

Construction Focus Four: Fall Hazards
Student Handouts

- Guardrail and Safety Net Systems Summary
- Personal Fall Arrest Systems Summary
- Preventing Ladder Falls
- Scaffold Work Can Be Dangerous

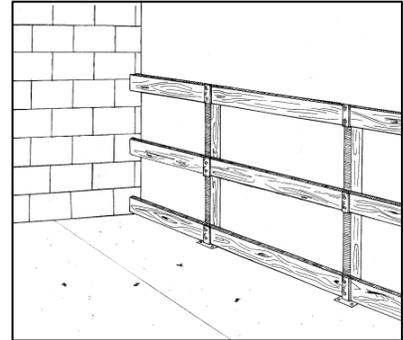
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Guardrail and Safety Net Systems Summary

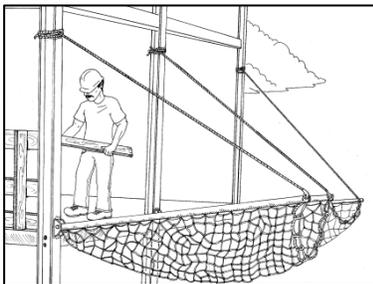
Guardrail and safety net systems are two ways to protect workers from falls on the job. If you are more than 6 feet above the lower surface, some type of fall protection must be used by your employer.

If your employer uses **guardrails**:

- Toprails must be at least $\frac{1}{4}$ inch thick to prevent cuts and lacerations; and they must be between 39 and 45 inches from the working surface;
- If wire rope is used, it must be flagged at least every six feet with highly visible materials;
- Midrails, screens or mesh must be installed when there are no walls at least 21 inches high. Screens and mesh must extend from the toprail to the working level.
- There can be no openings more than 19 inches;
- The toprail must withstand at least 200 lbs. of force; the midrail must withstand 150 lbs. of force;
- The system must be smooth enough to protect workers from cuts and getting their clothes snagged by the rail.
- If guardrails are used around holes at points of access, like a ladderway, a gate must be used to prevent someone from falling through the hole, or be offset so that a person cannot walk directly into the hole.



If your employer uses **safety nets**:



- The nets must be as close as practicable under the working surface, but never more than 30 feet below;
- The safety net must be inspected every week for damage;
- Each net must have a border rope with a minimum strength of 5,000 lbs.;
- The safety net must extend outward a sufficient distance, depending on how far the net is from the working surface (OSHA has a formula to follow);
- The safety net must absorb the force of a 400-pound bag of sand dropping on to the net ("the drop test");
- Items in the net that could be dangerous must be removed as soon as possible.

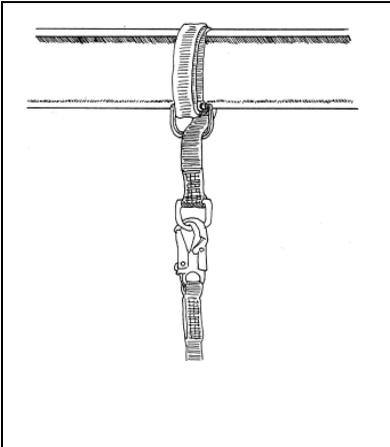
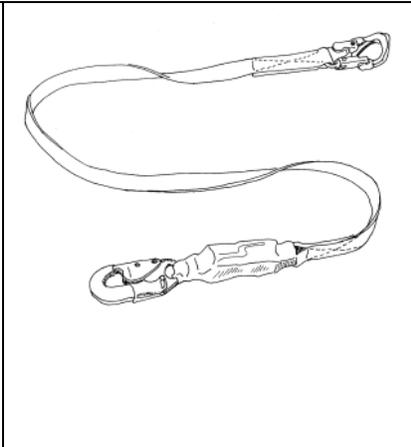
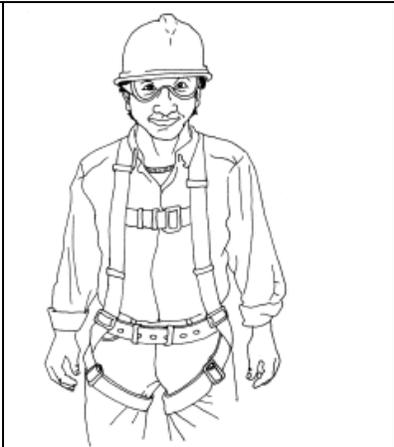
SOURCE: Construction Safety & Health Fall Hazards, Central New York COSH, 2007, OSHA grant product

Personal Fall Arrest Systems Summary

Personal fall arrest systems are one way to protect workers from falls. In general, workers must have fall protection when they could fall 6 feet or more while they are working.

