Respirable Crystalline Silica

- ***29 CFR 1926.1153***

Presented by: ETTA Bureau, 919-707-7876

Objectives

1926.1153

After this course, students we will recognize:

- Respirable crystalline silica – what it is, sources and health effects
- Identification/exposure controls – silica producing work processes and how to control it
- New OSHA regulatory requirements

What is Crystalline Silica?

Crystalline silica is a basic component of soil, sand, granite, and many other minerals

- Quartz is the most common form
- Cristobalite and Tridymite are two other forms
- Respirable size particles generated when workers chip, cut, drill, or grind materials that contain crystalline silica

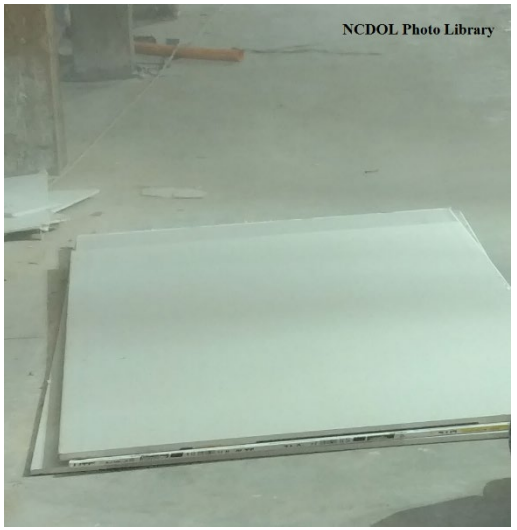
Hazards of Crystalline Silica

Exposure to respirable crystalline silica has been linked to:

- Silicosis
- Lung cancer
- Chronic obstructive pulmonary disease
- Kidney disease

Some Common Products

- Fiber cement board
- Sand
- Brick
- Block
- Concrete
- Drywall



Previously

§§ 1910.1000 and 1926.55 only established Permissible Exposure Limit (PEL)

$$PEL_{mppcf} = \frac{250}{\%Silica+5}$$

mppcf – million particles per cubic foot

1 mppcf = 0.1 mg/m^3

mg/m^3 – milligrams per cubic meter

Old PEL Versus New PEL

$$PEL_{mppcf} = \frac{250}{\%Silica+5}$$

At 100% Silica, the PEL would be 0.238 mg/m^3 = 238 µg/m^3

New PEL = 50 µg/m^3

238 µg/m^3 / 50 µg/m^3 = 4.76 times less

Published March 25, 2016

Sections

(a) Scope and application
(b) Definitions
(c) Specified exposure control methods
(d) Alternative exposure control methods
(e) Respiratory protection
(f) Housekeeping
(g) Written exposure control plan
(h) Medical surveillance
(i) Communication of respirable crystalline silica hazards
(j) Recordkeeping
(k) Dates

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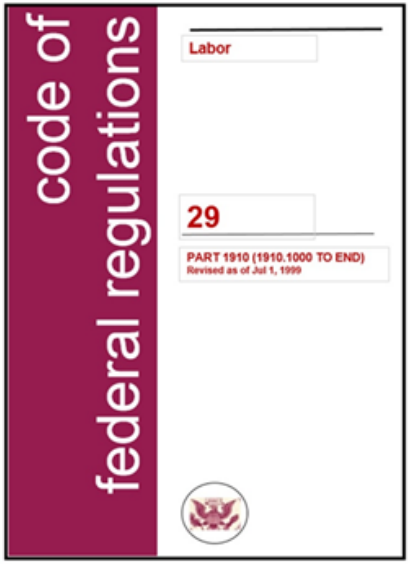

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Dates

(1) Became effective June 23, 2016

(2) All obligations of this section shall commence June 23, 2017, except requirements for methods of sample analysis in paragraph (d)(2)(v)

(3) Requirements for methods of sample analysis in paragraph (d)(2)(v) of this section commence June 23, 2018

Definitions

1926.1153(b)

1. Action level
2. Assistant secretary
3. Director
4. Competent person
5. Employee exposure
6. High-efficiency particulate air [HEPA] filter
7. Objective data
8. Physician or other licensed health care professional
9. Respirable crystalline silica
10. Specialist

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Competent Person

1926.1153(b)

An individual who is:

