Health, Safety, Security and Environment

Process Title
Abrasive Blasting Program

Process Objective
Ensure compliance with corporate standards and government requirements.

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1 OBJECTIVE

The purpose of this program is to inform Mechanical Systems, Inc. employees of the hazards of abrasive blasting and the safe work practices that should be used to reduce exposure to such hazards. Occasionally, Mechanical Systems, Inc. employees are involved in sandblasting operations. One of the most prevalent hazards associated with sandblasting is the potential for exposure to respirable crystalline silica dust. Silica is a major component of sand, rock and mineral ores. Overexposure to dust that contains microscopic particles of crystalline silica can cause scar tissue to form in the lungs, eventually leading to a disease known as silicosis, a serious and potentially fatal respiratory disease. This program will help to emphasis our commitment to preventing silicosis at our worksites and will also assist Mechanical Systems, Inc. in complying with OSHA regulations on respirable crystalline silica and abrasive blasting (Also see Lead Exposure Control Program). Awareness and planning are keys to protecting the health and safety of our employees.

2 SCOPE

This program applies to all operations where an abrasive is forcibly applied to a surface by pneumatic or hydraulic pressure, or by centrifugal force. It does not apply to steam blasting, or steam cleaning or hydraulic cleaning methods where work is done without the aid of abrasives.

3 DEFINITIONS

**Abrasive**: A solid substance used in an abrasive blasting operation.

**Clean air**: Air of such purity that it will not cause harm or discomfort to an individual if it is inhaled for extended periods of time.

**Dust collector**: A device or combination of devices for separating dust from the air handled by an exhaust ventilation system.

**Exhaust ventilation system**: A system for removing contaminated air from a space, comprising two or more of the following elements (a) enclosure or hood, (b) duct work, (c) dust collecting equipment, (d) exhauster, and (e) discharge stack.

**Particulate-filter respirator**: An air purifying respirator commonly referred to as a dust or a fume respirator, which removes most of the dust or fume from the air passing through the device.

**Respirable dust**: Airborne dust in sizes capable of passing through the upper respiratory system to reach the lower lung passages.
Abrasive blasting: The forcible application of an abrasive to a surface by pneumatic pressure, hydraulic pressure, or centrifugal force.

4 DUST HAZARDS FROM ABRASIVE BLASTING

During abrasive blasting, abrasives and the surface coatings on the materials blasted are shattered and pulverized, and the dust formed may contain particles of respirable size. The composition and toxicity of the dust from these sources must be considered in making an evaluation of the potential health hazards.

- Whenever hazardous substances such as dusts, fumes, mists, vapors, or gases exist or are produced in the course of construction work, their concentrations shall not exceed the limits specified in the "Threshold Limit Values of Airborne Contaminants - 1970" of the American Conference of Governmental Industrial Hygienists. When ventilation is used as an engineering control method, the system shall be installed and operated according to the requirements of this section.
- The concentration of respirable dust or fume in the breathing zone of the abrasive-blasting operator or any other worker shall be kept below the levels specified in § 1910.1000 (Appendix A).
- Organic abrasives, which are combustible, shall be used only in automatic systems. Where flammable or explosive dust mixtures may be present, the construction of the equipment, including the exhaust system and all electric wiring, shall conform to the requirements of American National Standard Installation of Blower and Exhaust Systems for Dust, Stock, and Vapor Removal or Conveying, Z33.1-1961 (NFPA 91-1961). The blast nozzle shall be bonded and grounded to prevent the build up of static charges. Where flammable or explosive dust mixtures may be present, the abrasive blasting enclosure, the ducts, and the dust collector shall be constructed with loose panels or explosion venting areas, located on sides away from any occupied area, to provide for pressure relief in case of explosion, following the principles set forth in the National Fire Protection Association Explosion Venting Guide, NFPA 68-1954.

