102)

Tips and Tricks

Here are some other ways to make computer use as comfortable as possible:

- Take a break to stand and stretch at least once an hour. To relax the eyes, stare into the distance (preferably out a window) every half hour.
- Try using keyboard shortcuts instead of the mouse.
- Choose ergonomic keyboards and mice where possible.
- To raise the monitor, put a package of paper under it.
- Use an ergonomic headset instead of crooking your neck to hold the phone.
- Keep frequently used items within easy reach.

Making Connections

Review the main hazards that you identified in your pre-assignment.

Which of these ergonomic issues could be resolved with changes to workstations (computer or otherwise)?

Safe Tool Selection and Use

Safe Tool Design

The tools we use to complete our work should also be designed ergonomically. There are several important factors to consider.

Are You Using the Right Tool?

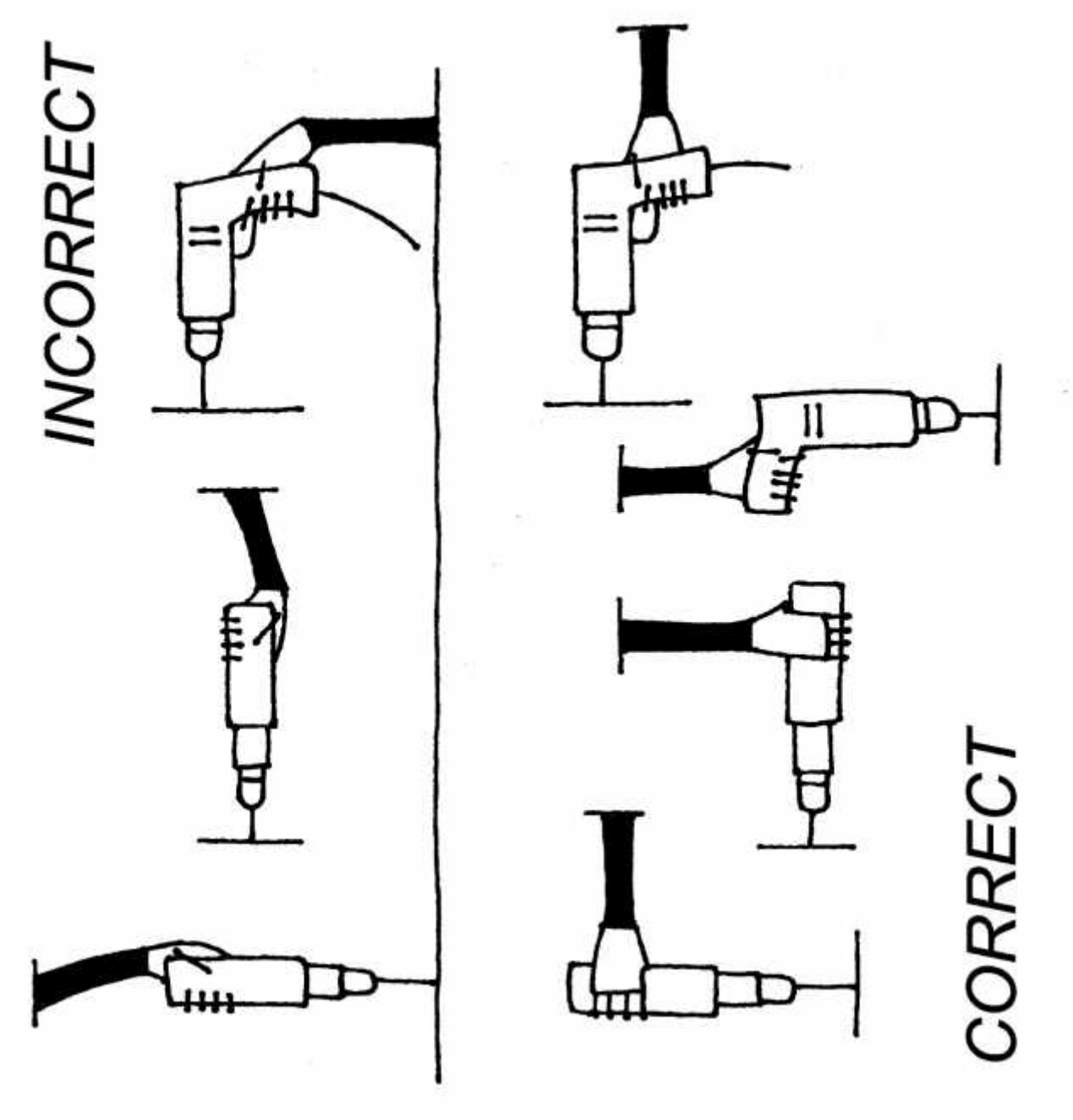
The first factor to consider is if you are using the right (and best) tool for the job. There are many specialty tools designed to make jobs easier and more ergonomic; take advantage of them if you can.

