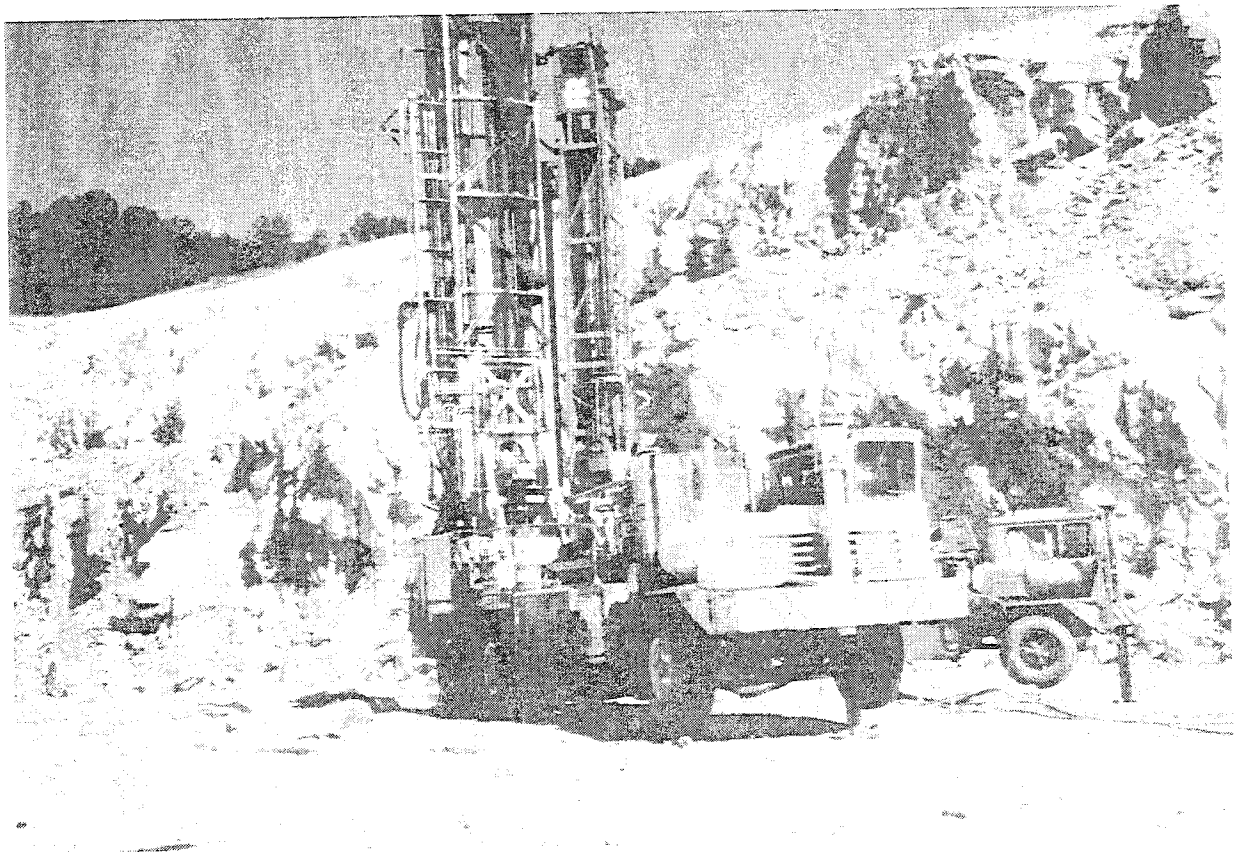
MODULE NUMBER 10
OF
INSTRUCTION GUIDE NUMBER 43

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

DRILL OPERATION



This module describes the basic job steps, potential hazards or accidents, and recommended safe job procedures for drill operation. It is designed for use in the training of drill operators and helpers. Where the drill crew is also involved in explosives transport or blasting operations, Module 11, "Transportation, Use, And Storage Of Explosives," should be used in conjunction with this module.

When the overburden is hard, competent rock that cannot be loaded directly by excavators, drilling and blasting of the overburden is necessary. Highwall drills are used to drill a pattern of holes for blasting, in order to fragment the overburden.