OSHA **requires** workers to wear a full-body harness, (one part of a *Personal Fall Arrest System*) when they are working on a *suspended scaffold* more than 10 feet above the working surface, or when they are working in *bucket truck or aerial lift*. Employers may also choose to use a Personal Fall Arrest System, instead of a guardrail, when workers are working on a *supported scaffold* more than 10 feet above the working surface.

There are **three** major components of a Personal Fall Arrest System (PFAS):

		
● the anchor and the anchorage connector	● the connecting device, which is a lanyard or a retractable lifeline, with snaphooks	● the full-body harness

The following are some things to remember about personal fall arrest systems:

1. A personal fall arrest system is made up of an **anchorage, connecting device, and a full-body harness**. The connecting device may be a lanyard with snaphooks, or a self-retracting lifeline. A lanyard could also include a deceleration device. Make sure you are using components from the same manufacturer to ensure that the system works as it should. If not, any substitution or change must be evaluated or tested by a competent person to ensure that it meets the standard.
2. **Body belts cannot be used** for fall arresting service. However, a body belt is allowed as part of a positioning system. A positioning system is one way to prevent falls from occurring. It involves equipment for keeping your body in a position where you are not able to fall. For all situations where you could actually fall, you need to wear a full-body harness.
3. Your personal fall arrest system must be **inspected for damage** each time before you wear it. [If there are defects, or if someone has taken a fall using the equipment, it must be removed from service.]

4. The **attachment location** of the body harness must be in the center of your back, near the shoulder level or above your head.
5. **Vertical lifelines or lanyards** must have a minimum breaking strength of 5,000 lbs., and be protected against being cut or abraded.
6. Each worker must be attached to a **separate vertical lifeline**. [There is a special exception when constructing elevator shafts.]
7. The **webbing**, which is the materials used for ropes and straps of lifelines, lanyard and harnesses, must be made of **synthetic** fibers.
8. **An anchorage** for workers' personal fall arrest equipment must be **independent of any anchorage** used to support or suspend platforms, and it must be able to support at least 5,000 lbs. per worker attached to it.
9. **Connectors** must be made from **steel or equivalent** materials, with a corrosion-resistant finish and the edges must be smooth.
10. **D-rings and snaphooks** must have a **minimum tensile strength** of 5,000 lbs.
11. **Snaphooks** must be a **locking-type** (they are generally double-locking) and designed to prevent the snaphook from opening and slipping off the connector.
12. **Snaphooks cannot be directly connected** to the webbing, rope or wire, to each other, to a D-ring to which another snaphook or other connector is attached, to a horizontal lifeline, or to any other object that could cause the snaphook to open.

Preventing Ladder Falls - *Construction Safety*

Why construction falls?

Here are a few basic facts about falls in construction:

- Every day, four construction workers die on the job.
- Falls are the most common cause of fatal injuries to construction workers.
- The consequences of a fall affect not only the worker, but also his or her family and community.
- Construction falls can be prevented. Contractors and foreman can do many things to organize the worksite to be safer for their employees. But workers themselves can also make some inexpensive, simple changes to the way they work that can save their lives.
- Ladders are one of the most common pieces of equipment on a construction site. But that doesn't mean they are safe. There are construction workers who are injured or killed falling from a height every day. Using ladders more safely is one way to start preventing falls at your work site.



Set an example at work

Your co-workers can learn a lot from you. At first, you might be the only one who is concerned with safety at your worksite. But over time, other workers will see that the foreman will give you the time you need to be safe. They will see how many little things add up to big effects on safety. And they will see how they, too, can help to make your worksite safer.

So, set an example. Don't worry about being the first—they'll thank you for it later.

How can I prevent a fall from a ladder?

There are many ways you can prevent a fall from a ladder—here are just three suggestions to get you started.

