

Dock Safety Guide
Loading and Unloading Risks

RISK CONTROL







We make docks safe work spaces.

Loading, unloading and moving materials/goods from trucks are daily activities that, when done unsafely, can result in serious accidents and expensive insurance claims. Whether you are a small business owner or a large enterprise, an unsafe dock affects the trailer transporter, the dock receiver/loader and/or any person within the dock work space. CNA Risk Control assists businesses of all sizes and in all industries in preventing dock accidents. We explain to businesses how they can lower their exposure to risk by creating safety strategies to protect the trailer transporter, dock receiver/loader and/or any person within the dock work space.

Dock Risks

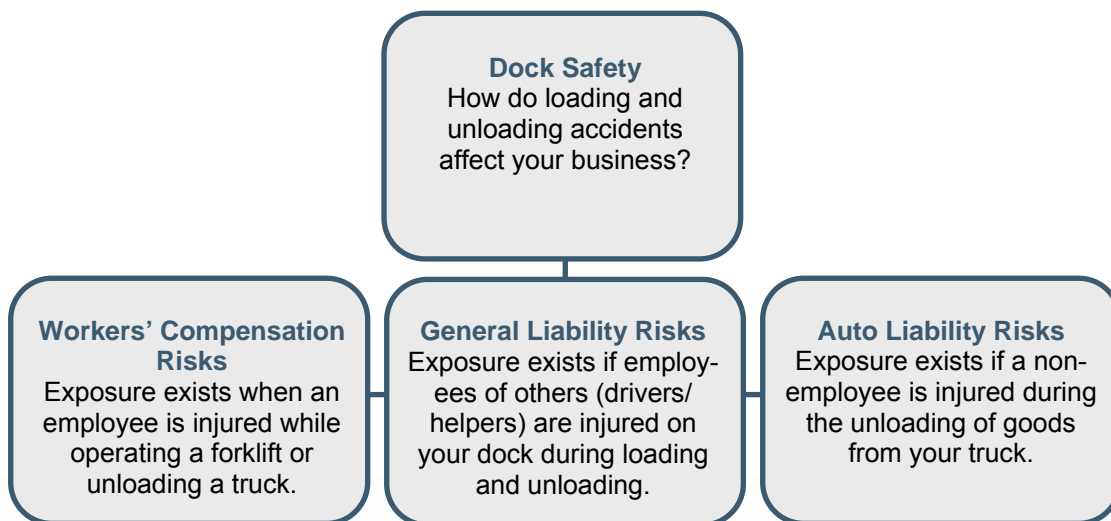
As Risk Control, we identify the reasons dock injuries occur and how insurance coverage is impacted. Here are three examples of dock risks:

- A person is injured while loading a stack of pallets inside a trailer when another stack of pallets falls on that person. Another person is working in the area and may be responsible for

the accident. Liability is questionable and will probably boil down to the credibility of the witnesses. However, the injured person has sustained serious injuries estimated at \$1.3 Million dollars.

- The insured is an exporter of products hired by a common carrier to transport his finished product to another company. When the driver reached his destination he was struck by several bundles of product when he opened the door. His injuries included several fractures to the pelvis, leg, ankle, right arm and deep abrasions to the right leg. The driver's recovery was delayed by the need for extensive physical therapy and complications from a medical condition. Value of this injury was estimated at \$800K.
- During warehouse racking, product became separated from the pallet spilling onto the floor. A forklift operator noticed the spill and left the work area to obtain cleanup equipment. During her absence, a co-worker, unaware of the product spill, slipped and fell, resulting in a \$400,000 injury.

**Dock Safety Chart:
Exposures by Lines of Insurance Coverage**





These types of situations can and often do impact more than one line of insurance coverage. This guide will inform you about risk exposures and insurance impacts from dock accidents.

From a Workers' Compensation Perspective

In order for workers' compensation benefits to apply, bodily injury to an employee must arise while working in the dock area. But what happens if the dock workers are contracted or subcontracted?

The majority of workers' compensation laws impose liability on companies for compensation benefits for employees of contractors or subcontractors. The status of the injured worker as an independent contractor versus an employee can be challenged. In general, however, the party that controls the work is the employer.

Answers to the following help determine which party is the employer:

- Who delivers the work instructions?
- How is training conducted?
- Where does the direction and control come from?
- Who does the hiring/firing, supervising and paying?
- Who sets the work hours?
- Who furnishes the equipment and materials?
- Who has supplied the investment or capital?

General Liability Perspective

Both bodily injury and property damage are covered in general liability coverage. Under this coverage the insurer agrees to pay those sums that are legally obligated such as compensation, lost wages and pain/suffering resulting from bodily injury.

In the case of a loading and unloading exposure, a third party could be injured in your retail or warehouse dock while goods are being loaded. Such injury could result from a forklift truck or from a simple trip and fall. Liability also exists if the third party is injured by improperly secured goods falling from a truck. Seldom is the contributory negligence of the employee of others a factor in removing your liability for the injury to this third party.

Auto Liability Perspective

When your vehicle is moving and causes damage to the property of others, another vehicle, or injures a person, auto liability pays the cost to repair or replace damaged property or those sums that are legally obligated such as compensation, lost wages and pain/suffering resulting from bodily injury.

In a dock area, auto liability coverage applies if someone working on or around your vehicle is injured as a result of a defect or problem with your vehicle, even if the vehicle is not moving. One example would be if a worker loading your vehicle falls through a defective section of the trailer floor and is injured. Another example would be if the overhead door or swing door closes on a worker, or cargo falls off your vehicle causing damage or injury.

Building Safety Around Docks

1. **Identify hazards** — Think about the transfer of goods/products in the warehouse. Check the manufacturers' instructions or data sheets for handling chemicals and other hazardous goods. Talk with people who perform the work and know the work process best.
2. **Determine who might be harmed** — Identify people working around the dock work space and people walking by. Remember workers who use equipment such as forklift operators, janitorial staff or maintenance workers can be harmed when working around dock areas. Lastly, don't forget to assess the dock areas where you have public contact.



- 3. Determine what to do** — Spot for hazards, decide “reasonable practices” needed to protect people from harm and property from damage. Use the hierarchy of controls to determine how to manage your risk.

Removing Safety Hazards from Docks

Loading docks are busy work spaces where an unintended or unexpected event can occur. At CNA, we have the expertise to help businesses prevent accidents and injuries from becoming major cost burdens.

Traffic and Workflow

Mixing vehicle and pedestrian traffic can be disastrous. By permitting entry only to those trucks making deliveries or picking up merchandise you limit dock risks. Visibility is important when moving a vehicle on the lot. Therefore, identify blind spots at corners, around buildings. Post warning signs and, if possible, flashing lights to alert drivers of the hazard. Continue to minimize yard risks by filling any potholes and defining pedestrian routes. Remember authorized drivers need clearly posted “rules of the road and enforced speed limits.”

