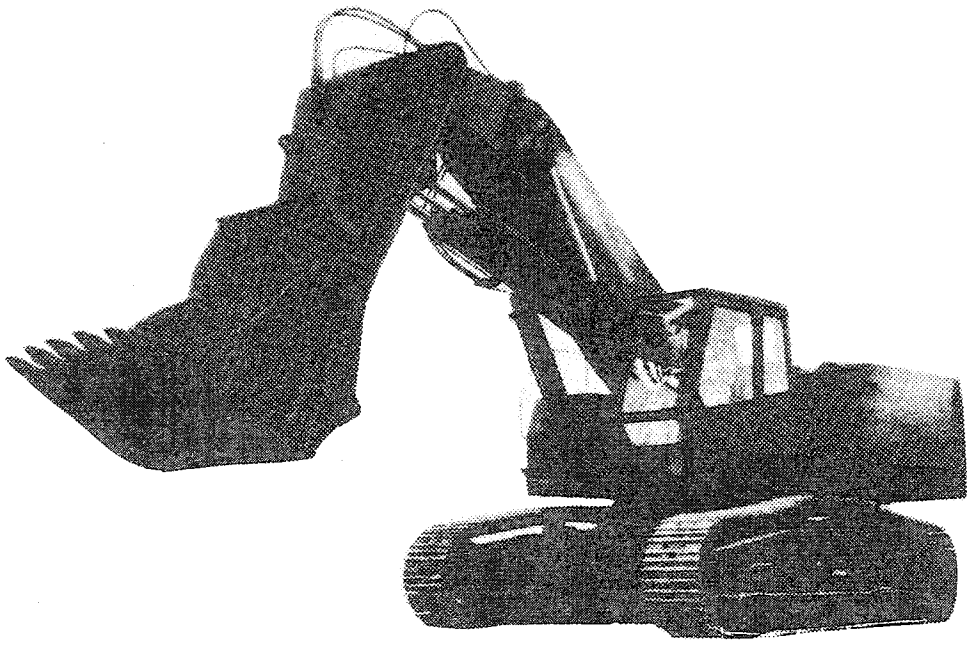
MODULE NUMBER 7
OF
INSTRUCTION GUIDE NUMBER 43

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

HYDRAULIC SHOVEL OPERATION



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

Hydraulic shovels are used at surface metal and nonmetal mines for overburden and ore loading. They are becoming increasingly popular because of their mobility, ability to mine selectively, and independence of electric power. Hydraulic shovels can also work on steeper slopes than electric shovels. They can be fitted with a backhoe attachment, which permits them to dig below ground level.

Potential accidents relating to hydraulic shovel operation include slips and falls, caught in or struck by moving mechanisms, tipping or overturning the machine, contacting energized power lines, and injuries to persons who are standing or walking near the machine while it is in operation.

Slips and falls are most likely when mounting and dismounting, and when performing maintenance, repair, cleaning, or refueling. Miners may be struck by moving mechanisms during greasing or oiling, or when performing maintenance or repair. Tipping or overturning may be caused by lifting or handling materials improperly, or by traveling or operating with disregard to roadway conditions, grades, clearance, visibility, etc. Contact with power lines can occur if the machine is operated too close to energized electrical lines or installations. Persons standing or walking near the machine are especially vulnerable when they are in the area of the shovel, and the shovel operator is unaware of their location.

The basic job steps included in this module are:

1. Conduct walk-around inspection of shovel and work area.
2. Mount and dismount.
3. Conduct on-board inspection and start shovel.
4. General operation.
5. Park.
6. Refuel.
7. Perform repairs and maintenance.

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 inspection of shovel and work area.	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 shovel are lowered to the ground.
	C) Personal injury, unsafe equipment or work area.	C) Visually inspect machine and work location for defective equipment and/or unsafe conditions prior to operation. Report any unsafe conditions to your supervisor and correct all defects.
	D) Rock fall. Striking personnel, or damaging machinery with shovel.	D) Inspect highwall, bank and pit conditions in your work area. Check area around shovel for people or obstructions. Know traffic patterns, and communicate with fellow workers before operating shovel. Warning signs are recommended to prohibit unauthorized persons from coming near the shovel.

SEQUENCE OF BASIC JOB STEPS	POTENTIAL ACCIDENTS OR HAZARDS	RECOMMENDED SAFE JOB PROCEDURES
1. (Continued)	E) Slips and falls.	E) Be especially careful of ruts, uneven ground, and frozen ground. Avoid slick spots and keep area free of slipping or tripping hazards. Use suitable access if necessary to mount and dismount shovel to check engine or other area of machine. Make sure all steps, ladders, handrails, handholds, and walk-ways are in good condition and free of oil, grease, mud, snow, and ice.
	F) Falling material, improper operation, loss of control, machine damage.	F) Inspect bucket teeth and adapters for tightness. Check tracks for tightness and rollers, idlers, and sprockets for damage. Check for oil leaks, gear wear, seized bearings, and lubrication of gears and rollers.
	G) Caught in moving parts.	G) Check all bolts, guards, covers, and mechanical components of shovel to make sure they are in place.
	H) Equipment malfunction or damage, fire hazard.	H) Check engine compartment for dirt, debris, oily rags, tools, and leaks. Grasp engine covers firmly when removing. Avoid overreaching. Get help if needed.
	I) Splashed fluids, burns.	I) Check fluid levels. Wear safety glasses with side shields and gloves. Remove tank caps or covers carefully. It is important to know if gear cases are hot or cold.

