Individuals with chronic silicosis are more susceptible to developing active tuberculosis than the general population. However, it is not clear whether low-level exposure to silica, in cases where silicosis has not developed, also predisposes employees to tuberculosis [Davis, 1996].

Chronic Obstructive Pulmonary Disorder

Epidemiologic studies have shown that occupational exposure to respirable crystalline silica is associated with chronic obstructive pulmonary disease, including bronchitis and emphysema. The findings from some of these studies suggest that emphysema and bronchitis may occur less frequently or not all in nonsmokers. Epidemiologic studies have also found significant increases in mortality from nonmalignant respiratory disease, a category that includes silicosis, emphysema, and bronchitis, as well as some other related pulmonary diseases [NIOSH, 2002].

Immunologic Disorders and Autoimmune Diseases

Several epidemiologic studies have found statistically significant increases in mortality from or cases of immunologic disorders and autoimmune diseases in employees exposed to silica. These disorders and diseases include scleroderma (a rare multisystem disorder characterized by inflammatory, vascular, and fibrotic changes usually involving the skin, blood vessels, joints, and skeletal muscle), rheumatoid arthritis, systemic lupus erythematosus (lupus), and sarcoidosis (a rare multisystem granulomatous disease characterized by alterations in the immune system) [NIOSH, 2002].

Renal Disease

Epidemiological studies report statistically significant associations between occupational exposure to silica dust and several renal diseases or effects, including end-stage renal disease morbidity (including that caused by glomerular nephritis, chronic renal disease mortality, and Wegener's granulomatosis (systemic vasculitis often accompanied by glomerulonephritis) [NIOSH, 2002].

Stomach and Other Cancers

There is some evidence from studies of various occupational groups exposed to crystalline silica of statistically significant excesses of mortality from stomach or gastric cancer. However, most of these studies did not adjust for confounding factors and possible exposure-response relationships were not assessed. Similar issues with confounding and lack of exposure-response assessment exist for the infrequent reports of statistically significant numbers of excess deaths or cases in silica-exposed employees of other non-lung cancers such as nasopharyngeal or pharyngeal, salivary gland, liver, bone, pancreatic, skin, esophageal, digestive system, intestinal or peritoneal, lymphopoietic or hematopoietic, brain, and bladder [NIOSH, 2002].

Summary

As these health findings indicate, crystalline silica exposure is associated with a number of diseases, in addition to silicosis. Silica exposure continues to pose substantial risks to employees, centuries after it was first identified as an occupational hazard. The only way to prevent disease is to eliminate exposure to crystalline silica or reduce crystalline silica exposure to safe levels.

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Appendix B: Industries with Potential Overexposure to Crystalline Silica

This appendix contains a list of industries in which employees may be exposed to elevated levels of crystalline silica. The list is based on a review of inspection data from OSHA's Integrated Management Information System (IMIS) for crystalline silica (quartz), for the period January 1996 through March 2007. This table is intended to show the range of industries in which crystalline silica exposure may occur, but should not be considered to be an exhaustive listing. Employee exposure to crystalline silica may occur in industries not listed here. Likewise, crystalline silica exposure does not occur in all establishments encompassed within these North American Industry Classification System (NAICS) or Standard Industrial Classification (SIC) codes.

Industries with Crystalline Silica Exposure, 1996–2007		
1987 SIC Code[1]	1987 SIC Industry Title	2002 NAICS Code[2]
1521	General Contractors–Single Family Houses	236115, 236118
1522	General Contractors–Residential Buildings Other Than Single-Family	236115, 236118
1541	General Contractors–Industrial Buildings and Warehouses	236210, 236220
1611	Highway and Street Construction, Except Elevated Highways	237310
1622	Bridge, Tunnel, and Elevated Highway Construction	237310, 237990
1623	Water, Sewer, Pipeline, and Communications and Power Line Construction	237110, 237120, 237130
1629	Heavy Construction, n.e.c.	236210, 237110, 237120, 237130, 237990
1721	Painting and Paper Hanging*	237310, 238320
1741	Masonry, Stone Setting, and Other Stone Work	238140
1742	Plastering, Drywall, Acoustical, and Insulation Work	238310
1761	Roofing, Siding, and Sheet Metal Work	238160, 238170, 238390
1771	Concrete Work	238110, 238140, 238990
1794	Excavation Work	238910
1795	Wrecking and Demolition Work	238910
1799	Special Trade Contractors, n.e.c.	236220, 237990, 238150, 238190, 238290
3251	Brick and Structural Clay Tile	327121, 327331
3253	Ceramic Wall and Floor Tile	327122
3255	Clay Refractories	327124

