Ergonomic solutions

Ergonomics is a process for improving the fit between the physical demands of a job and the employees who perform the work. Finding ergonomic solutions is a process, not a one-time effort. Saying that a job has been “fixed” implies that it can’t be improved any further, but there’s always room for improvement. Consider this example:

At a tool repair shop, Jacob takes apart, repairs, and reassembles small power tools. He removes and replaces cover plates using a screwdriver. Jacob notices that the tool digs into his palm, and by the end of the day, his arm and wrist begin to ache.

Jacob convinces his supervisor that he could work faster using a power drill with a screwdriver tip. The supervisor agrees and provides a drill. This allows Jacob to work faster, but he must hold the drill at an awkward angle. At the end of the day, his shoulder is sore from using the new drill.

Jacob remembers seeing a powered, in-line screwdriver in a magazine. He shows it to his supervisor and says it should allow him to work more comfortably. The supervisor agrees and obtains one of the new drills. With the new in-line tool, Jacob’s productivity increases, and at the end of the day, his arm and shoulder aren’t sore.

This illustrates the process of making improvements a little at a time, and shows the importance of re-evaluating every “solution” to make sure it solved the problem without creating new problems. The power drill solved one problem (grip and wrist motions), but created another problem (an awkward work angle). The in-line tool provided a better fit between Jacob and his job demands, allowing him to work faster with less pain.

The process of making ergonomic improvements involves looking at equipment and job tasks, trying out improvements, looking again to see if they work, making further changes, and so on. The process also evaluates employees’ abilities, which may differ because of age, physical condition, and other factors. The goal is to remove conditions that could lead to injuries.

The cost of injuries

Ergonomics programs create a structure for evaluating jobs and trying out improvements. Job tasks that require awkward postures or repetitive motions can cause damage to muscles, tendons, ligaments, nerves, and blood vessels. These injuries are known as musculoskeletal disorders (MSDs), and they cost employers thousands of dollars. Direct costs include medical services and higher workers’ compensation premiums. Indirect costs include increased turnover, lost work days, lower productivity, and re-training of replacement workers.

Employers can reduce injuries and avoid these costs by improving the “fit” between the worker and the job tasks. Tasks are the activities a worker performs during a particular job. Some jobs consist of a single task, but most require multiple tasks. For example:

- A warehouse worker’s tasks might include stacking materials, shrink-wrapping pallets, and moving pallets with a hand cart.
- A janitor’s tasks might include emptying trash, dusting, and vacuuming.
- A forklift driver’s tasks might include setting dock plates, re-stacking unstable materials, and twisting around to drive in reverse.

Finding ways to eliminate awkward postures and repetitive motions usually involves a process of trial and error. More often than not, this process reduces injuries, increases productivity, saves money, and improves product quality and job satisfaction.
Get ahead of the problem
Why wait until an employee gets hurt before looking for hazards? Taking a proactive approach can be as simple as talking to employees and asking questions like:

- Do you have ideas about how to make your job less physically demanding and more efficient?
- Do you work in uncomfortable positions, or experience muscle fatigue and discomfort?

It’s best to take action as soon as you identify warning signs. These signs include employee fatigue or discomfort, reports of problems, and high levels of absenteeism. Early action is important because MSDs tend to be treatable and less expensive in the early stages, but irreversible and expensive as they get worse.

Contributing factors
Most job tasks involve movement and physical effort. The key is identifying when they could lead to injuries. To find out which tasks may cause problems and what to do about them, look for contributing factors in the workplace.

Identifying contributing factors, and the reason for them, is essential to coming up with effective improvements. The factors to look for include:

- Awkward postures,
- Repetitive motions,
- Forceful exertions,
- Pressure points (local contact stress),
- Vibration, and
- Environmental factors.

In the example above, Jacob performed repetitive motions and experienced contact stress from the screwdriver. These contributing factors were caused by the need to remove and replace cover plates (the reason for the factors). The solution was to use an in-line tool to eliminate the contributing factors.

Solutions can range from replacing a tool to adding support/padding to providing mechanical assistance to adjusting a workstation to changing a work schedule. Before looking for solutions, however, the contributing factors must be identified. Each is explained below.