Many highwall drills are rotary type, where a bit is rotated, and rock is removed by abrasion, scraping, and chipping. Rotary drills can be mounted on trucks or trailers, or on crawlers, in the case of larger models. Smaller, crawler mounted, air-track drills, which tow their own air compressor, are also used.

A rotary drill consists of the power unit (usually a diesel engine, and a generator or hydraulic pumps); the air compressor; the controls, located on a truck, trailer, or in a housing on crawlers; and the mast for carrying the rotary motor, drill stem, and drill pipe. Rotary drill bits have diameters up to 26 inches. The most common sizes used are between 6 and 9 inches. Air-track drills generally drill a 4 or 4 ½ inch hole. Blasthole depths generally do not exceed 100 feet. The cuttings from rock drilling generally make good stemming material. Compressed air is used to flush these cuttings from the hole.

Drilling is frequently the most expensive operation in a surface mine. The cost justifies careful study and experiment to determine the most efficient hole diameter, spacing and depth, bit type, rotation speed, and pull down pressure. Flexibility must be maintained in a drilling operation to adjust for changing strata and mining conditions. Penetration rates are an indication of rock hardness, which affects blasthole loading requirements. Good drilling records should be kept, and good communication should be maintained between drillers and blasters.

Drilling and blasting operations determine highwall stability, and the loading characteristics of the broken material. Remember that each blast requires site analysis and planning. The proper drilling layout is gauged by the extent to which the layout helps reduce operating costs, and produces stable, safe highwalls. Drilling and blasting operations should break rock into sizes that can be readily loaded and handled by the equipment that is available. There is often a tendency to space blastholes too far apart. Each job is subject to many variables, which make it impractical to state a rule about the proper spacing of blastholes.

Safety problems involved in the drilling operation itself may include ground failure, highwall hazards, electrical hazards, moving machinery, broken pull-down chains or cables, whipping air or hydraulic hoses, and exposure to excessive noise levels, or to respirable

dust. These hazards are eliminated or controlled by inspection of the drilling equipment and the work area, proper maintenance of the drilling equipment, use of personal protective equipment, and by following safe job procedures. The drill operator and crew are responsible for the safe operation of the machine at all times, and under all conditions.

Dust is a major concern for drill operators. The benefits of dust suppression when drilling blastholes are:

- Clean air for drill operators.
- Longer maintenance intervals on engine air cleaner.
- Longer maintenance intervals on compressor air cleaner.
- Less accumulated dust on drilling machine.

Manufacturers are the bast source for information on how to reduce dust on their drilling machines. Manufacturers can also provide data and expert advice on other concerns which may arise about their products.

The basic job steps included in this module are:

1. Conduct walk-around inspection of drill.
2. Mounting and dismounting.
3. Check cab and controls.
4. Start drill and complete pre-shift inspection.
5. Traveling.
6. Drilling.
7. Parking and refueling.
8. Complete drilling records/reports.
9. Nighttime operations
10. Emergency procedures.
11. Performing repairs and maintenance.

Note: All procedures included will not apply to all drills. Delete procedures related to truck-mounted drills if drill is track-mounted, or procedures related to electric power cable if drill is diesel powered, etc.

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, snug fitting 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 drill.	1. A) Accidents, injuries or inefficiency because of inattention, misunderstanding, or slow reaction time.	1. A) Try to be mentally and physically prepared to do your job each day. Be sure you clearly understand your work assignment prior to starting shift. (Drill rigs must be operated only by authorized persons.)
	B) Frostbite, hypothermia, sunburn, heat stroke, heat cramps, heat exhaustion, clothing catching fire.	B) Dress to suit weather conditions. Do not allow excessive oil or grease to accumulate on coveralls, etc.
	C) Electrocution, power failure.	C) Visually check position and condition of trailing cable when walking to drill rig.
	D) Electrocution, shock, burns.	D) If trailing cable must be handled manually, check rubber gloves and cable pull hook.
	E) Struck by moving drill or other machines.	E) Be sure brakes are set, and are properly adjusted. If rubber-tired drill is parked on a grade, check to be sure wheels are blocked and/or turned into a bank. Be alert for nearby machines.

