MODULE NUMBER 5
OF
INSTRUCTION GUIDE NUMBER 43

ON-THE-JOB TRAINING MODULES
FOR
SURFACE METAL AND NONMETAL MINES

BACKHOE AND HYDRAULIC EXCAVATOR OPERATION

This module describes the basic job steps, potential hazards or accidents, and recommended safe job procedures for backhoe and hydraulic excavator operation.

Backhoes are used at surface metal and nonmetal mines for various types of applications. Their versatility makes these machines widely used pieces of mobile equipment. Backhoes were designed basically for ditching and cleanup. Their use has been broadened to include removal and loading of ore and overburden material by large backhoes, known as hydraulic excavators.

Backhoe operators must be aware of some of the same general types of hazards as other mobile equipment operators. Many job procedures and related hazards are common to the operation of all mobile equipment.

The most common hazards related to backhoe and excavator operation are: slipping and falling of the machine operator, tipping or overturning of the machine, and contacting energized power lines with the machine.

Slips and falls occur most often when mounting and dismounting, cleaning windows, or refueling. Tipping or overturning can occur if the machine is not properly leveled, if materials are lifted or handled improperly, or when traveling or operating without proper care for roadway conditions, grades, clearance, visibility, traffic, etc. Contacting energized power lines is most often caused by operating the machine too close to electrical lines or installations.

The basic job steps included in this module are:

1. Conduct walk-around check of backhoe or excavator.
2. Mount backhoe or excavator, and check cab and controls.
3. Start backhoe or excavator, and complete pre-shift inspection.
4. General operation of backhoe or excavator.
5. Park backhoe or excavator.
6. Refuel backhoe or excavator.
7. Perform repairs and maintenance on backhoe or excavator.

The operator's manual provided with the machine, and the mine's operating procedures, should also be used in training machine operators.

The following safe job procedures will help minimize incidents which may cause injuries and adversely affect production:

Required and/or recommended personal protective equipment:

Hard hat, safety shoes, safety glasses with side shields, gloves, clothing appropriate for weather conditions, hearing protection where needed

SEQUENCE OF BASIC JOB STEPS	POTENTIAL ACCIDENTS OR HAZARDS	RECOMMENDED SAFE JOB PROCEDURES
1. Conduct walk-around check of backhoe.	1. A) Frostbite, hypothermia, sunburn, heat stroke, heat cramps, heat exhaustion.	1. A) Dress to suit weather conditions.
	B) Struck by falling equipment.	B) Make sure all raised parts of backhoe are lowered to the ground.
	C) Struck by, or run over by, backhoe or other machine. Slipping, tripping, falling.	C) If parked on a grade or incline, make sure wheels are turned into bank and/or blocked to prevent movement. Be alert for nearby machines.
	D) Slips or trips, struck by flying objects such as dirt or splashed fluids, caught in pinch points.	D) Avoid slick spots and keep area free of slipping or tripping hazards during walk-around. Use suitable access if necessary to mount and dismount backhoe to check engine or other area of machine.

SEQUENCE OF BASIC JOB STEPS	POTENTIAL ACCIDENTS OR HAZARDS	RECOMMENDED SAFE JOB PROCEDURES
1. (Continued)	E) Check for problems that could cause the following hazards:	E) Examine:
	1) Loss of control, equipment malfunction.	1) Tires and wheels for lug nuts, cracked rims, cuts, tire pressure. If equipped with tracks, check tracks for tightness and rollers, idlers, and sprockets for damage.
	2) Running over someone.	2) Area around backhoe for people or obstructions.
	3) Caught in moving parts.	3) All bolts, guards, covers, and mechanical components of backhoe to make sure they are in place.
	4) Equipment malfunction or damage, fire hazard.	4) Engine compartment for dirt, debris, oily rags, tools, and leaks. Grasp engine covers firmly when removing. Avoid overreaching. Get help if needed.
	5) Burns, splashed fluids	5) Fluid levels. Wear safety glasses with side shields and gloves. Remove tank caps or covers carefully.
	6) Burns, high pressure fluids.	6) Hydraulic oil, coolant, and air leaks, rubbing lines, cracks or loose fittings.

SEQUENCE OF BASIC JOB STEPS	POTENTIAL ACCIDENTS OR HAZARDS	RECOMMENDED SAFE JOB PROCEDURES
1. (Continued)	7) Fire hazard.	7) Fire extinguisher (if on outside of machine) to make sure it's secured in place and fully charged.
	8) Equipment failure.	8) Machine for any physical damage, hydraulic cylinders and hoses for leaks and/or damage, boom or lift arms for cracks or damage.
	9) Slips and falls.	9) Ladders, steps, and handholds for broken rungs, loose bolts, breaks, cracks, or missing parts.
	F) Potential hazards not corrected.	F) Report and, if possible, repair any defects found. Do not use machine with uncorrected safety defects.
2. Mount backhoe and check cab and controls.	2. A) Slips and falls.	2. A) Wear snug fitting clothing and keep steps, mounting ladders, and shoes free from mud, dirt, snow, ice, grease, and oil. On track mounted backhoe, make sure cab is positioned correctly for mounting and walkways around engine and hydraulic enclosures are free from debris and slipping or stumbling hazards. Make sure grab rails or handholds are provided and in good condition.