Awkward postures
Awkward postures can result from using poorly designed workstations, tools, and equipment, or from using poor work practices. Awkward postures typically include repeated or prolonged:

- Reaching,
- Twisting,
- Bending,
- Working overhead,
- Kneeling,
- Squatting, and
- Holding fixed positions.

Awkward postures may affect different areas of the body such as the hands, wrists, arms, shoulders, neck, back, and knees. The effects are worse if the work also involves repetitive motions or forceful exertions. For example, removing heavy boxes from a high shelf might involve reaching overhead, and require substantial effort from the muscles. This combination can lead to injury.

Sometimes employees use awkward postures or experience eye strain and fatigue because it’s hard for them to see their work. This can be caused by poor lighting or by working on small objects. We’ve all seen someone hunched over a workbench, squinting at a small item. Handling or assembling very small parts or performing precise tasks may contribute to eye strain and awkward postures.
Similarly, when materials block the field of vision (like a large load on a forklift), employees may have to bend, reach, or twist (like twisting around to drive the forklift in reverse). The blocked vision is the cause, and the contributing factor is an awkward position.

**Repetitive motions**
In repetitive work, the same motions are performed over and over using the same muscles, tendons, or joints. The effects on the body depend on the pace of the work, the recovery time provided (number and length of breaks), and the amount of variety in work tasks.

The pace of work could be controlled by the employee, by machines, by other employees, or by company policy. Jobs that involve machine-controlled pace include working on assembly, packaging, or quality-control lines. Work tasks controlled by company policy include those linked to performance or incentive bonuses. These policies can encourage a faster work pace with fewer breaks.

The risk of injury is greater when repetitive tasks also involve awkward postures or forceful exertions. A production line job may involve repetitive hand, wrist, elbow, and shoulder movements combined with low-force exertions, like placing and tightening screws or bolts. Having to grip a tool for a long time, without being able to set it down and rest the hand, is also a repetitive task with low-force exertion.

**Forceful exertions**
Forceful exertions are another contributing factor. Force is the amount of muscular effort used to perform work. Exerting large amounts of force can cause fatigue and physical damage. Typical tasks include pushing a loaded pallet jack, or gripping a drill tightly so it doesn’t rotate during use.

The amount of force required depends on several factors. A rough floor will increase the force needed to move the pallet jack, while a drill with a dull bit may require more force than a sharp bit. Other factors include:

- Load shape, weight, and bulk;
- Grip type and position (an object with handles is easier to hold);
- Amount of effort to start and stop a moving load (rolling versus sliding an object);
- Amount of time the load is handled without a break;
- Number of times the load is handled per hour or shift;
- Body posture used (if the task requires awkward postures);
- Resistance to moving the load (like rough floors or poorly maintained equipment); and
- Environmental temperature.

**Pressure points (local contact stress)**
Contact stress is when part of the body presses against hard or sharp surfaces, like resting the forearms or wrists against the edge of a work table. Certain areas of the body are more vulnerable because nerves, tendons, and blood vessels are close to the skin and bone. These pressure points include:

- Sides of the fingers,
- Palms,
- Wrists,
- Forearms,
- Elbows, and
- Knees.

Job tasks that cause contact stress include using tools with unpadded handles that dig into the palm or fingers, and kneeling on hard surfaces.

**Vibration**
Continuous or intense vibration is also a contributing factor. Vibrating tools like sanders, grinders, drills, and saws can cause hand-arm vibration. Using tools that aren’t properly maintained, or using the wrong tool for the task, may increase the amount of vibration. These exposures can cause fatigue, pain,
numbness, tingling, increased sensitivity to cold, and decreased sensitivity to touch in the fingers, hands, and arms.

Whole-body vibration can result from sitting or standing on surfaces that vibrate such as vehicles, equipment, and platforms. It can be lead to general discomfort and lower back pain.

**Environmental factors**

Environmental factors can also cause problems. Poor lighting can cause workers to use awkward postures as they try to focus. High temperatures can cause fatigue more quickly, while cold can decrease blood flow, muscle strength, and manual dexterity. These conditions can increase the risk from other factors. For example, workers with cold hands might use excessive grip force when handling tools.

**How much is too much?**

When you start identifying contributing factors, keep in mind that no one knows exactly:

- How many repetitions are too many,
- What degree of awkward posture is harmful,
- What duration of a task is too long,
- How much force is too much, or
- What the effects are from combinations of these factors.