SEQUENCE OF BASIC JOB STEPS	POTENTIAL ACCIDENTS OR HAZARDS	RECOMMENDED SAFE JOB PROCEDURES
1. (Continued)	F) Falling or sliding over highwall (you and/or your machine), struck by falling rock.	F) Check work area, highwall, and/or bench for unsafe conditions. Look for possible cracking and soft ground which may slide. Keep drill rig on solid ground. Remain safe distance from edge of highwall.
	G) Slips or trips, struck by flying objects such as dirt or splashed fluids, caught in pinch points, high pressure fuel lines and hydraulic hoses, faulty equipment.	G) Conduct walk-around inspection of drill. Avoid slick spots and keep area free of slipping or tripping hazards during walk-around. Use suitable access if necessary to mount and dismount drill to check engine or other area of machine. Check the following: 1) tires and wheels for lug nuts, cracked rims, cuts, tire pressure. 2) area around and under drill for people or obstructions. 3) suspension and steering linkage. 4) all bolts, guards, covers, and mechanical components of drill to make sure they are in place and undamaged. 5) engine compartment for dirt, debris, oily rags, tools. Grasp engine covers or hood firmly when removing. Avoid over-reaching. Get help if needed. Visually check batteries for damage. 6) fluid levels and fuel supply. Wear safety glasses with side shields and gloves. Remove tank caps or covers carefully.

SEQUENCE OF BASIC JOB STEPS	POTENTIAL ACCIDENTS OR HAZARDS	RECOMMENDED SAFE JOB PROCEDURES
1. (Continued)	G) (Continued)	7) hydraulic oil and coolant lines and hoses for breaks, leaks, rubbing lines or loose fittings. 8) drill rig's air system (hoses, clamps, chains, safety relief valves, receiver tanks, gauges, instruments, couplings, etc.) for safe working order. 9) safety chains or suitable locking devices at all connections of high pressure hose lines of one inch or larger inside diameter where a connection failure would create a hazard. 10) fire extinguisher (if on outside of machine) to make sure it's in place and fully charged. Know how to operate the fire extinguishers provided. 11) combustible material, grease, lubricants, paints, or flammable liquids accumulated on drill. Be sure flammable liquids are stored in their proper safety containers. Avoid storing flammable or combustible material next to electrical equipment and installations. 12) ladders, steps, handrails, and platforms for broken rungs, loose bolts, breaks, floor openings, or missing parts.
	H) Sludge deposits or ice which might prevent valve operation, tank rupture from excessive pressure.	H) Drain air tanks to release any condensation that might have accumulated and trip the pressure relief to be sure it's operable.

SEQUENCE OF BASIC JOB STEPS	POTENTIAL ACCIDENTS OR HAZARDS	RECOMMENDED SAFE JOB PROCEDURES
1. (Continued)	I) Falls, struck by broken machinery or falling material, equipment malfunction.	I) Regularly inspect drilling equipment such as mast, cables, rigging, hardware, carriage, sheaves, braces, and crawlers for worn or defective parts. Use safe access, and safety belt where necessary.
	J) Explosion, tank rupture.	J) If compressed gas cylinders are present, check that they are secured in an upright position. Keep covers over valves when not in use. Keep cylinders, hoses, torches, and regulators free of grease and oil.
	K) Struck by flying parts of broken tools, shock or electrocution.	K) Check tools for safety defects.
	L) Potential hazards going uncorrected.	L) Report and if possible repair any defects or hazards found. Do not use machine with uncorrected safety defects.
2. Mounting and dismounting.	2. A) Slips and falls, being run over by machine.	2. A) No one, including the operator, should get on or off drill rig while it is moving.
	B) Shock, burns, electrocution.	B) It is a good habit to slap handrail with back of hand before taking hold to mount, in case any stray current is present.
	C) Slips and falls, clothing caught on control levers or other projections.	C) Wear snug-fitting clothing. Use extreme care in adverse weather, or if grease, oil, or water is present. Keep steps, tracks, handholds, and boots free of mud, ice, snow, grease, and oil to extent possible.