Industries with Crystalline Silica Exposure, 1996–2007		
1987 SIC Code[1]	1987 SIC Industry Title	2002 NAICS Code[2]
3261	Vitreous China Plumbing Fixtures and China and Earthenware Fittings and Bathroom Accessories	327111
3262	Vitreous China Table and Kitchen Articles	327112
3264	Porcelain Electrical Supplies	327113
3269	Pottery Products, n.e.c.	327112
3271	Concrete Block and Brick	327331
3272	Concrete Products, Except Block and Bricks	327332, 327390, 32799
3273	Ready-Mixed Concrete	327320
3281	Cut Stone and Stone Products	327991
3291	Abrasive Products	327910, 332999
3299	Nonmetallic Mineral Products, n.e.c.	327112, 327420, 327999
3312	Steel Works, Blast Furnaces (Including Coke Ovens), and Rolling Mills	324199, 331111, 331221
3321	Gray and Ductile Iron Foundries	331511
3322	Malleable Iron Foundries	331511
3325	Steel Foundries, n.e.c.	331513
3334	Primary Production of Aluminum	331312
3365	Aluminum Foundries	331524
3366	Copper Foundries	331525
3369	Nonferrous Foundries, Except Aluminum and Copper	331528
3431	Enameled Iron and Metal Sanitary Ware	332998
3441	Fabricated and Structural Metal*	332312
3443	Fabricated Plate Work (Boiler Shops)*	332313, 332410, 332420
3444	Sheet Metal Work*	332321, 332322, 332439, 333415
3471	Electroplating, Polishing, Anodizing, and Coloring*	332813
3479	Coating, Engraving, and Allied Services, n.e.c.*	332812, 339911, 339912, 339914
3531	Construction Machinery and Equipment*	333120, 333923, 336510

Industries with Crystalline Silica Exposure, 1996–2007		
1987 SIC Code[1]	1987 SIC Industry Title	2002 NAICS Code[2]
3599	Industrial and Commercial Machinery and Equipment*	332710, 332813, 332999, 333319, 333999, 334519, 336399
3715	Truck Trailers*	336212
5032	Brick, Stone, and Related Construction Materials[3]	423320, 425110, 425120, 444190
7532	Top, Body, and Upholstery Repair Shops and Paint Shops*	811121

*Crystalline silica exposure primarily from abrasive blasting operations

[1] *Standard Industrial Classification Manual*, 1987. Executive Office of the President, Office of Management and Budget.

[2] *North American Industry Classification System*, United States, 2002. Executive Office of the President, Office of Management and Budget.

3 This industry may be subject to OSHA Instruction CPL 02-00-051 - Enforcement Exemptions and Limitations under the Appropriations Act (or a subsequent version).

Source: Federal OSHA Inspection Data for Silica (Code 9010–Quartz) compiled in the OSHA Integrated Management Information System (IMIS), from 01/01/1996 through 03/31/2007.

Appendix C – Guidelines for Air Sampling

This appendix summarizes the procedures for collecting air samples of respirable crystalline silica, contained in OSHA sampling and analytical method ID-142. Although OSHA ID-142 applies to the collection of quartz and cristobalite, tridymite can also be collected and analyzed using this method if the appropriate reference material and diffraction pattern are used. Compliance Safety and Health Officers (CSHOs) should consult the method directly for detailed information. Additionally, information on respirable dust samplers and crystalline silica sampling is contained in the OSHA Technical Manual, Section II: Chapter I.

Sampling Equipment

1. A 5-μm pore size, 37-mm diameter polyvinyl chloride (PVC) filter, preceded by a 10-mm nylon Dorr-Oliver cyclone, is used with a personal sampling pump for the collection of airborne respirable crystalline silica. Note: SKC metal cyclones shall not be used for sampling respirable dust (OSHA Instruction TED 01-00-015 [TED1-0.15A]). The metal cyclones do not “cut” the appropriate particle size as required by the OSHA standard.
2. CSHOs may obtain pre-weighed PVC filters by contacting OSHA's Salt Lake Technical Center (SLTC) or Cincinnati Technical Center (CTC).

