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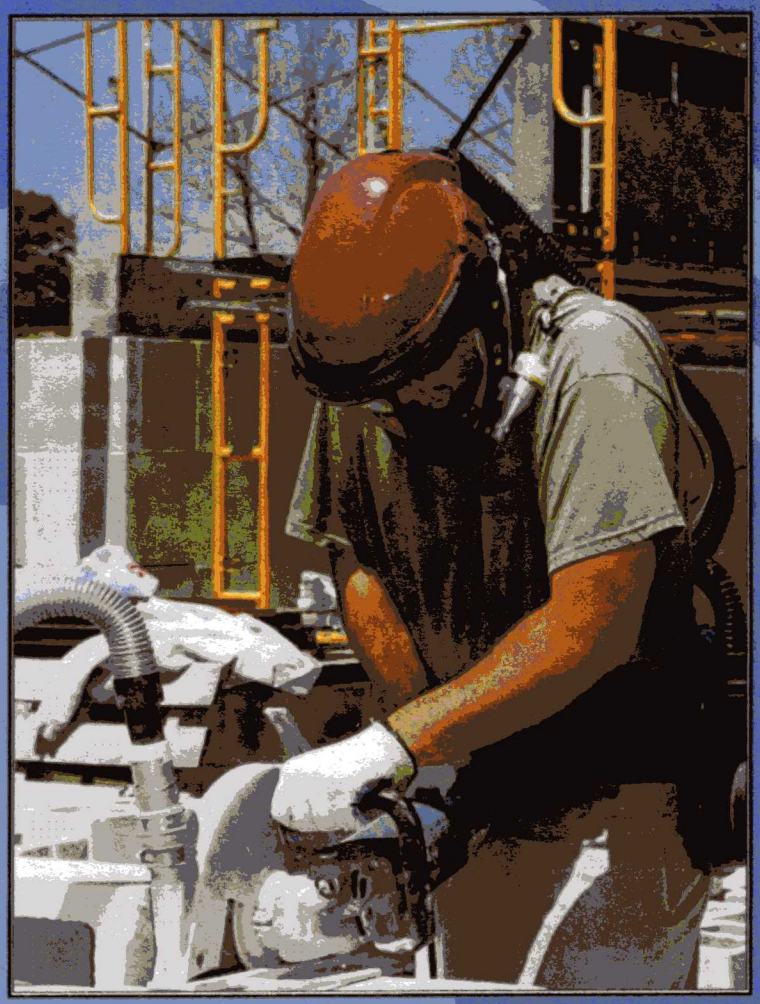
Controlling Silica Exposures in Construction



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General Housekeeping and Use of Dust Suppressants

This section covers dust control methods for general housekeeping activities at construction sites, including site cleaning, material handling and the use of dust suppressants. The term "silica" used in this document refers to respirable crystalline silica.

Introduction

Exposure to fine particles of silica has been shown to cause silicosis, a serious and sometimes fatal lung disease. Construction employees who inhale fine particles of silica may be at risk of developing this disease. Silica dust can be generated when materials such as ceramics, concrete, masonry, rock and sand are mixed, blasted, chipped, cut, crushed, drilled, dumped, ground, mixed or driven upon. Employees at construction sites may be exposed to silica dust during general housekeeping activities such as sweeping, emptying vacuum cleaners and using compressed air for cleaning. Silica exposures may also occur whenever silica-containing dusts are disturbed, such as during material handling. The small particles generated during these activities easily become suspended in the air and, when inhaled, penetrate deep into employees' lungs.

Examples of Construction Materials that Contain Silica

- Concrete
- Brick, tile and other masonry
- Mortar
- Asphalt
- Sand
- Many stone products (such as granite, slate and sandstone) and rock aggregate[1]

In several studies of construction sites, silica exposure levels rose when employees engaged in general construction cleaning activities such as dry sweeping, using backpack blowing equipment and emptying vacuums used to collect concrete dust.[2] For example, the National Institute for Occupational Safety and Health (NIOSH) determined that a concrete finisher handling a vacuum bag containing concrete dust was exposed to approximately 0.79 mg/m³ (milligrams of silica per cubic meter of air) (NIOSH, 2001b).[3] This level is more than five times higher than the finisher's average silica exposure for the day, which already exceeded the Occupational Safety and Health Administration's (OSHA) benchmark of 0.1 mg/m³ (milligrams per cubic meter of air) as an 8-hour time-weighted average (TWA), an exposure approximately equivalent to OSHA's general industry permissible exposure limit (PEL).[4] While most employees do not handle vacuum bags for their full shifts, this activity presents a significant source of exposure for employees who may also be exposed to silica from other sources.