SEQUENCE OF BASIC JOB STEPS	POTENTIAL ACCIDENTS OR HAZARDS	RECOMMENDED SAFE JOB PROCEDURES
1. (Continued)	J) Burns, high pressure fluids.	J) Check for hydraulic oil or coolant leaks, rubbing lines, cracks or loose fittings. Pay particular attention to hydraulic hoses which flex in normal operation of shovel functions.
	K) Equipment failure.	K) Check machine for any physical damage, especially boom or lift arms for cracks or damage.
2. Mounting and dismounting.	2. A) Rock fall, caught between shovel and other machines.	2. A) Never walk or stand between the shovel and the bank, highwall, or other nearby machines while mounting.
	B) Clothing caught on control levers or other projections.	B) Wear snug fitting clothing.
	C) Slips and falls.	C) 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. Keep both hands free for climbing. Keep boots, steps, ladders, etc., free from oil, grease, mud, etc. NOTE: Slip resistant flooring is recommended for walkways.

SEQUENCE OF BASIC JOB STEPS	POTENTIAL ACCIDENTS OR HAZARDS	RECOMMENDED SAFE JOB PROCEDURES
3. Conduct on-board inspection and start shovel.	3. A) Controls jammed by debris, poor visibility.	3. A) Make sure cab is free from debris, etc., and windows are clean.
	B) Equipment movement and/or failure, stuck or inoperative controls.	B) Check all instruments, gauges, and controls before starting engine to ensure they aren't stuck or malfunctioning. All controls should be in neutral position, bucket lowered to the ground, and the parking brake set.
	C) Caught in, or struck by, moving parts.	C) Make sure all guards and safety devices are in place and in good condition.
	D) Slips, trips, falls.	D) Check for uncovered openings, and slipping, or tripping hazards. Practice good housekeeping.
	E) Fire hazard.	E) Know location and operation of fire extinguishers, and make sure they are fully charged and operable. Clean up spills of flammable or combustible materials or liquids. Practice good housekeeping.
	F) Operating with safety or mechanical defects, struck by moving parts, or backing over person.	F) Check equipment for warning or out-of-service tags. Sound horn before starting or moving machine. Be sure all persons and objects are clear before starting or moving.

SEQUENCE OF BASIC JOB STEPS	POTENTIAL ACCIDENTS OR HAZARDS	RECOMMENDED SAFE JOB PROCEDURES
3. (Continued)	G) Engine or auxiliary equipment malfunction.	G) 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.
	H) Poor visibility.	H) Check lights and wipers.
	I) Loss of control.	I) Check brakes (including swing brake) and steering.
	J) Potential hazards remaining uncorrected.	J) Report and, if possible, repair any defects or hazards found during walk-around or on-board inspections. Do not use machine with safety defects. If the shovel is unsafe and removed from service, tag it to prohibit further use until repairs are completed.
4. General operation.	4. A) Personal injury.	4. A) Do not allow anyone 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 bucket or other attachment as a staging platform for workers.
	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 shovel from outside operator's compartment.

SEQUENCE OF BASIC JOB STEPS	POTENTIAL ACCIDENTS OR HAZARDS	RECOMMENDED SAFE JOB PROCEDURES
4. (Continued)	E) Striking or catching other personnel.	E) By visual observation or verbal communication, make certain all persons and machines are clear before starting. Sound an audible horn prior to starting shovel in motion, after repairs or after being idle.
	F) Machine or control malfunction.	F) Make sure pressures are in proper operating range. Check out motions of machine and all controls, limits, and warning devices. Check all brake systems. Stop machine if you feel or see any unusual response or hear any abnormal sounds.
	G) Personal injury, inefficient operation.	G) Clearly understand any work assignment before starting. Make certain helpers and others know and understand all signals.
	H) Personal injury, machine damage.	H) When operating and/or moving shovel, be alert for pit elevations, highwalls, banks, trenches, faults, clearances, traffic, machine crew, other workers, sump holes, and power cables. Keep shovel on good, sound footing.