Sampling Instructions

1. Calibrate the personal sampling pump to a flow rate of 1.7 liters per minute (L/min), with a representative sampler assembly (cyclone, filter, etc.) in-line. The pump shall be calibrated before and after each use. Refer to the OSHA Technical Manual (OTM), Section II: Chapter 1, for detailed information on pump calibration when sampling with cyclones. The recommended and maximum sampling time is 480 minutes (resulting in a sample air volume of 816 liters at 1.7 L/min.), and the minimum sample time is 240 minutes (408 liters collected at 1.7 L/min.).
2. Before and after each use, clean the cyclone gently, taking care not to scratch it. A leak test must be conducted on a cyclone at least once a month with regular usage. Refer to the OSHA OTM Section 1: Chapter 1. Also, Appendix D summarizes the Cyclone Leak Test Procedure.
3. The cyclone shall be positioned outside of the employee's personal protective equipment but within the breathing zone. Do not allow the cyclone to be inverted during or after sampling. Maintain the cyclone in an upright position until the filter is removed from the cyclone.
4. Check the pump and sampling assembly periodically, to verify pump performance and monitor particulate loading on the sample filter. Filters should be replaced when employees move to another task or activity, or if observation during sampling suggests possible filter overload (greater than 3 mg.). [Note: The CSHO should not enter an area while the abrasive blasting operation is active.]
5. When submitting the sample to the laboratory, indicate whether the requested analysis is for quartz, cristobalite, or both. Operations in which the material has been heated to high temperatures generally should be analyzed for both. When other airborne compounds are known or suspected to be present, such information, including the suspected identities, should be provided to the laboratory. Where possible, a copy of the {MSDS/SDS} should be

submitted to aid in identifying interferences. Potential analytical interferences are listed in Appendix A of OSHA ID-142. A partial listing follows:

- Aluminum phosphate
- Feldspars (microcline, orthoclase, plagioclase)
- Graphite
- Iron carbide
- Lead sulfate
- Micas (biotite, muscovite)
- Montmorillonite
- Potash
- Sillimanite
- Silver chloride
- Talc
- Zircon (Zirconium silicate).

6. Identify and submit an appropriate blank filter from each lot of filters used.

7. Obtain bulk samples in accordance with standard procedures described in the OTM, Section II: Chapter 1. The bulk sample should be representative of the airborne silica content of the work environment, e.g., from settled dust. A bulk sample of the raw material should be collected to evaluate compliance with the Hazard Communication standard. The type of bulk sample shall be stated on the OSHA-91 form and cross-referenced to the appropriate air samples.

Determining Compliance with the PEL for Respirable Crystalline Silica

The General Industry permissible exposure limit (PEL) for respirable dust containing crystalline silica (as quartz), codified at 29 CFR 1910.1000, is determined individually for each sample, according to the following formula:

$$PEL\,(mg/m^3) = \frac{10\ mg/m^3}{2 + \%\ respirable\ quartz}$$

The PEL can be calculated either by following the steps below, or by accessing the "Advisor Genius" on-line at the OSHA web site. The Advisor Genius performs the calculations for a respirable dust sample and yields three values: the PEL for the sample, the respirable dust exposure result, and the severity.

To determine the PEL for an air sample containing respirable crystalline silica:

1. Obtain the respirable dust concentration for the sample. The weight of the respirable dust in the air sample (expressed as mg or µg) is the net filter weight gain, as determined by the industrial hygienist or the laboratory. The sample air volume is then used to express the concentration of respirable dust in air, as mg of respirable dust per cubic meter of air (mg/m^3), as follows:

$$respirable\ dust\ concentration\ in\ air\ (mg/m^3) = \frac{sample\ respirable\ dust\ weight\ (mg)}{total\ air\ volume\ sampled\ (m^3)}$$

2. Obtain the percent respirable crystalline silica (e.g., as quartz) in the respirable dust sample, determined analytically by the laboratory and derived as follows:

$$\%\ respirable\ quartz = \frac{weight\ of\ quartz\ (mg\ or\ \mu g)\ x\,100}{sample\ respirable\ dust\ weight\ (mg\ or\ \mu g)}[from\ 1\ above]$$