SEQUENCE OF BASIC JOB STEPS	POTENTIAL ACCIDENTS OR HAZARDS	RECOMMENDED SAFE JOB PROCEDURES
2. (Continued)	D) Falling from ladder.	D) Use proper boarding places and handholds and handrails provided. Face ladder and climb with both hands free.
	E) Falling from mast.	E) If necessary to climb mast, climb on correct side. Use ladder with back guards and/ or safety belts or harness.
	F) Slips, trips, and falls.	F) Check walkways, passageways, and platforms for clearance, cleanliness, and good repair. Do not use walkways for storage.
	G) Slips and falls, sprains, strains, broken bones.	G) Never jump from drill when dismounting.
3. Check cab and controls.	3. A) Struck by flying objects, jammed controls, projecting control levers.	3. A) Remove or secure any loose objects in cab. Avoid projections.
	B) Accident caused by poor visibility.	B) Inspect and clean windows and mirrors. Adjust mirrors if necessary.
	C) Thrown against cab interior or thrown out of the machine.	C) Seat belts, where provided, should be in good condition and should be worn by the operator.
	D) Machine malfunction.	D) Check all instruments and gauges before start-up to be sure they aren't stuck. Make sure all controls are in neutral position and parking brake is set.
	E) Fire hazard.	E) Do not carry flammable liquids in operator's compartment.

SEQUENCE OF BASIC JOB STEPS	POTENTIAL ACCIDENTS OR HAZARDS	RECOMMENDED SAFE JOB PROCEDURES
4. Start drill and complete pre-shift inspection.	4. A) Equipment damage, striking cab interior or other persons if drill moves unexpectedly.	4. A) Check machine for warning tags. Check controls to be sure they are in the proper position.
	B) Electrocution, unexpected machine movement.	B) Do not make or break trailing cable connections until the power is off. Do not touch drill rig while electrical cable is being energized. Maintain good communication with all concerned whenever power is taken off or placed on drill.
	C) Hitting, catching, or running over persons in the area.	C) Make sure everyone is in the clear prior to starting up or moving any part of the drill. Sound audible warning before starting or moving. Check back-up alarm after start-up.
	D) Engine or auxiliary equipment malfunction.	D) Let engine run at low idle until it reaches normal operating temperature. Check gauges and warning lights again for normal readings.
	E) Engine malfunction .	E) Check engine for smooth idle and unusual smoke or noise.
	F) Poor visibility, poor operation.	F) Check all lighting systems and controls on drill rig for proper operation.
	G) Loss of control.	G) Check all brake systems and steering according to company policy or manufacturer's recommendations. Check transmission operation.

SEQUENCE OF BASIC JOB STEPS	POTENTIAL ACCIDENTS OR HAZARDS	RECOMMENDED SAFE JOB PROCEDURES
5. Traveling.	5. A) Injury or equipment damage due to human error.	5. A) Be sure you are trained and authorized to operate the drill.
	B) Electrocution, strain or sprain.	B) If trailing cable must be moved, inspect and use properly rated rubber gloves and insulated cable handling hooks.
	C) Various equipment operation hazards, electrocution, cable damage.	C) If trailing cable is moved with dozer or other machine, be sure you are trained, authorized, and follow safe procedures for machine being used. Do not move cable with machine blade unless proper cable sling equipment is utilized. Keep kinks, twists, knots, or short bends out of cable. Take several loops, instead of pulling long lengths, to minimize strain on cable.
	D) Personal injury.	D) Do not get on or off moving machine or permit others to do so.
	E) Striking other machines or people.	E) Be aware of the location of other machines and personnel within your working area, especially in congested areas.
	F) Caught in moving parts, run over by machine.	F) Keep clear of track when tramming.

SEQUENCE OF BASIC JOB STEPS	POTENTIAL ACCIDENTS OR HAZARDS	RECOMMENDED SAFE JOB PROCEDURES
5. (Continued)	G) Electrocution.	G) Make sure drill rig is clear of all electrical power cables when moving. When drill rig must be moved near power lines, do so under the direction of a supervisor and use extreme caution. The mast must not pass within a minimum distance of ten feet from any energized overhead power line. High voltage may dictate distances up to 35 feet.
	H) Electrocution, shock, burns, explosions, cable damage.	H) Never run over unprotected trailing cables. Use proper crossover or crossunder points.
	I) Drill overturning, ground failure, struck by falling material.	I) Keep drill rig on solid roadway and do not operate where there is a danger of tipping over. Use extreme caution when operating over rough terrain, on frozen ground, next to coal ribs, and on benches.
	J) Loss of control, collisions, overturning.	J) Use prudent speeds consistent with conditions and keep drill rig under control at all times. Obey all traffic rules, signals, signs, and lights.
	K) Loss of control, machine damage.	K) Always anticipate grades and select proper gear range accordingly. Never over-speed the engine and never coast in neutral. Stay in proper gear when traveling uphill or downhill. Use each type of brake carefully and in accordance with manufacturer's instructions.