Since each person has different physical capabilities, the “safe” exposure level may be different for each worker. What is known is that the more time spent performing physically demanding or repetitive tasks, the more likely an injury will occur.

Both the total time per shift and the duration of each period can be factors. A solid 20 minutes of exposure to vibration might be worse than a series of one minute exposures which are spread throughout the shift, even if the total time per shift exceeds 20 minutes.

As repetitive motions, forceful exertions, and other factors increase, so does the recovery time (the length and frequency of muscle relaxation breaks) needed to help reduce fatigue and prevent injury. The more contributing factors present, the more likely an injury will occur. Identifying them requires evaluating each job.

**Job analysis methods**

There are many ways to analyze jobs and identify contributing factors. Some methods are relatively simple, and others require detailed analysis and sophisticated equipment. A simple method might involve using checklists, while a more comprehensive method breaks each job down into specific movements like reach and grasp.

Job analysis methods also vary according to the type of work they address. Some focus on workstation design, while others are specific to types of work, like materials handling. Still others focus on the work environment, like lighting and temperature extremes.

Whatever method is used, identifying potential problems is essential to coming up with improvements. Identifying contributing factors can be done in three simple steps:

1. **Step 1: Look for clues**

   Try to identify jobs that may be causing problems by looking around the workplace, talking to employees, and looking for early warning signs such as:
- Employees restricting their movements or range of motion because of fatigue or discomfort (like a stiff neck, sore shoulder, or backache);
- Employees modifying tools, equipment, or workstations on their own;
- High absenteeism or turnover rates;
- Poor product or service quality;
- High error rates or waste of materials;
- Customer complaints;
- Production bottlenecks; and
- Employee reports of problems

You can also review written records like the OSHA 300 Log and workers’ compensation claims to identify jobs or tasks that might contribute to injuries.

**Step 2: Prioritize the tasks in each job**

For each job evaluated in Step 1, prioritize the tasks based on the potential for injury. To do this, ask the workers the following questions and note the number for each response:

**How hard is this task?**
1. Very easy
2. Easy
3. Somewhat hard
4. Hard
5. Very hard

**How often is this task done?**
1. Seasonally (a few times a year)
2. Occasionally (a few times a shift or week)
3. Frequently (up to 4 hours per shift)
4. Constantly (more than 4 hours per shift)
5. Extended hours (more than 8 hours per shift)

Simply multiply the two scores. A worker who spends three hours raking leaves performs the task “frequently,” but the job might be “easy” for a score of six. A worker who changes a grinding wheel once a week performs the task “occasionally,” but might describe the heavy lifting as “hard” for a score of eight. If the task requires more than a brief period a few times a shift, it should fall into the “frequently” category.

The numbers are rough estimates, and the results are general, but they allow you to compare different tasks and prioritize those with the highest risk. Tasks with higher scores should be addressed before looking at tasks with lower scores.

**Step 3: Observe the work**

Observe only one job at a time, and look at each task in that job separately. Begin with tasks assigned the highest score, and any tasks rated “very hard” (given a score of 5) because they might contribute to fatigue and injury even when performed rarely. For each task, list the contributing factors observed and the reasons for them (i.e., what needs to be accomplished).

For example, contact stress from kneeling on a hard floor might be caused by the need to access materials from a bottom shelf. An awkward posture that requires reaching might be caused by a tool storage board that is behind a wide workbench. The results from evaluating work tasks can be used to develop ergonomic improvements.

Remember, contributing factors include:
- Awkward postures;
- Repetition;
- Forceful exertion;
• Pressure points;
• Vibration; and
• Environmental factors.

It’s important to observe all of the tasks in a job. Each task may have contributing factors, and injuries can be caused by a combination of factors in multiple tasks. Talking to employees who actually perform the work can provide valuable information about how the job might be improved.

This three-step system may not be the best method for evaluating your particular workplace, but it is simple and inexpensive. As noted above, different approaches are designed to address specific jobs, tasks, or workstations. If problems seem complicated or widespread, you may need to contact an ergonomics consultant or other expert.

Improving the workplace

With your evaluation results in hand (the contributing factors, the reasons for them, and the priority list), you can make changes to improve the “fit” between jobs and the employees who perform them. Ergonomic improvements are commonly grouped into three categories:

• Engineering changes (changing the tools, workstation, and environment),
• Administrative changes (changing schedules and work procedures), and
• Safety gear (using protective equipment like padded glove).

