

Shotcrete Work in Confined Space Areas

By Ted Sofis

Shotcrete work, by its very nature, provides an excellent method of installing concrete materials in storage bins, hoppers, culverts, inlets, vaults, tanks, and other areas, where it is difficult to transport and efficiently install materials by conventional casting methods. The shotcrete equipment and materials can be staged outside the enclosed area and the gunning hose can be fed in through an access hatch, a manhole, or any other small opening to convey the shotcrete material into the internal enclosed area and onto the receiving surface. Many of these tight or restricted areas are regarded as confined spaces. When working in confined spaces, it is of utmost importance to ensure the safety of those working in the enclosed area and to follow all OSHA safety requirements (refer to Fig. 1 through 3).

OSHA defines a confined space as a space that has a restricted or confined area that hinders the activities of employees who must enter, work in, and

exit from the space. Such areas fitting the definition of a confined space have a limited or restricted means of entry or exit and are not designed for continuous employee occupancy. Confined spaces may include inlets or manholes, vaults, process vessels, tanks, excavations or pits, boiler dead air spaces, or a multitude of other areas where the configurations and entry issues meet the defined criteria.

Permit-required confined spaces are spaces that OSHA describes as having one or more of the following characteristics: contains or has the potential to contain a hazardous atmosphere, contains a material that has the potential to engulf the entrant, has walls that could converge or collapse inward, a sloping floor or bottom that slopes into a taper or smaller area that could trap or asphyxiate the entrant, or contains ANY OTHER RECOGNIZED SAFETY HAZARD. These may include unguarded machinery, exposed live wires, or high-temperature areas that can cause heat stress.

When dealing with permit-required confined spaces, it is mandatory to have an attendant at an opening into the confined space at all times while entrants are in the space. There are specific OSHA



Fig. 1: Worker entering a manhole opening into a confined space along the side of a ventilation tube



Fig. 2: In confined areas like this steel mill smokestack and ductwork, a refractory lining is being gunned in place using the dry process



Fig. 3: In this confined space area in a power plant ash pit, dry-process shotcrete is being gunned in place

Safety Shooter



Fig. 4: Nozzleman shooting overhead in a tightly confined area. In areas where visibility and ventilation are concerns, adequate lighting should be provided and the appropriate personal protective equipment should be worn

requirements for the entry supervisor, the attendant, and the entrants that must be followed. Before the initial work assignment begins, the employer must provide training for all employees who are required to work in permit-required spaces. If anything changes, additional training becomes necessary. Atmospheric testing is required for two reasons: evaluation of the potential hazards of the permit space and verification that acceptable atmospheric conditions exist for entry into the space.

There are many additional OSHA requirements regarding written safety plans, entry permits, retrieval and rescue operations, identification of hazards, and training, so please refer to OSHA Standards 29 CFA 1910.146 for all the specific requirements and procedures.

In addition to the specific OSHA requirements, there are a few rules of thumb that warrant mention and are specific to shotcrete applications. First and foremost is having and maintaining good communication. It is imperative that clear radio or wire communication exist between the nozzleman and others working within the confined space, and with the equipment operator outside. In the event of a problem, such as with a plug-up or an injury, the material flow can be shut off quickly. Also of concern is visibility; in enclosed areas, it is important to have adequate lighting. It is not only necessary for the nozzleman to see well for his gunning but it is also imperative that those inside the space can see and clearly identify any obstacles and potential hazards. Finally, with confined spaces, ventilation options can often be limited, so care should be exercised to provide proper respiratory protection for the workers (refer to Fig. 4 and 5).



Fig. 5: Dry-process shotcrete being gunned overhead in an underground culvert

It is good practice to identify all the potential hazards beforehand. Make sure that the workers have received the necessary training, that they wear the proper personal protective equipment, and that all OSHA requirements are addressed and followed. No one wants to see an injury or a fatality; the OSHA standards were established for this reason. Therefore, in addition to your concerns involving the performance of the work, take the additional measures to ensure a safe workplace.



Ted Sofis and his brother, William J. Sofis Jr., are the Principal Owners of Sofis Company, Inc. After graduating from Muskingum College, New Concord, OH, with his BA in 1975, Ted began working full time as a shotcrete nozzleman

and operator servicing the steel industry. He began managing Sofis Company, Inc., in 1984 and has over 38 years of experience in the shotcrete industry. He is the Treasurer for ASA, Chair of the ASA Publications Committee, and a member of multiple ASA committees. Over the years, Sofis Company, Inc., has been involved in bridge, dam, and slope projects using shotcrete and refractory installations in power plants and steel mills. Sofis Company, Inc., is a member of the Pittsburgh Section of the American Society of Highway Engineers (ASHE) and ASA.