SEQUENCE OF BASIC JOB STEPS	POTENTIAL ACCIDENTS OR HAZARDS	RECOMMENDED SAFE JOB PROCEDURES
5. (Continued)	L) Collisions, forcing another vehicle into an accident.	L) Know your stopping distance and follow other vehicles at a safe distance. Yield right-of-way to all loaded haulage vehicles. Limit passing to areas of adequate visibility and clearance. Don't hog the road or race with other vehicles.
	M) Collisions, overturning, striking obstructions or persons.	M) Use extreme caution and be prepared to stop at intersections, railway crossings, one-lane bridges, and underpasses . When in pit, be alert for pit elevations, trenches, benches, open cuts, sump holes, clearances, grades, and workers.
	N) Overturning, striking obstructions.	N) Slow down before turning. Allow enough clearance and do not cut corners too close when making a sharp turn. Never turn sharply uphill or downhill.
	O) Poor visibility because of blind spots behind drill.	O) When preparing to back up, check area before changing directions. Look behind drill to extent possible before and while backing up. Ask assistance from drill helper or hole loader.
	P) Poor visibility.	P) Use headlights and/or operating lights at night or in cases of poor visibility because of weather conditions.

SEQUENCE OF BASIC JOB STEPS	POTENTIAL ACCIDENTS OR HAZARDS	RECOMMENDED SAFE JOB PROCEDURES
6. Drilling.	6. A) Catching someone in moving parts, running over someone.	6. A) Make sure everyone is in the clear and sound audible warning before starting up any part of drill and before moving drill.
	B) Struck by falling or sliding material, falling over highwall, overturning.	B) Always visually inspect work area, highwall, and bench for unsafe conditions, cracking, and soft ground which could slide. Keep drill rig on solid ground and remain a safe distance from edge of highwall.
	C) Ground failure under operating machines, struck by falling materials.	C) Do not drill or shoot holes underneath operating machines, such as shovels, bucket wheels, or draglines. Never get under the swinging buckets of these machines.
	D) Excessive respirable dust.	D) Use dust control equipment provided, and inspect regularly for proper operation.
	E) Slips and falls, fire hazard.	E) Do not work from a slippery platform, or use insecure footing or staging not designed for the job. Keep platform free of mud, ice, and snow, and as dry as possible. Keep oil and grease spills cleaned up.
	F) Detonating explosives.	F) Never drill in a previously drilled hole (one cannot assume that it is free of unshot powder). Do not drill holes where there is danger of intersecting a charged or misfired hole.
	G) Caught in moving parts.	G) Keep hands and clothing clear of rotating drill stems and other moving parts.

SEQUENCE OF BASIC JOB STEPS	POTENTIAL ACCIDENTS OR HAZARDS	RECOMMENDED SAFE JOB PROCEDURES
6. (Continued)	H) Uncontrolled machine.	H) Never leave drill unattended while in operation. Stay in position where you have ready access to control levers.
	I) Struck by shifting or falling material.	I) Stay clear when making and breaking joints. Stay clear of lifted loads.
	J) Struck by falling drill steel, caught in rotating auger.	J) Keep firm grip on drill steel when handling must be done. Do not remove or install augers while power is on.
	K) Falling from mast, struck by falling objects.	K) Do not climb mast while drilling, or if drill is moving. Persons must not be on the mast while drilling unless a safe platform is provided and safety belts are used. Don't leave tools or other objects loose on the mast or mast platform.
	L) Struck by broken or whipping drill steel.	L) Keep clear of drill steel which is bowed or bent under pressure of any kind. Bent drill steel should be removed from service.
	M) Crushed between drill pipe and stationary object.	M) Always keep hands and feet clear when hoisting drill pipe to the deck.
	N) Struck by falling drill rods.	N) When storing spare drill rods in rack, make certain they are effectively secured to prevent falling from rack. Be sure safety sling is in place and secure at all times.
	O) Fire or explosion.	O) Don't smoke or use an open flame around flammable or combustible materials, or where "No Smoking" signs are posted.