- **Choose the right ladder for the job.**
- **Tie the top and bottom of the ladder to fixed points when necessary.**
- **Don't carry tools or other materials in-hand while climbing the ladder.**

1. Choose the right ladder for the job.

- First you need to make sure that a ladder is the best equipment for what you need to do. Would scaffolding or a mechanical lift be better?
- Many times, the ladder is the only physical support you have while you are working. If it fails, you can fall. That's why it is so important to find the right ladder when you do need to use one. The three main types of ladders—step ladders, straight ladders, and extension ladders—are used in different situations for different tasks.
- Before you start using a ladder, ask yourself two questions.
- **Is the ladder long enough?** It should be long enough for you to set it at a stable angle and still extend at the top to give you something to hold on to when you get

on the ladder to descend. Setting the ladder at the right angle helps you keep your balance on the ladder. It also helps keep the ladder from falling backwards.

- Make sure the ladder extends 3 feet (3 rungs; 0.9 meters) above the surface you will be working on.
 - Make sure the ladder is placed at a stable angle. For every four feet (1.2 m) high the ladder is, the base should be 1 foot (.3 m) out from the wall
 - For example, if you will be working on a 10 foot-high roof (3 m), you need a ladder that is at least 14 feet (4.25 m) long. The base should be 2 ½ feet (.75 m) from the wall.
- **Is the ladder in good working condition?** It shouldn't be missing pieces or be cracked or otherwise damaged. Check the duty rating on extension ladders – is it high enough for the weight you will be putting on it? Longer ladders don't always have higher duty ratings, so be sure to check. In construction, the most common ratings are:
- Heavy Duty (I) supports up to 250 pounds (113 kg).
 - Extra heavy duty (IA) supports up to 300 pounds (136 kg).
 - Special duty (IAA) supports up to 375 pounds (170 kg).

2. Tie the top and bottom of the ladder to fixed points when necessary: if it doesn't extend 3' above the landing, on slippery surfaces, and where it could be displaced by work activities or traffic.

- Tie both sides of the top of the ladder to a fixed point on the roof or other high surface near where you are working. The bottom should be tied to a fixed point on the ground. Securing the ladder in this way prevents the ladder from sliding side-to-side or falling backwards and prevents the base from sliding.
- Tying the ladder off at the beginning of the day and untying it at the end will only take you about 5 minutes. It can make all the difference for your safety. If you need to move the ladder around, allow extra time for this important step, or consider using something else, such as a scaffold.

3. Don't carry tools or other materials in-hand while climbing the ladder.

- Take precautions when you are going up or down a ladder. Instead of carrying tools, boards, or other materials in your hands, use a tool belt, install a rope and pulley system, or tie a rope around your materials and pull them up once you have reached the work surface. Ask for help if you need to use more than one hand to pull them up.
- Carrying tools or anything else in your hands as you climb the ladder can throw you off balance. When you climb a ladder, always use at least one hand to grasp the ladder when going up or down.

Source: CDC/NIOSH in partnership with CPWR-The Center for Construction Research and Training, Hollywood, Health and Society, and the Spanish-language network Telemundo.

Scaffold Work Can Be Dangerous: Know the Basics of Scaffold Safety

There are thousands of scaffold-related injuries – and about 40 scaffold-related deaths – every year in the U.S. If you are doing work on scaffolds, know how to work on them safely – it could save your life!



Here are some rules about scaffolds that must be followed if you want to work safely:

1. A **competent person** must be available to direct workers who are constructing or moving scaffolds. The competent person must also train workers, and **inspect** the scaffold and its components **before every work shift, and after any event that could affect the structural integrity of the scaffold**. The competent person must be able to identify unsafe conditions, and be authorized by the employer to take action to correct unsafe conditions, to make the workplace safe. And a **qualified person**, someone who has very specific knowledge or training, must actually design the scaffold and its rigging.
2. Every **supported** scaffold and its components must **support, without failure, its own weight and at least four times the intended load**. The intended load is the sum of the weights of all personnel, tools and materials that will be placed on the scaffold. Don't load the scaffold with more weight than it can safely handle.
3. On **supported** scaffolds, working platforms/decks must be planked close to the guardrails. Planks are to be overlapped on a support at least 6 inches, but not more than 12 inches.
4. Inspections of **supported** scaffolds must include:
 - Checking metal components for bends, cracks, holes, rust, welding splatter, pits, broken welds and non-compatible parts.
 - Covering and securing floor openings and labeling floor opening covers.
5. Each rope on a **suspended** scaffold must support the scaffold's weight and at least **six times** the intended load.
6. Scaffold **platforms** must be at least **18 inches wide**, (**there are some exceptions**), and guardrails and/or personal fall arrest systems must be used for fall protection any time you are working 10 feet or more above ground level. **Guardrails** must be between 39 and 45 inches high, and **midrails** must be installed approximately halfway between the toprail and the platform surface.
7. OSHA standards require that workers have **fall protection when working on a scaffold 10 or more feet above the ground**. OSHA requires the following:

- The use of a **guardrail OR a personal fall arrest system** when working on a *supported scaffold*.
- **BOTH a guardrail AND a personal fall arrest system** when working on a *single-point or two-point suspended scaffold*.
- A **personal fall arrest system** when working on an *aerial lift*.

