

# Abrasive blasting

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This publication provides practical workplace safety and health information to assist you in making your place of work safer. It is not legal advice. SAIF has made every effort to bring significant Oregon Occupational Safety and Health Administration (Oregon OSHA) regulations to your attention. Nonetheless, compliance with Oregon OSHA remains your responsibility. You should read and understand all relevant Oregon OSHA regulations that apply to your job site(s). You may want to consult with your own attorney regarding aspects of Oregon OSHA that may affect you.

**Note:** The information in this publication is time sensitive. Do not rely upon this document if its publication date is more than three years old. Please check the "Safety and health" section of our web site at [saif.com/safetyandhealth](http://saif.com/safetyandhealth) for a more recent, printable copy. You'll also find a variety of other valuable safety information designed to help your business prevent injuries and control costs.

## Introduction

Abrasive blasting operations forcibly apply abrasive materials to surfaces using pneumatic pressure, hydraulic pressure, or centrifugal force. In addition to exposure to the impact of rebounding material, hazards related to abrasive blasting include the toxicity of the abrasive material and the surface being abraded.

This guide will review the Oregon OSHA code OAR 437 Division 2 Subdivision G Occupational Health & Environmental Control 1910.94 (a) Abrasive blasting, and other safety information to guide you in safe abrasive blasting operations.

## Abrasive blasting hazards

### Dust hazards

Abrasives and surface coatings on materials are shattered and pulverized during blasting operations. The dust formed will contain particles that could result in the following:

- Respiratory hazards
- Fire hazards
- Explosion hazards

Wet blasting methods minimize dust exposure, but dispersed droplets, mists, and dried residues may become airborne and create potential exposures.

1. Evaluate the potential health hazards from abrasive blasting operations by considering the composition and toxicity of the abrasive material and the surface being abraded.
2. Keep dust concentrations below the permissible exposure limits found in Oregon OSHA code OAR 437, Division 2 Subdivision Z – Toxic and Hazardous Substances.
3. Evaluate the combustible dust hazard controls of the abrasive blasting process. For more information, refer to SAIF's Combustible dust guide.

### Noise hazards

Abrasive blasting operations can be loud and expose operators to potentially hazardous noise levels. Assess employee noise exposures to determine if they need to be part of a hearing conservation program. Refer to the Oregon OSHA Hearing Conservation Program fact sheet for more information: [osha.oregon.gov/OSHApubs/factsheets/fs01.pdf](https://osha.oregon.gov/OSHApubs/factsheets/fs01.pdf)

### Other hazards

Operators need to be equipped with heavy canvas or leather gloves and aprons, or equivalent protection, to protect them from the impact of abrasives. Safety shoes need to be worn to protect against foot injury where heavy pieces of work are handled.

Eye and face protection must be supplied to the operator—and to any other personnel working in the vicinity of abrasive blasting operations—when the respirator design does not provide such protection (e.g. full face respirator).

## Types of abrasives used in blasting operations

Type of abrasive	Examples of abrasives	Other information
Synthetic or natural mineral grains	Crystalline silica Garnet	Silica sand is the most hazardous. Limit the use of silica sand wherever possible. For types of abrasive used in place of silica, go to the Occupational Safety and Health Administration's (OSHA) silica topic page at: <a href="https://osha.oregon.gov/Pages/topics/silica.aspx">https://osha.oregon.gov/Pages/topics/silica.aspx</a>
Slag abrasive	Copper slag Nickel slag Mixed metal slag	Contains heavy metals and impurities. Exposure to heavy metals can cause a variety of adverse health impacts.
Metallic shot or grit	Steel Chilled cast iron	The potential dust hazard is usually lower than other kinds of abrasives.
Organic	Ground corncobs Ground walnut shells	Readily combustible organic abrasives can form explosive mixtures with air. <ul style="list-style-type: none"> <li>Prohibit the use of combustible organic abrasives, except in automatic blast cleaning systems.</li> <li>Bond and ground the blast nozzle to prevent the buildup of static charges.</li> <li>Refer to SAIF's combustible dust guide for more information: <a href="http://www.saif.com/combustibledust">www.saif.com/combustibledust</a></li> </ul>
Other alternative abrasives	Sodium bicarbonate Dry ice Plastic bead media	These materials are considered less hazardous than those listed above. Use of less hazardous alternative abrasive materials are recommended when feasible.