Key Rules for Truck Drivers

- Sound the horn with two quick beeps before backing to the dock.
- Use back-up alarms on company vehicles.
- Use co-workers as spotters and make sure the driver understands their signals. Spotters should always wear safety vests, never walk directly behind a vehicle and always be visible in the driver’s mirror.
- Use markings on trailer lanes for easy backing and spotting.
- Ensure chocks (i.e., wheel stops) and dock bumpers are available and in good repair.
- Prevent trailer creep or dock walk, which can cause a gap to open between the trailer and dock by providing adequate trailer locking devices.

- Use dock levels and locking devices with signal lights so you know when it is safe to move the trailer.

In the warehouse, marking permanent aisles, passage-ways and forklift lanes are certainly helpful, particularly where hazards cannot be removed. Make sure goods, equipment, and waste do not cause obstructions or protrude into places where people walk. Provide good lighting. If items fall onto traffic routes, clear them as soon as possible. Always inspect the workplace regularly, removing trip hazards.

Source: ANSI (Z535.1-1998) and OSHA (29CFR 1910.144)

Key Rules for Pedestrian Spaces

- If workers must walk in the yard to enter the dock, have a clearly marked, possibly covered, walkway for them to use.
- Clearly mark where drivers and helpers are to enter the building.
- Do not allow anyone to wander around the yard or dock area.
- Have a designated place for drivers and helpers to go when not in their trucks.
- Have a designated place for drivers to stand when they must watch their trucks being loaded or unloaded.
- Require anyone walking or working in the yard to wear a safety vest.
- Require drivers to wear safety vests around the dock area.
- Make sure stairs and/or ramps from the yard are level to the dock and have adequate handrails.
- Make sure stairs have uniform risers and level treads.



Spill Containment and Cleanup

Water, oil or other liquids can cause slips and falls. Spills can also include substances that may be flammable or toxic. Even the smallest spill amount may cause respiratory nuisance or other physical symptoms. OSHA mandates that employees be properly trained in the use of personal protective equipment (PPE) for spill cleanup and manage spills that are not flammable or toxic.

No one glove is suited for all chemical exposures. Base your glove material selection on the manufacturer's chemical resistance guide. Watch the manufacturers' label as chemical compatibility of glove material can vary.

OSHA, Appendix B - Personal Protective Equipment rule 29 CFR 1910.138 Subpart I recommends the following for chemical mixtures:

“Employers shall base the selection of the appropriate hand protection on an evaluation of the performance characteristics of the hand protection relative to the task(s) to be performed, conditions present, duration of use, and the hazards and potential hazards identified.”

Source: http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=9788

Check the shipping containers for a material safety data sheet (MSDS) that explains the health effects and the proper PPE to wear. For chemical situations, knowing the hazard includes being aware of the type(s) of chemical(s) and the level of exposure (or potential exposure). Some containers may have an icon or image to denote material is flammable, toxic, or might react if exposed to water. Icons are a more universal method of illustrating the risk because they transcend language barriers.

There are 7 basic steps we recommend for spill containment and cleanup.

1. Select and train employees.
2. Determine medical qualification needed for the goods handled.

3. Appropriately contain leaks.
4. Set up proper hazard/warning signage (i.e. implement a cone procedure).
5. Neutralize spill.
6. Properly dispose of waste.
7. Cleanup the floor or external work area after a spill.

Note: Large spills require special cleanup and are best handled by the fire department with specialized clothing, respirators, and use of decontamination procedures.

Cargo Securement

Damaged cargo can be costly to your business and result in losing valuable customers. Improperly secured cargo can cause injury to drivers and others. Consider the type of trailer you will be using: type of floor, anchor points for load straps, and proper space for the cargo. Consider what cargo materials can be transported together and whether the cargo is on pallets, in containers, etc.

Federal Motor Carrier Safety Regulation (FMCSR), Part 392.9, covers inspection of cargo, cargo securement devices and systems. FMCSR, Parts 393.5 and 393.100 - 393.136, cover specific securement requirements. The FMCSR standards apply to commercial motor vehicles including vehicle combinations that have a gross vehicle weight rating (GVWR) or gross combination (GCWR) of 10,001 pounds or more. This standard also is used in transporting hazardous materials in a quantity requiring placards.

Cargo securement applies to all types of cargo **except** commodities in bulk that lack structure or fixed shape (i.e. liquids, gases, grain, sand, gravel, aggregate, liquid concrete) or ones that are transported in the structure of a commercial motor vehicle such as a tank, hopper or box.

There are specific requirements that apply to the following types of cargo, for which drivers must have training.



Proper securement equipment must be used with these types of cargo:

- Logs
- Metal coils
- Concrete pipe
- Automobiles, light trucks and vans
- Flattened or crushed vehicles
- Large boulders
- Dressed lumber or similar building products
- Paper rolls
- Intermodal containers
- Heavy vehicles, equipment and machinery
- Roll-on/roll-off or hook lift containers

Cargo Tips

- Lighter cargo can be stacked on top of heavier freight. But keep the load as low as possible and toward the center of the trailer.
- Avoid disasters by packing compatible cargo together on the same pallet or trailer.
- Do not allow the cargo to obscure the driver's view or interfere with movement of driver's arms or legs. Keep the exit from the driver's compartment unblocked.
- Cargo must be secured to prevent it from leaking, spilling, and blowing off the vehicle, falling from the vehicle or otherwise becoming dislodged from the vehicle.
- Cargo must be secured to prevent shifting within the trailer so that the stability or maneuverability of the trailer or truck is not adversely affected.
- Even though cargo is secure, caution should be taken when opening trailer doors, as cargo may fall out.

- All cargo must be firmly secured within the trailer through the use of floors, walls, blocking, bracing, dunnage or dunnage bags, shoring bars, tie downs or a combination of these.

Note: Cargo in a sided vehicle may not need additional securement if each article of cargo is in contact with, or sufficiently close to, a wall or other articles so that the cargo cannot shift or tip.

Other Driver Responsibilities for Securing Cargo

Trip planning starts the duties of drivers before leaving the shop/facility. Within the first 50 miles after starting, drivers should adjust cargo or load securement as necessary. Re-inspection of goods during the trip should occur every three hours or 150 miles, whichever occurs first.

Cargo is immobilized or secured on or within a vehicle by tie downs along with blocking, bracing, friction mats, other cargo, void fillers or a combination of these. Drivers should determine the proper number and type of tie downs needed to secure the cargo.

When tie downs (chains, wire rope, steel strapping, synthetic webbing or cordage) are used as part of a cargo securement system, the number of tie downs needed depends on:

- Whether the cargo is prevented from moving forward. FMCSA recommends use at least one tie down for every 10 feet or part thereof.
- The length and weight of the cargo
- The strength of the tie downs

Note: It is always better to go beyond the minimum so the cargo remains secure even if one component of the securement system fails. Use the table found in FMCSR, Part 393.108, as a tie down guide.



