# Materials Handling SPP# 1910.176

## Quick Reference



## 1.0 Purpose

The purpose of this safety policy and procedure is to establish guidelines to ensure the prevention of injuries when materials are handled and stored either manually or equipment-assisted.

## 2.0 Scope and Applicability

Materials handling injuries originate in inadequate planning, work location design, scheduling, storage, housekeeping, training, work performance, and equipment selection and use. This safety policy and procedure provides guidelines for the elimination or reduction of injuries due to manual or equipment-assisted materials handling.

This safety policy and procedure includes training provisions, manual materials handling guidelines, requirements for the use of materials handling equipment and

materials storage. Additionally, It presents guidelines on housekeeping, securing railroad cars, and requirements on labels, signs, and marking.

This document also details the areas of responsibility for the managers/unit heads, supervisors, employees, Safety and Loss Control, and Central Equipment Unit within the North Carolina Department of Transportation (NCDOT).

This safety policy and procedure affects any employee who as a result of his or her job duties handles materials.

## 3.0 Reference

This safety policy and procedure is established in accordance with Occupational Safety and Health Standards for General Industry (29 CFR 1910.176) and Occupational Safety and Health Standards for Construction Industry (29 CFR 1926.250).

## 4.0 Policy

It is the policy of NCDOT to provide a place of employment that is free from recognized hazards that cause or are likely to cause death or serious physical harm to employees or the public. Therefore, materials must always be handled such that injuries are eliminated or significantly reduced. When materials handling hazards exist that cannot be eliminated, then engineering practices, administrative practices, safe work practices, Personal Protective Equipment (PPE), and proper training regarding Materials Handling will be implemented. These measures will be implemented to minimize those hazards to ensure the safety of employees and the public.

## 5.0 General Responsibilities

It is the responsibility of each manager/unit head, supervisor, and employee to ensure implementation NCDOT's safety policy and procedure on Materials Handling. It is also the responsibility of each NCDOT employee to report immediately any unsafe act or condition to his or her supervisor. Specific responsibilities are found in Section 6.3.

## 6.0 Procedure

This section provides applicable definitions, establishes general provisions, and identifies specific responsibilities required by NCDOT’s safety policy and procedure on Materials Handling.

## 6.1 Definitions

**Flammable**
A material capable of being easily ignited, that burns intensely, or rapidly spreads flames.

**Handling**
The movement of materials either by manual lifting or mechanical means.

**Mechanical Equipment**
Fork lifts, cranes, front-end loaders, pallet jacks, backhoes, hand trucks, etc.

## 6.2 General Provisions

This section details the provisions of this safety policy and procedure with each provision discussed in a separate subsection. These provisions are:

- Training
- Manual Materials Handling
- Materials Handling Equipment
- Storage
- Housekeeping
- Rolling Railroad Cars
- Labels, Signs, and Markings

### 6.2.1 Training

Training shall be required for employees who manually handle or move materials and for employees who perform equipment assisted materials handling.

This training should be provided prior to employees' assumption of jobs requiring manual handling or equipment assisted handling tasks. This initial training should be based on the discretion of the supervisor and supplemented with refresher training.

Applicable training will include instruction in:

- Proper lifting techniques for manual materials handling
- Available equipment types for equipment assisted materials handling
- Equipment operations for applicable materials handling equipment
- Any special rules or guidelines that may cover specific types of materials handling equipment

### 6.2.2 Manual Materials Handing

Manual materials handling involves the handling, moving, lifting, and carrying of materials without the use of mechanical equipment. Minimizing injuries from materials handling requires forethought about these tasks. Some basic materials handling methods include:

- Inspecting materials for slivers, jagged edges, burrs, rough or slippery surfaces
- Getting a firm grip on the object
- Keeping fingers away from pinch points, especially when setting down materials
- Keeping hands away from ends of lumber, pipe, or other long objects, to prevent them from being pinched
- Wiping off greasy, wet, slippery, or dirty objects before trying to handle them
- Keeping hands free from oil and grease

In most cases, gloves, hand leathers, or other hand protectors must be used to prevent hand injuries.