## Coatings removed in blasting operations

Types of coatings	Examples of coatings	Other information
Surface <ul style="list-style-type: none"> <li>Formed or applied during the fabrication of a part</li> </ul>	Those containing toxic metals: <ul style="list-style-type: none"> <li>Paints containing mercury</li> <li>Cadmium plating</li> <li>Lead paints on structural steel</li> </ul>	To evaluate potential hazards in coatings, the specific components contained within the coating need to be understood.
Protective and other <ul style="list-style-type: none"> <li>Applied after fabrication</li> </ul>	Those containing toxic metals: <ul style="list-style-type: none"> <li>Paints containing mercury</li> <li>Cadmium plating</li> <li>Lead paints on structural steel</li> <li>Lead deposits on pistons of internal combustible engines</li> </ul>	

## Personal protective equipment (PPE)

### Respiratory equipment

The National Institute for Occupational Safety and Health (NIOSH) is the certifying agency for respiratory protection. Specifically, 42 CFR Part 84 covers respiratory protective devices. A NIOSH-approved respirator must be worn by personnel exposed to concentrations of particulate matter or other hazards that are above the Oregon OSHA Permissible Exposure Limits (PELs) found in Oregon OSHA code OAR 437, Division 2 Subdivision Z – Toxic and Hazardous Substances. SAIF strongly recommends that personal protective equipment (PPE) be worn when Threshold Limit Values (TLVs) established by the American Conference of Governmental Industrial Hygienists (ACGIH) are exceeded to protect workers against recognized adverse health outcomes. For more information, refer to SAIF’s respiratory protection guide.

### Type of PPE to be provided during blasting operations

Type	When to provide
Abrasive blasting respirators—A supplied air or continuous flow respirator constructed to cover and protect the operator’s head, neck, and shoulders from rebounding abrasive	Work in any of the following situations: <ul style="list-style-type: none"><li>• Inside blast cleaning rooms</li><li>• Where silica sand is used in manual blasting operations</li><li>• Where concentrations of toxic dust exceed occupational exposure limits</li></ul> <p><i>Exception:</i> An abrasive respirator doesn’t need to be worn if the operator is physically separated from the nozzle and blast by an exhaust ventilated enclosure.</p>
Elastomeric negative pressure (cartridge) or filtering facepiece (dust mask) respirator	Work with short, intermittent, or occasional dust exposures during the following tasks: <ul style="list-style-type: none"><li>• Abrasive blasting operations performed outside the enclosure or outdoors where non-silica abrasives are used on materials with low toxicity</li><li>• Clean-up</li><li>• Dumping dust collectors</li><li>• Unloading shipments of sand at receiving areas when the following controls are not feasible: enclosures, exhaust ventilation, or other means</li></ul>
Eye and face protection	If respirators worn during blasting operations don’t provide eye and face protection for operators or for personnel working nearby
Gloves and aprons made of heavy canvas or leather, or equivalent protection	Operators are exposed to the impact of rebounding abrasives.

### Housekeeping

Abrasive blasting operations can create slick floor or other surface conditions that result in injuries related to slip, trips, and falls. Housekeeping procedures should include:

- Keeping aisles and walkways clear of steel shot or similar abrasives that may create a slipping hazard
- Prohibiting the accumulation of dust on the floors or ledges outside blasting enclosures

- Cleaning up dust spills promptly
- Using a high-efficiency particulate air filter (HEPA) vacuum cleaner, by a person wearing a respirator approved for the existing conditions, when the plant is not in operation