Engineering improvements

Raising or lowering a work surface can reduce bending, reaching, and awkward postures. Providing an in-line tool can eliminate awkward posture and reduce the necessary grip force. These improvements can be very effective because they reduce or eliminate the contributing factors.

The best time to consider engineering improvements is in the planning stage for new facilities, processes, or work procedures. Starting with proper design is easier than fixing problems later. However, existing problems can be addressed as well.

Other examples of engineering improvements include:

• Providing adjustable equipment to allow comfortable, upright working posture.
• Using close, convenient storage (above the hips and below the shoulders) to reduce reaching, bending, and awkward postures.
• Supplying foot rests to reduce strain on the lower back.
• Providing cushioned floor mats for standing work tasks.
• Using good lighting to reduce eyestrain.
• Installing mechanical lifting aids to reduce force, repetition, and awkward postures in lifting.
• Supplying carts or conveyors for moving materials.

Providing tools with a design that helps reduce pressure points, awkward postures, and other contributing factors is also an engineering improvement. Some tools are designed for specific tasks, and have a certain orientation or grip angle. Other ergonomically-friendly tools have:

• Reduced weight, impact, and vibration;
• Padded handles to reduce contact stress;
• Extensions on the handles to reduce reaching; and
• Wraps on handles to absorb vibration.

The possible engineering improvements differ as much as the job tasks they address. If engineering improvements aren’t cost effective, or can’t address all of the contributing factors in a job, you can evaluate administrative changes.
Administrative improvements

Some tasks can be performed differently to reduce the chance of injury. For example, lifting with the legs instead of the back can help prevent back injuries. Taking short breaks allows the muscles to rest and recover, which can also reduce the chance of injury. The frequency and duration of breaks may change with the task, and even with the physical abilities of the person doing the work.

Administrative improvements include:

- Providing variety by adjusting work schedules,
- Providing recovery time,
- Modifying work practices,
- Ensuring regular housekeeping and maintenance, and
- Encouraging exercise.

Changing work practices and schedules usually requires continual employee feedback to ensure that the practices are effective. The benefits and limitations of each administrative change are explained below.

Providing variety

Rotating employees through different jobs can increase the variety of tasks and allow workers to use different muscles or postures. Combining two or more jobs, or adding tasks to a particular job, can also increase variety. To be effective, these changes rely on rotating through or combining tasks which differ in the:

- Muscles or body parts used,
- Working postures,
- Amount of repetition,
- Pace of work,
- Amount of physical exertion required,
- Visual and mental demands, and
- Environmental conditions.

Providing recovery time

Recovery periods are breaks that allow muscles to relax and recover. Breaking up work with frequent, short recovery periods can help reduce the chance of injury. Even breaks as short as a few seconds can help. For example, setting down a drill momentarily between uses allows the hands to relax and stretch.

Try to limit the amount of time any employee has to spend performing a “problem job,” like jobs described as “very hard.” If you have new employees, or workers returning from long absences, increase their workload gradually so their muscles can become accustomed to the work.

Modifying work practices

Our bodies function best in natural positions, like sitting or standing upright instead of hunched forward. Employees should be encouraged to use comfortable postures that keep the neck, back, arms, and wrists within a range of natural positions. They should also change positions frequently, and stretch when working. If they must operate outside of natural positions (like straining to reach overhead or bending to reach below the knees) it may be time to consider engineering improvements like re-arranging the storage area or re-designing the workstation.

Improving work practices includes using good lifting techniques. Proper lifting involves:

- Keeping the load close to the body and at a comfortable height (between the knuckles and mid-chest).
- Maintaining an upright posture that avoids bending or twisting at the waist.
Knowing personal limits and getting help for lifting bulky or heavy items, or for performing difficult tasks.
Exercising, warming up, and stretching regularly.
Pushing or pulling instead of lifting, when possible.

Other work practice improvements include encouraging employees to:
- Carry roughly equal amounts of weight in each hand.
- Turn or pivot the entire body instead of twisting at the waist.
- Avoid jerking by using smooth, even motions.
- Lift with the legs instead of the upper body or back.
- Plan ahead by making sure paths are free of obstructions.
- Wear shoes with appropriate soles for the surfaces in the workplace.

