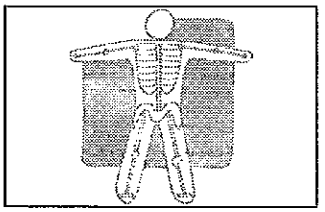


Ergonomics—An Overview

Overview of Topic

Ergonomics is an applied science concerned with the characteristics of people that need to be considered in designing and arranging things that they use in order that people will interact most effectively and safely. Ergonomics involves arranging the environment to fit the person.

On the construction worksite, ergonomic principles are being used to help adapt the job to fit the person, rather than force the person to fit the job. Redesigning the job to fit the worker can reduce stress and eliminate many potential injuries and disorders associated with the overuse of muscles, bad posture, and repetitive motions. Also referred to as biotechnology or human engineering, it is intended to maximize productivity by reducing worker fatigue and discomfort.

Construction workers' hands, wrists, arms, shoulders, backs, and legs may be subjected to thousands of repetitive twisting, forceful, or flexing motions during a typical workday. Many construction jobs expose workers to excessive vibration and noise, eye strain, repetitive motion, and heavy lifting. In many instances, machines, tools, and the workflow are poorly designed, placing undue stress on workers' tendons, muscles, and nerves. In addition, temperature extremes may aggravate or increase ergonomic stress. Recognizing ergonomic problems on the construction site is the essential first step in correcting these problems and improving construction worker safety and health.

The three most important issues related to ergonomics for construction workers are:

- Back safety and lifting.
- Equipment and tool vibration.
- Repetitive motions.

Each of these three has its own section in this manual.

Costs associated with ergonomics

Every year, about 19 million American workers are disabled by musculoskeletal injuries at a cost of about $100 billion. Over one third of all workers' compensation costs are associated with cumu-

lative trauma disorders, injuries caused by trauma to the body occurring over a period of time.

In 1981, cumulative trauma disorders (CTDs) made up about 18 percent of the occupational injuries and illnesses reported to OSHA. By 1991, that percentage had increased to over 60 percent. A conservative estimate of the medical costs of treating one industrial case of carpal tunnel syndrome, a type of cumulative trauma disorder affecting the wrists and hands, is about $20,000 a year. This cost estimate does not take into consideration the costs involved with lost work time, replacement workers, and lower productivity. Only the common cold and the flu cause workers to miss more work annually. Additional expenses to the employer resulting from ergonomic hazards in the workplace are administrative expenses associated with filing insurance claims and recordkeeping.

Employee Training

There are no specific employee training requirements on ergonomics, or on any of the three ergonomic issues identified as most likely to affect construction workers (back safety and lifting, equipment and tool vibration, and repetitive motion) but because OSHA has issued ergonomic guidelines, OSHA may cite construction companies under the General Duty Clause.

The ergonomic guidelines stress administrative controls, like training employees in proper work techniques to avoid repetitive motions, vibrations, improper lifting, etc., and engineering controls, like implementing the use of equipment to perform tasks, or redesigning job tasks, work areas, and procedures to be performed.

Training Tips

Use demonstration techniques when training employees about proper performance of jobs.

Where To Go For More Information

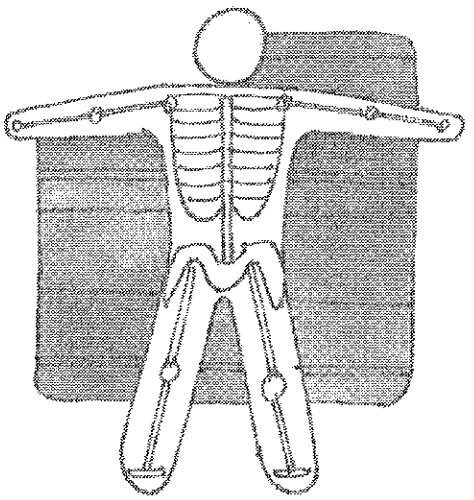
The OSH Act General Duty Clause (5.(a)(1))

KELLER'S CONSTRUCTION TOOLBOX TALKS

Ergonomics

Ergonomics is the science concerned with designing and arranging things that people use so that people will interact with the environment most effectively and safely. Ergonomics means arranging the environment to fit the person.

On the construction worksite, ergonomic principles are being used to help adapt the job to fit the person, rather than force the person to fit the job. Redesigning the job to fit the worker can reduce stress and eliminate many potential injuries and disorders associated with the overuse of muscles, bad posture, and repetitive motions.