Moving Goods from Docks to the Storage

When the material is received off the trailer, it can be staged on the dock temporarily or sent to warehouse storage. Conversely, product can be taken out of the storage system and sent to the shipping dock. The layout of the storage system, the aisle widths and goods transported will determine the transporting equipment. There are numerous items to consider for safe movement of goods such as motorized forklifts, counterbalanced riders, stocker pickers, walkie stackers, pallet jacks etc. Without proper equipment employees are susceptible to a variety of injuries including MSDs (musculoskeletal disorders).

Forklift Safety

Never underestimate the hazards of driving a forklift. They weigh more than a vehicle and have a high center of gravity. Since the loads are not secured to the vehicle directly, the loads can shift and/or fall. Common hazards associated with forklift trucks include:

- Driving over a person or object. Running into protruding objects, storage racks, door frames or suspended light fixtures.
- Exceeding the safe load limit designed for the vehicle resulting in damage to the truck or the load.
- Poor understanding of the vehicle, including its maintenance. Remember, battery powered trucks use lead-acid with potential hazards associated with electricity and recharging. Gasoline and propane fuels have potential hazards associated with ignition, and confined spaces might create carbon monoxide.
- Driving too fast, creating the potential for a “roll-over.”

Good control of the vehicle with good visibility is the cornerstone to forklift safety. Consider the following guidelines:

- **Seek OSHA certification for all forklift opera-**

tors. Operating a forklift is a specialized job. The federal government requires all forklift operators be trained and authorized by their organizations. OSHA federal regulation CFR1910.178 states “only trained and authorized operators shall be permitted to operate a powered industrial truck.”

- **Inspect forklifts before each shift.** Use the data plate attached to the truck body for important information about the truck’s capacity. Ensure that the proper tire is used. Solid tires are designed for use inside on smooth, dry surfaces. Pneumatic tires (tires filled with air) are designed for indoors as well as outdoors.
- **Check forklift warning signals.** Before operating a forklift, check the back-up alarm, horn and blinking light on top.
- **Explain the rollover protection system (ROPS) to employees.** ROPS is the structure of the compartment which protects the employee during a rollover or when objects fall. In addition, inform employees to wear their seatbelts to prevent the employee from being thrown in the event of a forklift rollover. Forklift drivers should never permit an employee to ride on the vehicle.
- **Ensure stability of the loads prior to load transportation.** Unlike a car or truck, forklifts use the rear wheels for steering. When gravity remains in the center of the forklift, it is stable. But when it shifts forward or backward, the forklift can tip over. This can occur when:
 - Traveling with an elevated load
 - Trying to carry too heavy a load
 - Trying to turn the lift truck while it is moving too fast
 - Operating the lift truck on a hill or incline
 - Starting or stopping too fast.



- **Lift and carry loads, placing the heaviest load against the back of the forks.** This method places the load center closer to the front wheels and makes for a more stable load.

Racking Systems

Due to congestion, traffic and their exposure to racking systems, loading and unloading of goods are dangerous areas. Damage to storage racks can be caused by impact from lift trucks colliding into the racks. By design, some palletizing equipment gets closer to racks and creates the likelihood of more damage. Corners and aisle ends are the most vulnerable areas for collisions and should be protected by corner protectors and other guards. Use of bright paint, colored markings, deflectors or contrasting materials help to denote rack corners, beams and edges.

It is still the responsibility of the forklift driver to properly drive the vehicle, load the rack, and understand structural integrity of the racking system. Following are some general guidelines to minimize losses and help the forklift driver work with racks:

- Limit the amount of lift trucks operating in the aisles, and provide movement patterns for the trucks. Provide adequate lighting for truck maneuvering and placing/retrieving product onto the shelves.
- Consult the supplier of the lift truck to determine optimal aisle width and lift clearances. Rack suppliers typically recommend a minimum clear aisle (pallet to pallet) equal to the lift truck minimum turning radius plus 6 inches.
- Ensure racking is capable of supporting the loads and is properly secured/anchored (e.g., bolted to the floor). Anchors need to be strong enough to resist shear forces, especially if an earthquake occurs. Consult NFPA 13 (National Fire Protection Association) for anchoring recommendations involving height and depth ratios for anchor locations.
- Use beam safety clips between beam connectors in accordance with NFPA 13 to further secure the racks.
- Consider shelves that are open framed/wire mesh so the water from the sprinkler system can penetrate through the racks.
- Ensure proper flue space, or clearance, both transverse (6 inch minimum between loads/goods) and longitudinal (6 inch clearance space minimum) to allow overhead water penetration through the rack in case of fire. Consult your local fire department to comply with all local regulations. The acceptable distance between the top of the pallet to the building truss is dictated by the sprinkler system and local fire codes.
- Stack goods securely on shelves with the heaviest items at the bottom. Maintain sufficient clearance between shelves to allow for safe pallet loading/unloading. For manual stock retrieval consider tilted shelves that can be gravity fed. When working with double-deep racking systems, don't attempt to pull pallets forward unless the racking tracks and wheels are properly working.
- Train the operators to visually inspect all racks on a regular basis and repair/replace all defective racks (e.g., dents, kinks, misalignment of racks, loose bolts, damaged components, missing end caps).
- Teach operators how to operate lift trucks, especially when working with racks and in aisles. Have the operators understand aisle clearances and rack tolerances. Instruct the operator for proper pallet placement on the rack.
- Be sure the loading of the racks and storage does not exceed the maximum load carrying capacity of the concrete slab. The depth of the concrete aids in its loading capacity tolerance.



Manual Material Handling Techniques for Warehouse Workers

Job tasks for warehouse workers pose some of the most physically demanding challenges. Activities such as picking, lifting, moving and restacking often involve extended arm reaches, excessive forward torso flexion (forward bending), twisting of the torso and reaching overhead – often in combination while handling heavy loads.

In distribution, incoming goods are being shared on multiple docks that move directly to outgoing orders or lanes without any storage stops.

The reduction of muda (Japanese for waste or an activity that does not add value) within facilities is crucial to cutting costs and allowing for greater useable space.

Ergonomic assessments can help determine if material handling methods employed in a facility are appropriate since lifting, lowering, pushing and pulling have great potential for costly injuries. Manual material handling equipment provides a solution that can often be inexpensive. A \$2,500 lift table may prevent a \$100,000 back injury. A lift table with a turntable top is most favorable as it will minimize body motions. As an alternative, stacking two to three pallets on the floor can be used to raise the load height.

CNA Risk Control can provide several ergonomic practices for warehouse workers that can minimize dock risks.

Common solutions include:

1. Spring-loader pallet positioners and telescopic conveyors that allow the work to be at a comfortable height and reach.
2. Storage racks that deliver product directly in front of the worker – making order picking easy.
3. Pallet bays with easy access.
4. Weight storage design recommendations or.

