Safety Considerations for Abrasive Blasting Operations

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The Occupational Safety and Health Administration (OSHA) writes and enforces many safety regulations that govern safety and health practices in the workplace. Many of these regulations pertain to cleaning and painting operations. Most local fire and health departments also regulate these activities.

Many safety regulations are very specific about how to do a job safely. Their purpose is not to make our job more difficult but to make it safer. These regulations have been developed over many years by studying how and why accidents happen and writing procedures (regulations) for us to follow to see to it that we don't make the same mistakes that injured others. In this lesson we will review some of the general requirements of regulations on abrasive blasting and explain how they can help us make our jobs safer.

When you blast-clean surfaces with abrasive driven by air, you have to deal with several hazards to your health and safety. Some of these hazards can be lethal, so it is important that you understand what they are and observe the proper safety precautions.

The hazards of abrasive blasting include the following kinds:

- Dust
- Noise
- Pressures and Particle Velocities

Fig. 1 NIOSH-approved, type "CS" continuous flow, air-supplied respirator with extended length shroud assembly. Photos courtesy of 3M Company.

OSHA and Environmental Safety Division
### Dust

The dust produced by abrasive blasting is a very serious health hazard. The dust results from the breakdown of abrasives and the pulverizing of surface coatings, rust, millscale, and other materials on the steel surface being blasted.

The dust varies in size from 1 micron (1/25,000 inch) to 1,000 microns (1/25 inch) in diameter. Dust larger than 10 microns may be visible and settles quickly. Individual particles of dust smaller than 10 microns are invisible and remain suspended in the air for a longer period of time.

Dust smaller than 10 microns can be inhaled when you breathe. It passes through the respiratory system defenses and settles in the small air sacs in the lung, called alveoli.

The main dust of concern is free silica (SiO₂) from silica sand abrasive. This dust cannot be dissolved by the lung fluids. Since the lung cannot break down or cast out free silica, it does the next best thing in its defense program, which is to isolate the intruder by building a thick, fibrous tissue around it. When too much of this tissue develops, the lung is said to be "fibrotic" or to be in a condition of fibrosis. When the condition is severe enough to show up on x-ray, or when a decrease in lung function exists, it is called "silicosis." Only an air-fed respirator can protect you from the hazard of free silica.

Other dust hazards may be produced by the abrasive blasting process. These result from the removal of surface coatings containing such elements as lead, cadmium, zinc, and nickel. If the dust contains soluble chemicals, they can dissolve, pass through the walls of the alveoli in the lungs, and enter the bloodstream, where they can cause harm in accordance with their nature.

Lead is a poison that can damage the body’s blood-forming, nervous, urinary, and reproductive systems. Lead also accumulates in the body; thus, exposure to small doses over long periods of time can cause great harm. When removing lead-based paint, you should protect yourself with an air-supplied respirator.

Dust can also cause irritation of eyes, ears, nose, and throat.

Blasters must always use a NIOSH-approved type “C” air-fed respirator (Figs. 1 and 2). NIOSH, the National Institute of Occupational Safety and Health, is an organization of physicians, industrial hygienists, and other scientists who conduct research on health issues in the workplace. One of the functions of NIOSH is to test industrial respiratory protection equipment and certify the equipment if it complies with federal law. (For more information about NIOSH and protective equipment, see R.C. Miller, “Respiratory Protection in the Protective Coatings Industry,” JPCL, April 1988, pp. 36-43.)

Respiratory protection should continue to be worn after blasting as long as dust-laden air remains. This time period is largely a function of local winds or ventilation.

Workers in the vicinity of the blasting area, such as pot tenders and lookouts, are also required to wear respiratory protection. Workers engaged in clean-up operations should also be equipped with respiratory protection. Workers on clean-up, when no blasting is being done, may use passive dust respirators.

This is the only time passive dust respirators may be used around an abrasive blasting operation. By no means can a worker be protected by a bandanna tied around the head to cover the nose and mouth.