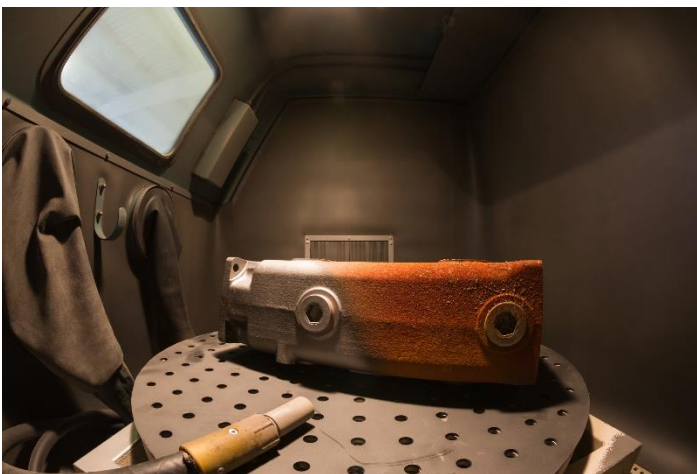
## Blast cleaning enclosures

Two basic types of enclosures are used for abrasive blasting:

1. **Blasting cabinet:** An enclosure where the operator stands outside, operating necessary controls or blasting nozzle from outside of the enclosure.



2. **Blast cleaning room:** A complete enclosure in which abrasive blasting is performed with the operator working inside the room.



## Blast cleaning enclosure recommendations

If you have	Then make sure
Air inlets and access openings	They are either baffled or arranged so the combination of inward airflow and baffles minimizes both of the following: <ul style="list-style-type: none"> <li>• The escape of abrasive or dust particles into adjacent work areas</li> <li>• Visible spurts of dust</li> </ul>
Small access openings where dust might escape	Slit-resistant baffles are installed in multiple sets of all small access openings. Do both of the following: <ul style="list-style-type: none"> <li>• Regularly inspect them.</li> <li>• Replace them when needed.</li> </ul>
An observation window in enclosures where hard, deep-cutting abrasives are used	The window is made of safety glass protected by screening. <i>Caution:</i> <ul style="list-style-type: none"> <li>• Hard, deep-cutting abrasives may shatter normal glass.</li> <li>• If the safety glass shatters, the protective screening will help contain the glass and protect employees from cuts and lacerations.</li> </ul>
Small operator-access doors	They are flanged and tight when closed, and open from both inside and outside the enclosure.  <i>Exception:</i> If there is a small operator-access door and a large work-access door, the large work-access door may open or close from the outside only.

## Blast cleaning enclosures and recommended air velocities

Examples of blast-cleaning enclosures	Recommended air velocities in feet of air per minute (fpm)
Abrasive blasting cabinets	At least 500 fpm at the hand openings
Blast-cleaning rooms	At least 200 fpm with well baffled air inlets Minimum 90 fpm for small rooms with downdraft ventilation Minimum 100 fpm for small rooms with cross draft ventilation
Rotary blast-cleaning tables	250 fpm at the access opening
Abrasive separators	250 fpm at all openings
Bucket elevators	
Other accessory abrasive handling equipment, including blast-cleaning drums and barrels	

Reference: ANSI Z9.4-2011 Abrasive Blasting Operations – Ventilation and Safe Practices for Fixed Location Enclosures

The exhaust systems should be constructed, installed, inspected, and maintained to meet both of the following:

- The American National Standards Institute (ANSI/AIHA), Z9.2-2006 for – Fundamentals Governing the Design and Operation of Local Exhaust Systems
- The National Fire Protection Association (NFPA) 91-2010 for – Exhaust Systems for Air Conveying of Vapors, Gases, and Noncombustible Particulate Solids

If flammable or explosive dust mixtures may be present:

- Make sure the construction of equipment, including the exhaust system and all electrical wiring, meets both of the following:
  1. The American National Standard Installation of Blower and Exhaust Systems for Dust, Stock, and Vapor Removal or Conveying, NFPA 91-1961
  2. The electrical requirements for Class II locations
- Make sure blast-cleaning enclosures, ducts, and dust collector are constructed with either loose panels or explosion venting areas that meet all of the following:
  1. Provide pressure relief in case of an explosion
  2. Are located away from occupied areas
  3. The Standard on Explosion Protection by Deflagration Venting, NFPA 68-2007