8. Your lifeline must be tied back to a **structural anchorage** capable of withstanding **5,000 lbs** of dead weight **per person** tied off to it. Attaching your lifeline to a guardrail, a standpipe or other piping systems will not meet the 5,000 lbs requirement and is not a safe move.

9. Wear hard hats, and make sure there are toeboards, screens and debris nets in place **to protect other people from falling objects**.

10. **Counterweights** for *suspended scaffolds* must be able to resist at least **four times the tipping moment**, and they must be made of materials that cannot be easily dislocated (no sand, no water, no rolls of roofing, etc.). [This would be calculated by the *qualified person* who designs the scaffold.]

11. Your employer must provide safe access to the scaffold when a platform is more than two (2) feet above or below the point of access, or when you need to step across more than 14 inches to get on the platform. **Climbing on cross braces is not allowed!** Ladders, stair towers, ramps and walkways are some of the ways of providing safe access.

12. All workers must be **trained** on:

- how to use the scaffold, and how to recognize hazards associated with the type of scaffold they are working on;
- the maximum intended load and capacity;
- how to recognize and report defects;
- fall hazards, falling object hazards and any other hazards that may be encountered, including electrical hazards (such as overhead power lines); and,
- having proper fall protection systems in place.

SOURCE: Construction Safety & Health Fall Hazards, Central New York COSH, 2007, OSHA grant product

Construction Focus Four: Struck-By Hazards Student Handouts

- Hazard Alert – Nail Gun Safety
- Focus 4 “Cranes and Rigging”
- PPE for Workers Checklist

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How to prevent injury

- ◆ Ask for a nail gun with a sequential trigger mechanism.
- ◆ **NEVER** shoot towards yourself or a co-worker.
- ◆ Do not press the trigger unless the nose of the gun (contact element) is firmly pressed against the work material.
- ◆ **NEVER** walk around with your finger on the trigger.
- ◆ **NEVER** clean or clear jams or adjust a nail gun when it is connected to the air supply.
- ◆ Avoid nailing into knots and metal; nails are more likely to ricochet. Dense materials, like laminated beams, are also difficult to nail.
- ◆ **NEVER** remove or bypass safety devices, triggers, or contact springs.
- ◆ **NEVER** use a defective tool. If a tool is malfunctioning, it needs to be tagged and taken out of service.

To read stories about nail gun injuries and see photos, visit
www.cpwr.com/nailguns

To learn more about CPWR, visit
www.cpwr.com

For more safety and health information, visit
www.elcosh.org



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HAZARD ALERT

Nail Guns



Serious –
even fatal –
injuries
are happening
to workers
using these
tools.

What's the problem?

Nail guns are popular for a reason. They get the job done in a blink of an eye.

But that rapid-fire action can work against you. In a split second, a nail can enter your finger, your hand, or worse.

Nail gun injuries are much more common than people think. Most injuries involve puncture wounds to hands or fingers, but serious, even fatal, injuries are also associated with the use of these tools.

How most nail gun injuries happen

- ◆ Accidental or unintended firing, often associated with recoil of the tool after firing
- ◆ Ricocheting nails
- ◆ Nail going through work surface
- ◆ Airborne nails
- ◆ By-passed safety features
- ◆ Unsafe work practices
- ◆ Holding finger on contact trigger



Basic information about nail guns

Although there are many types of nail guns (framing, finishing, flooring, etc.), there are two common triggers:

Contact trip trigger mechanisms allow the tool to fire anytime the trigger and the nose of the gun (contact element) are both depressed. Trigger can be held down to allow bump or bounce nailing.

Sequential triggers require the nose of gun (contact element) to be depressed before the trigger is pulled. That avoids inadvertent discharge of nails.

WARNING:

The two triggers look exactly alike. You will not be able to tell the difference!

If you can "bump nail" by holding the trigger down, and bouncing the nose against a nailing surface, that is a contact trigger gun.

Use extreme caution.