5 CONTROLS

Depending on the circumstances, engineering controls can sometimes eliminate or reduce the amount of silica in the air and the build-up of dust on equipment and surfaces. Examples of engineering controls include exhaust ventilation and dust collection systems, water sprays, wet drilling, enclosed cabs, and drill platform skirts. When sandblasting is going to take place at a job site, it will be up to the Site Forman and the Safety Director to evaluate the conditions and determine if engineering controls are necessary and feasible for the project.
Mechanical Systems, Inc. will substitute less hazardous materials for abrasive blasting than crystalline silica, when possible. Silica should be avoided as a dry abrasive blasting agent. ANSI/AIHA Z9.4:1997 recommends that silica sand be prohibited as an abrasive blasting agent for use in fixed location abrasive-blast enclosures. There are many abrasive blasting materials available other than silica, such as aluminum oxide, smelter slags, glass beads, plastic beads, or carbon dioxide pellets. Each of these materials has specific characteristics for given applications. The use of sand with lower quartz content, or a large fraction off non-respirable particles content for blasting, will help to reduce the potential hazard associated with silica.

However, no comprehensive studies have been conducted to evaluate the health effects of substitute materials. Until more data is available, engineering controls and personal protective equipment should be used for all sandblasting operations.

6 AIR MONITORING

Air monitoring should be performed to measure worker exposure to airborne crystalline silica and to provide a basis for selecting engineering controls. If airborne contaminants exist in the breathing zone, the appropriate respirator will be provided by the Site Foreman to all exposed employees. The Company that hired Mechanical Systems, Inc., by a competent Mechanical Systems, Inc. employee, or by any other qualified person with air monitoring instrumentation on-site will perform air monitoring. Air monitoring should be performed as needed to measure the effectiveness of the controls. Air samples should be collected and analyzed according to NIOSH Method 7500 and 7602 [NIOSH 1984] or their equivalent. The results of any site air monitoring will be provided to the site employees.

7 CONTAINMENT METHODS

- Blast-Cleaning Machines and Cabinets

Whenever possible, blasting should be done in enclosed blast-cleaning machines or cabinets. These devices permit operators to stand outside the cabinet and direct the stream of abrasive material inside with the hands and arms in gloved arm holes.

- Abrasive Blasting Rooms

Abrasive blasting rooms contain the hazard and protect adjacent workers from exposure. However, such rooms may increase the risk for blasters, since they must work inside the enclosure in high concentrations of hazardous blasting material. Blasting rooms must be ventilated to reduce these concentration and to increase visibility. A supplied-air respirator is required for any blaster working inside a blasting room.
• Portable Blast-Cleaning Equipment

Portable blast-cleaning equipment presents particularly serious health problems because engineering controls are rarely used. Curtains can be used as temporary containment structure to reduce the hazard to adjacent workers and the general public. However, such temporary structures often leak and may allow large amounts of debris to escape. As with abrasive blasting rooms, these structures should be ventilated. During work inside the containment, a supplied air respirator is required for the blaster.

All containment structures should be ventilated to maintain a continuous air flow and prevent any leakage of dust to the outside.

Exhaust air should be discharged to the outside through an appropriate dust collector. The dust collector should be suet up so that accumulated dust can be removed without contaminating work areas.

8 PERSONAL PROTECTIVE EQUIPMENT

Respiratory Protection

OSHA’s health standards require employers to implement engineering or administrative controls to reduce employee exposure to toxic air contaminants within the PEL whenever feasible. Since it is not always feasible to control silica exposure during a sandblasting operation, respirators such as supplied air respirators approved for abrasive blasting are permissible to reduce worker exposure to free silica during the blasting operation. A properly operated and maintained approved abrasive blasting respirator may provide adequate protection to the wearer.

Only respiratory protective equipment approved by the Mine Safety and Health Administration and the National Institute for Occupational Safety and Health will be used for protection of personnel against dusts produced during abrasive-blasting operations.