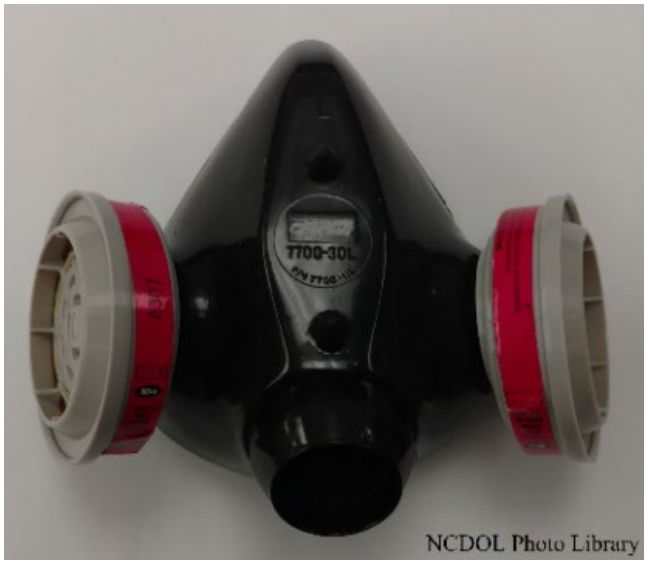
- Capable of identifying existing and foreseeable respirable crystalline silica hazards in the workplace, *and*
- Has authorization to take prompt corrective measures to eliminate or minimize them

Competent person must have the knowledge and ability necessary to fulfill the responsibilities set forth paragraph (g) of this section

Employee Exposure

1926.1153(b)

Exposure to airborne respirable crystalline silica that would occur if the employee were not using a respirator



Respirable Crystalline Silica 1926.1153(b)

Quartz, cristobalite, and/or tridymite contained in airborne particles that are determined to be respirable by a sampling device designed to meet the characteristics for *respirable-particle-size-selective samplers* specified in the International Organization for Standardization (ISO) 7708:1995

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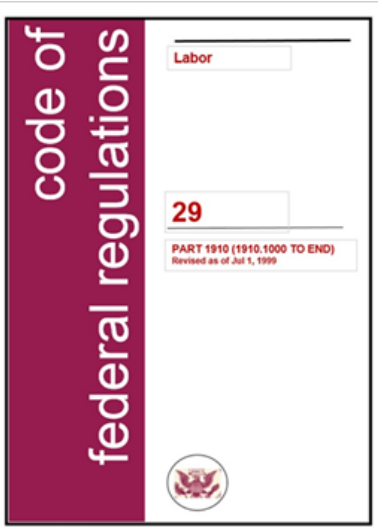

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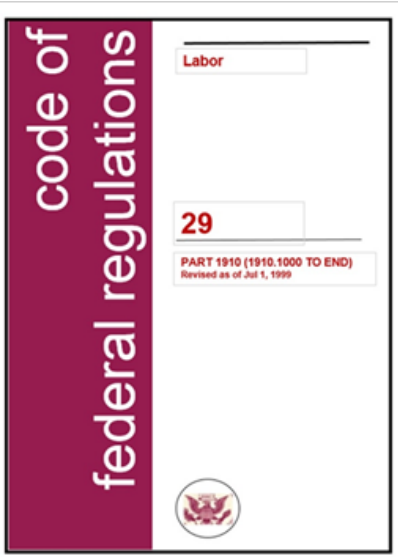