5. Automatic plastic wrapping machine with turntable designs.

Be on the lookout for process and methods improvements. By changing a processing method, a company can simplify or reduce the cost of handling and storage and reduce setup time. Examine whether implementing manufacturing cells and using teams of employees cross-trained on various tasks will improve production. Ergonomic audits provide a roadmap for what issues must be addressed and what budget will be needed for improvements. Employers should establish the criteria for this audit, whether it be reductions in lost work time or improvements in quality or production.

If You Must Lift Manually, Think Ahead

Good planning is the best method of preventing material handling injuries. Every lift should be planned before it is made. Proper lifting is handling the object as close to your body as possible and lifting between the knees and shoulders. Get a good footing as falling while carrying a load or under a load can compound any injury that occurs. Material handling is more difficult when water, snow, mud or grease is permitted to accumulate. Keep work areas and floors clean, dry and free of debris.

Procedures for Mitigating Risks

Dock work areas tend to have several variables that may create risks for your business. The mixture of humans, machines and materials can impact the overall safety of the dock environment.

Following are some key risk strategies that promote dock safety:

- Implement a loading zone procedure that clears all personnel on foot when loading and unloading trailers as material and equipment can shift or break free during any location transfer.



- Workers on foot should never be on the opposite side of a flatbed truck from a forklift while it is loading or unloading material.
 - Workers should not be allowed on foot in trailers while a forklift is involved in loading/unloading operations.
 - Drivers should be provided a place to wait away from the truck while loading/unloading operations are being performed.
 - Provide loader and driver practices that identify work area hazards and safe work procedures.
 - Visiting drivers should be made aware of their responsibilities.
 - Assure that trailers and wheels are clear before moving.
 - Drivers should visually inspect and secure their truck or trailer and the area around it to make sure the area is clear of all workers.
 - A visual signal, such as a sign indicating workers are in a trailer, should be visible from the truck mirrors any time personnel are working in or on a truck at a loading dock.
 - Truck keys may be placed on a board by the loader during operations and returned to the driver once trailer loading/unloading is completed.
 - Protect all gaps and drop-offs at loading docks.
 - All loading docks should be equipped with dock-plates and physical barriers around any gaps that present fall hazards to workers or equipment. Use dock levelers to provide safe access to trailers.
 - Incorporate appropriate forklift equipment and training for forklift operators.
 - Forklift operators are responsible for the safety of ground personnel, as well as themselves. In accordance with OSHA, operators must be trained on safe operation of the equipment, load limits, loading procedures, and communication with other personnel.
 - Disallow personnel underneath a moving load as heavy loads can be unstable. Equipment failure could crash anyone underneath.
 - Ensure that the trailer uses wheel chocks and other vehicle restraint devices.
 - All vehicles should be parked with a fully operational parking brake engaged during loading and unloading. Wheel chocks should be used in addition to the brake, particularly if any slope is present.
- Safe docks reduce serious accidents and insurance claims. All size companies can have positive effects on the trailer transporter, the dock receiver/loader and/or any person within the dock work area.
- The attached Risk Control bulletins support the information contained in CNA's Dock Safety Guide:
- Conveyor Safety
 - Emission Controls
 - Fire Extinguishers
 - Refueling Forklifts
 - Worker Fatigue and the Relation to Manual Material Handling Tasks



Basics of Conveyor Safety

Mechanical conveyors, whether package, bulk or unit are used in nearly all warehouses. They are essential to most production processes.

Conveyor safety starts with the conveyor manufacturer, as they are responsible for the function of the equipment and meeting the customers' expectation of its performance. The manufacturer is also responsible for the ability of the conveyor to be operated safely and to be serviced under defined operating conditions.

In order for this to happen, the designer/manufacturer must:

- Define the use and possible misuse of the conveyor.
- Define the environment in which the conveyor should be used.
- Define the typical user.
- Identify possible hazards resulting from misuse and define design solutions, including safety solutions that can be adapted to the conveyor.

With a conveyor some safety features are incorporated in the design and some are incorporated in the field, with the final installation. Safety strategies may include:

- Available conveyor safety standards – some apply to the equipment itself and others apply to safety/worker interface.
- Known hazards which occur at action points, such as drives, head and tail terminals, product loading/unloading points and areas where workers will have unplanned actions.
- Design fixed safeguards and use warning signs to alert workers to the hazards.
- Training requirements for operating and maintaining the conveyor.

OSHA does not specifically address conveyor safety however, ANSI b20.1 Safety Standards for Conveyors and Related Equipment calls for conveyors to be:

- Tested, including switches and guards before placed in service.
- Visually check with audible signals of operation.
- Understood by those operating conveyors.
- Accessible for maintenance...no employee should climb or ride conveyor.
- Guarded when operated...not removing casings, guards and safety devices.
- Equipped with emergency stop buttons, pull cords, limit switches and other safety devices if an operator's station is not manned or is not within voice contact.
- Visually inspected daily, repaired and serviced by trained personnel.

In addition, lubrication fittings should be placed in accessible and guarded locations with drip pans available if needed. If a conveyor passes through a floor opening, it should be guarded and warning signs provided. Conveyors passing through fire resistant floors or walls require suitable protection.

Conveyor Guards

The need for power transmission equipment is common to all types of powered conveyors involving items such as drives, gears, shafts, couplings, etc. Installations of guards include sources of mechanical power and drive machines up to and including the point of operation. Typical items to be observed include:

- Drive guards for durable chains, v-belt and gearing
- Coupling guards around all direct connections between motors and gear boxes or other



similar power transmissions when couplings are used to connect shafts.

- Line shaft guards – although not prevalent today protecting entry from bottoms and sides, care should be given to avoid fingers, apron strings or hair from entering this type of guard from the top.
- End shaft gears – plastic end caps used to enclose ends and prevent items from becoming caught in shafts or keyways.

Conveyor safety is a combination of physical guards, safety devices, proper operating procedures and training. Accidents are minimized when conveyors are designed safe and installed properly.

Nip point: A nip point is that point at which an element of the conveyor, moving in a line or rotating, meets another element which is either rotating or moving in a line, in such a way as to possibly nip, pinch or squeeze a body part (usually a finger) or entrap objects. Common nip points are seen at the conveyor belt take-off points, meshing of gears and belt/pulley area.

Passage Areas Under Conveyors

Conveyors can be elevated and/or situated over walkways or when employees are working. One of the more common applications is the overhead trolley and/or chain conveyor. Guards are typically fabricated with a wide variety of materials such as mesh panels or expanded metals. The choice of material is usually determined by the height and width of the material being handled.

Exposed Edges of Conveyors

There are many safely operating conveyors with their edges exposed. While it may be too expensive to cover all edges, this must be considered a potential safety hazard. On occasion continuous guarding is needed, such as on a chain-driven live roller conveyor. Other times a guard and other safety devices are used, such as with a belt-driven live roller conveyor with paddle guards on the curve with pop-out rollers on the straight sections of the conveyor. With this device the roller axle is freely floating in the bed frame and will pop out if fingers, hands or clothing become wedged between the rollers and drive bed.