Why it's important:

- 1) The **contact trip trigger mechanism carries twice the risk** of the sequential trigger, even after considering experience and training.
- 2) Accidental firings are most common following recoil of tools with contact trip triggers.
- 3) If **you are not trained** in using either of these tools, you are at high risk of injury.



"Faster" trigger does not increase productivity

A recent study measuring productivity in construction found that the contact trip trigger showed no significant difference (less than 1 percent) in productivity than the sequential trigger. Also, there was no significant difference between the two tools in nail count and placement.

The study, which involved journeymen carpenters with an average of 13 years in the trade, found that **the difference in productivity was the worker, not the tool.**

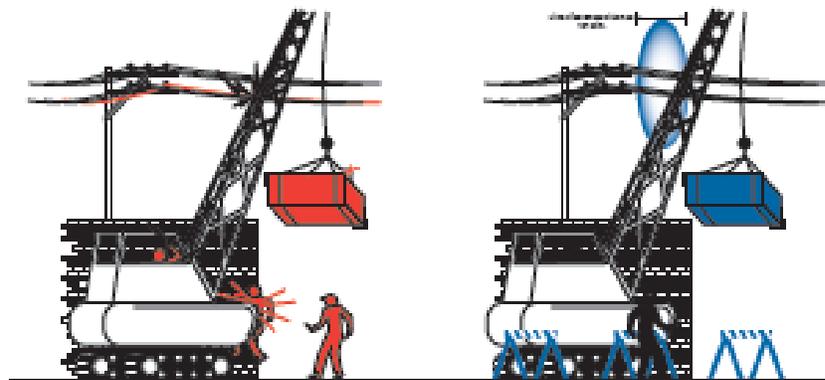
FOCUS

Cranes and rigging

Properly securing any load with appropriate rigging is crucial to any lifting being done by machinery on the job-site. If the rigging fails the results can cause serious injury and even death. Before any load is lifted all components of the rigging hardware should be evaluated to ensure they can withstand the forces of the load.

Follow these safe work practices

1. Guard all exposed gears, rotating shafts, pulleys, sprockets or other moving parts to prevent contact with employees.
2. Guard or block the swing radius of the crane to restrict and prevent employees from entering into and being struck by the machine.
3. Inspect all rigging equipment prior to each lift, this should include all slings, chains, ropes, and like materials used to support and lift materials.
4. Remove from service any defective equipment immediately.
5. Be sure to inspect all hooks, clamps, and other lifting accessories for their rated load.
6. Clearly communicate to all employees on site that no one is permitted to work under loads.
7. Be sure the person responsible for signaling the crane operator stays in visual contact with the operator and has been trained to use the correct signals.



WRONG WAY

RIGHT WAY

PPE for Workers Checklist

Protection	TYPICAL OPERATIONS OF CONCERN	YES	NO
EYE 	Sawing, cutting, drilling, sanding, grinding, hammering, chopping, abrasive blasting, punch press operations, etc.		
	Pouring, mixing, painting, cleaning, siphoning, dip tank operations, dental and health care services, etc.		
	Battery charging, installing fiberglass insulation, compressed air or gas operations, etc.		
	Welding, cutting, laser operations, etc.		
FACE 	Pouring, mixing, painting, cleaning, siphoning, dip tank operations, etc.		
	Welding, pouring molten metal, smithing, baking, cooking, drying, etc.		
	Cutting, sanding, grinding, hammering, chopping, pouring, mixing, painting, cleaning, siphoning, etc.		
HEAD 	Work stations or traffic routes located under catwalks or conveyor belts, construction, trenching, utility work, etc.		
	Construction, confined space operations, building maintenance, etc.		
	Building maintenance; utility work; construction; wiring; work on or near communications, computer, or other high tech equipment; arc or resistance welding; etc.		
FEET 	Construction, plumbing, smithing, building maintenance, trenching, utility work, grass cutting, etc.		
	Building maintenance; utility work; construction; wiring; work on or near communications, computer, or other high tech equipment; arc or resistance welding; etc.		
	Welding, foundry work, casting, smithing, etc.		
	Demolition, explosives manufacturing, grain milling, spray painting, abrasive blasting, work with highly flammable materials, etc.		
HANDS 	Grinding, sanding, sawing, hammering, material handling, etc.		
	Pouring, mixing, painting, cleaning, siphoning, dip tank operations, health care and dental services, etc.		
	Welding, pouring molten metal, smithing, baking, cooking, drying, etc.		
BODY 	Pouring, mixing, painting, cleaning, siphoning, dip tank operations, machining, sawing, battery charging, installing fiberglass insulation, compressed air or gas operations, etc.		
	Cutting, grinding, sanding, sawing, glazing, material handling, etc.		
	Welding, pouring molten metal, smithing, baking, cooking, drying, etc.		
	Pouring, mixing, painting, cleaning, siphoning, dip tank operations, etc.		
HEARING 	<p>Machining, grinding, sanding, work near conveyors, pneumatic equipment, generators, ventilation fans, motors, punch and brake presses, etc.</p> <p style="text-align: center;">Samples shown are: ear muffs (left) and earplugs (right)</p>		