Employees should be physically suited to perform jobs requiring heavy and/or frequent lifting. If a load is thought to be more than one person can handle, 2 employees should be assigned to the operation or materials handling equipment should be provided.

All employees who lift materials will be trained on the proper way to pick up and put down heavy, bulky or long objects. NCDOT's program "Back to Work" and SPP #1910.001 should be consulted for additional details.

All attempts should be made to reduce manual lifting by using mechanical equipment or rearranging the storage of materials.

### 6.2.3 Materials Handling Equipment

When there is excessive manual handling of materials over 50 pounds, then additional tools and equipment may be required for materials handling.

A variety of tools and equipment is available to assist in the handling of materials. These tools and equipment fall into the following categories:

- Manual Materials Handling Equipment
- Powered Industrial Trucks (rider-operated and walker-operated)
- Hoists
- Rigging

**Manual materials handling equipment** is used in NCDOT for a wide variety of tasks. Each of these items should be used only for its designed task and kept in good condition. Selected manual materials handling equipment in NCDOT include:

- Hooks
- Dollies
- Four wheel trucks
- Rollers
- Jacks

Figure 1

Figure 2

Figure 1 presents a illustration of a hand dolly and Figure 2 illustrates a typical four-wheel truck. Appendix A presents details on safe use of these manual materials handling equipment.

**Powered industrial trucks** come in two general classifications:

- Rider-operated (mostly forklifts)
- Walker-operated (motorized handtrucks)

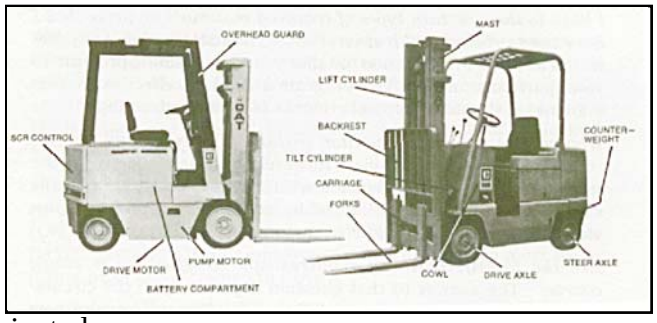



Figure 3

Figure 3 illustrates a forklift with its major components and Figure 4 illustrates a walker-operated forklift. Powered industrial trucks are versatile and efficient materials handling equipment, which have eliminated many high risk manual handling tasks.

Figure 4

However, inherent in their physical and operational design are potential hazards which can lead to accidents. Occupational injuries involving forklifts or lift trucks are commonplace.

Major reasons for forklift accidents include:

- Improper ventilation and battery charging
- Instability caused by shift in the center of gravity

- Limited visibility
- Poor communication among employees in the work area
- Inadequate vehicle maintenance
- Using trucks for unsuited tasks

Appendix B presents a checklist to help prevent forklift accidents.

**Hoists** are used to raise, lower, and transport heavy loads for short distances. They usually range from 1/4 to 2 tons in capacity. Figure 5 illustrates typical hoist configurations. Major factors affecting the safe use of hoists are design and operating conditions, operator skills and knowledge, and proper rigging practices.

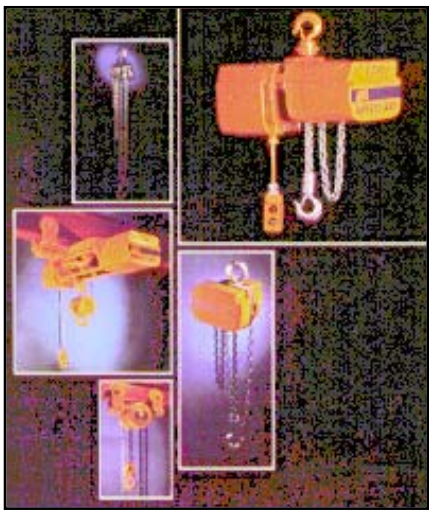


**Figure 5**

Accidents generally associated with hoists are:

- Failure of attachment devices during a lift, resulting in dropped loads
- Collision with persons or objects as a consequence of uncontrolled movement of the hoist or load
- Contacts to personnel in the work area while loads are being attached
- Failure of structural or mechanical parts of hoists during the lifting or moving of loads.
- Lift loads greater than the rated capacity of hoists

Appendix C presents suggestions for design and operator conditions and operator control to minimize accidents and injuries on hoists. Also, refer to SPP# 1910.184, Slings, for related information on slings and chains.