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Silica Flow Chart

1926.1153

(a) Scope and application
(g) Written exposure control plan

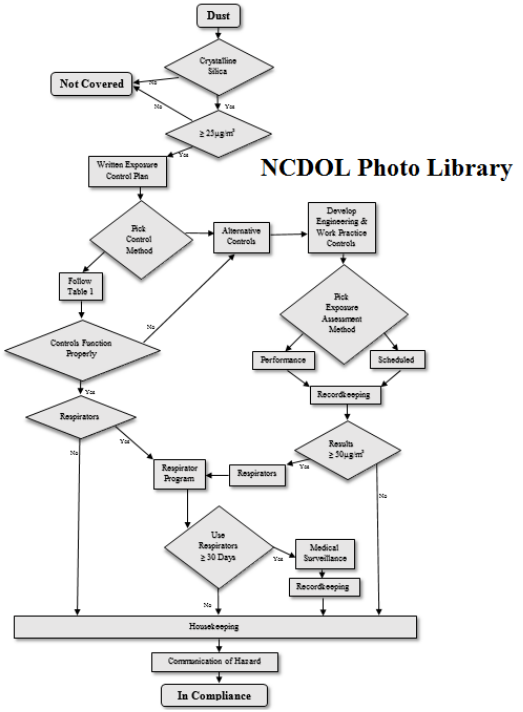
(c) Specified exposure control methods

OR

(d) Alternative exposure control methods

Maybe
(e) Respiratory protection
(h) Medical surveillance

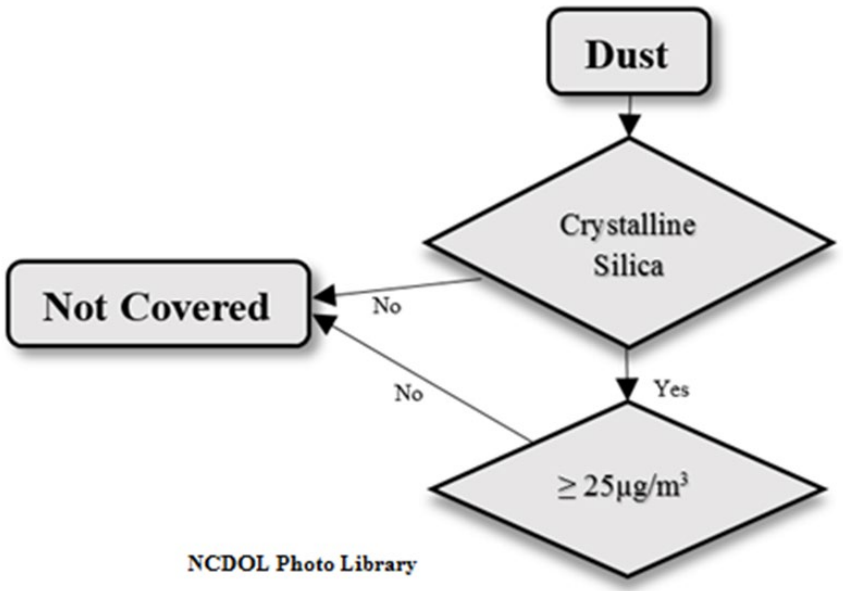
(j) Recordkeeping
(f) Housekeeping
(i) Communication



Scope and Application

1926.1153(a)

- Applies to all occupational exposure to respirable crystalline silica in construction work, except where employee exposure will remain below 25 micrograms per cubic meter (µg/m^3)



Exposure

- Exposure to Silica begins with performing an activity that results in dust generation examples:
  - Chipping
  - Cutting
  - Sawing
  - Drilling
  - Grinding
  - Sanding
  - Crushing

