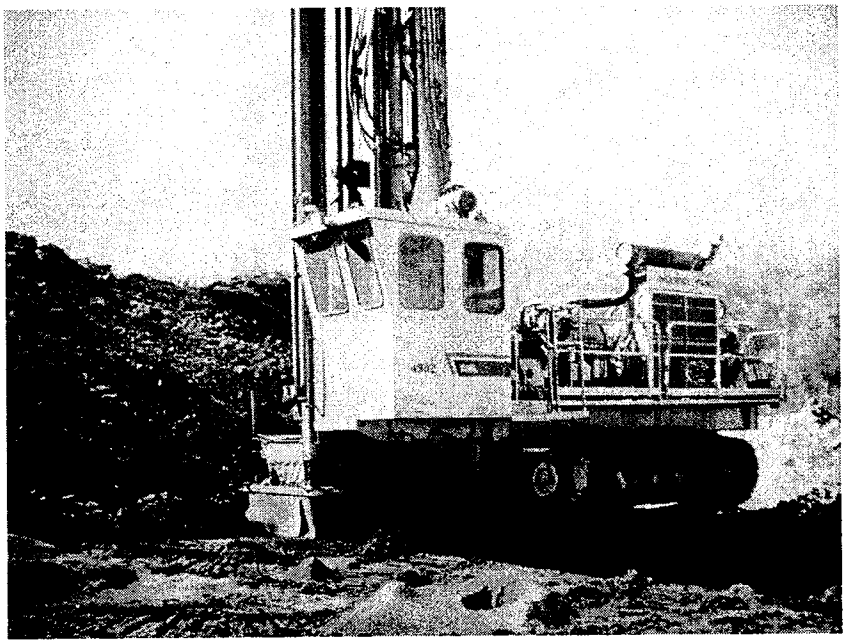
MODULE NUMBER 18
OF
INSTRUCTION GUIDE NUMBER 40

ON-THE-JOB TRAINING
FOR THE
SAND, GRAVEL, AND CRUSHED STONE INDUSTRY

OPERATING DRILLING EQUIPMENT



This module discusses basic job steps, potential hazards and accidents, and recommended safe job procedures for operating drilling equipment.

Drilling produces the holes in which explosives are detonated. Correct hole layouts for low cost rock breakage cannot be planned without evaluating the characteristics of the deposit, the capabilities of drilling equipment, and applicable explosives.

Deposit hardness, strength, and rock structure are some of the characteristics that affect drilling. These characteristics are usually appraised by field tests before drilling begins.

Drilling layouts should be specifically designed for the explosives, and the blasting methods, used at the job site. If available equipment limits the drilling capabilities, then the choice of explosives, and blasting methods, is also limited. Field tests will show which types of explosives, and which blasting methods, are best suited to the job. Explosives manufacturers can also provide data, and expert advice, about their products.

Placement of blasting holes should be determined before drilling begins. Each job is subject to many variables, which make it impracticable to state a rule about distance between blasting holes.

Many factors have to be considered while placing blasting holes. Some of these factors include:

1. The type, and amount, of burden imposed on each hole.

2. The location of dips, seams, and joints.

3. Methods, and costs, of drilling.

4. The diameter of, and the space between, holes.

5. The strength of explosives.

6. The proximity of dwellings, or other structures.

7. Compliance with environmental, and safety, regulations.

8. Other mine specific conditions.

Remember that each blast requires strategy, planning, and site analysis. The appropriateness of a drilling layout is gauged by the extent to which the layout helps to reduce operating costs, and produce stable highwalls. Drilling and blasting operations should break rock into sizes that can be readily loaded, and fed into the crusher.

Inclined drilling is frequently used to obtain more consistent results in breakage and displacement. Larger inclinations yield better fragmentation, especially near the toe of the highwall. Better fragmentation lowers production costs by increasing efficiency in handling, crushing, and other phases of production.

Make sure that the proper type of equipment is used for the job. Equipment too large to maneuver, or too small to properly perform the work, may create additional hazards. Many types of drills are available. Drill manufacturers can provide data, and expert advice, on their products. Operators must be trained for the specific equipment.

Dust is a major health and safety concern for drill operators. Dust suppression during drilling yields benefits that include clean air for drill operators, longer maintenance intervals on the engine and the compressor air cleaners, and less accumulated dust on the drilling machine. Drill manufacturers are the best source for information on how to reduce dust on their machines.

Make sure that access to the drilling area is safe. Make sure that roadways are stable, and are properly bermed. Check for loose rocks and unconsolidated material on highwalls above roadways. Correct all unsafe conditions prior to entering the work area.

Conduct an inspection of the work area. Check for loose or unconsolidated material on highwalls. Determine the condition of the floor that you are drilling on. Determine the "hazard zone," which is at least 6 feet from the stable crest. Slips, faults, backbreak, overhang, cavities, and loose rock constitute an unstable crest. Once the hazard zone has been determined, place visual and/or physical barriers to warn persons of the hazards.