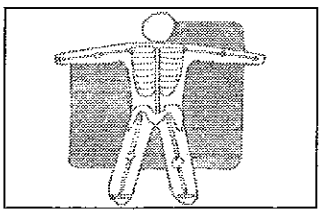


As a construction worker, your hands, wrists, arms, shoulders, backs, and legs may be subjected to thousands of repetitive twisting, forceful, or flexing motions during a typical workday. Many construction jobs can expose you to excessive vibration and noise, eye strain, repetitive motion, and heavy lifting.

If machines, tools, and the workflow are poorly designed, they can place undue stress on tendons, muscles, and nerves. In addition, temperature extremes may aggravate or increase ergonomic stress. Your ability to recognize ergonomic problems on the construction site is the essential first step in correcting these problems and improving construction worker safety and health.

The three most important issues related to ergonomics for construction workers, and ways to control them, are listed in the table below:

Ergonomic Issue	How To Control
back safety and lifting	• practice proper lifting techniques, • get help with large loads, and • use materials handling equipment.
equipment and tool vibration	• use only the force necessary to perform the job, • hold and use tools properly, and • rotate tasks and take break from tasks during the work day to avoid vibration for too long a duration.
repetitive motions	• perform tasks following proper job procedures at all times, • select the right tool for the job, and • rotate the tasks you perform during the work day to avoid a single type of repetitive motion for too long a duration.



Ergonomics — An Overview Sign-Off Sheet

This sign-off sheet documents the employees who have taken part in a training session on Ergonomics — An Overview at _____.
(company name)

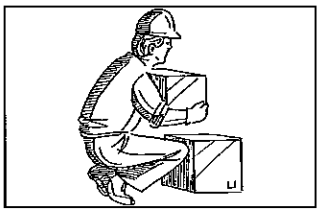
The session covered the following:

- An overview of ergonomics.
- Types of issues associated with ergonomics on construction sites.
- Ways to help avoid injuries due to poor ergonomics on the jobsite.

The space below is for each individual who has been trained on this topic to sign his/her names.

Date of Training: **Job Location:**

Employee Signature	**Print Name Here**



Ergonomics — Back Safety & Lifting

Overview of Topic

Sprains and strains are the most common causes of lower back pain. The back can be injured by improper lifting of moderate to heavy objects, falling, auto accidents, and sports activities. But of these, lifting improperly is the largest single cause of back pain and injury. Luckily, construction workers can prevent back pain by knowing and using proper lifting techniques. Safe lifting is a special concern on the construction job site because lifting is a major part of the job. Without lifting, through either physical or mechanical means, materials could not move around the site to build the project.

There is no OSHA regulation on safe lifting, but the subject is always near the top of the list of concerns because about 17 percent of all occupational injuries or illnesses are from overexertion in lifting (Bureau of Labor Statistics, 1994).

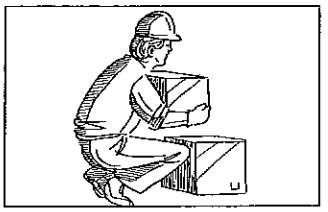
Back disorders are frequently caused by the cumulative effects of faulty body mechanics: excessive or repetitive twisting, bending and reaching; carrying, moving, or lifting loads that are too heavy or too big; staying in one position for too long; poor physical condition; and poor posture.

Prolonged sitting also stresses the body, particularly the lower back and the thighs, and may cause the lower back (lumbar) region to bow outward if there is inadequate support. This abnormal curvature (called kyphosis) can lead to painful lower back problems, a common complaint among drivers of dump trucks, back hoes, and other heavy construction equipment.

Other factors which are contributors to back injuries include the natural degeneration of the back due to aging; inactivity both at work and at home; seasonal activity undertaken without prior physical conditioning; stress and vibration.

Employee Training

There are no specific employee training requirements on safe lifting, but because back injuries due to improper lifting are a commonly recognized hazard identified by OSHA in ergonomic guidelines, OSHA may cite construction companies under the General Duty Clause. Fortunately, the basics of safe lifting are well known and easy to understand. Administrative controls, like



Ergonomics — Back Safety & Lifting

teaching safe lifting and work techniques, are a proven way to reduce employee lost time and workers' compensation costs.

In addition, engineering controls, like limiting weights to be lifted, having people lift in pairs and teams, or using materials-handling equipment as much as possible to assist in lifting, can also be used to reduce or eliminate problem lifting tasks.

