METHODS TO REDUCE BACK INJURY

Contributing factors to low back pain can include:

- Poor physical fitness
- Lack of flexibility
- Participation in certain recreational activities
- Emotional stress
- Lack of rest
- Poor back support when sleeping
- Poor posture when sitting and standing for long periods

Although an employer may have some control over these factors, in most cases **employees** have the greater control.

UNDERSTANDING WHAT CAUSES THE PAIN

The main structure in the back that provides support and allows for movement is the spine. The spine is composed of 33 separate bones or **vertebrae**, 24 of which are movable. Each of the 24 movable vertebrae are stacked on top of each other and separated by a fibrous cartilage called a **disc** Each disc consists of a tough fibrous band of tissue that surrounds the inner core of gel-like substance. The inner gel-like substance consists mainly of water, and acts like a hydrostatic shock absorber to protect the spine from large compressive forces. The outer wall protects the inner contents and prevents the gel from leaking out. Over time the outer wall can start to break down due to frequent stresses from activities such as repetitive lifting, awkward work postures and standing on hard surfaces, all of which accelerate the process. When the disc wall develops a weak spot, it can begin to bulge. This **disc bulge** can put pressure on the nerves in and around the disc, causing pain. If pressure, and wear and tear continue on the disc, the outer wall can rupture or herniate. Not only can this put additional pressure on the disc and spinal nerves, it can make the vertebrae on top and below the disc unstable. This instability can place more pressure on the surrounding nerves as well as stressing ligaments attached to each vertebrae.

In addition to low back pain associated with disc problems, pain can commonly be attributed to **muscle and fascia strains and ligament sprains.** These strains and sprains occur when the back is bent too far in one direction, bent repeatedly, or when too much load is applied in a bent position. When damage to the muscle or ligament occurs from overstretching or overloading these structures, inflammation can occur which, in turn, may cause pain. In addition, the larger muscles in the back may begin to spasm, also referred to as muscle guarding. If the muscle and ligaments aren't allowed to heal properly before being stressed again, scar tissue can develop. Because scar tissue is not as strong or flexible as normal muscle or ligament tissue, it is prone to recurring injury.

Causes of Back Pain and Injury

Overexertion back injuries, as defined above, are rarely the result of a single event or accident. In some cases, an accident may have resulted in a pulled muscle. But the muscle really didn't become bothersome until after several weeks or months of repetitive lifting or awkward work postures. In other cases, months or years of repetitive lifting, pushing, pulling and carrying didn't become noticeable until a single lift produced significant pain from a bulging or ruptured disc. The low back is especially susceptible to breakdown due to the mechanics of the human body and the type of tissue and structures that make up the spine.

The upper body can be thought of as a **lever arm** and the low back as the **fulcrum point** at which the trunk rotates around. For this reason, the **compressive forces** on the spine are the greatest in this region and consequently can cause the most damage to the discs that sit between each vertebrae. For instance, lifting a 20 lb. bag of flour 20 inches away from the body produces approximately 400 lbs. of compressive force on the disc at the fulcrum point. This is 20 times the weight of the actual object lifted! In this case it is not only the distance of the sack of flour from the body that contributes to the large compressive force, but also the weight of the trunk as it is bent forward. The muscles in the back have to work to support the flour sack and the weight of the upper body. For this reason, even if a person is not lifting an object, large compressive forces are produced just to maintain the trunk in a forward bent posture. Therefore, tasks that require employees to work in forward bent postures, also contribute to the risk of developing low back pain.

Risk Factors Associated with Lifting and Moving Materials

Risk factors are characteristics of the job or task that increase the risk or chance of sustaining a low back injury. The more risk factors that are present on the job, the greater the employee's risk of back injury. With lifting injuries, one of the most obvious risk factors is the weight of the object. Heavier objects require more muscle force to stabilize the trunk and produce greater compressive forces on the spine. Heavier objects are also more hazardous to handle for the following reasons:

■ Heavier objects require more strength to handle which limits the number of employees who can safely handle them.

■ When an object is too heavy for an employee to easily move, he/she may attempt to force the object
to move by assuming an awkward posture or using momentum to jerk or twist. Abruptly twisting the
back while lifting or quickly accelerating objects produces even larger forces on the spine, and greatly
increases the risk of muscle and ligament strains and sprains as well as wear and tear on the discs.