**Rigging** is also used to raise, lower, and transport loads. The rigging of loads must be accomplished with relative precision by trained, experienced personnel. To ensure that safe practices are followed, competent supervision must see that:

- Rigging equipment has the capacity for the job
- Rigging equipment is in safe working condition
- Loads are rigged properly
- Rigging crew and other affected personnel maintain safety practices

Refer to SPP # 1910.184, Slings, for related rigging information on slings and chains.

### 6.2.4 Storage

Planning for materials storage reduces the handling required to move materials and articles for processing, use, or shipment. Material movement is

facilitated by adequate storage space at receiving, processing, and shipping areas. Long-and short-term storage should be considered to reduce hazards and to facilitate the placement and removal of materials.

Storage equipment (racks, bins, pallets, etc.) should match the materials to be temporarily held or stocked. Bags, bundles, and other containers should be properly stacked, blocked, interlocked, and limited in height. For open pits, tanks, vats, etc., covers and guardrails must be provided to reduce contact and fall hazards.

Special precautions are required for the storage of hazardous and flammable materials. Refer to SPP # 1910.106, Flammable and Combustible Liquids, for additional details on hazardous and flammable storage requirements. Also see SPP# 1910.109, Explosives, for details on explosives storage requirements. The level of precaution should match the potential for injury posed by particular substances.

Appendix D presents detailed storage guidelines on:

- Warehouse Storage
- Open Yard Storage
- Lumber
- Bagged Material
- Pipe and Bar Stock
- Sheet Metal
- Brick and Masonry Blocks

### 6.2.5 Housekeeping

Storage areas will be free from excess materials that create hazards that result in fire, explosion, slips, trips, or infestation by insects or rodents. Weeds and other vegetation must be controlled by cutting or using herbicides when necessary.

### 6.2.6 Rolling Railroad Cars

Derail and/or bumper blocks will be provided on spur railroad tracks to prevent a runaway rail car from entering a work area, striking a building, or making contact with another rail car being loaded or unloaded.

### 6.2.7 Aisles and Passageways

Where mechanical handling equipment is used, sufficient safe clearances shall be allowed for aisles, at loading docks, through doorways and wherever turns or passage must be made. Aisles and passageways shall be kept clear and in good repair, with no obstruction across or in aisles that could create a hazard.

Permanent aisles and passageways shall be appropriately marked. Additionally, clearance signs and warning of clearance limits shall be posted. Equipment will be marked indicating the working load it will safely support.

## 6.3 Specific Responsibilities

### 6.3.1 Managers/Unit Heads

Managers/Unit Heads are responsible for ensuring that adequate funds are available and budgeted for the purchase and repair of materials handling equipment and storage facilities in their areas. They will also be responsible for identifying the employees affected by this safety policy and procedure. Managers/Unit Heads will obtain and coordinate the required training for the affected employees. Managers/Unit Heads will also ensure compliance through their auditing process.

### 6.3.2 Supervisors

Supervisors will not allow any employee who has not received the required training to perform any of the tasks or activities associated with this safety policy and procedure.

Supervisors will be responsible for communicating appropriate needs to managers/unit heads and/or supervisors.

Supervisors will audit for compliance with this safety policy and procedure during their facility and jobsite audits. Appendices E and F present sample forms for performing facilities and jobsite audits.

Supervisors will ensure employees are provided with Personal Protective Equipment (PPE) as necessary for their job.

Supervisors will evaluate, note, and correct any deficiencies observed in materials storage and handling equipment and practices while conducting facility and job site audits.

Supervisors are responsible for ensuring that only employees trained and qualified will operate materials handling equipment.

### 6.3.3 Employees

Employees shall comply with all applicable guidelines contained in this safety policy and procedure.

Employees are responsible for requesting/selecting the appropriate materials handling equipment for the task to be performed.