General lifting instructions stress these key aspects of safe lifting above all others:

- Size up the load.
- Plan ahead, making sure you have a clear path to carry your load.
- Bend your knees.
- Place your feet close to the object and center yourself over the load.
- Get a solid hand hold.
- Lift straight up and smoothly, letting your legs do the work instead of your back.

With the above lifting techniques as the basics, these additional points should be stressed:

- Do not twist or turn your body once you have made the lift.
- Set loads down properly, once again bending your knees.
- Always push objects instead of pulling them if you have a choice.
- Keep the load as close to your body as possible.
- Split larger loads into several smaller ones if you can.
- If it's a long or awkwardly shaped load, get some help.

Training Tips

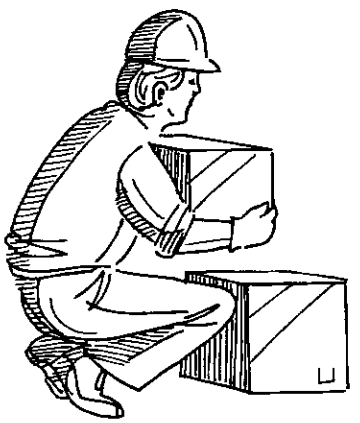
Use the demonstration method to show employees proper examples of lifting techniques.

KELLER'S CONSTRUCTION TOOLBOX TALKS

Ergonomics—Back Safety & Lifting

Heavy objects on construction sites are usually lifted by forklifts, hoists, platforms, cranes, and other types of materials-handling equipment. However, it's often necessary to load or unload moderate to heavy objects by hand. When that is the case, knowing the proper ways to lift can save you a great deal of pain and misery from a sprained back.

1. *Size up the load before trying to lift it*—Test the weight by lifting at one of the corners. If the load is too heavy or of an awkward shape, the best thing to do is: (1) get help from a fellow worker, (2) use a mechanical lifting device like a dolly, or (3) if you must lift, make sure you can handle the weight.

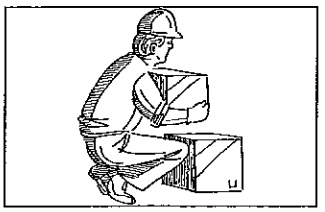


2. *Bend the knees*—This is the single most important rule when lifting moderate to heavy objects. Take a tip from professional weight lifters. They can lift tremendous weights because they lift with their legs, not their backs. When lifting a crate or box, place your feet close to the object. Center yourself over the load, then bend your knees and get a good handhold. Lift straight up, smoothly. Allow your legs, not your back, to do the work.
3. *Do not twist or turn your body once you have made the lift*—Keep the load close to your body, and keep it steady. Any sudden twisting or turning could result in injuring our back.
4. *Make sure you can carry the load where you need to go before attempting to move it*—Make sure your path is clear of obstacles and that there are no hazards, such as holes or spilled liquids in your path. Turn your body by changing foot positions, and make sure of your footing before setting out.
5. *Set the load down properly*—Setting the load down is just as important as lifting it. Lower the load slowly by bending your knees, letting your legs do most of the work. Don't let go of the load until it is secure on the floor.
6. *Always push, not pull, the object when possible*—When moving an object on rollers, for example, pushing puts less strain on the back and is safer, should the object tip.

Planning ahead makes sense. If you know certain loads will have to be carried from an unloading areas, place the objects on racks, not on the ground, whenever possible. That way the load will not have to be lifted from the ground. Do not attempt to carry loads that are clearly too heavy for you. Long objects, such as pipes and lumber, may not be heavy, but the weight might not be balanced and such lifting could also result in back sprain. Such objects should be carried by two more people.

If the load can be split up into smaller ones, you're better off in doing that, even if loading takes a few extra minutes. Trying to lift it all at once or even two or three loads may be asking for trouble when the weight is great.

By using common sense, you can help keep your back out of trouble. Every time you think about lifting, think defensively about your back and the possibility of a back sprain. Follow good lifting techniques, not only at work, but also at home.