Abrasive-blasting respirators shall be worn by all abrasive-blasting operators:

• When working inside of blast-cleaning rooms, or
• When using silica sand in manual blasting operations where the nozzle and blast are not physically separated from the operator in an exhaust ventilated enclosure, or
• Where concentrations of toxic dust dispersed by the abrasive blasting may exceed the limits set in § 1910.1000 (Appendix A) and the nozzle and blast are not physically separated from the operator in an exhaust-ventilated enclosure.
Particulate filter respirators, commonly referred to as dust-filter respirators, properly fitted, may be used for short, intermittent, or occasional dust exposures such as cleanup, dumping of dust collectors, or unloading shipments of sand at a receiving point, when it is not feasible to control the dust by enclosure, exhaust ventilation, or other means. Respirators used shall be approved for protection against the specific type of dust encountered.

- Dust-filter respirators may be used to protect the operator of outside abrasive-blasting operations where nonsilica abrasives are used on materials having low toxicities. Mechanical Systems, Inc. will supply 3M 6X00 Half-Mask Respirators with P100 Particulate Filters for this purpose.
- Dust-filter respirators shall not be used for continuous protection where silica sand is used as the blasting abrasive, or toxic materials are blasted (see table on next page for appropriate respirator).

The following table lists the minimum respiratory equipment required to meet the NIOSH REL for crystalline silica under given conditions. Workers will be supplied with the most protective respirator that is feasible and consistent with the task to be performed.

<table>
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<tr>
<th>Condition</th>
<th>Minimum Respiratory Protection Required to meet the NIOSH REL for Crystalline Silica (50 ug/m³)</th>
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<tr>
<td>( \leq 500 \text{ ug/m}^3 ) ( (10\times\text{REL}) )</td>
<td>Any air-purifying respirator with HEPA filter</td>
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<tr>
<td>( \leq 1,250 \text{ ug/m}^3 ) ( (25\times\text{REL}) )</td>
<td>Any powered, air-purifying respirator with a HEPA filter, or&lt;br&gt;Any air supplied respirator equipped with a hood or helmet and operated in a continuous-flow mode (for example, type CE abrasive blasting respirators operated in the continuous-flow mode)</td>
</tr>
<tr>
<td>( \leq 2,500 \text{ ug/m}^3 ) ( (50\times\text{REL}) )</td>
<td>Any powered, air purifying respirator with a tight fitting facepiece and a HEPA filter</td>
</tr>
<tr>
<td>( \leq 50,000 \text{ ug/m}^3 ) ( (1,000 \times\text{REL}) )</td>
<td>Any supplied-air respirator equipped with a half-mask and operated in a pressure-demand or other positive-pressure mode</td>
</tr>
<tr>
<td>( \leq 100,000 \text{ ug/m}^3 ) ( (2,000 \times\text{REL}) )</td>
<td>Any supplied air respirator equipped with a full facepiece and operated in a pressure-demand or other positive-pressure mode</td>
</tr>
<tr>
<td>Planned or emergency entry into environments containing unknown concentrations or concentrations ( \leq 500,000 \text{ ug/m}^3 ) ( (10,000 \times\text{REL}) )</td>
<td>Any self-contained breathing apparatus equipped with a full facepiece and operated in a pressure-demand or other positive pressure mode, or&lt;br&gt;Any supplied air respirator equipped with a full facepiece and operated in a pressure-demand or other positive-pressure mode</td>
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Mechanical Systems, Inc.’s written respiratory protection program based on 29 CFR 1926.103 should be reviewed for more information.

**Air supply and air compressors**

The air for abrasive-blasting respirators shall be free of harmful quantities of dusts, mists, or noxious gases, and shall meet the requirements for air purity set forth in ANSI Z9.2-1960. The air from the regular compressed air line of the plant may be used for the abrasive-blasting respirator if:

1) a trap and carbon filter are installed and regularly maintained, to remove oil, water, scale, and odor,

2) a pressure reducing diaphragm or valve is installed to reduce the pressure down to requirements of the particular type of abrasive-blasting respirator, and

3) an automatic control is provided to either sound an alarm or shut down the compressor in case of overheating.