SEQUENCE OF BASIC JOB STEPS	POTENTIAL ACCIDENTS OR HAZARDS	RECOMMENDED SAFE JOB PROCEDURES
4. (Continued)	I) Injury or equipment damage from fall of material, excessive spillage, increased maintenance costs and tire wear because of overloading.	I) Never swing bucket over workers, vehicles or machines. When loading haulers don't swing over cab. Be sure of clearance over hauler bed and position bucket before tripping. Load hauler evenly to avoid overloading rear axles and causing spillage. Don't drop material into truck bed from unnecessary heights.
	J) Equipment damage, overturning.	J) Avoid fast swings, hoists, or sudden braking, except in an emergency. Avoid jerking and abrupt motions. Be sure of the working range and lifting capacity of the machine at all times. Move loads carefully.
	K) Fall of material and/or bucket.	K) Do not leave a loaded or empty bucket in the air for long time periods. Lower to ground when not in use.
	L) Ground failure, rock fall.	L) Observe condition of highwall and banks at all times. When freezing, thawing, rain, etc., have created a potential highwall or bank failure condition, immediately notify crew, others working in the area, and your supervisor. Use machine's audible alarm signal to warn personnel of this immediate danger if necessary.

SEQUENCE OF BASIC JOB STEPS	POTENTIAL ACCIDENTS OR HAZARDS	RECOMMENDED SAFE JOB PROCEDURES
4. (Continued)	M) Ground failure, rock fall. NOTE: IG 43, Module 15, contains more information on ground control.	M) Loose hazardous material must be stripped for a safe distance (10 feet or more) from the top of pit or quarry walls, and loose unconsolidated material must be sloped to the angle of repose. Leave highwall as safe as possible before moving up.
	N) Cab struck by rolling material, machine damage.	N) When dumping to a higher level, be alert for rocks or material rolling down the bank, especially when cab is beside the bank.
	O) Fall of material.	O) Do not work between machines and the highwall or bank, where your escape from falls or slides may be hindered. Stay away from edge of banks, pits, and highwalls. Stay clear of overhangs and slide areas.
	P) Electrocution, burns, machine damage.	P) Never work or swing boom within a minimum distance of 10 feet from any energized overhead power line.
	Q) Backing over person, tipping or overturning.	Q) Do not back up until you have checked to see that area is clear of personnel and/or obstructions.
	R) Tipping, overturning, collision.	R) 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.

SEQUENCE OF BASIC JOB STEPS	POTENTIAL ACCIDENTS OR HAZARDS	RECOMMENDED SAFE JOB PROCEDURES
4. (Continued)	S) Cable damage, shock or burns.	S) Don't cross power and/or trailing cables unless suitable cross-overs or cross-unders are provided or the cable is properly trenched.
	T) Loss of control.	T) Always set swing brake and/or lock boom when traveling to, or from, a job site.
	U) Loss of control, machine damage.	U) Always keep your machine under control and in safe operating condition at all times. Report and correct any unsafe conditions and/or job procedures.
5. Park.	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 machine, material, or attachment.	B) Never leave the operator's cab with the engine running or with a load or bucket suspended.
	C) Run over or struck by machine.	C) Place all controls in parking position. Set swing lock or brake, and set parking or traction brake or lock, to prevent machine movement.
	D) Engine damage.	D) Idle engine a short period before shutdown.

SEQUENCE OF BASIC JOB STEPS	POTENTIAL ACCIDENTS OR HAZARDS	RECOMMENDED SAFE JOB PROCEDURES
5. (Continued)	E) Trips, slips and falls, clothing caught on controls or projections.	E) Dismount machine (see Job Procedures 2.A-C).
	F) Hazards due to lack of communication.	F) Always inform appropriate personnel of any abnormal conditions, defects, changes made in machine and/or job procedure or condition.
6. Refuel.	6. A) Collision, equipment movement, traffic obstruction.	6. A) If refueling, park at fuel station and follow parking procedure.
	B) Slips, trips and falls, clothing caught.	B) If necessary to mount shovel to refuel, use ladder, steps, rails, or handholds (see Job Procedures 2. A-C).
	C) Fuel on skin or in eyes.	C) Wear safety glasses. Remove fuel cap slowly.
	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 shovel and return fuel hose and nozzle to the rack.

SEQUENCE OF BASIC JOB STEPS	POTENTIAL ACCIDENTS OR HAZARDS	RECOMMENDED SAFE JOB PROCEDURES
7. Performing repairs and maintenance (if applicable).	7. A) Personal injury from improper procedure.	7. A) Do not attempt repairs or maintenance you do not understand, and have not been trained to perform.
	B) Caught or struck by moving or falling parts, or moving machine.	B) Do not attempt any repairs or maintenance until the engine is off, the machinery is blocked against motion, all raised equipment lowered, and hydraulic pressure is relieved. If necessary to perform work on top of, under, around, or from a raised piece of equipment, block or mechanically secure the equipment to prevent accidental rolling, falling, or lowering.
	C) Personal injury.	C) Plan any work to be done and maintain good communications. Know and observe safe work practices. Inspect tools, and maintain in good condition.
	D) Caught in, or struck by, moving parts.	D) Replace all guards and other safety devices before starting or using shovel.

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.