■ Heavier objects require more energy to handle and can cause early whole-body and local muscle fatigue. As an employee becomes fatigued, he/she will be more likely to make errors, use improper lifting techniques, and cause an accident that could produce more severe consequences than a back injury.

These are just a few of the potential side effects of allowing employees to handle objects that are beyond their physical capabilities. The next section will describe additional workplace risk factors that can contribute to back pain. Provided with a description and example of each risk factor are examples of control methods for eliminating or reducing the employees exposure to each risk factor.

Controlling Risk Factors in the Workplace

Control methods are changes that can be made to the physical work environment, equipment, tools, work processes, and employees' behavior to reduce the number or level of risk factors. Think of these as solutions that eliminate or reduce employees' exposure to risk factors. Most control methods fit into one of three general categories:

■ **Engineering controls** are physical changes or modifications to workstations, tools, or equipment that make it easier for employees to handle materials. Engineering controls may also improve material handling by using equipment or tools in areas where they weren't used in the past. An example would be raising the height of a work surface to reduce the amount of bending forward required by the employee to work on materials. Another example of an engineering control would be using a pallet jack or fork lift to move bags of flour from a pallet to a mixing area, rather than manually carrying them.

■ **Administrative controls** are procedures for safe work methods that reduce the duration, frequency, or severity of exposure to a hazard. Administrative controls can include gradual introduction to work, regular recovery pauses, job rotation, job design and maintenance and housekeeping.

■ **Training** involves educating workers and managers about the potential risks of back and manual handling injuries, their causes, and prevention. Training can involve education on safe lifting techniques and proper body mechanics.

The best approach usually involves a combination of the three control methods. You may find a mechanical lifting aid that could easily replace the old method of manual lifting, but unless employees receive training on how to use the new device and its advantages, they may use it improperly or not at all.

FACTORS FOR CONSIDERATION

Distance of Load from Body

For most tasks, the horizontal distance combined with the weight of the object is the most important factor in terms of producing the greatest stress on the back. The following characteristics of the materials and workplace increase the horizontal distance.

■ Wide objects (distance in front of the body).
■ Obstacles or barriers between the worker and the object.
■ Tasks requiring extended reaches in front of the body to handle objects.
■ Lifting objects near floor level.

Engineering controls should seek to eliminate these characteristics whenever possible. Rather than trying to measure the actual horizontal distance of the load away from the spine, a simpler method can be used to estimate the distance from the employee's toes. **A general guideline is to design for products that can be handled within 10 inches or less from the front of the toes.**

Example 1:
Employee has to bend and reach over barrier in front of a conveyor belt transporting packages.
Control Measure:
A section of the barrier has been removed and a cutout allows the employee to get much closer to the packages before lifting them off the conveyor.

Example 2:
Large awkward packaging increases the horizontal distance and the compressive forces on the spine.
Control Measure:
A request is made to the supplier to reduce the size of packaging, thus reducing the horizontal distance.

Weight of Object and Solutions

The weight of an object is one of the most obvious risk factors for producing low back pain. Lifting heavier objects requires more strength and energy. With a heavy object, workers are more likely to use awkward postures, such as twisting, where momentum may be used, Heavier objects also increase the risk of bruises, contusions, and broken bones when they are mishandled or dropped.

Depending on the work environment, the materials being handled, and the financial resources of the company, several controls may be possible. The most obvious example is reducing the weight of the object by reducing the package contents, or the size of the object. For instance, one of the country's largest food manufacturers, General Mills, asks its suppliers to provide dessert mixes in 50-lb. bags instead of 100-lb. bags whenever possible. The smaller bags are easier to handle and the company has reduced the risk of back injuries.

The other extreme can also apply, that is, increasing the weight of the object to a point where it's impossible for one person to handle it. For instance, an industrial bakery that orders ingredients in 50-lb. bags could ask suppliers to ship ingredients in large totes weighing 500-1000 lbs. The totes could then be dumped automatically into hoppers that feed filling stations on the production line. The heavy totes would make it impossible for workers to handle them manually.

The use of **mechanical lifting devices** to handle large, heavy or awkward objects can also save backs and considerable time and money. Although mechanical lifting aids can be a large initial investment, businesses can quickly see a return on that investment if workers' compensation claims are a significant expense. Mechanical aids range from simple overhead hoist and chain systems to hydraulic lift tables to electrical powered vacuum lifts.