**Other Personal Protective Equipment**

- Operators shall be equipped with heavy canvas or leather gloves and aprons or equivalent protection to protect them from the impact of abrasives.
- Safety shoes shall be worn to protect against foot injury where heavy pieces of work are handled. Safety shoes shall conform to the requirements of American National Standard for Men's Safety-Toe Footwear, Z41.1-1967.
- Equipment for protection of the eyes and face will be supplied to the operator when the respirator design does not provide such protection and to any other personnel working in the
vicinity of abrasive blasting operations. This equipment shall conform to the requirements of 1926.102.

9 GENERAL SAFE WORK PRACTICES

- Dust shall not be permitted to accumulate on the floor or on ledges outside of an abrasive-blasting enclosure, and dust spills must be cleaned up promptly. Aisles and walkways should be kept clear of steel shot or similar abrasive, which may create a slipping hazard.
- Minimize dust by following good work practices, such as removing dust with a water hose or vacuum with a high-efficiency particulate filter rather than blowing it clean with compressed air, or by wet sweeping instead of dry sweeping.
- Wear, maintain, and correctly use approved particulate respirators provided by Mechanical Systems, Inc. when engineering controls alone are not adequate to reduce exposures below permissible levels. Beards will not be allowed on respirator users, as they interfere with the respirator seal to the face and make most respirators ineffective.
- Change into disposable or washable work clothes at your worksite, shower if possible, and change into clean clothing before leaving the worksite.
- Avoid eating, drinking, or using tobacco products in work areas where there is dust or other toxic materials.
- Wash your hands and face before eating or drinking.
- Park your car where it will not be contaminated with silica and other substances such as lead.
- Abrasive blast cleaning nozzles: The blast cleaning nozzles shall be equipped with an operating valve which must be held open manually. A support shall be provided on which the nozzle may be mounted when it is not in use.
- Compressed air shall not be used for cleaning purposes except where reduced to less than 30 p.s.i. and then only with effective chip guarding and personal protective equipment.

10 TRAINING

Mechanical Systems, Inc. employees will receive training that includes the following (29 CFR 1926.21):

- Information about the potential adverse health effects of silica exposure as well as the potential for exposure to the material being removed during sandblasting (lead paint, for example)
- Material safety data sheets for silica, alternative abrasives, or other hazardous materials
- Instruction about obeying signs that mark the boundaries of work areas containing crystalline silica
- Information about safe handling, labeling, and storage of toxic materials
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- Discussion about the importance of engineering controls, personal hygiene, and work practices in reducing crystalline silica exposure
- Instruction about the use and care of appropriate protective equipment to wear during abrasive blasting operations

All training will be documented and signed by the instructor and will include the employees’ names, signatures, and dates of training. Records of training will be kept on file at the Corporate office with the Safety Manager.

### 11 WARNING SIGNS

If employees will be working in a silica work area, signs will be posted to warn Mechanical Systems, Inc. employees about the hazard and specify any PPE required. The sign below contains the information needed for a silica work area where respirators are required:

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WARNING
CRYSTALLINE SILICA WORK AREA

Exposure may cause silicosis (a serious lung disease), cancer and death
RESPIRATOR REQUIRED
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### 12 MEDICAL MONITORING

Medical examinations will be made available to all workers who may be exposed to crystalline silica. Such examinations should occur before job placement and at least every 3 years thereafter. Annual examinations may be necessary if any Mechanical Systems, Inc. workers at risk of acute or accelerated silicosis. Examinations should include at least the following items:

- A medical and occupational history to collect data on worker exposure to crystalline silica and sings and symptoms of respiratory disease
- A chest X-Ray classified according to the 1980 International Labour Office (ILO) International Classification of Radiographs of Pneumoconiosis
- Pulmonary function testing (spirometry)
- An annual evaluation for tuberculosis