All exposed moving parts of a conveyor present a hazard to employees at work and should be mechanically or electrically guarded or should be guarded to keep employees away from them. Ease of access is essential to safety. An emergency pull cord that runs parallel to the conveyor with a stop switch provides safety.

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A Stepwise Approach to Lower Truck Emissions

The majority of lift trucks are fueled by liquefied petroleum gas (LPG). LPG is a mixture of petroleum and natural gases of high propane and some butane content. The major emissions from LPG engines are similar to those from other internal combustion engines, powered by either gasoline or natural gas.

The three primary emissions are carbon monoxide (CO), oxides of nitrogen (NO_x), and a group called hydrocarbons. CO gas is the most hazardous because we cannot see or smell the chemical gas. However, we certainly can be affected. Tobacco smoking can compound the effects. Even when you leave an area with high CO gas levels, it still takes hours before you stop feeling the health effects.

Carbon Monoxide (CO) is a colorless and odorless gas. It causes headaches, dizziness, lethargy, and death. It is absorbed through the lungs into the blood where it bonds to the red-blood cells (called hemoglobin), which keeps oxygen from bonding to the cells. CO gas is about 30 times more efficient in bonding. Exposure to high CO gas concentration will raise our carboxyhemoglobin (COHg) level. Also, it takes time for the carboxyhemoglobin to leave the body so the effects last a long time.

Nitrogen Oxides (NO_x) are composed of nitrogen dioxide (NO₂) and nitric oxide (NO). Those gases have a pungent, acrid odor. We can smell NO₂ gas around 0.14 ppm, which is a very low airborne concentration. Their short term health effects are irritation to the eyes, nose, throat, cough, and decreased pulmonary function.

Hydrocarbons (HC) and their derivatives are responsible for the characteristic odor of propane exhaust gases. This is a very large and diverse group of chemicals. Methane is a chemical compound with the molecular formula **CH₄**. It is the simplest alkanes, and the principal component of natural gas. The most common health effect from inhaling a high concentration would be lightheadedness. The short term health effects diminish quickly after leaving the area or going outdoors.

The main engine exhaust concern is carbon monoxide. If the engine is not running efficiently and there is insufficient fresh air, then high levels of carbon monoxide gas can accumulate inside the building. Carbon monoxide gas can be hazardous to life if the concentration reaches high levels. CO gas cannot be seen or smelled; however, the other emission gases have an odor that should alert us to a potential danger.

If the airborne CO gas concentration is kept below the OSHA PEL (Permissible Exposure Limit), then the other emission gas concentrations should not harm employees.

The amount of the engine's emission concentrations typically is low when the engine is properly tuned. Also, when the dock doors are open exhaust gases are quickly diluted. However, the fresh air won't reach all areas inside the building. Therefore, a good preventative maintenance program saves fuel cost and lowers emissions.

These factors influence emission concentrations:

1. The efficiency of the engine.
2. The horsepower size of the engine.
3. The amount of time the engine runs under load and when idling.
4. The number of trucks running in an area.
5. The size and shape of the building.
6. The ability of the building's doors and windows to be open to allow natural ventilation.
7. Mechanical ventilation that would be operating, such as power exhaust fans.

Clean Atmosphere

Tighter emission regulations are coming. Meeting those regulations will be an additional factor to consider when purchasing of new trucks. Table-1 lists factors to consider when addressing replacement vehicles. The 80/20 rule applies. Eighty percent of the truck's lift cost is for maintenance. The 20% relates to the purchase cost of the vehicle.



- One truck on propane-butane produces the same quantity of emissions as 20 cars on natural gas.
- Typically, CO gas emissions constitute 1-2% (10,000-20,000ppm) of LPG exhaust gas. PPM means parts of CO gas per million parts of air.
- Poorly tuned engine conversions or a rich fuel mixture will result in much higher CO concentra-

Table-1

Forklifts Features	Propane	CNG	Battery	Gasoline
Low Greenhouse Gas Emissions	YES	YES	YES	NO
Low Infrastructure Costs	YES	NO	NO	NO
Consistent Power	YES	YES	NO	YES
Total Energy Efficiency	YES	YES	YES	NO
Low Unit Costs	YES	NO	NO	YES
Low Maintenance	YES	YES	YES	YES
8-hour Operating Time	YES	NO	NO	YES
Refueling less than 5 minutes	YES	YES	NO	YES

tions.

Factors that affect the amount of emissions inside the building are the number of vehicles operating, the size of the engines, the length of time running, plus the driver's technique. The size of the building can dilute the exhaust emissions; however, most buildings are closed up to conserve energy. Emissions can build up quickly inside the plant when it is closed up. Typically, the exhaust emissions are the highest around the dock area because more trucks are running under full load.

The Federal Occupational Safety and Health Administration (OSHA) established permissible exposure limits (PEL) for many of the major emission gases. Table-2 lists some of those chemical limits. The PEL are expressed in parts per million (ppm) for an 8-hour time-weighted average (TWA).

A ceiling limit means the airborne concentration should not be exceeded even for an instantaneous exposure.

If a properly turned LPG lift truck emits 1% of CO gas, then 10,000 ppm would be exhausted into the building.

More CO gas would be exhausted when the truck is under load. It doesn't take long before the exhaust gas con-

Table 2
Occupational Health Limits for Various Engines Emissions

Substance	OSHA PEL	ACGIH® TLV (3)
Carbon Monoxide gas (CO)	50 ppm TWA	25 ppm TWA
Nitric Oxide gas (NO)	25 ppm TWA	25 ppm TWA
Nitrogen Dioxide gas (NO2)	5 ppm (ceiling limit)	3 ppm TWA
Sulfur Dioxide gas (CO2)	5 ppm	2 ppm TWA

centrations can fill up even a large building.

Exposure Reduction Options

Various controls can be taken to lower the lift trucks' exhaust emissions. The best way to keep the airborne CO gas levels low is to keep the engine in tune.

Lift trucks should receive a periodic tune-up so that less than 1% (preferably 0.5%) of CO is discharged. The next best step is to set the air/fuel mixture is at its most efficient level. The tune-up mechanic should place a CO gas probe in the tailpipe.

Adjustments to the carburetor can be seen quickly on the CO meter's readout. There is a fallacy that running a lean mixture is always best. That isn't entirely true because the NOx emissions increase. An ammonia odor will be released.

These are four effective ways to lower the LPG engine's emissions:

1. The best way to be sure the CO emissions are minimized would be an engine tune up using an electric CO meter. The meter's probe is placed in the tailpipe to measure the emissions

It should be used when performing periodic lift truck tune-ups. This is an excellent tool to help the mechanic determine the amount of CO being emitted.



