TRACTOR SAFETY

TRACTOR HAZARDS

Objectives:
- Comprehend the hazards associated with operating a tractor.
- Develop tactics that prevent injuries while operating a tractor.

Concept: Tractors are used extensively on most farms. These tractors range from small lawn tractors to large, powerful, highly specialized vehicles. All machines can be hazardous when they are operated improperly.

Hazard examples include:
- The tractor motor has many moving parts. The moving parts can cut, pinch, and crush body parts if not used properly.
- Fuel used to power the engine can ignite causing a fire.
- Tractors that are very large can create a long fall if a person slips from the top of the machine.
- The power of a tractor is often transferred to another implement by way of a power take-off (PTO). The spinning shaft of the PTO creates a hazard if anyone gets too close.
- If hydraulics are used, the hoses are under extremely high pressure and can be dangerous if they become undone.

Targeted Age: Upper elementary school students and above

ACTIVITY 1 - MOVING PARTS

Materials:
- Uncooked hot dog (several if all students participate)
- 3 foot x ¼ inch dowel stick (several if all students participate)
- Spinning wheel (bicycle wheel, fan blade, small motor, etc.)

Place the dowel stick into the hot dog lengthwise. Start the fan, motor, or bicycle wheel spinning. Holding the dowel close to the end opposite the hot dog, place the hot dog end into the blade. The stick represents a bone and the hot dog represents flesh. The motor or wheel represents the tractor motor.

Discussion:
Each year, people are hurt when they tempt fate by working around motors that are not shut off or shielded properly. Ask the students to list items on a tractor that can move quickly (motors, fan blades, auger, PTOs).

Question & Answer

Q: Where are fast moving parts found on the tractor?
A: The tractor motor has fan blades and belts that move quickly. Implements that are powered by the tractor often have fast moving objects. Augers, PTOs, and fans all fall into this category.

Q: What things can you do to prevent injuries from moving parts on a tractor?
A: Install shields over moving parts to prevent a person from getting caught. If a shield becomes defective due to age, it should be replaced.

Q: Which body parts are most likely to be hurt by moving parts on the tractor?
A: Fingers, feet, and hair are body parts most often caught in moving mechanisms.

Q: What can youth do to prevent injuries from powerful, moving parts?
A: If you see a missing shield, tell an adult so they can repair it.
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ACTIVITY 2 - HEAT AND FIRE

Question & Answer

Q: What could cause a fire to start around the tractor?
A: Flammable liquid fuel is present because it’s used to power the motor. Harvesting dried plant crops, such as corn, beans, and hay can also produce a combustible fuel source.

Q: Which fire extinguisher would be the best to carry in the tractor?
A: There is no way to know how a fire might start on a tractor, so multi-class rated fire extinguishers are preferable.

Q: What is the best procedure to make sure a fire is put out?
A: PASS will help you remember the proper way to use a fire extinguisher:

- Pull the pin at the top of the extinguisher to release the safety lock.
- Aim the nozzle toward the base of the fire.
- Squeeze the handle to discharge the extinguisher (approximately 8 feet from the fire). If you release the handle, the emission will stop.
- Sweep the nozzle back and forth at the base of the fire. After the fire appears to be out, watch it carefully since it may reignite.

Q: What should you do if you notice that a fire has started around a tractor?
A: Tell an adult about the fire. Remind parents and adults to make sure fire extinguishers are working properly and they know how to use them.

Match up the shapes with the classes of fire extinguishers. Using a multi-class fire extinguisher, practice extinguishing a fire using the Pull, Aim, Squeeze, and Sweep system. Have each student practice putting out an imaginary fire to perfect the PASS system.

NOTE: If a professionally trained fireman is present, build a small fire in a self-contained trough and have the students use the fire extinguisher on a real fire.

Discussion: There are four types or classes of fire extinguishers, each of which puts out a specific type of fire. Newer fire extinguishers use a picture labeling system to show which type of fire the extinguisher will put out.

