MATERIAL HANDLING IN MANUFACTURING

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OBJECTIVES OF THIS SESSION

- Discuss material handling safety issues in manufacturing
- Become aware of the some of the unique hazards that arise with automated guided vehicles (AGV’s)
- Take action on material handling hazards in your workplace
WHY IS THIS IMPORTANT?

OUTLINE

A. Conveyors
B. Cranes
C. Forklift trucks
D. Automated Guided Vehicles
E. Loading Docks
CONVEYORS

GENERAL SAFETY MEASURES FOR CONVEYORS

- Install an emergency button or pull cord designed to stop the conveyor at the employee’s work station.
- Install emergency stop cables that extend the entire length of continuously accessible conveyor belts so that the cables can be accessed from any location along the conveyor.
- Design the emergency stop switch so that it must be reset before the conveyor can be restarted.
GENERAL SAFETY MEASURES FOR CONVEYORS

- Ensure that appropriate personnel inspect the conveyor and clear the stoppage before restarting a conveyor that has stopped due to an overload.

- Prohibit employees from riding on a materials-handling conveyor.

- Provide guards where conveyors pass over work areas or aisles to keep employees from being struck by falling material.

CONTROL STATIONS

- Controls stations should be located so that the operation of the equipment is visible from them.

- A conveyor that is automatically controlled, or controlled from a remote location shall have an audible or visual device to warn workers that conveyor is starting.
SCREW CONVEYORS

- Screw conveyors should be completely covered except at loading and discharging points.
- Guards must be placed at loading and discharge to protect employees against contacting the moving screw. If the guards are removable, they must be interlocked to prevent conveyor movement when the guards are not in place.

BELT CONVEYORS

Nip and shear points must be safeguarded
Side guards (spill guards)
Railings or Fencing placed around the area.
WORKER KILLED WHEN AIR HOSE CAUGHT IN BELT CONVEYOR

Worker was killed when while using an air hose with a 10 foot long metal pipe (stinger) to blow debris. The hose got caught in a belt conveyor pulling him from a catwalk. He struck a steel framework and fell to the floor.

Ref: NIOSH FACE Michigan Case Report: 08MI003

SLAT CONVEYORS
ROLLER CONVEYORS

GUARDING BY LOCATION
CRANES

OVERHEAD CRANES
WALL MOUNTED JIB CRANE

GANTRY CRANE
CRANES-CONTROLS

Switches on pendant control boxes should be momentary contact type or spring return buttons.

Rotary switches and toggle switches should NOT BE USED.

OSHA 1910.179 INSPECTION OF CRANES

OSHA has two type of inspections:

Frequent- daily to monthly intervals
Periodic- 1 to 12 month intervals
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<th>OSHA 1910.179 INSPECTION OF CRANES</th>
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<tr>
<td><strong>Frequent- daily to monthly intervals</strong></td>
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<td>• Functional operating mechanisms <strong>DAILY</strong></td>
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<td>• Deterioration or leakage in lines, tanks, valves <strong>DAILY</strong></td>
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<td>• Hooks with deformation or cracks, visual <strong>DAILY</strong></td>
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<td>• Hoist chains, visual <strong>DAILY</strong></td>
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<td><strong>Periodic- One month to 12 month intervals</strong></td>
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<td>• Deformed, cracked of deformed members</td>
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<td>• Loose bolts or rivets</td>
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<td>• Worn, cracked, or distorted pins, bearings</td>
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<td>• Excessive wear on bearings</td>
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<td>• Excessive wear on chain drive</td>
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BUT, THE CRANE WORKED YESTERDAY

Do a quick daily inspection, it only takes a minute

- Does the crane look to be in operable condition?
- Have any parts fallen to the floor?
- Are there any signs of collisions or damage?
- Run the hoist up. Do you hear any unusual sounds?
- Does the trolley and bridge movement sound right?
- Are the controls operating OK?

DAILY INSPECTION
CRANE BREAKS MOUNTING BASE AND CRUSHES EMPLOYEE

- A worker used a jib crane to lift a 442-pound steel plate approximately 6 inches from a steel table. The column which the crane was mounted to was held in place by a steel plate welded to the bottom of the crane. The steel plate was held in place by three 1-inch thick anchor bolts welded to the bottom of the steel plate and embedded in concrete. The welds connecting the tops of the anchor bolts to the bottom of the steel plate broke causing the column and crane to collapse. As it collapsed, it struck the worker and killed him.