3. Calculate the PEL for the sample, using the reported percent respirable quartz, from no. 2 above, as follows:

$$PEL\ for\ respirable\ dust\ with\ quartz\ (mg/m^3) = \frac{10\ mg/m^3}{2 + \%\ respirable\ quartz\ in\ sample}$$

4. To determine whether there is an overexposure, compare the PEL, calculated in no. 3, with the sample respirable dust reading (from no. 1). The severity ratio is determined by the following formula:

$$Severity\ Ratio = \frac{respirable\ dust\ in\ sample\ (mg/m^3)}{calculated\ PEL\ (mg/m^3)}$$

5. Calculate the Lower Confidence Limit (LCL) by subtracting the Sampling and Analytical Error (SAE) from the severity:

   LCL = Severity - SAE

   If the LCL is greater than 1, there is a greater than 95% confidence that the sampled employee's exposure exceeded the PEL, and the employee was, therefore, overexposed to respirable dust containing crystalline silica as quartz.

Other factors may have to be considered before arriving at a final exposure value. For example, the Time Weighted Average (TWA) calculation may require combining two or more sample results and adjusting to an 8-hour workday. Consult the OTM, Section II: Chapter 1 for procedures to determine the PEL when the employee is exposed to different types of respirable crystalline silica (i.e., quartz, cristobalite, and tridymite) during the course of a single work shift.

References

Occupational Safety and Health Administration (OSHA). OSHA ID-142. Quartz and Cristobalite in Workplace Atmospheres (XRD). December 1996.

Occupational Safety and Health Administration (OSHA), OSHA Technical Manual TED 01-00-015 (TED 1-0.15A). Section II: Sampling, Measurement Methods and Instruments, Chapter I: Personal Sampling for Air Contaminants, Appendix II:1-5. Sampling for Special Analyses, Samples Analyzed by X-Ray Diffraction, Air Samples, January 20, 1999.

Appendix D: Cyclone Leak Test Procedure

This section summarizes procedures for leak testing of the Dorr-Oliver cyclone samplers used for collecting respirable dust. Further details on this procedure are contained in the Cyclone Leak Test Procedure (CLTP) available through the OSHA Cincinnati Technical Center (OSHA, 1997). Compliance Safety and Health Officers (CSHOs) should review the entire leak test procedure before conducting the leak test as summarized below. See the CLTP for more specific procedures regarding leak tests.

Nylon Part Inspection

- Disassemble the cyclone assembly, clean it, and inspect it for cracks and worn fit between parts. Take care not to scratch the inside surface of the cyclone chamber.
- Replace any worn or cracked units or parts.

O-Ring, Tubing, and Filter Leak Test

- Connect the entire cyclone assembly (minus the cyclone body) to the pressure gauge and aspirator, maintaining the normal spacing between the plastic filter adaptor (coupler) and the vortex finder.
- Seal the cyclone vortex finder opening by placing an airtight cap or your fingertip over the hole.
- Hold the cyclone assembly together with one hand.
- With your other hand, squeeze and gently release the aspirator bulb until the pressure gauge reads between 4" H_2O and 10" H_2O, then fold the tubing halfway between the “Tee” fitting and the aspirator. If the pressure reading is beyond full scale, release the vacuum and try again.
- Observe the pressure gauge reading for 30 seconds. If the pressure drops less than 25 percent, the leakage is acceptable and the unit passes the leak test. If the pressure drops more than 25 percent, corrective action is necessary. Sources of leaks include worn or damaged O-rings, cracked or ill-fitting tubing, and leaky pre-weighed filter cassettes.

Note: Leaks between the filter input and the air sampling pump are more disruptive than leaks at the plastic filter adaptor O-rings.

Final Pump-Fault Leak Test

- Connect the cyclone assembly to the pump in the normal sampling configuration with the air sampling pump running at 1.7 L/min.
- Close the inlet to the cyclone with tape or a finger. If the pump bears down and goes into a fault mode, the assembly passes this final, but crude, pump-fault leak test.

Reference

Occupational Safety and Health Administration (OSHA). Cyclone Leak Test Procedure. OSHA Cincinnati Technical Center. September 15, 1997.