Dust

Dust

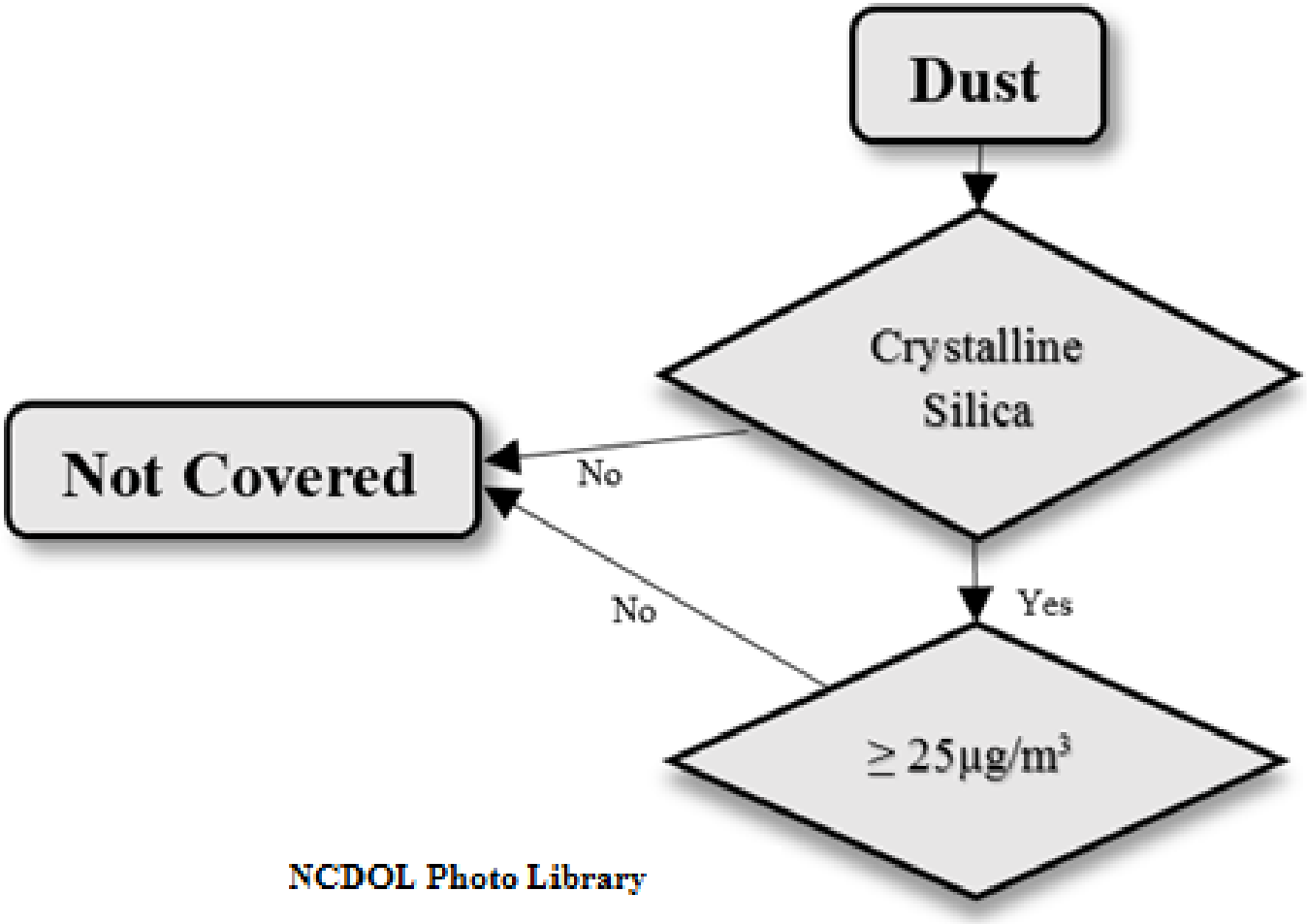
Dust

Dust

Dust

Scope and Application

1926.1153(a)



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Crystalline Silica?

Crystalline Silica?

Crystalline Silica?

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Crystalline Silica?

Presence of Crystalline Silica?

MSDS – Material Safety Data Sheet

Section II – Hazardous Ingredients of Material

	CAS#	%	OSHA PEL	ACGIH TLV
Calcium Hydroxide	6599-15-1	>1%	15 mg/m³ Total Dust 5 mg/m³ Respirable	5 mg/m³
Dust Silica (quartz)	14808-60-7	10%	10 mg/ m³ % Silica+2	0.0025 mg/m³
Vinyl Bromide	593-60-2	1 – 5%	N/A	0.5 ppm
Carbon Black	1333-86-4	<1%	3.5 mg/m³	3 mg/m³

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Presence of Crystalline Silica?

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Presence of Crystalline Silica?

SDS – Safety Data Sheet

3. COMPOSITION / INFORMATION ON INGREDIENTS

Component	CAS No.	Percent
Almandine Garnet	1302-62-1	>10%
Cellulose	9004-34-6	<15%
Crystalline Silica (quartz)	14808-60-7	30%
Calcium Compounds	Various	0-3%

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Presence of Crystalline Silica?