## Specific operating requirements

### Blasting cabinets

- Ventilation is required so that there is a continuous flow of air into all openings in the enclosure during blasting. The exhaust must promptly clear the dust-laden air within the cabinet after blasting.
- Inlets and access openings are to be baffled to minimize escape of abrasive or dust particles into adjacent work areas. No visible spurts of dust are to be observed. Slit, abrasive-resistant baffles are needed at all small access openings where dust might escape. These are to be regularly inspected and replaced when needed.
- Before the cabinet is opened, the blast is to be closed off, and the exhaust system operated long enough to remove the dusty air within.
- Safety glass protected by screening is needed for observation windows where hard-cutting abrasives are used.
- Doors are to be flanged and fit tight when closed.
- Dust leaks are to be promptly repaired.
- Static pressure drop at exhaust ducts is to be measured after installation and periodically thereafter to assure satisfactory operation.
- Exhaust ducts are to be cleaned whenever there is an indication of a partial blockage.
- An abrasive separator is to be used in installations where the abrasive is recirculated.
- Air exhaust from the cabinet is to be discharged through dust collecting equipment.
- Dust collectors are to be installed so that accumulated dust can be emptied and removed without contaminating other work areas.



## **Blast cleaning rooms**

- Ventilation is needed so that there is a continuous flow of air into the room from all doorways and other openings.
- Doors on blast-cleaning rooms are to be operable from both inside and outside. If there is a small operator-access door, the large work-access door may be closed or opened from the outside only.
- Static pressure drop at exhaust ducts is to be measured after installation and periodically thereafter to assure satisfactory operation.
- Exhaust ducts are to be cleaned whenever there is an indication of a partial blockage.
- An abrasive separator is to be used in installations where the abrasive is recirculated.
- Air exhaust from the room is to be discharged through dust collecting equipment.
- Dust collectors are to be installed so that accumulated dust can be emptied and removed without contaminating other work areas.

## **Open air blasting**

Ventilation for open air blasting work is not needed. Provide and ensure use of personal protective equipment for the abrasive blaster.

## **Blast cleaning nozzles**

Make sure all of the following are true:

- Nozzles are mounted on a support when not in use.
- Nozzles are equipped with operating valves that are manually held open.
- Pressurized tanks used to supply abrasive are connected to the manual control of the nozzle to prevent the buildup of static charges.
- The relief valve or opening is located so that it can safely vent.

## **Inspection and maintenance**

- Make sure the exhaust ventilation system is fully operational by checking the static pressure drop at the exhaust ducts leading from the equipment when an installation is completed and annually after installation.
- Repair or clean exhaust systems when dust leaks are found or the pressure drop gauge indicates a change exceeding 20 percent.
- Use an abrasive separator to separate larger particles for reuse on installations where abrasive is recirculated.
- Set up dust collecting equipment to:
  1. Empty and remove accumulated dust without contaminating work areas
  2. Discharge the air used in blast-cleaning equipment
- Dispose of fine dust from dry collectors by:
  1. Emptying and transporting the fine dust in enclosed containers
  2. Using a sluice with a wetting process to contain the dust

## Resources

Oregon OSHA topic page: Blasting

[osha.oregon.gov/Pages/topics/blasting.aspx](https://www.osha.oregon.gov/Pages/topics/blasting.aspx)

Federal OSHA safety and health topics: Silica, Crystalline

[www.osha.gov/dsg/topics/silicacrystalline/index.html](https://www.osha.gov/dsg/topics/silicacrystalline/index.html)

SAIF safety and health links: Respiratory protection

[www.saif.com/S833](https://www.saif.com/S833)

American National Institute Standards - ANSI Z9.4-2011 Abrasive Blasting Operations – Ventilation and Safe Practices for Fixed Location Enclosures (Available for purchase)

[webstore.ansi.org/Standards/ASSE/ansiaihaassez92011](https://webstore.ansi.org/Standards/ASSE/ansiaihaassez92011)