Consider adverse weather conditions. Heavy rains, snow, sleet, lightning, and wind can create poor visibility, slippery ground conditions and fall hazards, and electrocution hazards. Discontinue drilling activities when adverse conditions exist.

All equipment must be inspected before use. Safety defects must be corrected before the equipment is used.

Make sure the area is clear of obstacles and persons before moving equipment. Position the drilling equipment at a safe distance from the stable crest. Do not operate equipment within the hazard zone. When the drill is in the proper location, set the brakes and chock the wheel or lock the tracks, to prevent movement. Block the tracks, when angle drilling, to prevent possible movement during the drilling process. Lower the hydraulic jacks or outriggers, if provided, and level the unit.

The following safe job procedures will help to minimize incidents which could cause injuries and adversely affect production.

REQUIRED OR RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT:
HARD HAT, SAFETY SHOES, SAFETY GLASSES, GLOVES, HEARING PROTECTION, RESPIRATOR.

SEQUENCE OF BASIC JOB STEPS	POTENTIAL ACCIDENTS OR HAZARDS	RECOMMENDED SAFE JOB PROCEDURES
1. Check equipment.	1. A) Slips, trips, and falls.	1. A) Keep area free of slipping and tripping hazards. Check for leakage of oil, grease, and water. Safety defects must be corrected before use.
	B) Bruised or cut knuckles.	B) Make sure all bolts and cables are tight.
	C) Cut or puncture from broken wires.	C) Check all wire ropes, and replace those that are damaged or deteriorated.
	D) Struck by equipment.	D) Be sure all controls are in the "off," "brake set," or "neutral" position, as appropriate.
	E) Equipment damage or improper operation.	E) Check hydraulic and compressor oil levels. Check hydraulic lines, air lines, and electrical cables. Check cooling system. Check gauges and warning lights. Check condition of drill bit. Report or repair equipment defects. Defects affecting safety must be corrected before equipment is used.

SEQUENCE OF BASIC JOB STEPS	POTENTIAL ACCIDENTS OR HAZARDS	RECOMMENDED SAFE JOB PROCEDURES
	F) Fire.	F) Check fire extinguisher.
	G) Ground failure under weight of equipment. Falling hazard.	G) Check drilling area for hazardous ground conditions. You must wear fall protection when you are exposed to falling hazard.
2. Start engine (diesel), or energize machine (electrical).	2. A) Caught in, or struck by, moving parts.	2. A) Be sure all persons are in the clear.
	B) Equipment damage.	B) Switch on any auxiliary motors, such as the oil pump motor. Check engine operation and maintain proper adjustment. Check gauges for proper air pressure, oil pressure, voltage, etc.
3. Back up to wall.	3. A) Striking other personnel.	3. A) Make sure area is clear of other personnel.
	B) Drill overturning or falling off highwall.	B) Make sure surface is firm and solid before starting.
4. Secure and level machine.	4. A) Drill steel stalling or breaking.	4. A) Set propel brakes, or otherwise lock tracks to prevent movement during drilling.
	B) Improper hole angle or diameter.	B) Tracks may have to be blocked to ensure they will not move during drilling.

SEQUENCE OF BASIC JOB STEPS	POTENTIAL ACCIDENTS OR HAZARDS	RECOMMENDED SAFE JOB PROCEDURES
4. Cont.	C) Machine overturning.	C) Lower hydraulic jacks or outriggers, if provided, and level machine.
5. Begin drilling.	5. A) Personnel caught in equipment. Struck by pull-down chains or cables.	5. A) Examine work area and make sure it is clear of personnel.
	B) Oil leaks from hoses.	B) Watch for wear on hoses and maintain hoses to prevent oil leakage.
	C) Burns from being sprayed with hot hydraulic oil.	C) Make sure cab door (where provided) is closed, to prevent getting sprayed with oil.
6. Unscrew drill pipe.	6. A) Hydraulic hose could break, and cause burns.	6. A) Check hoses for leakage and general condition.
7. Take drill head back to top of pipe. Screw head on pipe, and repeat steps 5 and 6 above.	7. A) Head could fall and splinter a piece of metal.	7. A) Make sure drill head is properly secured on pipe. Watch out for other personnel in the area.

SEQUENCE OF BASIC JOB STEPS	POTENTIAL ACCIDENTS OR HAZARDS	RECOMMENDED SAFE JOB PROCEDURES
8. Shut down machine at end of shift.	8. A) Pipe lodged in hole because of ground movement.	8. A) Drill pipe must be out of hole. Raise and clear jacks. Turn off all switches. Leave all controls in "off" or "neutral" position. Ensure all brakes have been applied. Inspect equipment and report any damage.

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"

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.