Employees are responsible for performing daily pre-shift checks to ensure the safe operation of materials handling equipment.

Employees will report all defective equipment to their supervisors.

Employees must report any observed unsafe act or condition relating to materials storage and handling to their immediate supervisor. Employees will attend training on the proper way to handle and store materials specific to their operation. This may also include mechanical equipment training.

Employees will place materials only in the area designated for such storage.

### 6.3.4 Safety and Loss Control

Safety and Loss Control will provide prompt assistance to managers/unit heads, supervisors, or others as applicable on any matter concerning this safety policy and procedure. Safety and Loss Control will assist in developing or securing required training. Safety and Loss Control will also work with Purchasing and Central Equipment Unit to ensure that all newly purchased material handling equipment complies with current safety regulations.

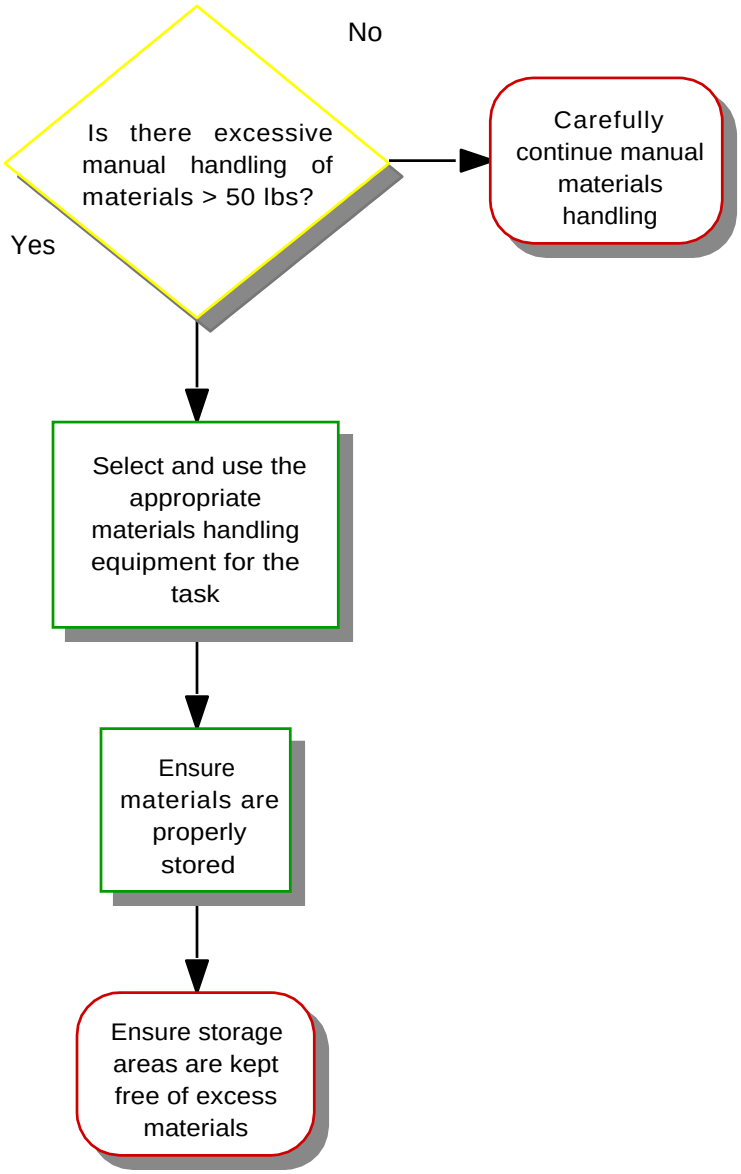
Safety and Loss Control will periodically inspect and report to supervisors any deficiencies observed that relate to material handling and storage in facilities or job sites.

Safety Engineers will provide consultative and audit assistance to ensure effective implementation of this safety policy and procedure.

### 6.3.5 Central Equipment Unit

Central Equipment Unit will support Divisions/Units with the selection and purchase of mechanical equipment necessary to move stored materials.