SEQUENCE OF BASIC JOB STEPS	POTENTIAL ACCIDENTS OR HAZARDS	RECOMMENDED SAFE JOB PROCEDURES
2. (Continued)	B) Falling while climbing up or down, clothing caught on control levers or other projections.	B) Keep both hands free for climbing. Use handholds and select firm footing. Avoid haste and projections.
	C) Struck by flying objects, jammed controls, ROPS or FOPS failure in an accident, poor visibility.	C) Inspect cab for housekeeping (extraneous materials) and FOPS or ROPS damage. Make sure windows and mirrors are clean and in good repair.
	D) Personal injury, missing or inoperative fire extinguisher.	D) Check fire extinguisher if located at cab. Make sure starting fluid is not stored inside cab.
	E) Thrown out of cab or against cab interior.	E) Check seat belts to be sure they are in good condition. Always wear them when operating equipment.
	F) Equipment failure or rolling out of control.	F) Check all instruments, gauges, and controls before starting engine to ensure they are not stuck or malfunctioning. All controls should be in neutral position and the parking brake set.

SEQUENCE OF BASIC JOB STEPS	POTENTIAL ACCIDENTS OR HAZARDS	RECOMMENDED SAFE JOB PROCEDURES
3. Start backhoe and complete pre-shift inspection.	3. A) Operating with safety or mechanical defects, struck by moving parts, or backing over person.	3. A) Check equipment for warning or out of service tags. Sound horn before starting or moving machine. Check backup alarm after starting. Be sure all persons and objects are clear before starting or moving.
	B) Engine or auxiliary equipment malfunction.	B) After starting engine, idle until normal operating temperature is reached and check gauges and warning lights again for normal readings. Check engine for smooth idle and unusual smoke or noise.
	C) Poor visibility.	C) Check lights and wipers.
	D) Loss of control.	D) Check brakes (including swing brake) and steering. Don't operate machine with uncorrected safety defects.
4. General operation.	4. A) Personal injury.	4. A) Allow no one to ride outside the cab for any reason. No one should ride with the operator unless safe seating is provided.
	B) Personal injury, falling hazard.	B) Never use basket or other attachment as a staging platform for workers.

SEQUENCE OF BASIC JOB STEPS	POTENTIAL ACCIDENTS OR HAZARDS	RECOMMENDED SAFE JOB PROCEDURES
4. (Continued)	C) Overturning and/or collision.	C) Keep machine under control at all times. Use prudent operating speeds consistent with conditions.
	D) Loss of control.	D) Never attempt to operate backhoe from outside operator's compartment.
	E) Bystanders may not consider the swing radius at the rear of larger machines.	E) Be sure all persons and obstacles are clear before swinging or moving machine in any direction. Always have adequate clearance before swinging machine.
	F) Tipping and/or overturning.	F) Avoid fast swings, hoists, or sudden braking. Be sure of the working range and lifting capacity of the machine at all times. Move loads carefully. Be alert for trenches, open cuts, sump holes, coal rib, clearances, grades, etc. Keep machine as level as possible when operating.
	G) Fall of material, overturning machine.	G) Observe highwall, pit, and/or travel conditions. Stay away from edge of banks, pits, and highwalls. Stay clear of overhangs and slide areas. Never undercut the machine.
	H) Collision.	H) Know traffic patterns of the job location and obey flaggers, road signals, and signs.

SEQUENCE OF BASIC JOB STEPS	POTENTIAL ACCIDENTS OR HAZARDS	RECOMMENDED SAFE JOB PROCEDURES
4. (Continued)	I) Electrocution.	I) Always check for overhead power lines and be sure you have adequate clearance if working near overhead lines. Keep boom at least 10 feet from any energized power line. High voltages may dictate distances up to 35 feet.
	J) Property damage, fire or explosion, electrocution.	J) Learn beforehand as much about your work area as possible. Be sure of the location of gas lines, sewers, utility lines, buried cables or lines.
	K) Dropping material on hauler operator or bystanders, damaging hauler, excessive spillage.	K) Don't load a hauler until the driver is in a safe place. Load the hauler from the rear or side. Load hauler evenly to avoid overloading rear axles and causing spillage. Don't drop material into truck bed from unnecessary heights. Never swing bucket over hauler cab or workers.
	L) Backing over person.	L) Never back up until you have checked to see that area is clear of personnel and/or obstructions.

SEQUENCE OF BASIC JOB STEPS	POTENTIAL ACCIDENTS OR HAZARDS	RECOMMENDED SAFE JOB PROCEDURES
4. (Continued)	M) Tipping, over-turning, collision.	M) Use caution when working on, or crossing, sidehills, ridges, ditches, slopes, etc. Cross at an angle and at reduced speed. Except for short distances, position boom in direction of travel. Always face the direction of travel.
	N) Cable damage, shock or burns.	N) Don't cross power and/or trailing cables unless suitable crossovers or cross-unders are provided, or the cable is properly trenched.
	O) Loss of control.	O) Always set swing brake and/or lock boom when traveling to or from a job site.
	P) Loss of control, machine damage.	P) Always keep your machine under control and in safe operating condition at all times.
5. Parking.	5. A) Collision, personal injury, traffic obstruction.	5. A) Always park in designated parking area if provided or select a safe parking area. Don't park on haul roads or active work areas. If you must park in an emergency, pick the safest place and use warning signals, flares, or barriers.
	B) Struck by equipment.	B) If necessary to park on an incline, block against motion and/or turn toward embankment.