Housekeeping Activities that Can Release Airborne Dust Containing Silica

- Dry sweeping
- Using blowers or compressed air for cleaning
- Dumping bags of raw material
- Dumping wheelbarrow loads
- Breaking or crushing materials
- Spreading crushed materials (concrete, aggregate)
- Dropping, tossing, or pouring dusty materials
- Operating a vacuum with the air discharge near a source of dust
- Emptying vacuums
- Driving over piles of dust or debris
- Other actions that disturb or create dust

This section describes several methods available to reduce employees' silica exposure during housekeeping and related activities. These methods include general measures to suppress the creation of dusts (use of water and other dust suppressants), vacuuming, using cabs and enclosures, and modification of work practices. Many of these methods can be used to reduce exposures to silica in a broad range of construction activities in addition to housekeeping tasks.

Visible and Respirable Dust

Visible dust contains large particles that are easy to see. The tiny, respirable-sized particles (those that can get into the deep lung) containing silica pose the greatest hazard and are not visible. Most dust-generating construction activities produce a mixture of visible and respirable particles.

Do use visible dust as a general guide for improving dust suppression efforts. If you see visible dust being generated, emissions of respirable silica are probably too high. Measures that control tool-generated dust at the source

require less suction power to move air through filters with larger areas. Manufacturers often provide information about filter surface area.

Cabs and Enclosures

Use material handling equipment for moving large amounts of silica-containing dusty material. Select equipment with enclosed cabs and positive pressure ventilation systems (to isolate operators from dust) and air conditioning (to encourage operators to keep windows and doors closed, so dust stays out). Many cabs can be retrofitted to add a filtered ventilation system and air conditioning.[10]

Put the cab on a regular maintenance schedule. Check for leaking seals around windows, doors and electrical wiring. Change ventilation system filters on schedule. For maximum protection from exposure to small particles, use the most efficient filter recommended by the cab manufacturer.

Clean the cab interior daily so that dust does not accumulate and is not dispersed by the cab ventilation system.

Compressed Air

The use of compressed air to clean surfaces or clothing is strongly discouraged. Using compressed air to clean work surfaces or clothing can significantly increase employee exposure, especially in enclosed and semi-enclosed spaces. Cleaning should be performed with a HEPA-filtered vacuum or by wet methods.

Work Practices

Common sense work practices can help employees limit their exposure to silica. Examples include:

- Clean up spills and waste before dust can spread.
- Wear a rubber apron to keep wet dust off clothing. When it dries, the dust can become airborne.
- Whenever possible, work upwind of any dust sources. This can be as simple as working from the other side of the pile when shoveling debris.
- Keep roadways damp at sites where the surface includes high silica aggregate or crushed concrete.
- Wet down silica-containing debris and rock spoil piles prior to removal or disturbance.

Encourage employees to watch for dust sources containing silica and make adjustments or use dust control methods to reduce their silica exposure.

Dumping or Pouring Materials

The farther objects fall when dropped, the more dust they will generate on impact. When dumping or pouring materials (for example, debris into a dumpster or raw materials into a mixer), minimize drop distances by releasing materials close to their destination level. Support the bag, bin, or barrow just above the top of the pile and slowly add materials onto the pile. When a long drop is unavoidable, use enclosed disposal chutes or slides.

Use wheelbarrow ramps of appropriate height (not too tall for a small dump pile).

Moisten the dumpster contents, floors and walls prior to adding any debris to reduce dust released upon impact.

Spray the debris stream with water mist to help suppress dust.

Sweeping

Take steps to limit the use of dry sweeping. Reduce the quantity of debris and the distance and frequency of sweeping. Use a vacuum or wet mop, or moisten the material and scrape it into position.

Collect and transport debris by bucket or wheelbarrow from smaller local piles rather than pushing it for longer distances to a central pile.

Avoid dry sweeping debris with sweeping compounds that contain quartz sand (crystalline silica) as the grit.

Removing Debris from Slots or Uneven Surfaces

Use a vacuum instead of a blower. Use vacuum hose attachments sized for the situation. For example, remove tailings from handheld drill holes using a HEPA-filtered vacuum.