# Materials Handling Flowchart



## APPENDIX A: Manual Handling Equipment Guidelines

**Bars**
Remember to position your body to avoid materials which may slip or fall.

**Dollies**
Load materials evenly on dollies to prevent tipping and view obstruction. Push rather than pull dollies, unless specially designed to be pulled.

**Hooks**
Hooks should be used in a manner so as not to glance off hard objects. Store hooks in a safe place and maintain them in a ready to use condition.

**Jacks**
Use a jack properly rated for the load. Place the jack on a level, stable, and clean surface. Avoid metal-to-metal contact (jack to surface being lifted) by using wooden shims. Block the load after the jack lift.

**Rollers**
Keep hands and feet away from pinch points and make sure that rollers extend beyond the load.

**Two wheel trucks**
Select trucks with widely spaced wheels to prevent overloading. Use knuckle guards to protect hands from contact. Make sure that hand trucks are in a vertical position when not in use.

## APPENDIX B: Forklift (Lift Truck) Accident Prevention Checklist

| YES | NO | |
|---|---|---|
| | | **System Evaluation** |
| ☐ | ☐ | Operators Trained? |
| ☐ | ☐ | Production speed evaluated? |
| ☐ | ☐ | Trucks properly maintained? |
| ☐ | ☐ | Drivers' skills/trucks matched? |
| ☐ | ☐ | Truck tools/attachments/accessories available? |
| ☐ | ☐ | Age/Condition of trucks considered? |
| | | **Operational Requirements** |
| | | Operating speed controlled? |
| ☐ | ☐ | Proper loading practices? |
| ☐ | ☐ | Alerting workers of trucks' presence? |
| ☐ | ☐ | Proper backing/turning? |
| ☐ | ☐ | Proper lifting practices? |
| ☐ | ☐ | Prohibiting unauthorized operators/riders? |
| ☐ | ☐ | Communication with co-workers while performing shared tasks? |
| ☐ | ☐ | General attentive operation? |
| ☐ | ☐ | Servicing of trucks? |
| ☐ | ☐ | Blocking wheels on semitrailers/railroad cars? |
| ☐ | ☐ | General prohibition of unsafe behavior? |
| ☐ | ☐ | Parking of trucks? |
| ☐ | ☐ | |
| | | **Worksite Characteristics** |
| | | Sufficient width of travel lanes? |
| | | Travel lanes uncluttered? |
| ☐ | ☐ | Visibility/warnings at intersections/doors? |
| ☐ | ☐ | Environmental conditions considered (noise, fumes, gases, dusts, |
| ☐ | ☐ | lighting)? |
| ☐ | ☐ | Restriction of personnel in travel lanes? |
| | | Traffic patterns controlled? |
| ☐ | ☐ | Driving on level/nonslippery surfaces? |
| ☐ | ☐ | |
| ☐ | ☐ | **Load Characteristics** |
| | | Proper palleting? |
| | | Weight of loads? |
| ☐ | ☐ | Condition of pallets and skids? |
| ☐ | ☐ | Stable loads/good visibilility? |
| ☐ | ☐ | |
| ☐ | ☐ | |

## Appendix B: Forklift (Lift Truck) Accident Prevention Checklist (Continued) 2

### Truck Condition

| YES | NO | Are the following items in good repair, and/or in good condition, and have good design characteristics: |
|---|---|---|
| ☐ | ☐ | Brakes? |
| ☐ | ☐ | Transmission, clutch, and shift linkage? |
| ☐ | ☐ | Mirrors with unobstructed vision? |
| ☐ | ☐ | Operating controls? |
| ☐ | ☐ | Steering? |
| ☐ | ☐ | Minimal leaks (hydraulic, gas, oil, transmission, brakes)? |
| ☐ | ☐ | Operation of safety features? |
| | | Acceptable emissions from truck? |

## APPENDIX C: Hoist Safe Use Recommendations

### Design and Operating Conditions

- Supply hoists specifically designed to handle the maximum anticipated loads. Require the posting of safe load capacity charts and safe operating procedure on each hoist.
- Confirm that all hoists are properly installed and tested prior to initial use. Make certain that hoist supports have an adequate design factor for the maximum loads to be imposed (including the weight of hoists and rigging).
- Place hoists in a reasonably unobstructed area and away from personnel traffic areas. Do not allow workers under loads during any lift or movement.
- Perform regular inspection, testing, maintenance, and needed repair.
- Authorize only trained and experienced personnel to operate hoists, conduct hitching (rigging), and give load lift and movement signals.