NOTE: Pictures of PPE are intended to provide a small sample of what the protection gear may look like. They are not to scale nor are they inclusive of all protection gear required and/or that is available.

Construction Focus Four: Caught-In or -Between Hazards Student Handouts

- Fatal Facts Accident Summary #5
- Fatal Facts Accident Summary #13
- Fatal Facts Accident Summary #15
- Fatal Facts Accident Summary #18
- Fatal Facts Accident Summary #22
- Fatal Facts Accident Summary #31
- Fatal Facts Accident Summary #38
- Fatal Facts Accident Summary #50
- Fatal Facts Accident Summary #61
- Fatal Facts Accident Summary #73

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ACCIDENT REPORT FATAL FACTS

ACCIDENT SUMMARY No. 5

Accident Type:	Caught in or Between	
Weather Conditions:	Clear	
Type of Company:	Street Paving Contractor	
Size of Work Crew:	1	
Union or Non-union:	Non-Union	
Worksite Inspections Conducted (1926.20(b)(2)):	Yes	
Designated Competent Person on Site (1926.20(b)(2)):	Yes	
Employer Safety Health Program:	Yes	
Training and Education for Employees (1926.21(b)):	Yes	
Craft of Deceased Employee(s):	Ironworker	
Age & Sex:	22-Male	
Time on the Job:	1 day	
Time on Task:	3 Hours	

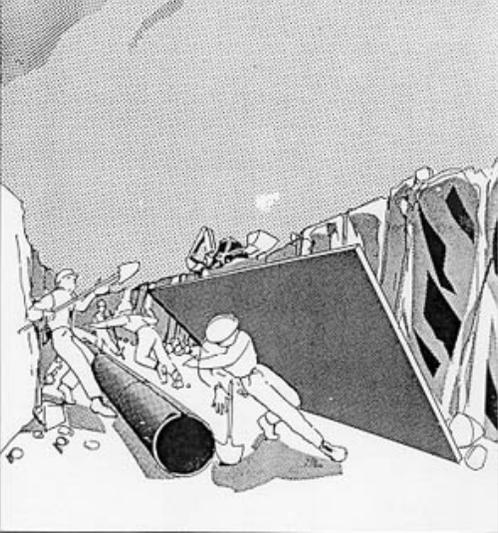
BRIEF DESCRIPTION OF ACCIDENT

A laborer was steam cleaning a scraper. The bowl apron had been left in the raised position. The hydraulically controlled apron had not been blocked to prevent it from accidentally falling. The apron did fall unexpectedly and the employee was caught between the apron and the cutting edge of the scraper bowl. The apron weighted approximately 2500 pounds.

ACCIDENT PREVENTION RECOMMENDATIONS

ACCIDENT REPORT FATAL FACTS

ACCIDENT SUMMARY No. 13

Accident Type:	Collapse of Shoring	
Weather Conditions:	Clear	
Type of Operation:	Boring and Pipe Jacking Excavation	
Size of Work Crew:	4	
Collective Bargaining	Yes	
Competent Safety Monitor on Site:	Yes	
Safety and Health Program in Effect:	No	
Was the Worksite Inspected Regularly:	Yes	
Training and Education Provided:	Yes	
Employee Job Title:	Pipe Welder	
Age & Sex:	62-Male	
Experience at this Type of Work:	18 years	
Time on Project:	2½	