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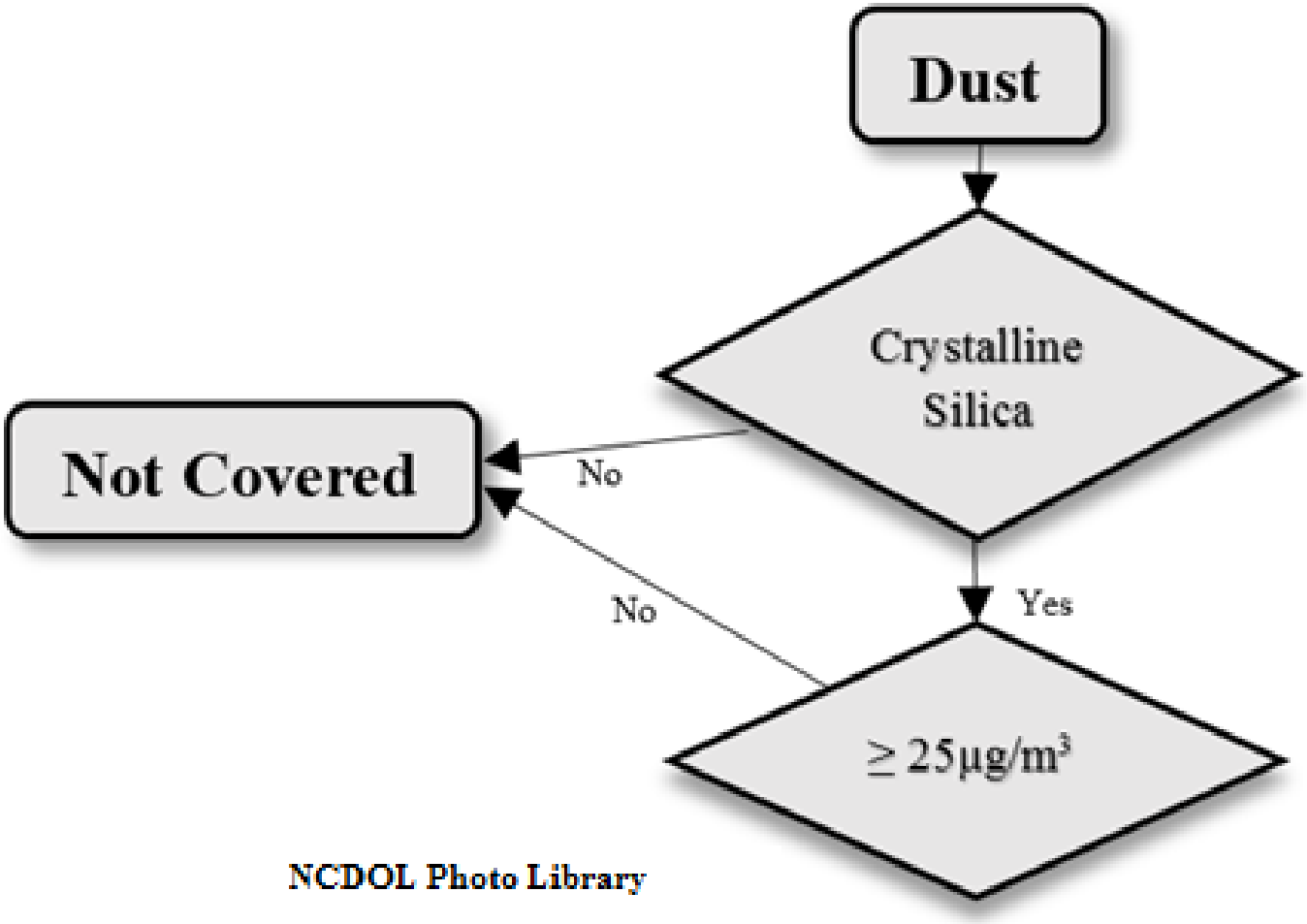
Scope and Application

1926.1153(a)