Operating the truck at a lean mixture will result in low CO abatement. However, the engine will emit more NOx gases. The overall effect greatly depends on the engine's age and its maintenance program.

Don't set your tune ups based on a schedule, but use the run time. The more time the engine operates, the more likely its emissions will increase.

www.nett.ca
www.cleanairinc.com
www.matthey.com
www.catalysts.basf.com/main
www.catalyticexhaust.ca
www.enginecontrolsystems.com
www.dieselnet.com/com/xco17.html

- The second way to lower emission is a catalytic muffler. An oxygen sensor in the exhaust manifold detects if the engine air/fuel ration is too rich or too lean for maximum efficiency and lowest possible harmful fuel emissions. This is a retrofit option.

www.toyotaforklift.com/
www.nett.ca
www.innovatemotorsports.com

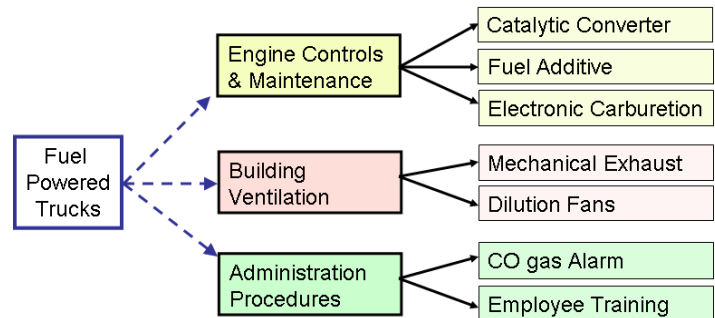
- The third way to lower emission is installing an air-to-fuel ratio controller. This is a retrofit option. Electronic air-to-fuel ratio controllers may reduce CO and NOx emissions up to 99.9%.

www.toyotaforklift.com/
www.nett.ca
www.innovatemotorsports.com

- The fourth way to lower emission is a fuel additive. Fuel additives reduce heavy-end buildup in the carburetor, improve engine combustion, and improve fuel economy. Propane additives may reduce CO emissions by 50 to 60%.

www.energyadditives.com

Chart-1 illustrates your options to lower the engine exhaust emissions. The next section explains in detail what can be done to lower the emissions after the engine has been properly tuned-up.



Steps to Lower the Indoor CO Gas Exposure Concentrations

The first ventilation requirement for an enclosed loading dock is fresh outdoor air.

If you are not able to be outdoors for some reason, make sure your loading dock is equipped with windows, doors and other options for the release of toxic diesel exhaust. If you have to, you can install wide doors or windows in the space you have. Just be sure the fumes are not getting trapped indoors where people are working.

Building ventilation is a method to lower the exhaust emissions effectively from inside the building. The ventilation guidelines provided by the American Conference of Governmental Industrial Hygienists (ACGIH) recommends 5,000 cubic feet per minute (cfm). 5000 cfm is equal to about 2.4 cubic meters per second of ventilation for every 60-horsepower propane engine emitting 1% of CO or less.

Building Ventilation

The building needs an air exchange to bring in fresh air and exhaust the buildup of truck exhaust gases. Typically, the most common placement of the inlet-air dampers and the exhaust fan is at the gable peaks of the building or on the roof. Both are logical choices, however, the air movement is not very effective to the workers at the ground



level. The fresh air channels across the roof and out the exhaust openings without much dispersion throughout the building. Following are two ways to improve the fresh air distribution.

Place the exhaust fan at the same height as the inlet air opening. Most facilities install sheet metal ductwork to divert the inlet air down near the floor level. The place of the inlet and exhaust should also be off set so they are not perfectly aligned across the width of the building. These steps allow the fresh air to disperse through out the building.

Many buildings have HVAC units mounted on top of the roof. Their tempered air discharges into the building at just a few spots. Install a flexible plastic duct extension that has holes open to allow the air to escape the duct. The warm or cooled air can then better reach remote areas and corners of the building.

The trend to install giant fans near the ceilings of the very tall buildings is another option. However, that option is limited to the building height. Too often, the height of the building will not accept the fan. Also, if the building has an automatic sprinkler protection system, those fans may disturb the water spread. It takes time, may be 15 minutes, for those large propeller blades to slow down after the power to the fan has been turned off.

Trailer Fans

Dock fans mounted on a swing articulating support arm is the most effective way to dilute the CO gas concentrations inside the trailers. A halogen light is offered as an option. Because the fan blows air into the semi-trailer, it can deliver a high volume of fresh air, which displaces the exhaust gases. High velocity 18" diameter fan moves 4,000 CFM. Dilution ventilation is an effective method of dissipating the truck emissions.

Products available from:

www.greenheck.com
www.wescomfg.com
www.northerntool.com
www.tmi-pvc.com

Ventilation Fans for the Dock

In order to ventilate an indoor space properly, the movement of air is necessary. Be sure to invest in multiple, good quality industrial fans.

The second effective method to dilute the building of exhaust emission gases is by using a large movable fan. The fan might be positioned near the dock area where it can draw the fresh outdoor air into the building, which then blows that air into the rest of the building. Using a fan to draw exhaust gases from inside a trailer will not work. But, turn the fan around and within seconds, the gases are blown out of the trailer. Large cooling fans can move 7000 to 17,000 cubic feet of air per minute. Fans have wheels attached or are mounted to a cart so they can be moved quickly and without much effort.

Carbon Monoxide Gas Detection Options

We cannot always rely upon building ventilation alone to prevent carbon monoxide gas (CO) build up inside the building or inside trailers. Conditions inside a building can change. Often during cold months, the exterior doors are closed and the fresh air supply fans are turned off to conserve heat and energy costs.

Take steps to check and recheck the employees' CO exposure concentrations. You may have a consultant test the CO gas concentrations. It would be best just before wintertime when the building is closed to conserve energy.

There are a variety of ways to test for CO gas. If you feel comfortable about testing, renting a direct reading instrument might be the quickest, easiest and least expense method. The rental equipment should be properly calibrated so all you have to do is turn it on and write down the measurements.

If you want to test frequently, it may be more cost effective to purchase the test equipment. There is a wide variety of CO gas detection methods. The most common is the typical household CO gas detector that you can purchase at hardware and variety stores. They plug into an electrical outlet and have a battery backup.



The CO meter that has a digital display allow you to see the airborne CO gas concentration. That meter wouldn't be calibrated, but it will still allow you to see which areas in the building how the highest CO gas concentrations. A logical are to measure in the shipping offices, which is located near the dock where there is a lot of truck traffic.

- A. There are "passive" monitors that will change color after being exposed to carbon monoxide gas. The "copper" colored spot will darken until the color matches the dark gray color of the rectangle. Daily exposures to CO gas will cause the color to change; therefore, it is not a method and should be replaced often. The cost per monitor is less than \$3.00.
- B. There are "diffusion" tubes (also called "dosimeter" tubes) that can provide a full workshift exposure test. This testing method is best for OSHA compliance or when people travel into areas of the building that might have high exhaust gas concentrations. Testing is easy. One end of the tube is broken off and the sample tube is pinned to a person's collar. The tube can be placed in a holder which comes with a clothes clip.