What Posture Do Tools Require?

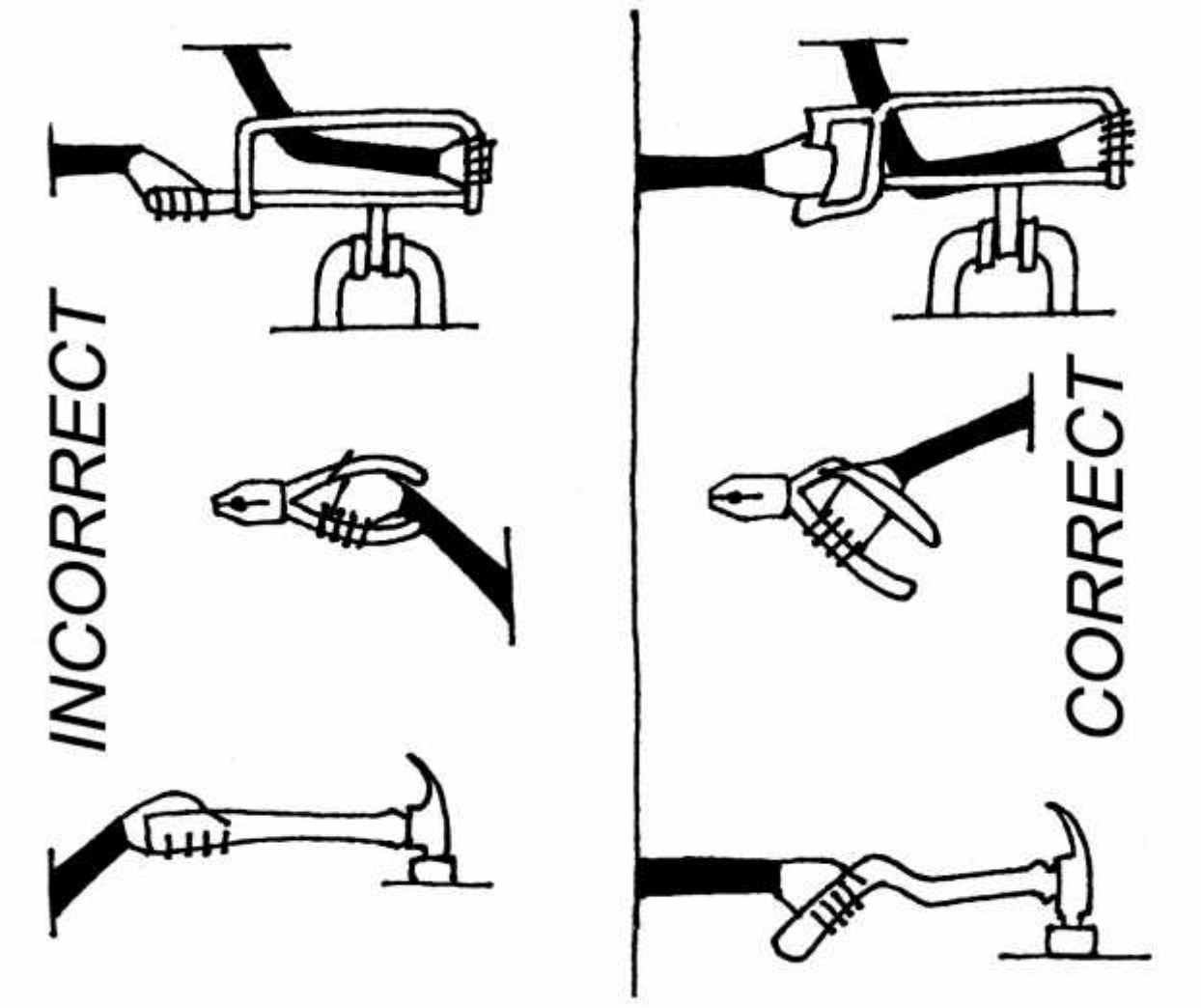
Tools that require you to bend your arm, wrist, or hand into an awkward position can cause severe musculoskeletal issues. These issues can be exacerbated if you are using the tool for a long time, if it is heavy, and/or if it vibrates considerably. (More on these issues in a moment.) Pay attention to what the tool requires of you and identify areas of discomfort.

Tool Design

Try to choose a tool that keeps joints in a neutral position as much as possible:



Proper handgrips can help with this:



We recommend a slightly **convex** handgrip that helps to keep joints in a neutral position. Handgrips with **finger depressions** or other **pre-shaped features** are not recommended. They are often not ergonomic (as everyone's hands and fingers are a different size and shape) and they can be hard to use if you have gloves on.