**Housekeeping and maintenance**
Regular housekeeping and maintenance of workspaces, tools, and equipment can help reduce or prevent injuries. For example:
- Keeping floors dry and free of obstructions helps eliminate slipping and tripping hazards.
- Keeping cutting or drilling tools sharp and in good condition can reduce the force and grip required to use them, and can also reduce their vibration.
- Fixing broken handles or replacing worn padding can help reduce vibration and contact stress.
- Making sure that carts and other equipment are in good working condition can reduce the amount of force required to move materials.

**Encouraging exercise**
Individuals in good physical condition are generally more productive and less likely to suffer injuries. Regular exercise can increase energy levels, alertness, and coordination. Encourage employees to warm up, perform gentle stretching, and increase their physical exertion gradually during each shift. New employees, or injured employees who return to work, should gradually increase their physical activity instead of starting with physically demanding labor.

**Safety gear**
Safety gear includes gloves, knee and elbow pads, footwear, and other items that employees wear. This equipment can protect workers from vibration, temperature, pressure points, and other factors. However, safety gear can also create additional hazards, and should not be a substitute for engineering or administrative controls. For example:
- Gloves can protect the hands from cold or injury. However, gloves can also decrease the ability to perform fine tasks, or create new problems if they don’t fit the job. For example, cotton jersey gloves may require more grip to handle smooth items.
- Proper footwear and anti-fatigue soles can prevent employees from slipping and can reduce fatigue from long hours of standing on hard surfaces. However, proper footwear is not a substitute for taking short muscle breaks.
- Knee and elbow pads can protect the body from contact stress against hard or sharp surfaces. However, pads should be used only after efforts to minimize sharp edges (by rounding or padding the equipment) or reducing the need for kneeling (by moving stored items to a higher shelf).

Safety gear is not a substitute for other ergonomic improvements. For most workplace hazards, the best option is to eliminate the hazard rather than supplying equipment to protect against the hazard. Safety gear, like other personal protective equipment, should be used only when no other methods can feasibly address the problem.

As with other personal protective equipment, the company needs to encourage and monitor the employees’ use of safety gear. If workers only kneel on a hard floor a few times a shift, they probably won’t put on knee pads each time, nor will they wear the pads all day. If the reason for kneeling can’t be eliminated (storage space is limited, and the bottom shelf must be used), a better solution might be to install a padded floor mat.
Also, note that both OSHA and NIOSH have questioned the effectiveness of using backbelts to prevent injury. In fact, these belts may give workers a false sense of security, which may lead to them lifting more than they should.

Training

Employees need training and opportunities for hands-on practice with any new tools, equipment, or work procedures. Training should provide the knowledge and the skills needed to work safely.

You gathered a lot of good information in looking at work tasks and considering improvements. Share this information with your employees. Inform them about:

- Factors that may contribute to injuries and how to identify them,
- Changes that have already been made to address any hazards, and
- How to report problems and request improvements.

Give some thought to how employees are trained. The most effective approaches are interactive and involve combinations of:

- Visual aids (pictures, charts, graphs, and videos);
- Hands-on exercises with tools and equipment;
- Case studies that focus on problem solving; and
- Small group discussions and problem-solving sessions.

Try to provide time for questions, and limit the use of traditional lectures or printed materials. Remember that videos are a useful training aid, but are not effective if used alone. Can you imagine trying to teach someone to drive a car by just showing them a video? Hands-on experience is much more effective.

Where to begin

You may want to choose a few improvement options to try before making substantial changes. Remember that making improvements is a process, and the first solution may not be the best. Setting priorities will help you decide which tasks to address first. To decide where to begin, consider the following:

- The relative risk from your rankings by priority;
- Frequency of complaints, symptoms, and injuries;
- Contributing factors or other problems identified;
- Ideas that employees have for improvements;
- The extent of change needed to make improvements;
- Your time frame for making improvements;
- Potential effects on productivity and efficiency; and
- Technical and financial resources available.