Ergonomics—Back Safety & Lifting Sign-Off Sheet

This sign-off sheet documents the employees who have taken part in a training session on Ergonomics — Back Safety & Safe Lifting at _____.
(company name)

The session covered safe lifting techniques, including the following safe lifting rules:

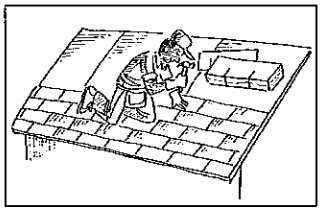
1. Size up the load before trying to lift it.
2. Bend the knees.
3. Do not twist or turn your body once you have made the lift.
4. Make sure you can carry the load where you need to go before attempting to move it.
5. Set the load down properly.
6. Always push, not pull the object when possible.

The space below is for each individual who has been trained on this topic to sign his/her names.

Date of Training: _____ **Job Location:** _____

Employee Signature	**Print Name Here**

_____
Supervisor's Signature



Ergonomics—Repetitive Motions

Overview of Topic

Among the many ergonomic disorders that can result from ergonomically incorrect actions or work/task design, repetitive motions are one of the most frequent types of injuries. Other than back injuries, repetitive motion injuries probably account for the largest percentage of ergonomic disorders in the construction industry.

Cumulative trauma disorders

Cumulative trauma, or repetitive motion, disorders (CTDs) are disorders of the musculoskeletal and nervous systems. They may be caused or aggravated by repetitive motions, forceful exertions, vibration, mechanical compression (hard and sharp edges), sustained or awkward postures, or by exposure to noise over extended periods of time.

CTDs can affect nearly all tissues, the nerves, tendons, tendon sheaths, and muscles, with the upper extremities being the most frequently affected. These painful and sometimes crippling injuries develop gradually over periods of weeks, months, and years. They result from repeated actions, such as twisting and bending of the hands, arms, and wrists.

A common risk factor among these disorders is the use of force, combined with repetitive motion over time. These conditions are common to construction site tasks such as hammering, sawing, and pounding.

Today, CTDs are recognized as a major occupational health hazard in the workplace and, according to the Bureau of Labor Statistics account for the largest share of occupational illnesses known as "repeated trauma" disorders.

The most common CTDs on construction jobsites are tendon disorders such as:

- Tendinitis, a form of tendon inflammation that occurs when a muscle or tendon is repeatedly tensed from overuse, vibration, or unaccustomed usage of the wrist and shoulder. Tendinitis is common among welders and painters.

- Tenosynovitis is an inflammation or injury to the sheath surrounding the tendon. Tenosynovitis can affect construction workers whose tasks require buffing, grinding, sanding, and sawing operations.
- Trigger finger is another tendon disorder, is attributed to the creation of a groove in the flexing tendon of the finger. Carpenters and other construction workers may be at risk of developing trigger finger.
- Raynaud's syndrome or white finger, occurs when the blood vessels of the hand are damaged as a result of repeated exposure to vibration for long periods of time. This condition is also intensified when the hands are exposed to cold temperatures, which can happen on jobsites in the fall, winter, and spring seasons.

Tendon disorders are very common and often occur at or near the joints where the tendons rub against ligaments and bones. The most frequently noted symptoms of tendon disorders are a dull aching sensation over the tendon, discomfort with specific movements, and tenderness to the touch. Recovery is usually slow and the condition may easily become chronic if the cause is not eliminated.

Employee Training

There are no specific employee training requirements, but because repetitive motion injuries are a commonly recognized hazard identified by OSHA in ergonomic guidelines, OSHA may cite construction companies under the General Duty Clause (section 5(a)(1) of the OSHAct).

Training Tips

Use demonstration techniques to show proper ergonomic work procedures as opposed to improper actions that can lead to repetitive-motion disorders.

Train construction workers how to avoid repetitive motion injuries by teaching them proper task performance. Teach them how to hold and use tools properly. Rotate tasks during the work day to avoid a single type of repetitive motion for too long a duration.

Where To Go For More Information

The OSH Act General Duty Clause (5.(a)(1))

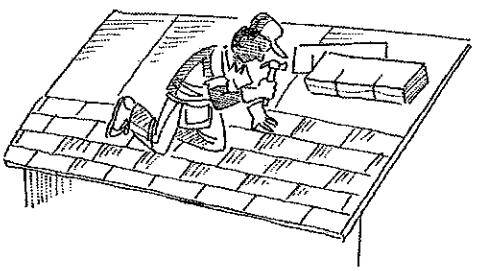
KELLER'S CONSTRUCTION TOOLBOX TALKS

Ergonomics—Repetitive Motion

You know the many aches and pains that can result from a long day on the job. Do you find some of those aches and pains last longer than others? Those may be repetitive motion injuries. Repetitive motion injuries are the ones that are caused by repeating the same action over and over. These types of injuries are long-term and can affect you even years after you retire. You want to be able to learn how to avoid them now to avoid pain down the road.