Ref: OSHA.gov Fatality and Catastrophe Investigation Summaries Accident #2007885459

WIRE ROPE SLINGS

Check for:

- Broken or worn wires
- Check end connections
- Kinks
- Crushed wires
- Unwinding strands
CHAIN SLINGS

Check for:

- Cracks or breaks
- Excessive wear, nicks, or gouges.
- Stretched chain links or components
- Bent, twisted, or deformed chain links
- Excessive pitting or corrosion.
- Lack of ability of chain or components to hinge (articulate) freely

METAL MESH SLINGS

Check for:

- Broken weld or a broken brazed joint along the sling edge
- Broken wire in any part of the mesh
- Lack of flexibility due to distortion of the mesh.
- A 15% reduction of the original cross-sectional area of any point around the hook opening of the end fitting.
SYNTHETIC SLINGS

Check for:

- Acid or caustic burns.
- Melting or charring of any part of the sling.
- Holes, tears, cuts, or snags.
- Broken or worn stitching in load bearing splices.
- Excessive abrasive wear.
- Knots in any part of the sling.

EMPLOYEE STRUCK BY FALLING CASTING

EMPLOYEE WAS USING A 1-TON JIB CRANE WITH A 1-INCH NYLON WEB SLING, RATED FOR UP TO 2000 POUNDS. TO LIFT THE CASTING INTO AN UPRIGHT POSITION. THE SLING BROKE AND THE CASTING DROPPED AND FELL ON HER. THERE WERE SHARP EDGES THAT CUT THROUGH THE NYLON SLING, ALLOWING THE CASTING TO FALL.

Ref: OSHA.gov Fatality and Catastrophe Investigation Summaries Accident #686485
RIGGING

What’s wrong with this picture?

POWERED INDUSTRIAL TRUCKS (PIT’s)
FORKLIFT TRUCK INJURY STATISTICS

According to 2008 data from the U.S. Department of Labor’s Bureau of Labor Statistics:

- The number one cause of lift truck related work fatalities is pedestrians being struck by the vehicle.
- The second leading fatal event associated with lift trucks is when the vehicle overturns.

FORKLIFT TIP OVER

On July 2, 2001, a 17-year-old male warehouse laborer (the victim) was fatally injured when the sit-down-type forklift he was operating tipped over and crushed him. The victim apparently lost control of the forklift, which had a load on its forks and the mast fully extended, as he was making a right turn, causing the forklift to tip over 90 degrees onto its left side. The unrestrained victim was crushed under the extended boom/mast of the forklift.

Ref: NIOSH In-house FACE Report 2002-02
PEDESTRIAN SAFETY-FACILITY FEATURES

- Identify proper aisle ways and widths.
- Mark aisle ways for equipment and pedestrian walkways.
- Mark slow-down locations: intersections, aisle ways, blind corners where doors open to an aisle, dock areas and where lighting is impaired.

PEDESTRIAN SAFETY-FACILITY FEATURES

- Install and train operators on how to use convex mirrors when appropriate.

- Ensure that only authorized and trained operators operate a lift truck. Employers must certify that operators have been trained and evaluated in accordance with the OSHA standard.
PEDESTRIAN SAFETY- OPERATOR RESPONSIBILITIES

- Use warning devices, such as lights, horns, and back-up alarms.
- Slow down, stop, and sound the horn at intersections, corners, and wherever your vision is obstructed.
- Do not move the truck if you do not have a clear view of travel. Use a spotter for blind spots.

PEDESTRIAN SAFETY- OPERATOR RESPONSIBILITIES

- When possible, make eye contact with pedestrians.
- Do not talk or text on a cell phone while operating a lift truck.
- Do not drive up to anyone standing in front of a bench or other fixed object.
FORKLIFT BACKING UP

A punch press was working at a punch press located adjacent to a designated forklift aisle. A co-worker was backing a forklift along the aisle. The forklift struck a scrap parts bin. The scrap bin was propelled toward the press where it struck and pinned the victim against the press frame.