Appendix E: Conversion Factor for Silica PELs in Construction and Maritime

The crystalline silica permissible exposure limits (PELs) for the construction and maritime industries, at 29 CFR 1926.55(a) and 1915.1000 respectively, are expressed in terms of millions of particles per cubic foot (mppcf). These PELs are based on a particle count method long rendered obsolete by respirable mass (gravimetric) sampling, which yields results reported in milligrams per cubic meter (mg/m^3). In contrast with the construction and maritime PELs, the crystalline silica PELs for general industry are based on gravimetric sampling, and are the only methods currently available to OSHA compliance personnel. Since the construction and maritime PELs are expressed in terms of mppcf, the results of the gravimetric sampling must be converted to an equivalent mppcf value.

In order to determine a formula for converting from mg/m^3 to mppcf, OSHA requested assistance from the National Institute for Occupational Safety and Health (NIOSH). Based on its review of published studies comparing the particle count and gravimetric methods, NIOSH recommended a conversion factor of 0.1 mg/m^3 respirable dust to 1 mppcf. OSHA has determined that this conversion factor should be applied to silica sampling results used to characterize exposures in construction and maritime operations. The following examples illustrate how the conversion factor should be applied to enforce the current PEL for crystalline silica (quartz) in the construction and maritime industries.

Reference Formulas

A. Construction/Maritime PEL for Crystalline Silica (Quartz):

$$PEL\ (crystalline\ silica,\ quartz) = \frac{250\ mppcf}{\%\ silica + 5}$$

B. General Industry PEL for Crystalline Silica (Quartz):

$$PEL\,(mg/m^3) = \frac{10\ mg/m^3}{2 + \%\ respirable\ quartz}$$

C. OSHA-adopted conversion factor:

1 *mppcf* = 0.1 mg/m^3 *respirable dust* or

1 mg/m^3 = 10 *mppcf respirable dust*

Example 1: A sample is obtained for a jackhammer operator, using the gravimetric sampling method specified in OSHA ID-142. The sample is run for 240 minutes at a flow rate of 1.7 liters per minute (L/min), yielding a total sample volume of 0.408 m^3. The respirable dust collected on the filter is determined to weigh 0.857 mg, resulting in a respirable dust concentration of 2.1 mg/m^3. OSHA's Salt Lake Technical Center (SLTC) laboratory reports that the sample contains

55 percent quartz. SLTC also reports a Sampling and Analytical Error (SAE) of 0.20 for the sample.

Step1. Determine the jackhammer operator's 8-hour Time Weighted Average (TWA) respirable dust exposure (assuming zero exposure for the unsampled portion of the 8-hour shift):

$$Exposure = \frac{2.1\ mg/m^3\ x\ 240\ \text{min}}{480\ \text{min}} = 1.05\ mg/m^3\ respirable\ dust$$

Step 2. Calculate the general industry PEL, assuming the conditions for the jackhammer operator sample containing 55 percent respirable quartz:

$$PEL\,(mg/m^3) = \frac{10\ mg/m^3}{2+55} = 0.175\ mg/m^3$$

Step 3. Calculate the Severity Ratio:

$$Severity = \frac{sample\ results\ (from\ Step\ 1)}{calculated\ \ PEL\ (from\ Step\ 2)} = \frac{1.05\ mg/m^3}{0.175\ mg/m^3} = 5.4$$

Step 4. Calculate confidence limits by applying the sampling and analytical error (SAE):

Lower Confidence Limits (LCL) = 5.4 - 0.20 = 5.2

Step 5. Based on a severity of 5.4, the sample exceeds the 95% confidence limit for overexposure.

Step 6. Apply the OSHA-adopted conversion factor to the jackhammer operator's exposure result from Step 1 and Reference Formula (B) above:

$$Exposure = 1.05\ mg/m^3 x \frac{1\ mppcf}{0.1\ mg/m^3} = 10.5\ mppcf$$

Step 7. Calculate the applicable construction PEL, for jackhammer operator sample containing 55 percent respirable quartz:

$$PEL = \frac{250\ mppcf}{55\% + 5} = 4.17\ mppcf$$

Step 8. Conclusion. The 8-hour TWA exposure of the jackhammer operator exceeds the construction industry PEL for crystalline silica (quartz).

