A *Shotcrete* feature:

SAFETY SHOOTER

Reducing the Risk of Airborne Hazards

By Joe Hutter

The hazards of airborne crystalline silica have long been recognized by the North American construction industry. The effects of these hazards on the health of our workers can be minimized through education and preventative actions. The first step in protecting our workforce against exposure to airborne crystalline silica is to make the workforce aware of the sources and the activities that contribute to potentially high silica exposure. Some of the common construction activities that can contribute to elevated levels of airborne silica include:

- Sandblasting;
- Abrasive blasting of concrete;
- Chipping, jack hammering, drilling, cutting, or other types of concrete or masonry demolition;
- Dry-sweeping or blowing rock or concrete with pressurized air;
- Mixing concrete; and
- The shotcrete process (dry or wet).

Once we recognize and identify the sources, training and education (before the work starts) will provide the workforce with the knowledge required for protection against the long-term effects of airborne silica. Training should include:

- Potential health effects of exposure to respirable crystalline silica;
- Access to material safety data sheets for related products;
- The affect of engineering controls, work practices, and personal hygiene in reducing crystalline silica exposure; and
- The use and care of appropriate personal protective equipment (including protective clothing and respiratory protection).

Predampening equipment should be used to reduce the amount of airborne dust at the machine and at the nozzle

Protection against Exposure to Crystalline Silica

OSHA publishes and enforces regulations designed to protect employees against exposure to crystalline silica. A permissible exposure limit (PEL) has been established to determine the maximum amount of allowable exposure. Protection against exposure above this PEL will be dependent on the measured amount of airborne crystalline silica. The two most effective ways to prevent the negative long-term health implications from exposure to airborne crystalline silica are first through the use of engineering controls to ensure that levels of airborne hazards are kept below the permissible exposure limits. When these controls fail to bring the exposure within permissible levels, it is important to ensure that the appropriate personal protective equipment is being used.

Engineering Controls

The first step in keeping exposure limits to a permissible level is to remove the airborne hazards from the environment through the use of engineering controls. These controls can be as simple as following common sense housekeeping practices on an outside construction site or as complex as designing a ventilation system in an underground hard rock mine.

Housekeeping—Good housekeeping practices will go a long way in stopping one common source of airborne dust. Concrete debris, dust from concrete removal, and rebound from the sandblasting and shotcrete process should be wetted down and collected. Empty sandblast, shotcrete, and cement bags should be gathered and disposed of. Dust from these sources can become airborne when disturbed by passing traffic, vibration, and other random air currents.

Isolation—Operations that directly or indirectly cause the formation of airborne crystalline silica should be isolated from the rest of the workforce using a physical barrier such as visqueen. Any employees not involved with the isolated operation should be removed from the area. Ventilation should direct airborne hazards away from unprotected employees.

Equipment Maintenance and Selection—To avoid creating unnecessary dust at the equipment source (the shotcrete machine), it is essential that the equipment is well maintained. In the case of a dry-mix shotcrete operation, the following recommendations will minimize the measured amount of airborne crystalline silica:

- Wear pads and plates should be inspected regularly to avoid dust from escaping into the atmosphere;
- Keep wear pads and air settings properly adjusted to prevent "blow-back" of dry shotcrete material from the hopper. Consult equipment supplier for proper equipment operating procedures;
- During the dry shotcrete process, always ensure sufficient water pressure to avoid continuous dry/wet adjustments;
- Use predampening equipment to reduce the amount of airborne dust at the machine and at the nozzle;
- Ensure the correct size of all air and material hoses are used. Consult the equipment supplier for proper hose selection; and
- Ensure adequate training by qualified personnel is provided to all equipment operators, nozzlemen, and other crew members.

Water—Airborne crystalline silica can often be kept below permissible exposure limits through the use of water. Any tools that directly increase airborne dust levels should be equipped with a water suppression system (for example, rock drilling rigs, concrete saws, and concrete coring equipment). Water should also be available for wetting down dry material spills, concrete debris, and roadways, and wet sweeping work areas (rather than dry sweeping) will also reduce airborne dust levels.

Ventilation—Ventilation in the workplace is essential in preventing the production of excessive amounts of airborne dust. Local ventilation should be modified as necessary to provide adequate airflow away from the points of major dust generation (the delivery hopper, the machine or pump, and the nozzle). Typical local exhaust systems consist of hoods, ducts, air cleaners, and fans. In some circumstances (for example, underground applications and confined spaces), additional fan capacity may be required to keep an adequate supply of clean air circulating properly.

Personal Protective Equipment

Respiratory protection suitable for the job-site exposure conditions should be worn and maintained by all members of the shotcrete crew when engineering controls alone are not adequate to reduce exposures below the levels permissible by OSHA. When respiratory protection is required, it should first be determined through a medical evaluation if the crew member meets the minimum health and physical conditions to use the equipment. Periodic follow-up medical evaluations may also be required if the crew member exhibits medical signs or symptoms that can affect his/her ability to wear the respiratory protection. After the individual has been deemed OK to wear the respirator, they should be fitted and trained on the use of the respirator to ensure that it is used and maintained properly. Beards and mustaches may interfere with the respirator seal (around the face) and can render it ineffective.

When ignored, exposure to crystalline silica and other airborne hazards can pose severe health risks with serious, long-term implications. An educated workforce provides the greatest defense against these types of workplace hazards. Through education, awareness, planning, and the implementation of preventive actions, the workplace can be a safe environment.

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