Power Take Off Safety Lesson Plan

Overview:
The Power Take Off (PTO) is a source of a great number of farm work-related injuries and deaths. Entanglements in PTOs can cause severe traumatic injuries, including lacerations, fractures, amputations, spinal cord injuries, or death. These incidents usually occur when clothing is caught in unguarded PTO driveline components. The prevention of PTO entanglements includes keeping driveline guards and tractor master shield in place, wearing snug fitting clothing, and using caution when working around PTO powered equipment.

Objectives:
1. Describe the basic structure and components of a PTO.
2. Describe the types of guards and shields available for PTO drivelines.
3. Describe the type of equipment involved with PTO entanglements.
4. List the necessary steps for preventing PTO-related injuries.

Lesson Content:
1. Function of PTO
    a. A rotating drive shaft that transfers tractor engine power to implements
    b. Replaces separate implement-mounted engines
2. Structure and Components
    a. External splined shaft on tractor-
        i. PTO shaft stub, referred to as PTO
        ii. Rotates clockwise
    b. Implement Input Driveline (IID)
        i. Consists of telescoping shafts, universal joints, and connectors
        ii. Driveshaft which transmits power from tractor to implement
    c. Implement Input Connector (IIC)
        i. Shaft that IID connects to on the implement, similar to PTO stub shaft on tractor
    d. Operating speed of PTOs
        i. 540 rpm shafts, 6 splined, approximately travel 7 feet per second
        ii. 1000 rpm shafts, 21 splined, approximately travel 17 feet per second
3. PTO shielding devices
    a. Inverted trough-first type of shield developed, tunnel shield
        i. Protects top & sides of shaft
        ii. Attached to tractor master shield by operator
        iii. Easily damaged or removed
    b. Integral mounted shield
        i. Tubular shield providing 360 degree protection
        ii. Developed by the Oliver corporation in 1940
        iii. Protects shafts and U-joints and is difficult to remove
        iv. Rotates on shaft, but becomes stationary if contacted or chained in place

    c. Tractor master shield
        i. Protects connection of PTO and IID
        ii. Some clearance required for turning, creating possible exposure
    d. Implement Stub shield
    e. Located at IIC
    f. Often small or not fully protective on older machines
4. PTO entanglements
    a. Definition: Incidents involving the shafts, u-joints between the tractor PTO shaft and implement
5. Equipment involved
    a. Stationary equipment
        i. Grinders, augers, elevators, post hole diggers, etc.
        ii. Most commonly involved in injuries
    b. Semi-stationary equipment
        i. Forage boxes, sprayers, feed wagons
        ii. Usually being used as stationary equipment when the entanglement occurs
    c. Non-stationary equipment
        i. Field equipment such as manure spreaders, balers, disc bines, etc.
        ii. Entanglements usually occur when repairs or adjustments are being made to machine and PTO is left engaged
6. Points of entanglement
    a. Clothing contacts a screw, pin, or other protrusions
        i. Spring-loaded push pin at connection with tractor is a common site of contact
    b. Any rotating surface not perfectly round and smooth may cause entanglement
7. Types of clothing effects entanglements
    a. Light clothing (hot weather)
        i. Cotton lightweight materials (ex.-tee-shirts, light weight pants)
        ii. Likely to tear resulting in less severe injuries or close call incidents
    b. Heavy Clothing (cold weather)
        i. Multi-layer or synthetic material
        ii. Strong, does not tear easily-results in more severe injuries and fatalities
8. Type of PTO injuries listed in order of occurrence:
    a. Abrasions & contusions
    b. Lacerations
    c. Fractures
    d. Amputations
    e. Joint separations and dislocations
    f. Death
9. Prevention of PTO entanglements
    a. Keep all shields in place and functioning properly

b. Prior to operation while the tractor engine is shut off, test the tubular PTO shield to make sure that it spins freely of the PTO shaft and cannot be slid back from the universal joints
c. Never step or lean across a PTO shaft
d. Never mount or dismount a tractor from the rear when PTO is operating
e. Position the drawbar correctly for each machine (refer to owners manual)
f. Wear snug fitting clothing with no dangling strings or shoelaces
g. Long hair should be tied up or kept protected under a hat
h. Shut down PTO and tractor engine when performing repairs
i. Wait until all moving parts have stopped rotating before servicing or adjusting equipment

10. PTO care and maintenance
    a. Keep u-joints and telescoping shafts lubricated
    b. Engage power to machine gradually
    c. Ensure that u-joints are in phase
    d. Disengage PTO for very sharp turns

Quiz Questions

1. How fast does a 540 RPM shaft travel?
   Answer: Approximately 7 feet per second

2. With field equipment, when do PTO entanglements usually occur?
   Answer: Entanglements usually occur when repairs or adjustments are being made to machine and PTO is left engaged

3. What is the PTO?
   Answer: A rotating drive shaft that transfers tractor engine power to implements

4. How should you dress if you are going to work with PTO powered equipment?
   Answer: Wear snug fitting clothing with no dangling strings or shoelaces

5. How can you check PTO shields to make sure they are working properly?
   Answer: Prior to operation while the tractor engine is shut off, test the tubular PTO shield to make sure that it spins freely of the PTO shaft and cannot be slid back from the universal joints

EMPLOYEE PTO DRIVEN EQUIPMENT OPERATION TRAINING RECORD

The following employee(s) have completed training in PTO Equipment Operation. Each trained employee is now knowledgeable in all 5 different training topics covered in the Safe Operation and Servicing of PTO Driven Equipment.

1. Keep all guards in place when the machine is in operation.
2. Permit no riders on farm field equipment other than persons required for instruction or assistance in machine operation.
3. Stop engine, disconnect the power source, and wait for all machine movement to stop before servicing, adjusting, cleaning, or unclogging the equipment.
4. Servicing operating machine must be done following specific safety procedures for that machine.
5. Make sure everyone is clear of machinery before starting the engine, engaging power, or operating the machine.

Employee's Name	Employee's Signature	Date of Training	Trainer	Trainer's Signature