### Operator Control

- Inspect and test hoist operating systems, including transport, controls, limit switches, hoist ropes and chains, and brake functions.
- Determine the weight of the load to be lifted keeping within structural and stability limitations.
- Make sure that the hoist and load hitch are centered above the load.
- Ensure that load attachments are secure and within capacity prior to the lift.
- Select in advance the load travel path, paying particular attention to personnel and fixed obstacles.
- Check to be certain that rigging and signaling personnel and others are away from the load when it is being lifted or moved.
- Make smooth lifts and movements of loads; avoid abrupt movements which may cause a load to fall.
- Report all equipment, structural, or functional problems.
- Have regular inspections, testing, lubrication, maintenance, and repairs performed.

## APPENDIX D: Materials Storage Guidelines

### Warehouse Storage

When planning materials storage, make sure materials do not obstruct fire alarm boxes, sprinkler system controls, sprinkler heads, fire extinguishers, first-aid equipment, lights, and electric switches. All exits and aisles must be kept clear at all times and shall be appropriately marked.

No Smoking signs must be posted where necessary throughout the warehouses. Maximum safe load limits of floors within buildings and structures, in pounds per square foot, shall be conspicuously posted in all storage areas, except for floors or slabs on grade. Maximum safe loads shall not be exceeded.

### Open Yard Storage

Plan open yard storage to have driveways between and around combustible storage piles at least 15 feet wide and maintained free from accumulation of rubbish, equipment, or other materials. Driveways should be spaced so that a maximum grid system unit of 50 feet is produced. Combustible materials must be piled with due regard to the stability of piles and no higher than 20 feet.

### Lumber

For outdoor storage of lumber, firm ground without yielding soil must be selected. The area must be well-drained to remove surface water and prevent softening of the ground. A periodic check should be made to determine if there is any shifting of materials.

For long-time piling, substantial bearings or dunnage is recommended. Concrete with spread footing extending below the frost line is a good method.

For temporary piling, heavy timbers may be used to support the cross-pieces. This type of support must be inspected periodically for deterioration which may cause the pile to list dangerously.

If lumber must be moved manually to or from a higher pile, the pile must be not more than 16 feet high and safe means of access to the top, such as a ladder, must be provided. Tie pieces are needed not only to stabilize the pile, but also to provide air circulation. Tie pieces must not extend into walkways, but are to be cut flush with the pile.

## APPENDIX D: Materials Storage Guideline (Continued) 2

### Bagged Material

Bagged material must be cross-tied with the mouths of the bags toward the inside of the pile. When the pile is 5 feet high, it must be stepped back one row for each additional 3 feet of height. A pile of sacks must never be undermined by the removal of sacks from lower rows.

### Pipes and Bar Stock

Pipes and bar stock must be stored on specially designed skills or racks and shall be safely blocked to prevent rolling or spreading. When moving these materials, employees should work from the end of the pile as much as possible. Employees must be instructed never to attempt to stop rolling or sliding pipes or bar stock.

### Sheet Metal

Sheet metal must be handled with hand leathers, leather gloves or gloves with metal inserts. All bundles must be separated by strips of wood to facilitate handling when the material is needed for production and to lessen chances of shifting or sliding of the piles of material.

### Brick and Masonry Blocks

Brick stacks shall not be more than 7 feet in height. When a loose brick stack reaches a height of 4 feet, it must be tapered back 2 inches in every foot of height above the 4-foot level.

Brick must never be stacked for storage purposes on scaffolds or runways. This does not prohibit normal supplies on bricklayers' scaffolds during actual bricklaying operations.

Masonry blocks should be limited to a stacked pile height of 6 feet. If blocks are stacked higher that 6 feet, the stack shall be tapered back one-half block per tier above the 6-foot level.