Flush cracks with water instead of using compressed air.

Vacuums

Use vacuums with self-cleaning features (backpulse). Make sure that employees are fully trained in vacuum operation.

Handle vacuum bags carefully and have a disposal receptacle nearby.

Avoid overfilling vacuum canisters or bags. The extra weight makes bags difficult to handle and subject to tearing.

Avoid shaking or jarring the vacuum. Follow the manufacturer's instructions for recommended handling.

Avoid depositing or storing collected debris where it will be disturbed or run over and become a source of dust exposure for another employee.

WARNING:

Breathing Silica Dust Can Cause Silicosis
-A Progressive, Sometimes Fatal Lung Disease-
May Cause Cancer

The vast majority of sorbent material used today is clay or clay based (i.e. diatomaceous earth). Clays are composed primarily of silica (SiO) and the dust from these products contains crystalline silica. Silica dust has been linked to a least two critical health problems: silicosis, a progressive and sometime fatal lung disease, and cancer. The consumer will be pleased to know that governments are starting to do something about warning the public of these dangers.

On November 4, 1989, California voters overwhelmingly approved Proposition 65, commonly referred to as the consumer protection act, consumer product warning label law, etc. As a part of this program, California now requires that consumer products containing clay and diatomaceous earth in the form allowing dust generation, will have to carry a warning label., Under #12601, b4A: WARNING: "THIS PRODUCT CONTAINS SILICA, KNOWN TO THE STATE OF CALIFORNIA TO CAUSE CANCER" would be the warning appropriate to clay and diatomaceous earth products.

It does not take large amounts of clay dust to create a problem. New U.S. Department of Labor, OSHA standards for silica-containing dust have been established at 0.1 milligrams per cubic meter. Based on manufacturer's data a typical clay absorbent contains approximately 0.1 percent dust by weight. Do not forget that we are talking about dust in the air which is very light material. It does not require much weight to create a respectable dust cloud.

Calculations show one 10 pound bag of clay that is 99.9% dust free includes 4 grams of silica dust. Four grams is enough to contaminate 40,000 cubic meters of space or 100 average homes. If evenly distributed, the quantity of silica-containing dust would require each person in the area to wear a dust mask in order to meet work place health standards.

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Exposure
Measure Amount
Compare to Limit
Protection

Deaths from Silica in the Workplace

The first column is the occupational title. The second column (PMR) is the observed number of deaths from silicosis per occupation divided by the expected number of deaths. Therefore, a value of one indicates no additiona risk. A value of ten would indicate a risk ten times greater than normal risk o silicosis. The first table below provides risk by occupation and the second provides risk by industry.

OCCUPATION	PMR
Miscellaneous metal and plastic machine operators	168.44
Hand molders and shapers, except jewelers	64.12
Crushing and grinding machine operators	50.97
Hand molding, casting, and forming occupations	35.70
Molding and casting machine operators	30.60
Mining machine operators	19.61
Mining occupations, *n.e.c.	15.33
Construction trades, *n.e.c.	14.77
Grinding, abrading, buffing, and polishing machine operators	8.47
Heavy equipment mechanics	7.72
Miscellaneous material moving equipment operators	6.92
Millwrights	6.56
Crane and tower operators	6.02
Brickmasons and stonemasons	4.71
Painters, construction and maintenance	4.50
Furnace, kiln, oven operators, except food	4.10
Laborers, except construction	3.79
Operating engineers	3.56
Welders and cutters	3.01

Machine operators, not specified	2.86
Not specified mechanics and repairers	2.84
Supervisors, production occupations	2.73
Construction laborers	2.14
Machinists	1.79
Janitors and cleaners	1.78

INDUSTRY	PMR
Metal mining	69.51
Miscellaneous nonmetallic mineral and stone products	55.31
Nonmetallic mining and quarrying, except fuel	49.77
Iron and steel foundries	31.15
Pottery and related products	30.73
Structural clay products	27.82
Coal mining	9.26
Blast furnaces, steelworks, rolling and finishing mills	6.49
Miscellaneous fabricated metal products	5.87
Miscellaneous retail stores	4.63
Machinery, except electrical, *n.e.c.	3.96
Other primary metal industries	3.63
Industrial and miscellaneous chemicals	2.72
Not specified manufacturing industries	2.67
Construction	1.82

*n.e.c. – not elsewhere classified

See References 17 and 18 in the Bibliography.

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