Ref: NIOSH FACE 9604

PEDESTRIAN RESPONSIBILITIES

- Never step in front of a lift truck or piece of powered equipment.
- Stay cleared of loaded trucks. A load being carried could easily tip over or slide off of the lift truck.
- Stop and look when approaching a corner before proceeding—look both ways.
PEDESTRIAN RESPONSIBILITIES

- Keep well away from the lift truck and other motorized equipment to avoid getting pinned by the swing.

- Never ride as a passenger on a piece of powered equipment.

- Never walk or stand under the mast or load of a lift truck.

- Know that a backing lift truck poses a hazard.

AUTOMATED GUIDED VEHICLES (AGV)

AGV’s are load carriers that travel throughout a facility without an onboard operator.
SEVERAL TYPES OF AGV’s

Automated Carts

Unit Load AGV’s

SEVERAL TYPES OF AGV’s

Tugger AGV’s

Forklift AGV’s
AGV OBSTACLE DETECTION

ADVANTAGES OF AGV’s (SAFETY)

AGV’s eliminate accidents due to on board operator error.
BUT...AGV SYSTEMS ARE NOT FOOL PROOF

There can be blind spots in the sensing field, especially when going around corners.

Depending on the height of the sensors, there can be difficulty sensing forklift trucks.

BUT...AGV SYSTEMS ARE NOT FOOL PROOF

Loads may be wider than the AGV.

Sensor field may have to be shortened or deactivated when inserting or picking a load.
BUT...AGV SYSTEMS ARE NOT FOOL PROOF

There can be potential conflict in mixed traffic areas: AGV/Forklift or AGV/Pedestrian

System layout constraints may require the AGV’s to travel close to fixed objects

ANSI/ITSDF B56.5 SAFETY STANDARD FOR DRIVERLESS, AUTOMATIC GUIDED INDUSTRIAL VEHICLES

ANSI B56.5 is the safety standard for AGV’s

The standard sets forth the responsibilities for the user and the manufacturer
4.7.2 In non-restricted areas, floor space for vehicle and load shall, including turning and maneuvering, be marked

4.7.1 Restricted areas require identification and/or marking
HAZARD AREA- An area of inadequate clearance, or which cannot be protected by object detection devices

A higher hazard area such as operation in rack area

4.7.4 Minimum clearance of 19.7 inches and obstructions and vehicles. Areas of reduced clearance shall be hazard or restricted areas and clearly marked.
ANSI/ITSDF B56.5 SAFETY STANDARD FOR DRIVERLESS, AUTOMATIC GUIDED INDUSTRIAL VEHICLES

4.7.5(a) Vehicle guide paths shall not go through doorways used by pedestrians unless there is adequate clearance.

TRAIN WORKERS TO PLACE CONES WHEN WORKING IN AN AGV TRAVEL AREA
LOADING DOCKS

TRAILER SEPARATION
TRAILER SEPARATION

- **1910.178(k)(1)** The brakes of highway trucks shall be set and wheel chocks placed under the rear wheels to prevent the trucks from rolling while they are boarded with powered industrial trucks.
FALLING OFF EDGE OF DOCK

FALLING OFF EDGE OF DOCK
BRIDGING THE GAP

Make sure a dock plate is secured and in position. Always walk and inspect trailer floor before boarding.
PEDESTRIANS

Don’t let any pedestrians in trailers or near a loading dock while forklift drivers are loading or unloading a truck.

CONCLUSION

- Check that all conveyor hazards are guarded (Be careful about guarding by location)
- Do a daily check of cranes
- Mark pedestrian walkways
- Make sure only authorized, trained operators operate forklifts.
- Check AGV obstacle detection systems for blind spots
- Make sure areas of inadequate clearance are highlighted
- Loading dock safety procedures in place
RESOURCES

OSHA 2236 Material Handling and Storage

ASME B20.1 Safety Standard for Conveyors and Related Equipment

Safeguarding Equipment and Protecting Employees from Amputations, OSHA 3170-02R

ASME B30.2 Overhead and Gantry Cranes

RESOURCES


Schultz, G. Conveyor Safety, ASSE

Swartz, G. Forklift Safety, Government Industries
ANY QUESTIONS???