## APPENDIX E: Facility Handling and Storage Checklist

### General Requirements

| Yes | No | |
|---|---|---|
| ☐ | ☐ | • Are fire alarm boxes, sprinklers, sprinkler system controls, fire extinguishers, first-aid equipment, lights, electrical switches and fuse boxes blocked by stored materials? |
| ☐ | ☐ | • Are non-compatible materials stored in separate locations? (Example: Corrosives stored away from metal containers of combustible liquids.) |
| ☐ | ☐ | • Are all aisles and passageways in good repair and free from obstacles that stretch across or in the path of employees or equipment? |
| ☐ | ☐ | • Are permanent aisles and passageways marked with white lines? |
| ☐ | ☐ | • Are exits free from obstacles and stored materials? (Check the exterior of the building to ensure that exit doors are not blocked by equipment or stored materials.) |
| ☐ | ☐ | • Are ramps available to ensure the safe movement of equipment between two working levels? |

### Clearances

| | | |
|---|---|---|
| ☐ | ☐ | • Is there a minimum clearance of 18 inches available between nonflammable stored materials and sprinkler heads? |
| ☐ | ☐ | • Is there a minimum clearance of 36 inches available between flammable stored materials and sprinkler heads? |
| ☐ | ☐ | • Are passageways and/or aisles at least 3 feet wider than the widest equipment used to move stored materials? |
| ☐ | ☐ | • Are material stacks over 5 feet high stepped back an additional row for each additional 3 feet in height of material? |
| | | • Are clearance heights posted and visible to equipment operators? |

### Employee Behavior

- Are employees storing materials in the correct locations, using the proper equipment, and following safe operating procedures?

## APPENDIX F: Job Site/Yard Evaluation Checklist

| Yes | No | |
|---|---|---|
| ☐ | ☐ | **General** |
| ☐ | ☐ | • Is the jobsite neat and orderly? |
| ☐ | ☐ | • Are materials stored in tiers, secured by blocks, interlocking or other means suitable to prevent the stack from sliding, falling or collapsing? |
| ☐ | ☐ | • Are employees working in silos, hoppers, tanks or other similar areas trained in Confined Space Entry? |
| ☐ | ☐ | • Is vegetation controlled by mowing or by using herbicide? |
| ☐ | ☐ | • Is space provided between stockpiled materials to allow equipment and/or personnel to safely access materials? |
| ☐ | ☐ | **Pipe Storage** |
| ☐ | ☐ | • Are stockpiles of pipe stored in pyramid stacks? (Stack heights shall be limited to 6 feet.) |
| ☐ | ☐ | • Are pipe stacks secured from spreading by blocks or other similar restraining methods? (Blocking shall be done after the first course of pipe is placed.) |
| | | • Are employees allowed to stand on the stack or around the base of the stack while equipment is placing or removing materials from the stockpile? |
| ☐ | ☐ | **Masonry Storage** |
| ☐ | ☐ | |
| ☐ | ☐ | • Are brick bundles stacked by mechanical equipment limited to 7 feet? |
| ☐ | ☐ | • Are loose brick stacked above 4 feet stepped back 2 inches for every additional 1 foot of height? |
| ☐ | ☐ | • Are blocks stacked above 6 feet stepped back by 1/2 block for every additional row over 6 feet? |
| ☐ | ☐ | • Are bricks or blocks stored for long periods on scaffolding? |
| ☐ | ☐ | **Lumber** |
| | | • Are all nails removed from used lumber before being stockpiled? |
| | | • Are lumber stockpiles below 16 feet in height? |
| | | • Are lumber stockpiles secured by blocks or interlocking to prevent the pile from tilting or collapsing? |

## APPENDIX F: Job Site/Yard Evaluation Checklist (Continued) 2

### Straw Bails

| Yes | No | |
|---|---|---|
| ☐ | ☐ | • Are straw bales tiered, interlocked, and secured to prevent the materials from spreading or collapsing? |
| ☐ | ☐ | • Are straw bales stored in partially open or well-ventilated facilities to prevent the explosion of dust particles? |
| ☐ | ☐ | • Are straw bales stored at least 3 feet from any electrical outlet or light fixture? |
| | | • Are No Smoking or Open Flame signs posted around the perimeter of the facility storing hay bales? |