The CO gas that is in the air enters the open end of the tube and reacts with the chemically coated resin material in the tube. The chemical reaction causes a color change, which allows you to see a stain. The tubes have a preprinted scale on the side of the tube, which allows you to read the airborne CO gas concentration. The cost for a box of 10 samples is less than \$80.00
- C. There are detector tubes that allow a person to test the test. This is referred to as "grab" sampling. The hand pump can be either a "bellows" or a "piston" model. Both types draw air through a detector tube. As the CO gas mixes with the chemical in the tube, a color stain occurs. The tubes have a preprinted scale on the side of the tube, which allows you to read the airborne CO gas concentration. The more CO in the air would produce a longer stain length. The cost of the hand pump is approximately \$350. A box of 10 tubes plus shipping costs about \$65.
- D. A direct reading meter offers many advantages over monitors and tubes because it provides an instantaneous readout. It also is the most expensive test

method and requires some maintenance. First, the meter needs to be calibrated before testing to be sure it is operating properly and will provide as accurate readout.

The CO gas "cell" typically expires in two years even if you do not use the meter. The CO in the air slowly consumes the chemicals in the gas cell. The cost for the meter, the calibration kit, and battery charger can be around \$700. However, if you do a lot of frequent testing, then it might be the most economical method.

References

- (1) The World LG Gas Association publication, "Cleaning the Air - A Technical Guide on Autogas (LPG) - Emissions, Test Methods, Standards and Technology."
- (2) Forklift Emission Study: Propane Delivers Highest Total Energy Efficiency When Compared to Other Engine Fuel Production Life Cycles, July/August 2003 issues of Industrial Utility Vehicle & Mobile Equipment Magazine, A Webcom Communications Publication www.SpecialtyVehiclesOnline.com
- (3) The American Conference of Governmental Industrial Hygienists (ACGIH), "Threshold Limit Values for chemical substances and physical agents and biological exposure indices, Kemper Woods Center, 1330 Kemper Meadow Drive, Cincinnati, Ohio 45240-4148, WWW.ACGIH.ORG, Pub. No.: 2091, ISBN: 978-1882417-95-7.



Usage of Fire Extinguishers

Almost all fires are small in their early stage and can be put out quickly if the proper fire extinguisher is available. Portable fire extinguishers must be:

- Proper type for the class of fire expected.
- Approved by FM Global (FM) or listed by Underwriters' Laboratories, Inc. (UL).
- Located where readily accessible for immediate use.
- Sufficient quantity and size to deal with the expected fire.
- Inspected annually and maintained in good operating condition.

OSHA requires fire extinguishers be selected based on the classes of anticipated workplace fires.

Also, the size of the extinguishers is based on the degree of the hazard. Some local requirements may be stricter.

The employer may use uniformly spaced standpipe systems or hose stations connected to a sprinkler system installed for emergency use by employees instead of Class A portable fire extinguishers. The employees are trained at least annually in their use.

Training





Where the employer has provided fire extinguishers for employee use, the employer shall provide an educational program to familiarize employees on the principles and use of the extinguishers.

This educational program should be completed during the initial hiring and annually thereafter.

Inspections

Portable fire extinguishers must be visually inspected monthly. The inspection should assure that:

- Fire extinguishers are in their assigned place.
- Extinguishers are not blocked or hidden.
- Extinguishers are mounted in accordance with NFPA Standard No. 10 (Portable Fire Extinguisher).
- Pressure gauges show adequate pressure (CO₂ extinguisher must be weighted to determine if leakage has occurred).

Symbol	Class of Extinguisher	Travel Distance
	Class A fire extinguishers are used for ordinary combustibles, such as wood, paper, some plastics and textiles.	75 feet
	Class B fire extinguishers are used for flammable liquids and gas fires such as oil, gasoline, etc.	50 feet
	Class C fire extinguishers are used on fires involving live electrical equipment. It contains nonconductive extinguishing agents.	Base on A or B approp. Hazard
	Class D fire extinguishers are used on combustible metals such as magnesium, titanium, sodium, etc.	75 feet



- Pin and seals are in place.
- Fire extinguishers show no visual sign of damage or abuse.
- Nozzles are free of blockage.

Sources for More Information

[29 CFR 1910.157](#), Portable Fire Extinguishers.

[29 CFR 1910.158](#), Standpipe & Hose Systems.

NFPA Std #10, Portable Fire Extinguishers.



Basics for Refueling & Fuel Storage

Forklifts run on different types of fuels: gasoline, diesel, natural gas and liquid propane. There are regulations to follow and controls to use for refuelling forklifts and storing fuel.

- The storage and handling of liquid fuels, such as gasoline and diesel fuel, should be in accordance with the National Fire Protection Association (NFPA) Flammable and Combustible Liquids Code (NFPA 30-1969) and Volume V, NC Building Code, Fire Prevention.
- The storage and handling of liquefied petroleum gas should be in accordance with NFPA Storage and Handling of Liquefied Petroleum Gases (NFPA 58-1969) and Volume V, NC Building Code, Fire Prevention.
- Propane fuel tanks should be stored outside the building in a secured area. Tanks should be protected from the weather and shaded from direct sunlight.
- When fueling tanks outside, turn the engine off.
- Avoid spillage of oil or fuel. Allow time for any spilled gasoline to evaporate before restarting the engine.
- Do not operate trucks with a leak in the fuel system until the leak has been corrected. Report any leaks to a supervisor so the truck is tagged out of service until repairs are made. Only qualified persons should be allowed to repair carburetors and fuel supply systems. Report any damaged propane tanks.
- Smoking is not permitted while refueling trucks.
- The LP gas tank should be shut off when "garaging" the lift truck (leaving the lift truck in a closed space or room or leaving the truck out of service for 8 hours or more).

Propane fuel is a colorless, tasteless, odorless, and heavier than air gas. A smell is added to propane to aid in the detection of leaks. It is stored in a cylinder under pressure and stays in a liquid state. Exchange removable cylinders

outdoors or in well-ventilated areas, away from sources of ignition. NFPA recommends propane tanks should be stored outside the buildings awaiting use. Tanks shall be at least 20 feet away from any doorway or opening of a building. Protect the cylinders in a lockable, ventilated metal locker or rack that prevents tampering with valves and pilferage of the cylinder.

Inside Fuel Cylinder Storage

OSHA states, "The quantity of LP gas stored inside a building will not exceed 300 pounds." This means if a standard LP tank holds 33 pounds, no more than nine tanks can be stored inside, even if some tanks are full, half full or empty. Note: propane tanks already on the forklifts do NOT count toward this number.