SEQUENCE OF BASIC JOB STEPS	POTENTIAL ACCIDENTS OR HAZARDS	RECOMMENDED SAFE JOB PROCEDURES
6. (Continued)	P) Burns.	P) Avoid contact with hot air lines, manifolds, etc.
	Q) Stepping\ falling into drill hole.	Q) Cover or guard drill holes which are large enough to constitute a hazard.
	R) Struck by falling or sliding objects.	R) Before moving drill from one hole to another, secure drill steel, tools, and all movable parts in a safe position.
	S) Striking persons, machines, or power cables; soft ground; roadway obstructions.	S) Before movement to the next hole site, the helper should check the area to be traveled, and make sure persons, machines, and power cables are in the clear.
	T) Running over someone.	T) Observe general area and sound alarm before moving from one hole to another. Know location of helper and shooter, and never move drill unless they can be seen or heard.
	U) Striking persons or obstructions.	U) Helper should give signals to assist operator in moving or spotting drill. Operator should observe for traffic or persons. Operator should signal before changing direction. Crew members must be sure their signals are understood.
	V) Explosion.	V) Do not run drill over loaded holes, or allow other machines to drive over them. Trailing cables of electrically operated drills or any other machines must be kept a sufficient distance from loaded holes.

SEQUENCE OF BASIC JOB STEPS	POTENTIAL ACCIDENTS OR HAZARDS	RECOMMENDED SAFE JOB PROCEDURES
6. (Continued)	W) Crushed between equipment.	W) Do not get between drill and compressors or other equipment.
	X) Bubbles in blood from high pressure air penetration of skin, ruptured air tanks, whipping air hoses .	X) Never direct compressed air toward a person. Be sure compressed air systems are properly installed, maintained, and used.
	Y) Catching persons in moving parts.	Y) After drill has been moved up to a new hole location and leveled, drill crew should make visual or verbal contact with operator before operation is resumed.
7. Parking and refueling.	7. A) Collision, runaway equipment, traffic obstruction.	7. A) Avoid parking on inclines or haul roads. If necessary to park on an incline, position drill to prevent rolling, turn wheels into bank, and/or block securely. If parking on a haul road is required, pick the safest place.
	B) Runaway equipment.	B) Place controls in neutral position. Engage parking brake (unless this occurs automatically when machine is turned off).
	C) Engine damage.	C) Idle engine for a short period of time and shut it off.
	D) Slips and falls.	D) Dismount drill (see Job Step 2).
	E) Fire, explosion.	E) Do not smoke while fueling machine. Avoid fuel spillage. Gasoline operated machinery and engines must be shut off before being fueled.

SEQUENCE OF BASIC JOB STEPS	POTENTIAL ACCIDENTS OR HAZARDS	RECOMMENDED SAFE JOB PROCEDURES
8. Complete drilling records/ reports.	8. A) Poor fragmentation in blast, hazardous highwall.	8. A) Maintain good drilling and blasting records. Inform shooter of hole penetration rates and other factors which may affect the blast.
	B) Flyrock.	B) Maintain effective communication with everyone concerned to eliminate any potential confusion prior to highwall shots.
	C) Hazards due to lack of communication.	C) Always inform appropriate personnel of any abnormal conditions, defects, changes made in machine, and/or job procedure or condition.
9. Nighttime operation.	9. A) Poor visibility.	9. A) During pre-shift inspection clean windows, mirrors, and all light lenses.
	B) Striking or catching persons, striking obstructions or machines.	B) Use headlights and/or operating lights at night or in cases of poor visibility, such as fog, rain, or snow.
	C) Ground failure.	C) Be sure to make a good inspection of the ground to be traversed, utilizing proper lighting.
10. Emergency procedures.	10. A) Power failure.	10. A) Place controls in the neutral position and secure the drill's position properly until power is restored.
	B) Lightning.	B) Suspend drilling activities when it is storming and lightning.