The suggestions below may help you when considering improvement options:

- Brainstorming sessions with engineers, maintenance people, managers, and production employees can identify problems and generate ideas for improvement. Involving everybody can also increase everyone’s acceptance of any changes.
- Review original designs. You may find that the job, equipment, tools, or work procedures have changed since the workstation was originally set up. A return to the original conditions may improve the situation.
- Look through equipment catalogs for ideas on how to address the problems in your workplace.
- Talk to equipment vendors. They may be able to share ideas on fixing similar problems.
- Contact others in your industry. They may have faced the same problems. You could save time, money, and effort by taking advantage of tested solutions.
Consult an expert in ergonomics. An expert can provide insight into available options, their cost, and their potential value. An expert may have experience with the tasks at your facility, and could save you from re-inventing the wheel.

Selecting improvements
Begin by making a list of tasks with the highest priority. For each task, write down several potential improvements. Sometimes a single improvement can reduce or eliminate multiple factors. Other times, several changes might be needed to address a single factor. Ask employees which improvements they think will work best.

After listing potential improvements, evaluate each one by asking the questions listed below. Will this improvement:

- Reduce or eliminate the contributing factors and the reasons for them?
- Create new or different contributing factors?
- Reduce or eliminate other problems identified and the reasons for them?
- Increase or decrease productivity and efficiency?
- Be practical from an engineering standpoint?
- Handle the required volume and pace of work?
- Be affordable (is another option less expensive)?
- Be accepted by employees?
- Positively affect employee morale?
- Take a long time to implement?
- Affect the rate of pay or a collective bargaining agreement?
- Require substantial training (is a simpler option available)?

Finally, select a few to try out in the workplace. As part of the evaluation, set up a trial period to test new tools, equipment, or procedures. Consider the following to test the idea without making major changes:

- Prepare a mock-up of a modified workstation;
- Change a single workstation first, and others only after the effectiveness is measured;
- Create an off-line workstation or training line;
- Insert an extra workstation on a full-speed production line; or
- Set up a practice or demonstration period.

Evaluating effectiveness
During the trial period, evaluate the improvements for effectiveness. Don’t make final decisions until enough time has passed for people to adjust to the changes. Employees should have a chance to practice using the new work-station, tool, equipment, or process. Any new tool or procedure can feel awkward at first, and providing an adjustment period may prevent you from rejecting an otherwise good improvement.

Some modifications may require employees to use new muscle groups or different body parts, and they may initially feel tired or sore. Check with employees to see how they think the changes are working. The process of improving the workplace is not exact. Expect to try out changes, see how they work, and either modify them or discard them for alternatives.

After an appropriate adjustment period, evaluate each improvement separately by considering the following questions. Has this improvement:

- Had enough time to work (are employees used to the changes)?
- Reduced or eliminated fatigue, discomfort, symptoms, or injuries?
- Reduced or eliminated the contributing factors or other problems?
- Added any new contributing factors or other problems?
- Worked from a financial standpoint?
- Had a positive effect on productivity and efficiency?
- Matched the production requirements of the job?
- Been accepted by employees?
- Been fully implemented in a reasonable amount of time?
- Had a positive effect on absenteeism and turnover rates?
- Been supported with the training needed to make it effective?

A good way to determine if you reduced or eliminated contributing factors is to go back and observe the workstation as you did during the initial evaluation. If necessary, you can try a new improvement option, or begin the process again to make further improvements. If the situation has improved, and the risk is lower, move on to the next job in your priority list.

**Activities outside the workplace**

Our bodies do not stop functioning when we go home from work. Home and recreational activities might contribute to MSDs or make them worse. Home activities may differ from work tasks, but the effects on the body from awkward postures, forceful exertions, or repetitive motions can be the same.

Activities that may contribute to MSDs include:
- Using home computers,
- Crocheting or knitting,
- Performing physical labor like home repairs,
- Working in awkward postures like gardening, and
- Playing recreational sports.

Keep in mind that personal factors such as physical fitness, weight, and lifestyle can affect the development of MSDs. Also, certain medical conditions may make some people more susceptible, or lead to other problems. Examples include:
- Arthritis,
- Pregnancy,
- Bone and muscle conditions,
- Previous trauma,
- Thyroid problems, and
- Diabetes.

In addition, psychological factors may have an impact. These factors include:
- Level of stress,
- Level of job security and satisfaction, and
- Degree of control over work areas or the pace of work.

Once employees understand the risks and solutions for the factors that contribute to ergonomic injuries, encourage them to apply the process at home to further reduce their risk of injury. Since damage to nerves and tendons happens at home as well as at work, the chance of developing an injury can be reduced by eliminating as many contributing factors as possible, both on and off the job.