Materials:
- Various Fire Extinguishers
  - Class A – Ordinary Combustibles (label showing a triangle)
  - Class B – Flammable Liquids (label showing a square)
  - Class C – Electrical Equipment (label showing a circle)
  - Class D – Combustible metals (label showing a star)
- Multi-Class Fire extinguisher (pictorial representation of fire types)
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ACTIVITY 3 - FALLING

Materials:
- Ripe Cantaloupe (or other melon)
- Ladder
- Plastic tarp

Draw a face on the melon to represent a person's head. Using the ladder, climb to the top of a tractor cab, approximately 10 feet. Drop the melon onto the plastic tarp on the ground below.

Discussion: Tractors and other farm machinery are tall. If farm equipment is available, estimate how many feet off the ground the driver's seat or the platform are located. Compare this to the number of stories or windows in a building. Talk about an instance where people have accidentally fallen from these heights.

Question & Answer

Q: How tall is a large tractor?
A: Large tractors can be up to 10 feet tall. Combines can be even taller.

Q: What part of your body is the most vulnerable during a fall?
A: The head is the most vulnerable. If your skull is broken or cracked, the brain could be damaged. While other bones and muscles can heal, the brain is not easily repaired.

Q: How can you prevent falls from tractors and farm machinery?
A: Ladders and platforms used to access the driver's seat need to be kept free of slippery substances such as water, ice, grease, and manure. When using the ladder and platform, be sure to use the hand rails. Always face the tractor when mounting and dismounting, using the hand rails. Dismounting facing forward may result in falling face first.
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ACTIVITY 4 - PTOS

Materials:
- Tyvek coveralls (a balloon can be attached to the collar to represent a head)
- Straw or paper for stuffing
- Working tractor and attached PTO
- Hazard tape
- String

Stuff the coveralls with straw or paper to represent a person’s body. An inflated balloon or Nerf ball can be attached to the coveralls to represent the human head. Make sure the PTO is in proper working condition.

Attach the stuffed “dummy” to the PTO shaft with a hidden string. (If you hold the dummy over the rotating PTO shaft it might not catch.) Do not allow youth to stand close to this demonstration. Create barriers using colored hazard tape to keep youth at least 10 feet from the demonstration. Have several adults present to make sure youth stay behind the barrier. Start the tractor and PTO. The dummy will begin spinning around the shaft. Stuffing may fly out of the Tyvek suit.

Discussion: Discuss why PTOs are used and the dangers that exist when the shaft is spinning. Discuss why shields are used to cover the PTO shaft and ways to identify when a shield needs replacing (cracked, bent, or missing areas, and protruding points).

Question & Answer

Q: What type of implements are powered by a running PTO?
A: Manure spreaders, augers, mowers, choppers, balers, and grinders, etc.

Q: How does the PTO transfer power from the tractor to the implement?
A: The tractor spins a metal shaft around very fast. This speeding circular action causes the mechanisms within the implement to rotate.

Q: How fast does a PTO shaft spin while it is working?
A: Depending on the power of the PTO, it could spin at 540 RPM or 1,000 RPMs (revolutions per minute). At 540 RPM the shaft is rotating 9 times per second. Our normal reaction time is 3/4 of a second - that means anything caught would wrap 6 times around the shaft before we realize it. The speed is dependent upon the power of the tractor and the implement that it is running.
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ACTIVITY 5 - HYDRAULIC SAFETY

Materials:
- Garden hose with a nozzle
- Water source with a faucet
- Sunny day

With the nozzle closed, fill the hose with water. Turn the water off at the source. Let the hose set in the sun for several hours. When the hose feels hot, open the nozzle and notice the force of the water. After the initial hot water in the hose is released and the pressure is relieved, the water flow should subside.

Discussion: Tractor hydraulics are used to move or lift heavy items. The built up pressure is the force that causes the action. The term "hydraulic" refers to fluids under pressure. In the demonstration, the water is the fluid but since water becomes steam at 212 degrees Fahrenheit, it can not be used within a hydraulic system because it cannot build up enough pressure.

Question & Answer

Q: What fluid is used in a tractor’s hydraulic system?
A: Oil is used. Oil has a much higher boiling point than water.

Q: How can tractor hydraulics be dangerous to a tractor operator?
A: The oil is under very high pressure, up to 3000 pounds per square inch. A leak in the hose could force oil under your skin and act like a poison. The heat generated by the pressure can also burn the operator.

Q: What precautions should be taken when using hydraulic components?
A: Wear gloves and safety glasses when working with a hydraulic system.