As well, consider the advantages of having a **motorized** tool versus a **manual** one. Make sure that buttons and other features are easy to reach and make the tool easier to use, not harder.

Tool Weight

Sometimes, however, we can go a little overboard in choosing tools. Or, perhaps the tool that you need to use is heavy enough to qualify as a lifting task! If this is the case, a counterweight or stand can be used to reduce the force that you need to exert.

Maintenance and Upkeep

Keep tools in good condition and well maintained. When it needs to be replaced, replace it! Take that time to shop around and see what other options might be available.

Making Connections

Think of tools that you use at work and at home.

Choose three or four items.

Re-design them to be more ergonomic.

Tool One	**Tool Two**
Tool Three	**Tool Four**

Vibration Considerations

Safe Levels

Did you know that exposure to high vibration levels can also cause musculoskeletal issues? Other risk factors (like excessive levels of vibration, extreme temperatures, and long-term exposure) can exacerbate issues caused by vibration.

The Washington State Department of Labor & Industries places hand-arm vibration into two categories:

- **High** vibrating tools (such as jackhammers, chainsaws, and impact wrenches), with a recommended limit of 30 minutes per day
- **Moderate** vibrating tools (such as grinders and drills), with a recommended limit of two hours per day

(Source: http://www.lni.wa.gov/Safety/TrainTools/Online/Courses/courseinfo.asp?P_ID=102)

A safe level is about 2.5 meters per second squared (m/s^2) for hand-arm vibration. If the source exposes the user to whole-body vibration (such as a machine or a vehicle), the safe level is 0.5 m/s^2. Note that this does not include shocks and jolts, which can cause damage to nerves after just one occurrence if the vibration level is strong enough.

Reducing Vibration

So how can we reduce the amount of vibration that we are exposed to? Here are some ideas:

- Wear gloves and use tools designed to reduce vibration.
- Know the level of vibration you are being exposed to and adhere to safe limits and practices.
- Reduce exacerbating factors like extreme temperatures and multiple vibration sources.
- Keep tools in good condition and well maintained.
- Vibration-dampening seats in machines and vehicles can help reduce whole-body vibration.

Creating an Ergonomic Environment

See the Light!

The light quality in an environment can have a tremendous impact on your well-being. It is important to choose the right light for the right task. Light is measured in units called **lux**. (You may have also heard the term **lumens** – one lux equals one lumen over one square meter.) You can also compare lux to **watts**: lux measures the light output, while watts measures the power needed to create that output.

Here is how some **common light sources** measure up on average:

- Moonlight at the equator: 1 lux
- Hallways: 100 lux
- Sunlight output on an overcast day: 100 lux
- Artificial office light: 500 lux
- TV studio: 1,000 lux
- Sunlight at the equator: 100,000 lux

So what kind of light is best for our bodies? The first step is to create the proper **ambient** (or background) lighting. For most offices, 200 to 750 lux is adequate. The preferred setup includes:

- Windows that let in adequate natural light
- Transparent shades over windows that let the user control the amount of natural light
- Overhead lighting that is around 500 lux and controllable (preferably via a dimmer switch; on/off switch at minimum)

Then, set up **task lighting** for the workstation. Ideally, a task light will provide high illumination on a small area of the work surface. The task light should be:

- Easily height-adjustable from the work surface
- Not hot to the touch
- Able to provide different levels of light (including completely turned off)

The brightness of the lamp will depend on the task that you are performing. For computer work, a low-level light of about 250 lux is sufficient. For highly detailed work, a light up to 5,000 lux may be required. Experiment with different levels to see what is most comfortable for you. However, it should be no more than five times as bright as the ambient light in the room.

Watch out!

Once you have established adequate light, you have solved half of the lighting equation. The next step is to check for shadows and glare.

One of the biggest culprits can be the surfaces in your workspace. Here are some things to watch for:

- Bare light in your line of vision
- Reflective or bright surfaces (ceilings, walls, floors, and workspaces)
- Bright, reflective colors on ceilings and walls
- White work surfaces are the worst; natural, low-gloss wood is best

If you are having issues with glare, try the following steps:

- Reposition your workspace or light
- Add denser shades to existing lights
- Use anti-reflective mats for your work surface
- Hang low-reflection art or screens on the walls

Breathe the Air!

Good air quality is another part of your ergonomic workspace. Think about the square footage of your workspace that is occupied by machines, furniture, and people. Now think about the square footage occupied by air!

Air pollution usually causes the following **symptoms**. (Typically, symptoms build gradually, unless there is a significant exposure.)