Common repetitive motion injuries, construction employees may be susceptible to are tendon disorders such as:

- *Tendinitis* is a form of tendon inflammation that occurs when a muscle or tendon is repeatedly tensed from overuse, vibration, or unaccustomed usage of the wrist and shoulder. Tendinitis is common among welders and painters.
- *Tenosynovitis* is an inflammation or injury to the sheath surrounding the tendon. Repetitions exceeding 1,500 to 2,000 per hour produce these symptoms. Tenosynovitis can affect construction workers whose tasks require buffing, grinding, sanding, sawing operations.

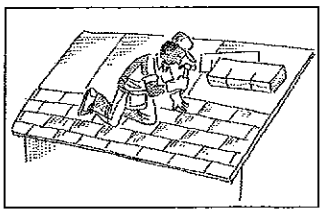


- *Trigger finger*, another tendon disorder, is attributed to the creation of a groove in the flexing tendon of the finger. If the tendon becomes locked in the sheath, attempts to move that finger will cause snapping and jerking movements. This disorder is often associated with using tools that have handles with hard or sharp edges or whose handles are too far apart for the user's hand. Carpenters and other construction workers may be at risk of developing trigger finger.
- *Raynaud's syndrome* or white finger, occurs when the blood vessels of the hand are damaged as a result of repeated exposure to vibration for long periods of time. This condition is also intensified when the hands are exposed to cold temperatures, which can happen on jobsites in the fall, winter, and spring seasons.

Tendon disorders are very common and often occur at or near the joints where the tendons rub against ligaments and bones. The most frequently noted symptoms of tendon disorders are a dull aching sensation over the tendon, discomfort with specific movements, and tenderness to the touch. Recovery is usually slow and the condition may easily become chronic if the cause is not eliminated.

You can avoid these types of injuries by following these guidelines on the work site:

1. Perform tasks following proper job procedures at all times.
2. Hold tools properly and only use tools for their intended purpose. Select the right tool for the job.
3. If possible, rotate the tasks you perform during the work day to avoid a single-type of repetitive motion for too long a duration.



Ergonomics—Repetitive Motions, Sign-Off Sheet

This sign-off sheet documents the names of employees who attended this training session on Ergonomics—Repetitive Motion at _____.
(company name)

The session covered:

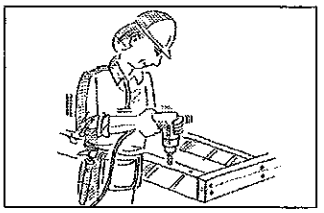
- Types of injuries associated with repetitive motion.
- The dangers of repetitive motion injuries.
- Ways to help avoid repetitive motion injuries on the jobsite.

The space below is for employees to "sign-off" that they were in attendance.

Date of Training: _____ **Job Location:** _____

Employee Signature	Print Name Here

_____
Supervisor's Signature



Ergonomics — Tool Vibration

Overview of Topic

Excessive or prolonged tool vibration is a potential cause of injury to construction workers to which little attention is often paid. Several specific conditions attributable to such vibration, as well as general negative health effects that can be traced back to prolonged vibration, are laid out in this section.

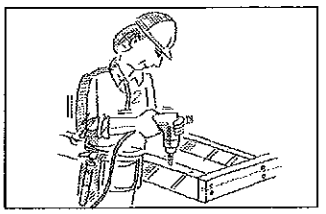
Raynaud's syndrome, also known as white finger, is associated with the prolonged use over time of vibrating tools, such as the following types of tools:

- Pneumatic hammers.
- Electric chain saws.
- Gasoline-powered tools.

After long-term exposure, perhaps 10 or 15 years working 6 to 7 hours a day with vibrating tools, the blood vessels in the fingers can become permanently damaged.

There is no medical remedy for white finger. If the fingers are fairly healthy, the condition may improve if exposure to vibration stops or is reduced. Typical construction activities that can lead to Raynaud's Syndrome include:

- Chain sawing.
- Jack hammering.
- Use of vibrating tools.
- Sanding.
- Painting.
- Using a tool too small for the hand, often in a cold environment.