Another possible solution is to have two or three workers **lift as a team**. This approach can be easy, inexpensive, and quite effective if certain precautions are taken. Team handling makes sense in those cases where all other approaches are either too costly or not feasible. Team handling does require coordination between the workers, therefore training should be a big part of this approach. Also, consideration should be given to matching the team members in terms of size and strength. Teaming a 5' 2", 110 lb. female with a 6' 4", 220 lb. male will likely result in an awkward posture for one or both of the workers and an unequal distribution of the object weight.

Frequent or repetitive handling is almost always the result of job demands, that is, characteristics of the job and work environment. In other words, the **only way to reduce the repetitiveness is to change the job itself by:**

■ Cross-training employees to perform several jobs; Cross-training employees to perform several different jobs also reduces the risk of injury. When deciding which jobs to cross-train employees on, make sure the jobs use different muscle groups and don't stress the same areas of the body. Rotating employees between jobs provides natural recovery breaks. It also gives employees greater variety and employers great flexibility when employees are sick or on vacation. Studies have also shown that employees who have a better understanding of the entire work process and contribute more overall tend to be more satisfied with their jobs and are more concerned with product quality.

■ Reorganizing work methods; Reorganizing work methods can reduce the frequency that materials are handled: the order of work can change or the number of times materials are handled can be decreased. For example, a large public library system that used to store book bins directly on the floor to be transported to other library branches now stores the bins on carts. Now workers only lift the book bins once as they place them into the transport van. With the previous method, the book bins had to be moved twice — from the floor to the cart, then the cart to the van. Reorganizing methods to avoid redundant handling not only reduces the risk of back injury but also makes the process more
efficient and safe.

■ Slowing production down; Slowing production down is one of the least desirable options for most businesses. However, there are benefits such as less worker fatigue, fewer human errors, and decreased injuries and costs associated with these injuries.

■ Increasing staff size

■ Eliminating piece-rate and production incentive programs

Twisting while Lifting and Bending Forward

Twisting the back while lifting and bending forward puts major stress on the vertebrae and discs. Twisting while bending forward not only increases the compressive forces on the low back, it also places torsion stresses that can overstretch ligaments. The workspace layout, the employee's technique when moving, or the two combined, may lead to twisting when lifting and lowering objects. Good training on proper technique may reduce twisting movements in some employees. A better approach is a well-designed layout of storage areas, equipment, and materials. In cases where the layout can not be modified, more emphasis should be placed on:
■ Training employees to step turn and square up the load before bending and lifting.
■ Reducing the frequency of lifts/lowers.

In many cases where frequent lifting is required, even a well-designed layout and good body mechanics training can not compensate for a task that requires an employee to constantly bend, reach, lift, and lower at a fast pace. **Twisting can often be minimized by reducing the frequency of lifts.**

Poor Handholds

Handling materials without adequate handholds increases the chance of dropping the load. **It also decreases by about 10 percent the amount of weight the worker can safely handle.** If handholds can be provided, the following guidelines should be considered in the design phase:
■ The handhold should be wide enough to accommodate a very large hand.
■ In most cases, the best design will allow for the most powerful grasp which in many cases is the power grasp.
■ The second best design will allow for a hook grasp, If the object must be lifted from the floor, a hook grasp is actually the most preferred. A hook grasp will reduce the amount of bending or squatting when lifting from the floor.
■ Handholds with sharp edges or square corners should be avoided when possible.
■ Locate the handhold at or slightly above the center line passing through the center of mass of the object.

Example 1:
When lifting trash cans without handles, this refuse worker must grasp the top lip of the can in order to lift and dump it.
Control 1:
A *better* designed can has a “drawer type” handle where the worker can hook his hand underneath the lip for a better grasp.
Control 2:
A *best* designed can has rounded handles where the worker can use a “power grasp” to grip the handle to lift and dump.

Example 2:
In the illustration below two workers lifting and carrying drywall have to grasp each board with one hand underneath to support the weight and one hand on top to stabilize the load. When two workers of different stature perform this lift and carry, awkward trunk postures are common.
Control:
A small, lightweight handle that easily attaches to the ends of the board can be used by each worker and grasped with one hand. The handle has cylindrical ends which can be grasped using a power grasp. There are various other tools for carrying these types of objects.