Steps to follow when handling propane fuel tanks

- Position the tank so the liquid propane does not come in contact with the relief valve.
- Make sure the locking pin engages into the cylinder.
- Make sure the valve is closed tightly.
- Store the cylinder outside, in an upright position, in an area where it can be secured and is protected from being struck.
- Put the cylinder down gently. Do not drop, dent, or damage.
- Always protect the valve from any damage.
- Avoid contact with liquid propane, as it can cause frostbite.
- Wear protective gloves and protective eyewear while making or breaking connections
 - Wearing rubber gloves is recommended to close the valve on the tank. The propane fuel will not absorb into the rubber gloves.
 - Wearing goggles or a face shield over safety glasses is preferred.
- Close the valve before breaking connections.



- The LP gas tank shall be shut off when "garaging" the lift truck (leaving the lift truck in a closed space or room or leaving the truck out of service for 8 hours or more).

Sources for more information

- OSHA regulation 29 CFR 1910.178, Powered Industrial Trucks, and 1910.110(f)(4)(i)
- ANSI/ASME B56.1-1993, Safety Standards for Low Lift and High Lift Trucks
- ANSI/NFPA 505, Powered Industrial Trucks Including Type, Area of Use, Maintenance and Operation
- Powered Industrial Truck Owner's Manual
- ANSI Z358.1-2004



The Aging Workforce

America's workforce is changing. Baby boomers, defined as those born between 1946 and 1964 are now reaching the age where retirement is just around the corner and it is estimated that there are 79 million baby boomers. The official retirement age of the first of these boomers is 2011.

The number of workers age 45 and older has doubled since 1950. According to the American Association of Retired Persons (AARP)¹, the number of older persons (55+) in the labor force, which stood at about 18.2 million in 2000 is projected to rise to 25.2 million in 2008 and 31.9 million by 2025. The resulting increase is 38% over 10 years and 75% over the next 25 years.

There are growing numbers of seniors at work. The trend toward earlier retirements seems to have ended, with more workers intending to stay employed, either full or part time, past traditional retirement age and well into their 60s and 70s.

For warehouse workers this is a significant issue given the fact that as we age, the accumulation of fatigue associated with aerobic energy expenditure is more rapid, increasing the risk of injury when performing manual material handling tasks such as pushing, pulling, walking, lifting, and re-stacking.

Loss of strength happens due to decreased muscle mass and diminished force capabilities of our muscles. The muscles take longer to respond to action and fatigue faster as we age. As muscles age, they begin to shrink and lose mass. The number and size of muscle fibers also decrease. It takes muscles longer to respond in our 50's than they did in our 20's. Heavy lifting and lowering, awkward positions and static postures are all risk factors for workplace injuries. Tasks requiring grip force and exertion as well as repetitive tasks are more difficult with decreased strength and endurance. As more work is performed, more energy is required/used and over time there is a buildup of fatigue. In the absence of rest and recovery

time, excessive fatigue can contribute to an injury while also resulting in decreased productivity.

Addressing Manual Material Handling Tasks

There are a number of factors to consider when addressing manual material handling tasks. It is crucial to take into account the period of time taken by workers to complete the task. The longer it takes, the higher the degree of fatigue. Factors such as the frequency and duration of recovery-time also affect fatigue levels and can reduce the impact of other factors such as the total duration of work and the lifting frequency per minute. Periods of recovery time allow workers to compensate for fatigue caused by repetitive handling tasks, and can help to make it easier for workers to sustain their work load.

The combined effects of load weight and lifting frequency directly affect worker fatigue. In addition, increases in lifting frequency diminish the worker's capacity to assess loads. Workers who are unable to estimate loads correctly will not apply appropriate muscular effort and will tire more easily than if they had evaluated the load correctly.

The specific properties of the load should be taken into consideration because they affect the way the charge is handled. The weight of the load is one example. Another is the location of the load: picking up loads from an elevated area is more likely to cause fatigue. In addition, heavier loads increase the risk of musculoskeletal injuries. The grip on the load is another important feature of the load. The grip is a function of the shape, texture (friction rate) and balance of the load. Workers have to exert greater force to handle loads with a poor grip in a safe way. For example, handles make boxes easier to carry.



Preventing Injuries

What can we do to prevent these fatigue-related injuries to the soft tissue? Identify the jobs that possess the greatest physical risks to the various soft tissue groups through an organized, systematic process that is quantifiable. The process will prioritize the jobs that need to be changed as well as those that could be used for return to work and to keep employees working longer. Some of the ways to help employees include:

- Reduce work with static muscle effort (i.e., sustained, fixed postures)
- Increase use of mechanized equipment
- Keep work in the power zone (i.e., get work and material off of the floor)
- Reduce or eliminate twisting of the upper torso

Reduced grip strength goes along with reduced muscle and soft tissue capabilities. Hand grip strength decreases, making it more difficult to accomplish routine activities such as gripping, lifting, turning a valve, opening material, and pulling tasks. We can assist the aging worker by reducing the time spent in these type jobs or providing mechanical assistance. Choose hand tools and handheld devices that are appropriately sized for the human hand to compensate for reduced grip strength.

To address fatigue associated with manual material handling tasks, the following points need to be successfully addressed:

- Make sure the physical and mental requirements of jobs match the capacities of the workers, especially older workers.
- Address the full range of needs older people bring to the job. This includes flexible options for making the transition to retirement and support for meeting family and community demands that might interfere with work.
- Begin to address aging when employees are young rather than waiting until later, ensuring all workers maintain their physical and mental capacities as they age.
- Take advantage of the mix of generations, using older employees to mentor younger ones, thereby nurturing talent and transferring knowledge, skills and values.

Ergonomics

The general methods of workplace ergonomics focus on reducing physical stress and fatigue on the body and to fit the workplace to the worker. These methods include substituting mechanical for manual strength, reducing highly repetitive tasks, allowing adequate recovery time, reducing stressful postures and job rotation. Use of manual material handling equipment such as work positioners, lift tables, carts, vacuum lifts, and conveyors will go a long way to reducing fatigue and allowing employees to work longer and more productively. Additionally, extra attention to workplace layout and the location of racks can minimize the amount of walking performed while performing tasks such as order picking, down-stocking and putting items away.

While most jobs can be designed to fit most workers, it is sometimes necessary to provide alternate job assignments and retraining for workers whose physical capacities are so reduced that even modest strength or endurance is impossible and adjustments on the usual job are not feasible.

Over the next few years we will see an increase in older people in the workforce. Surveys indicate baby boomers want to continue to work either full or part time. To ensure a long and healthy work life, employers and job designers need to address the relationship between the functional capacities of older populations and task performed in workers between the ages of 20 and 30, these are incompatible with the abilities of those aged 55 and older. Assessing these capabilities and limitations of older workers and designing within these parameters will positively affect productivity, efficiency and safety among all age groups.

References

1. Wright, U - (Aging American Workforce) Ergo Solution Magazine. October 2004.