SEQUENCE OF BASIC JOB STEPS	POTENTIAL ACCIDENTS OR HAZARDS	RECOMMENDED SAFE JOB PROCEDURES
5. (Continued)	C) Struck by machine, material, or attachment.	C) Never leave the operator's cab with the engine running or with a load or bucket suspended.
	D) Run over or struck by machine.	D) Place all controls in parking position. Set swing lock or brake and parking or traction brake or lock to prevent machine movement.
	E) Engine damage.	E) Idle engine a short period before shut down.
	F) Trips, slips and falls, clothing caught on controls or projections.	F) Dismount machine. Pay attention to travelways.
	G) Hazards due to lack of communication.	G) Always inform appropriate personnel of any abnormal conditions, defects, changes made in machine and/or job procedure or condition.
6. Refueling.	6. A) Collision, runaway equipment, traffic obstruction.	6. A) If refueling, park at fuel station and follow parking procedure (See Job Procedures 5. A-G).
	B) Slips, trips and falls, clothing caught.	B) If necessary to mount backhoe to refuel, use ladder, steps, rails, or handholds (See Job Procedures 2. A-B).
	C) Fuel on skin or in eyes.	C) Wear safety glasses. Remove fuel cap slowly.

SEQUENCE OF BASIC JOB STEPS	POTENTIAL ACCIDENTS OR HAZARDS	RECOMMENDED SAFE JOB PROCEDURES
6. (Continued)	D) Fire or explosion hazard.	D) Avoid fuel spillage at refueling station and on hot engine parts. Do not smoke at or near the refueling station.
	E) Slips, trips, falls.	E) Keep refueling area free from extraneous material.
	F) Fuel spillage or discharge, fire hazard.	F) Always replace fuel cap on backhoe and return fuel hose and nozzle to the rack.
7. Performing repairs and maintenance (if applicable).	7. A) Personal injury from improper procedure.	7. A) Do not attempt repairs or maintenance you are not trained to do.
	B) Caught or struck by moving or falling parts, or moving machine.	B) Do not attempt any repairs or maintenance until the power is off, the machinery is blocked against motion, and all raised equipment lowered. If necessary to perform work on a raised piece of equipment, securely block in place. Remove ignition key to prevent backhoe from being started while work is performed.
	C) Caught in or struck by moving parts.	C) Replace all guards and other safety devices before starting or using backhoe.

GENERAL INFORMATION

This module is part of an Instruction Guide that was developed to assist the surface metal and nonmetal mining industry in conducting effective on-the-job training (OJT) of new employees, or employees reassigned to different jobs. The use of training materials, such as this module, is an important part of an effective, systematic, OJT program.

This Instruction Guide uses a generic Job Safety Analysis (JSA) of jobs common to the industry. The JSA format facilitates uniform basic training in safe job procedures, while requiring only a minimum of time and effort on the part of the trainer. This material is generic to the industry; therefore, each company using this guide will need to tailor the material somewhat to fit their particular requirements. In some cases, the material must be general in nature, and will not include specific details of procedures or equipment that must be taught by the trainer.

Recommendations for an overall OJT program are contained in the Mine Safety and Health Administration (MSHA) guide: "Structuring Effective On-The-Job Training Programs," June, 1983.

TRAINING RECOMMENDATIONS

On-the-job training is usually best done by the employee's immediate supervisor. If the supervisor relies on another employee to do certain parts of the training, the supervisor should be present to monitor the training. OJT is conducted at the actual job site where the work will be done.

The supervisor/trainer should use the training materials (this module, or other materials) while the training is being done, to help ensure that all job steps are covered, and that no important safety precautions are omitted. Effective OJT should begin with an explanation (lecture and/or discussion) of the safe job procedure. The explanation should be followed by a hands-on demonstration of the proper job procedure. A good demonstration is, perhaps, the most important part of OJT. The demonstration is followed by supervised practice, during which the supervisor/trainer coaches (corrects and encourages) the employee, and evaluates when the employee is ready to do the job without direct supervision.

The first step – explaining the job to the employee – can be done in different ways. The supervisor/trainer and the employee can sit down and go through the training materials together. It may be advantageous to provide the employee with a copy of the training modules that are applicable to his/her job. The fact that most of the training is conducted at the job site does not preclude the use of a classroom or a quiet office for the first part of the training. Any general theory or knowledge training, as well as the initial explanation of the job procedure, may be best done in an office/classroom setting; especially when noise levels, or other conditions at the job site, make communication difficult. A complete series of job steps could be presented through the use of slides developed at the mining operation.