MODULE NUMBER 1
OF
INSTRUCTION GUIDE NUMBER 40

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

STARTING THE PLANT

This module describes basic job steps, potential hazards and accidents, and recommended safe job procedures for plant start-up.

This job is usually done by the plant operator, but may be done by other occupations, such as utility worker, laborer, etc. The plant operator/utility worker must make sure that employees, and others, are protected from accidents and injuries resulting from plant start-up.

While both sand and gravel plants, and crushed stone plants, are built by many different manufacturers, the processes and equipment involved in the production effort are similar.

SAND AND GRAVEL PLANTS

At a typical sand and gravel plant, raw material from a hopper at a dumping station is carried by a conveyor belt to a screening deck. The screening deck removes oversized material (large clay balls, roots, very large rocks, etc.), separates sand from gravel, and then separates the gravel into different sizes. Spray bars wash the gravel as it passes through the screening deck.

Large stones then go to log washers, while medium size material (chat and/or pea gravel) is carried to a screw. The large stone, after emerging from the log washer, and the finer material, after emerging from the screw, pass through separate final rinse stations on the way to storage areas. Transportation to a storage area may be by a fixed conveyor system, a radial stacker system, or an extendable belt conveyor system. A radial stacker is a conveyor system that rotates from a fixed pivot point, and stores the conveyed material in an arc-shaped stockpile. The extendable belt conveyor system has the capability of lengthening or shortening itself by moving the head section. The head section is mounted on wheels, and moves on rails, which allows the conveyor to supply several stockpiles, hoppers, or silos.

Sand, after being separated on a screening deck, flows to a classifier, where it is washed and sized. The sand is then carried by a screw, which separates the sand from the water, to a conveyor belt, which carries it to a storage area.

Water that is used in the plant is pumped from a freshwater pond. The discharged water is then pumped into a settling pond.

A crushed stone plant differs somewhat from a sand and gravel plant. Raw material is brought from a quarry to a primary crusher by rear dump haul trucks. Some primary crushers are fed by wobblers, which are chain driven conveying systems with eccentric rollers.

After primary crushing, material is conveyed by belt to a scrubber for washing. The scrubber is a cylindrical, rotary device with internal screens and auger type vanes that carry the material through the scrubber. Fine material is separated from the coarse material in the scrubber. The fine material is sent to a settling pond. The coarse material is sent to a surge pile, and then to a primary screening deck. Oversized material is carried from the primary screening deck to secondary crushers, and is then returned to the primary screening deck to be separated into desired products. A crushed stone plant contains a series of screening decks, crushers, and final rinse screening stations. Finished product travels through a final rinse stage, and is then stored in silos, bins, or stockpiles.

A sand and gravel, or crushed stone, plant consists of a number of interdependent production processes. Therefore, it is important to know how the plant operates in order to prevent a massive pile-up of material at a transfer point during plant start-up.

An improper start-up sequence can damage plant equipment, and also increase the risk of injury. Fresh-water, sand, and other pumps are started first. Other plant equipment must be started in reverse order of material flow, beginning with the finished product conveyor, and working back through the primary hopper feeder belt.

In addition to following the proper start-up sequence, the person starting the plant must take every precaution to ensure that other people are clear of equipment before the equipment is started.

The following safe job procedures will help to minimize incidents that may cause injuries, and adversely affect production.

REQUIRED, OR RECOMMENDED, PERSONAL PROTECTIVE EQUIPMENT:
HARD HAT, STEEL-TOED SHOES, LIFE JACKET, GOGGLES

SEQUENCE OF BASIC JOB STEPS	POTENTIAL ACCIDENTS OR HAZARDS	RECOMMENDED SAFE JOB PROCEDURES
1. Start primary pump.	1. A) Falling into water.	1. A) Wear life jacket.
	B) Slipping/falling on platform.	B) Use designated walkways, and examine for slipping/tripping hazards.
	C) Electrocution hazards.	C) Examine work area for exposed wires, frayed insulation, etc.
	D) Mechanical hazards.	D) Examine work area for missing guards, exposed moving machine parts, etc. Sound warning horn, if applicable.
2. Start all conveyors, shakers, and associated equipment in start-up sequence.	2. A) Personnel caught in conveyors and other equipment.	2. A) Check that all moving parts have guards in place. Make sure all personnel are clear of equipment. Sound alarm.
	B) Spillage at transfer points.	B) Proper start-up sequence begins with finished product belts, and continues to primary feeder.

SEQUENCE OF BASIC JOB STEPS	POTENTIAL ACCIDENTS OR HAZARDS	RECOMMENDED SAFE JOB PROCEDURES
	C) Short circuit in switch box.	C) Stand to the side of switch box, in case door blows open when activated.
	D) Problems with equipment at start-up, such as electric motor fires, belt slippage, etc.	D) Check piece of equipment after starting, before starting something else.
3. Inspect the operating plant for problems and hazards.	3. A) Getting caught in moving parts.	3. A) Check that all guards are in place. Cross belts only at designated crossovers. Do not extend any part of body beyond edge of belt.
	B) Tripping hazards.	B) Walkways should be kept clear of trash, tools, etc. Check for loose or missing handrails, walkway grating, or toeboards.
	C) Burns.	C) Check for overheated gearboxes (listen for grinding sound). Check if gearbox is loose on main shaft. Visually check bearings through guard while running. Look for orange color on shaft, or shaft wobbling.
	D) Electrical hazards.	D) Check for obvious electrical hazards, such as exposed wires, missing junction box covers, frayed insulation, missing light bulb guards, etc.

GENERAL INFORMATION

This module is part of an Instruction Guide that was developed to assist the sand, gravel, and crushed stone 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.