A safety engineer should review all projects that require abrasive blast cleaning to determine what precautions, if any, should be taken to eliminate the hazard of chemical exposure. Examples of these precautions include disposable clothing, boots, gloves, respiratory protective devices, and showering before leaving the job site.

### Noise

Most forms of abrasive blasting create the hazard of noise exposure, which will vary depending on the blasting conditions. Regardless of the nature, excessive amounts of noise may require personal hearing protection for blasters and other workers in the general area.

Depending on the size of the equipment, the material being blasted, and the location of the blasting operation, noise levels can range from about 90 decibels to more than 110 decibels. When there is any question about the existing levels, a safety consultant should be contacted, and a noise survey should be made. Personal hearing protection should then be recommended if the level and exposure time of the workers exceed the OSHA standard. Note that some abrasive blasting hoods already provide some degree of noise protection, but the manufacturer’s specifications should be checked to verify the degree.

### Equipment

The equipment used in abrasive blasting operations creates hazards that require certain precautions. The following are some of the equipment and the respective precautions that should be taken.

- **"Deadman" Control:** This is usually a spring-loaded control located near the nozzle end of the blast hose. When depressed, it starts the flow of high pressure air and abrasive. When released, it stops the flow. Deadman controls can be either pneumatic (air-operated) or electric. In either case, the control must be kept depressed by the oper-
ator for the system to work. This prevents a nozzle from blasting the operator or nearby workers if dropped. Always verify that there is a deadman control and that it is operable before any work is performed.

- **Hoses**: Hoses are subject to severe abrasion from the high pressure air and abrasive that move from the pressure vessel to the nozzle. Ruptures can cause serious injury. Metal piping carrying abrasive also deteriorates rapidly. Hoses and piping should be inspected on a regular basis and repaired or replaced periodically as necessary. Hose and pipe couplings should also be inspected regularly. Blast hose couplings should be wired together to assure that they will not disjoin.

- **Pressure Vessels**: Pressure vessels for compressed air or abrasive under pressure should be checked regularly since they are also subject to abrasion and deterioration beyond that of normal pressure vessels. Pressurized abrasive tanks must have a removable plate for internal inspection. All must conform to ASME boiler and pressure vessel codes.

- **Valves**: All valves and rubber valve parts are subject to wear and should be inspected and replaced periodically.

- **Fill Ports**: Pressure vessels for abrasive blasting should have a funnel-shaped input that is easily accessible to the operator so that a strain caused by lifting bags of abrasive is avoided.

Fig. 2: NIOSH-approved, powered air purifier with shroud assembly
• **Hoseline Grounding:** Nozzles should be grounded since the air and abrasive can create enough friction to develop a substantial charge of static electricity. This is most important while working inside of tanks or other areas where there is potential for explosion.

• **Personal Protective Equipment:** In addition to respiratory and noise protective equipment, blasters should wear apparel to prevent damage to their skin from abrasive blasting and ricochet. This includes safety footwear or toe guards, coveralls, leather or rubber capes, and gloves. Pant and sleeve cuffs should be secured with tape or other suitable fasteners. These clothing rules are most difficult to enforce during hot weather, but despite the discomfort, they still must be enforced. Protective equipment should be inspected daily and repaired or replaced as necessary. Clean storage areas should be provided for blasting helmets and protective wearing apparel. It is most important that blasters receive proper training in the use of protective equipment.

**Summary**

When performing abrasive blasting, safety considerations must be given to hazards including dust, noise, and equipment. Where there is doubt as to the nature or the degree of the hazard, a safety engineer should be consulted.

Once the hazards are determined, procedures for personnel protection can be developed. Personnel protection must conform to standards established by agencies such as OSHA.

In addition to being provided with personnel protection, workers must be properly trained in the use, inspection, maintenance, and repair of equipment.

Your employer should be aware of the health and safety regulations that govern blasting operations. They are developed and enforced by the Occupational Safety and Health Administration (OSHA) of the federal government. Additional regulations from state or local jurisdictions may be in force. ATB