Non-Specific Symptoms

* Headaches
* Drowsiness
* Aches and pains

Moderate Immune Response

* Throat complaints
* Lung problems
* Sinus/nasal problems
* Gastrointestinal issues

Severe Immune Response

* Fever
* Incapacitating pain
* Permanent damage
* Anaphylactic shock
* Organ shutdown

The **circumstances** that most commonly cause air pollution include:

- Allergens such as dust, perfumes, mold, and cigarette smoke
- Hazardous chemicals and materials, such as asbestos
- Fumes from chemicals and machinery that are not properly exhausted

So what can we do to make our air conducive to an ergonomic workplace? The most important factor is to ensure that a good ventilation system is in place that replaces stale air with fresh air (rather than just recycled air). The ventilation system also needs to be well maintained. In particular, filters need to be changed regularly and monitored for indications that it is not doing an adequate job.

Other measures may include:

- Special ventilation for areas requiring higher air exchange
- Direct-to-outdoors ventilation for heavy machinery and equipment
- Using less hazardous chemicals where possible
- Awareness of industry-specific issues and ways to mitigate those issues
- Independent breathing equipment (such as respirators or portable air) in areas where air pollution poses a high risk

Hear the Sounds!

The final component to creating an ergonomic environment is ensuring the correct level of sound is present. Excessive noise can put a high strain on your body; damage to the hearing system is the biggest risk. Excessive noise also causes tense muscles, an increase in adrenaline, and strain on the eyes and the brain as you try to focus on the task at hand through the noise.

Acceptable Noise Levels

The general acceptable noise level is 90 decibels for eight hours a day. Like lifting, louder noises are okay as long as they are for short periods of time. Here are the noise guidelines recommended by the United States Department of Labor Occupational Safety & Health Administration:

Sound Level in Decibels	Maximum Hours of Exposure per Day
90	8
92	6
95	4
97	3
100	2
102	1.5
105	1
110	30 minutes
115	15 minutes or less

(Source: http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=10625)

As a comparison, here is the average noise level that common tasks generate.

Activity	Noise Level in Decibels
Breathing	10
Refrigerator	40
Quiet conversation between two people	60
Group conversation	70
Vacuum cleaner	80
Traffic	80
Lawn mower	90
Subway train	95
Chainsaw	110
Sandblaster	115
Snowmobile	120
Gunshot	140
Aircraft at take-off	180

Curbing Noise in Your Environment

Your first step should be to use a decibel meter to identify the level of noise. Then, you can identify a target decibel level, do a direct before and after comparison, and see where other improvements need to be made.

Use these methods to turn down the noise level in your environment:

- When possible, use quiet machines. (For example, quiet keyboards are now widely available. Likewise, noise-reduced drills and saws are also common.)
- Ensure that machines are well maintained.
- Have a procedure for reporting unusual or excessive noises caused by machines and tools. This can indicate a mechanical problem.
- Use hearing protection when appropriate. (Did you know that earmuffs are typically more effective than earplugs?)
- Install baffles and muffling equipment in noisy areas to help absorb sound.
- Do not place a noisy area next to a quiet one. (For example, locating the library next to the gymnasium is probably a bad idea.)

Using White Noise

With the guidelines above in mind, the workplace also shouldn't be too quiet. Background noise of about 30 decibels is ideal; otherwise, you'll jump out of your skin if the phone rings!

White noise (also known as **background noise**) provides just enough sound to conceal annoying noises. (Think of how, when the air conditioner breaks down, you suddenly notice the traffic outside.)

Let's look at the differences between white noise and **annoyance noises**.

White Noise	Annoyance Noise
Music playing quietly in the background	Radio station playing so loud that you can sing along with it
Air conditioner humming	Air conditioner rattling and banging
Quiet chatter of the receptionist as he answers the phone	Receptionist talking so loudly that you could transcribe every conversation
Outdoor noise filtering in through the ventilation system	Constant parade of sirens from the police station next door

Note that those annoying noises can place a strain on you even if they are well within (or below) the recommended decibel levels. (Think of how that dripping tap slowly drives you out of your mind!) These annoyance noises should be handled like any other ergonomic hazard: identified, rectified, and then evaluated and reviewed.

Bringing It All Together

A Day in the Life at the Acme Widget Company

Ergonomic Analysis

Hazard	Resolution

Further Reading:

- ✓ *Alexander, Jane. The Weekend Healer. Gaia Books, 2002.*
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- ✓ *Dul, Jan, and Bernard Weerdmeester. Ergonomics for Beginners. CRC Press, 2008.*
- ✓ *Inkeles, Gordon, and Iris Schencke. Ergonomic Living. Fireside (Simon & Schuster), 1994.*
- ✓ *Linden, Paul. Comfort at Your Computer. North Atlantic Books, 2000.*