SEQUENCE OF BASIC JOB STEPS	POTENTIAL ACCIDENTS OR HAZARDS	RECOMMENDED SAFE JOB PROCEDURES
10. (Continued)	C) Contact with power line.	C) Stay on drill until it is free of line, or power is disconnected. If you must leave machine, jump free - don't touch drill rig and ground at same time.
	D) Fire.	D) 1) Know escape (exit) routes off drill rig. 2) Stop operation and shut down engine. 3) Use fire extinguisher to extinguish small fire or aid escape from large fire. Warn anyone in the immediate area. 4) If time is available, sound audible alarm to notify other crew members and supervisors. 5) Leave the operator's cab and climb down the ladder. 6) Do not jump down unless the fire has covered the ladder areas. 7) Notify foreman/obtain firefighting assistance. 8) Proceed to fight fire under direction of foreman. 9) Machine should be deenergized as soon as possible.
11. Performing repairs and maintenance (if applicable).	11. A) Personal injury from improper procedure.	11. A) Do not attempt repairs or maintenance you do not understand. If a problem arises which requires electrical work, contact a qualified electrician or your supervisor.

SEQUENCE OF BASIC JOB STEPS	POTENTIAL ACCIDENTS OR HAZARDS	RECOMMENDED SAFE JOB PROCEDURES
11. (Continued)	B) Increased seriousness of an injury.	B) Know the location and proper use of first aid equipment in case of emergency.
	C) Struck by flying objects; injured by slipping, dropped, or broken tools; scraped knuckles, electric shock.	C) Inspect all hand tools and portable power tools before using and maintain them in good condition. Controls of hand-held power tools must require constant hand or finger pressure to operate (or equivalent safety devices). Electric tools must have safely designed switches or other controls.
	D) Caught by or struck by moving or falling parts, or moving machine.	D) Lower all raised equipment and/or block against motion before servicing or repairing. Never work under a raised and unblocked load. Components being repaired and/or the entire drill should be blocked securely where there is any possibility of movement during repairs.
	E) Shock or electrocution, caught in moving parts.	E) Electrical equipment should be locked out and tagged prior to electrical or mechanical work.
	F) Caught in moving machinery.	F) Do not remove guards from moving machinery. Keep hands and clothing away from moving parts and do not work on moving machinery.
	G) Hot fluids, whipping hoses.	G) Relieve pressure from pressurized systems (hydraulic or air) before beginning repairs.

SEQUENCE OF BASIC JOB STEPS	POTENTIAL ACCIDENTS OR HAZARDS	RECOMMENDED SAFE JOB PROCEDURES
11. (Continued)	H) Struck by falling or sliding material.	H) Take special precautions against groundfall hazards when work must be performed between immobilized machine and the highwall or spoil bank, where escape may be hindered.
	I) Caught in moving machinery.	I) Do not lubricate moving machinery unless extended grease fittings permit this to be done from a safe location.
	J) Struck by falling equipment.	J) When drill carriage is being worked on, it must be fully lowered or blocked in place. Hoist brake alone is not acceptable. Do not work under suspended tools or loads.
	K) Strains, sprains, ruptures.	K) Follow proper lifting procedures, using legs instead of back. Get help with heavy or awkward loads (see Module 16, "Manual Handling of Materials").
	L) Caught between load and stationary object, caught in pinch points.	L) Never position your body between an anchored object and a swinging load. Be constantly aware of pinch points which may trap hands and fingers.

SEQUENCE OF BASIC JOB STEPS	POTENTIAL ACCIDENTS OR HAZARDS	RECOMMENDED SAFE JOB PROCEDURES
11. (Continued)	M) Fire or explosion, welding and cutting hazards.	M) Any repairs to drill rig or other machinery which require welding or cutting must be performed a safe distance from loaded holes and all other explosives (see Module 13, "Welding and Cutting"). Before repairs are made to vehicles used to transport explosives, remove all explosives and detonators.
	N) Caught in moving machinery.	N) Replace and secure all guards and other safety devices before the drill is operated.

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.