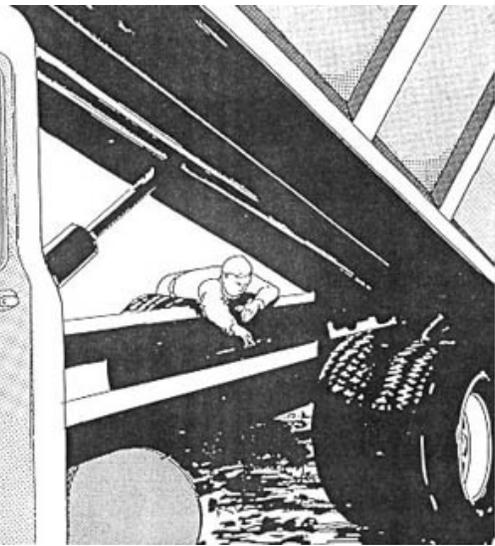
BRIEF DESCRIPTION OF ACCIDENT

Four employees were boring a hole and pushing a 20-inch pipe casing under a road. The employees were in an excavation approximately 9 feet wide, 32 feet long and 7 feet deep. Steel plates 8' x 15' x 3/4", being used as shoring, were placed vertically against the north and south walls of the excavation at approximately a 30 degree angle. There were no horizontal braces between the steel plates. The steel plate on the south wall tipped over, pinning an employee (who was killed) between the steel plate and the pipe casing. At the time the plate tipped over, a backhoe was being operated adjacent to the excavation.

ACCIDENT PREVENTION RECOMMENDATIONS

ACCIDENT REPORT FATAL FACTS

ACCIDENT SUMMARY No. 15

Accident Type:	Crushed by Dump Truck Body	
Weather Conditions:	Clear, Warm	
Type of Operation:	General Contractor	
Size of Work Crew:	N/A	
Collective Bargaining	Yes	
Competent Safety Monitor on Site:	Yes	
Safety and Health Program in Effect:	Yes	
Was the Worksite Inspected Regularly:	Yes	
Training and Education Provided:	No	
Employee Job Title:	Truck Driver	
Age & Sex:	25-Male	
Experience at this Type of Work:	2 Months	
Time on Project:	2 Weeks at Site	

BRIEF DESCRIPTION OF ACCIDENT

A truck driver was crushed and killed between the frame and dump box of a dump truck. Apparently a safety "over-travel" cable attached between the truck frame and the dump box malfunctioned by catching on a protruding nut of an air brake cylinder. This prevented the dump box from being fully raised, halting its progress at a point where about 20 inches of space remained between it and the truck frame. The employee, apparently assuming that releasing the cable would allow the dump box to continue up-ward, reached between the rear dual wheels and over the frame, and disengaged the cable with his right hand. The dump box then dropped suddenly, crushing his head. The employee had not received training or instruction in proper operating procedures and was not made aware of all potential hazards in his work.

ACCIDENT PREVENTION RECOMMENDATIONS

ACCIDENT REPORT FATAL FACTS

ACCIDENT SUMMARY No. 31

Accident Type:	Cave-in	
Weather Conditions:	Cloudy and Dry	
Type of Operation:	Trenching and excavation	
Size of Work Crew:	4	
Collective Bargaining	No	
Competent Safety Monitor on Site:	Yes	
Safety and Health Program in Effect:	Yes	
Was the Worksite Inspected Regularly:	Yes	
Training and Education Provided:	No	
Employee Job Title:	Pipe Layer	
Age & Sex:	32-Male	
Experience at this Type of Work:	9 Months	
Time on Project:	2 Weeks	

BRIEF DESCRIPTION OF ACCIDENT

Employees were laying sewer pipe in a trench 15 feet deep. The sides of the trench, 4 feet wide at the bottom and 15 feet wide at the top, were not shored or protected to prevent a cave-in. Soil in the lower portion of the trench was mostly sand and gravel and the upper portion was clay and loam*. The trench was not protected from vibration caused by heavy vehicle traffic on the road nearby. To leave the trench, employees had to exit by climbing over the backfill. As they attempted to leave the trench, there was a small cave-in covering one employee to his ankles. When the other employee went to his co-worker's aid another cave-in occurred covering him to his waist. The first employee died of a rupture of the right ventricle of his heart at the scene of the cave-in. The other employee suffered a hip injury.

ACCIDENT PREVENTION RECOMMENDATIONS

*Clay and loam are terms not used any longer; Soil condition is now described using A, B, or C



What is the OSHA standard for control of hazardous energy sources?

The OSHA standard for *The Control of Hazardous Energy (Lockout/Tagout)*, Title 29 Code of Federal Regulations (CFR) Part 1910.147, addresses the practices and procedures necessary to disable machinery or equipment, thereby preventing the release of hazardous energy while employees perform servicing and maintenance activities. The standard outlines measures for controlling hazardous energies—electrical, mechanical, hydraulic, pneumatic, chemical, thermal, and other energy sources.