Ergonomics — Tool Vibration

Other types of vibration may affect the entire body, producing overall fatigue and potential permanent damage. Vibration in conjunction with prolonged sitting may also result in degenerative changes in the spine. For example, lower back pain may be experienced by drivers of:

- Tractors.
- Dump trucks.
- Back hoes.
- Fork trucks.
- Cranes.
- Other heavy construction machinery and equipment.

This type of vibration, over time, can even result in permanent abdominal, spinal and bone damage.

Employee Training

There are no specific employee training requirements, but because vibration injuries are a commonly recognized hazard identified by OSHA in ergonomic guidelines, OSHA may cite construction companies under the General Duty Clause.

The company can help reduce excessive employee exposure to vibration by limiting the length of time in any given day an employee is exposed to vibration (by rotating employees between tasks, especially heavy equipment driving tasks), buying tools that limit vibration, or providing cushioning or padding that absorbs some of the vibration.

In addition, train construction workers how to avoid vibration injuries by teaching them to use only the force necessary to perform the job, how to hold and use tools properly, and to rotate tasks and take break from tasks during the work day to avoid vibration for too long a duration.

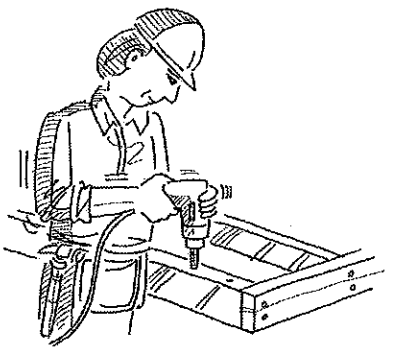
Training Tips

Use demonstration techniques in training sessions, to show proper ergonomic work procedures as opposed to improper actions that can lead to vibration-related disorders.

KELLER'S CONSTRUCTION TOOLBOX TALKS

Ergonomics — Tool Vibration

Excessive or prolonged tool vibration is a potential cause of injury to construction workers to which little attention is ever paid. But the fact is that excessive or long-term exposure to vibration can cause permanent injury to your nerve cells that can lead to numbness, pain, and lack of feeling in body parts. Some of the problems that can result from vibration include Raynaud's syndrome and vibration that affects the back and body.



Raynaud's syndrome

Raynaud's syndrome, also known as white finger, is associated with the use of commonly-used vibrating tools over time, such as pneumatic hammers, electric chain saws, and gasoline powered tools. This physical problem takes long-term exposure, perhaps 10 or 15 years working 6 to 7 hours a day with vibrating tools, to develop. Over the course of that time period, the blood vessels in the fingers may become permanently damaged.

There is no medical remedy for white finger. If the fingers are fairly healthy, the condition may improve if exposure to vibration stops or is reduced. Typical construction site activities that can lead to problems if done excessively over a long period of time include chain sawing, jack hammering, use of vibrating tools, sanding, painting, and using a tool too small for the hand, often in a cold environment.

Vibration that affects the back & body

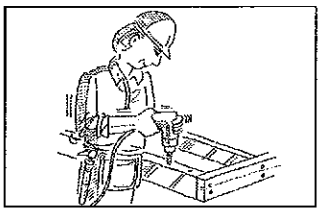
Other types of vibration may affect the entire body, producing overall fatigue and potential permanent damage. Vibration in conjunction with prolonged sitting may also result in degenerative changes in the spine. For example, low back pain may be experienced by drivers of:

- Tractors.
- Dump trucks.
- Back hoes.
- Fork trucks.
- Cranes.
- Other heavy construction machinery and equipment.

What to do to protect yourself from excessive vibration

Obviously, to work on a construction site, you cannot completely avoid exposure to vibrating tools and equipment. But complete avoidance is not necessary to avoid the problems that may be associated with vibration.

Avoid vibration injuries by using only the force necessary to perform the job, holding and using tools properly, and rotating tasks and taking break from tasks during the work day to avoid vibration for too long a duration.



Ergonomics — Tool Vibration Sign-Off Sheet

This sign-off sheet documents the employees who have taken part in a training session on Ergonomics — Tool & Equipment Vibration at _____.
(company name)

The session covered the following:

- Types of injuries associated with excessive or long-term tool and equipment vibration;
- The dangers of vibration injuries; and
- Ways to help avoid excessive vibration and long-term effects from it on the jobsite.

The space below is for each individual who has been trained on this topic to sign his/her names.

Date of Training: **Job Location:**

Employee Signature	**Print Name Here**