Example 2: Two samples are obtained for a construction foreman overseeing a concrete drill press operation. Both samples are collected at a flow rate of 1.7 L/min. The duration of Sample

A is 238 minutes, yielding a total sample volume of 0.40 m^3. The respirable dust collected on the filter is determined to weigh 0.855 mg, resulting in a respirable dust concentration of 2.1 mg/m^3. The SLTC laboratory reports that Sample A contains 30 percent quartz. The duration of Sample B is 192 minutes, yielding a total sample volume of 0.326 m^3. The respirable dust weight is 0.619 mg, resulting in a concentration of 1.9 mg/m^3. The total weight of respirable dust collected on both samples is 1.474 mg. The SLTC laboratory reports that Sample B contains 25 percent quartz. SLTC reports an SAE of 0.16 for both samples.

Step1. Determine the foreman's 8-hour TWA respirable dust exposure:

$$Exposure = \frac{(2.1\ mg/m^3\ x\ 238\ \text{min}) + (1.9\ mg/m^3\ x\ 192\ \text{min})}{480\ \text{min}} = 1.8\ mg/m^3$$

Step 2. Determine average quartz content since SLTC provided two different percentages of quartz:

$$\text{Re}culated\ \% = \frac{(30\%\ x\ 0.855) + (25\%\ x\ 0.619)}{(0.855 + 0.619)} = 28\%$$

Step 3. Calculate the general industry PEL, assuming the conditions for the construction foreman sample containing 28 percent respirable quartz:

$$PEL\,(mg/m^3) = \frac{10\ mg/m^3}{2+28} = 0.333\ mg/m^3$$

Step 4. Calculate the Severity Ratio:

$$Severity = \frac{1.8 mg/m^3}{0.333 mg/m^3} = 5.4$$

Step 5. Calculate confidence limits by applying the sampling and analytical error (SAE):

LCL = 5.4 - 0.16 = 5.24

Step 6. Based on a severity of 5.4, the sample exceeds the 95% confidence limit for overexposure.

Step 7. Apply the OSHA-adopted conversion factor to the construction foreman's exposure result from Step 1 and Reference Formula (B) above:

$$Exposure = 1.8\ mg/m^3 x \frac{1.0\ mppcf}{0.1\ mg/m^3} = 18.0\ mppcf$$

Step 8. Calculate the applicable construction PEL, using Reference Formula (A) above, for the foreman's samples containing an average of 28 percent respirable quartz:

$$PEL = \frac{250\ mppcf}{28 + 5} = 7.58\ mppcf$$

Step 7. Conclusion. The 8-hour TWA exposure of the foreman exceeds the construction industry PEL for crystalline silica (quartz).

Appendix F: Employee Questionnaire

This questionnaire, when completed, may be considered a medical record and must be used in accordance with 1913.10 - *Rules Concerning OSHA Access to Employee Medical Records*. The questionnaire is intended to provide Compliance Safety and Health Officers (CSHOs) with a form they may fill out when interviewing employees to evaluate the employer's medical monitoring program. CSHOs should consult with the OSHA Office of Occupational Medicine regarding any findings of potential silicosis.

Date: __________ Company Name: __________________ Location: ____________________

A. Personal Information

Employee's Name: ___________________________ Gender: ❒ Male ❒ Female

Current Job Title: ___________________________ Age: ____________________

B. Job-Related Information

Number of hours worked in silica-related tasks per week:

❒ 10-20
❒ 20-30
❒ 30-40
❒ More than 40 (________ hours)

List previous jobs and duration of each job:

a. ________________________ (___ yrs.)
b. ________________________ (___ yrs.)
c. ________________________ (___ yrs.)
d. ________________________ (___ yrs.)

Time at current job:

❒ Six months or less
❒ 1-2 yrs
❒ 3-5 yrs
❒ More than 5 yrs. (______ yrs.)