In addition, 29 CFR 1910.333 sets forth requirements to protect employees working on electric circuits and equipment. This section requires workers to use safe work practices, including lockout and tagging procedures. These provisions apply when employees are exposed to electrical hazards while working on, near, or with conductors or systems that use electric energy.

Why is controlling hazardous energy sources important?

Employees servicing or maintaining machines or equipment may be exposed to serious physical harm or death if hazardous energy is not properly controlled. Craft workers, machine operators, and laborers are among the 3 million workers who service equipment and face the greatest risk. Compliance with the lockout/tagout standard prevents an estimated 120 fatalities and 50,000 injuries each year. Workers injured on the job from exposure to hazardous energy lose an average of 24 workdays for recuperation.

How can you protect workers?

The lockout/tagout standard establishes the employer's responsibility to protect employees from hazardous energy sources on machines and equipment during service and maintenance.

The standard gives each employer the flexibility to develop an energy control program suited to the needs of the particular workplace and the types of machines and equipment being maintained or serviced. This is generally done by affixing the appropriate lockout or tagout devices to energy-isolating devices and by deenergizing machines and equipment. The standard outlines the steps required to do this.

What do employees need to know?

Employees need to be trained to ensure that they know, understand, and follow the applicable provisions of the hazardous energy control procedures. The training must cover at least three areas: aspects of the employer's energy control program; elements of the energy control procedure relevant to the employee's duties or assignment; and the various requirements of the OSHA standards related to lockout/tagout.

What must employers do to protect employees?

The standards establish requirements that employers must follow when employees are exposed to hazardous energy while servicing and maintaining equipment and machinery. Some of the most critical requirements from these standards are outlined below:

- Develop, implement, and enforce an energy control program.
- Use lockout devices for equipment that can be locked out. Tagout devices may be used in lieu of lockout devices only if the tagout program provides employee protection equivalent to that provided through a lockout program.
- Ensure that new or overhauled equipment is capable of being locked out.
- Develop, implement, and enforce an effective tagout program if machines or equipment are not capable of being locked out.

- Develop, document, implement, and enforce energy control procedures. [See the note to 29 CFR 1910.147(c)(4)(i) for an exception to the documentation requirements.]
- Use only lockout/tagout devices authorized for the particular equipment or machinery and ensure that they are durable, standardized, and substantial.
- Ensure that lockout/tagout devices identify the individual users.
- Establish a policy that permits only the employee who applied a lockout/tagout device to remove it. [See 29 CFR 1910.147(e)(3) for exception.]
- Inspect energy control procedures at least annually.
- Provide effective training as mandated for all employees covered by the standard.
- Comply with the additional energy control provisions in OSHA standards when machines or equipment must be tested or repositioned, when outside contractors work at the site, in group lockout situations, and during shift or personnel changes.

How can you get more information?

OSHA has various publications, standards, technical assistance, and compliance tools to help you, and offers extensive assistance through

its many safety and health programs: workplace consultation, voluntary protection programs, grants, strategic partnerships, state plans, training, and education. Guidance such as OSHA's *Safety and Health Management Program Guidelines* identify elements that are critical to the development of a successful safety and health management system. This and other information are available on OSHA's website at www.osha.gov.

- For a free copy of OSHA publications, send a self-addressed mailing label to this address: OSHA Publications Office, P.O. Box 37535, Washington, DC 20013-7535; or send a request to our fax at (202) 693-2498, or call us at (202) 693-1888.
- To file a complaint by phone, report an emergency, or get OSHA advice, assistance, or products, contact your nearest OSHA office under the "U.S. Department of Labor" listing in your phone book, or call us toll-free at **(800) 321-OSHA (6742)**. The teletypewriter (TTY) number is (877) 889-5627.
- To file a complaint online or obtain more information on OSHA federal and state programs, visit OSHA's website.

This is one in a series of informational fact sheets highlighting OSHA programs, policies, or standards. It does not impose any new compliance requirements or carry the force of legal opinion. For compliance requirements of OSHA standards or regulations, refer to *Title 29 of the Code of Federal Regulations*. This information will be made available to sensory-impaired individuals upon request. Voice phone: (202) 693-1999. See also OSHA's website at www.osha.gov.