C. Brief Medical History

Are you being treated by a physician for breathing problems? ❒ Yes ❒ No

Have you ever had a chest X-ray? ❒ Yes ❒ No
If yes, when was your last chest X-ray? ______________________________
Why was the chest X-ray taken? ______________________________

Did the doctor tell you everything was normal? ❒ Yes ❒ No
If no, what was noted? ______________________________
What treatment are you receiving for this problem? ______________________________

Have you discussed your medical history with your employer? ❒ Yes ❒ No

Are you a cigarette smoker? ❒ Yes ❒ No

Appendix G: Non-Mandatory Medical Monitoring Recommendations for Employees Exposed to Crystalline Silica

A. Recommendations for Baseline Medical Examination

Note: These are recommendations only and are not required by any current OSHA regulation.

It is recommended that a pre-placement baseline medical examination be provided to employees who are potentially exposed to crystalline silica at one-half the permissible exposure limit (PEL) or more. The baseline examination should contain the following elements:

- A medical examination emphasizing the respiratory system, as well as an occupational and medical history; and

- A chest roentgenogram (X-ray), posteroanterior 14" x 17" or 14" x 14", classified according to the 1980 ILO International Classification of Radiographs of Pneumoconiosis (ILO, 1981), and read by a board-certified radiologist or certified class "B" reader (who is qualified to distinguish silicosis from sarcoidosis, asbestosis, coal miner's pneumoconiosis, and other pneumoconioses).

B. Recommended Frequency of Examinations

- It is recommended that a medical examination emphasizing the respiratory system and a chest X-ray be repeated every three years if the employee has less than 15 years of crystalline silica exposure, every two years if the employee has 15 to 20 years of exposure, and annually if the employee has 20 or more years of exposure.

- It is recommended that a chest X-ray be obtained at termination of employment.

Appendix H: CSHO Checklist for Conducting Silica-Related Inspections

This non-mandatory checklist is intended as a quick reference tool for Compliance Safety and Health Officers (CSHOs) conducting silica-related inspections. The CSHO may wish to review the checklist before completing the inspection to make sure that none of the essential elements have been overlooked. The checklist addresses all of the topics discussed in Section XI(B), Inspection Procedures, of this directive.

__ Employee Exposure Monitoring
- ❒ Sample for Respirable Dust/Silica
- ❒ Leak Test Filters/Cyclones
- ❒ Bulk Samples of Settled Dust
- ❒ Employer's Monitoring Records
- ❒ Other _______

__ Engineering and Work Practice Controls
- ❒ Location of Employees
- ❒ Ventilation
- ❒ Wet Methods
- ❒ Other _______

__ Respiratory Protection
- ❒ Written Program
- ❒ Cartridge Selection and Change-out Schedule
- ❒ Medical and Fit Test Records
- ❒ Breathing Air Quality and Use
- ❒ Other _______

__ Hazard Communication
- ❒ Written Program
- ❒ {MSDSs/SDSs}
- ❒ Training
- ❒ Bulk Samples of Products
- ❒ Other _______

__ Symptoms of Silicosis in Workplace
- ❒ Survey/Interview Employees
- ❒ Employees Obtaining Medical Evaluations
- ❒ Other _______

__ Medical Surveillance
- ❒ Employer Aware of Silicosis Risk
- ❒ Employer Identifying Possible Cases
- ❒ Employer Referring Cases to Physician
- ❒ Other _______

__ Housekeeping and Hygiene Practices
- ❒ Facility Cleanliness
- ❒ Clean-up Methods (Compressed Air, Dry Sweeping?)
- ❒ Change Rooms/PPE Storage
- ❒ Separate Break Areas
- ❒ Other _______

__ Employee Exposure and Medical Records
- ❒ Employer Monitoring and Medical Records
- ❒ Employee Access and Confidentiality
- ❒ Other _______

__ Abrasive Blasting (on-site or off-site)
- ❒ Sample for Silica and Metals (including Bystanders)
- ❒ Sample for Noise
- ❒ Ventilation and Dust Containment
- ❒ PPE and Respirators
- ❒ Carbon Monoxide Alarm on Respirator
- ❒ Manual Control of Blast Nozzle Operating Valve
- ❒ Electrical Grounding
- ❒ Pressure Range (90-120 psi)
- ❒ Heat Stress
- ❒ Other _______

Appendix I: Case File Components to be Sent to the National Office

1. OSHA 1
2. OSHA 1A
3. OSHA 1B/IH for overexposures to silica.
4. Engineering Controls (including failed ones) used to control silica exposures.

See section **XI. D. – Follow-up and Monitoring** for additional information.

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