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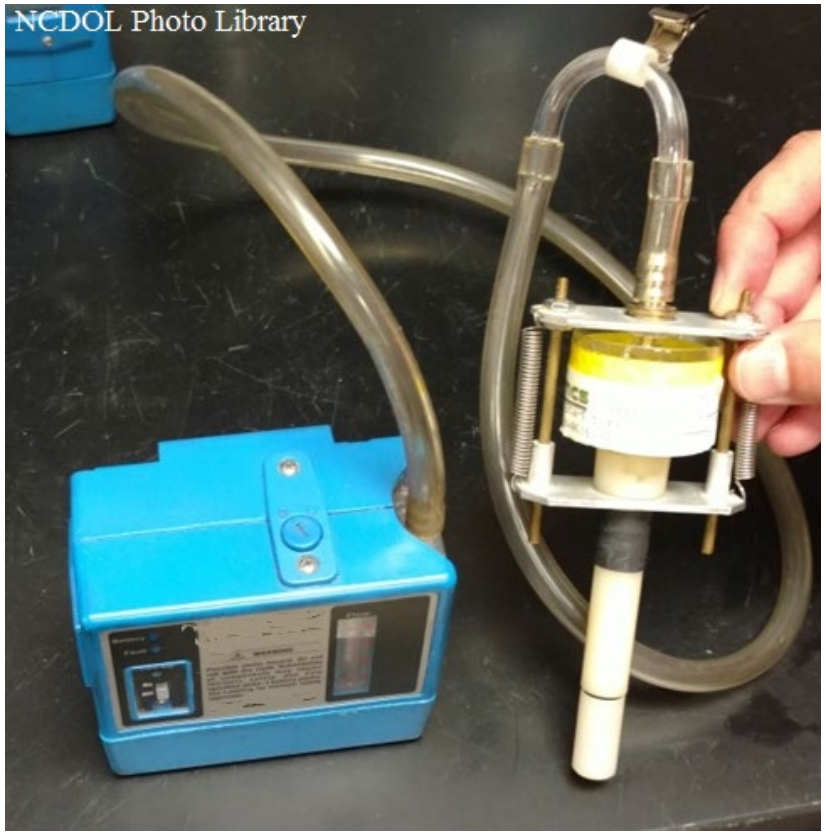
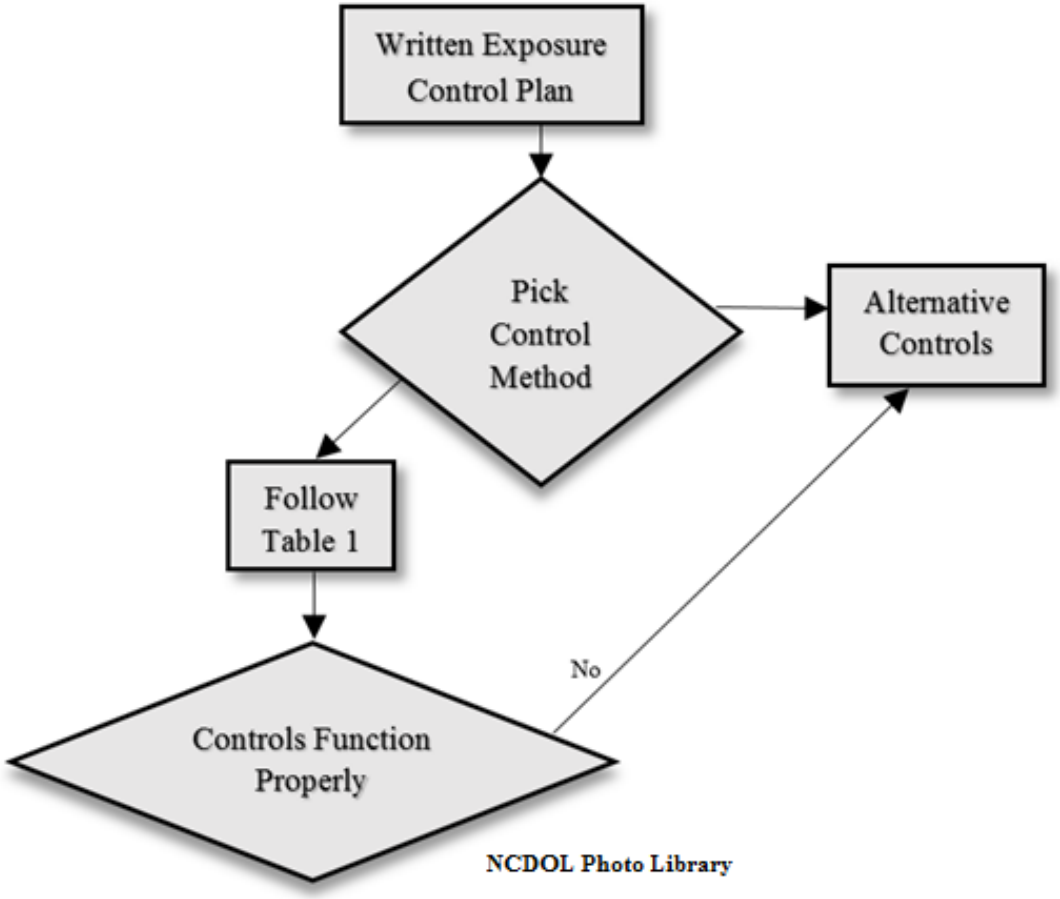
Crystalline Silica ≥ 25µg/m^3 1926.1153(d)(2)(i)

- Under any foreseeable conditions
- Sample



Written Exposure Control Plan 1926.1153(g)



Written Exposure Control Plan 1926.1153(g)(1)

Develop and implement a written exposure control plan to minimize or eliminate exposure to silica, which contains information on the following:

- Task description
- Description of the controls (engineering controls, work practices, personal protective equipment)
- Housekeeping measures
- Designates a competent person who will make frequent and regular inspections of the job sites, materials, and equipment to implement the written exposure control plan

Written Exposure Control Plan 1926.1153(g)(1)

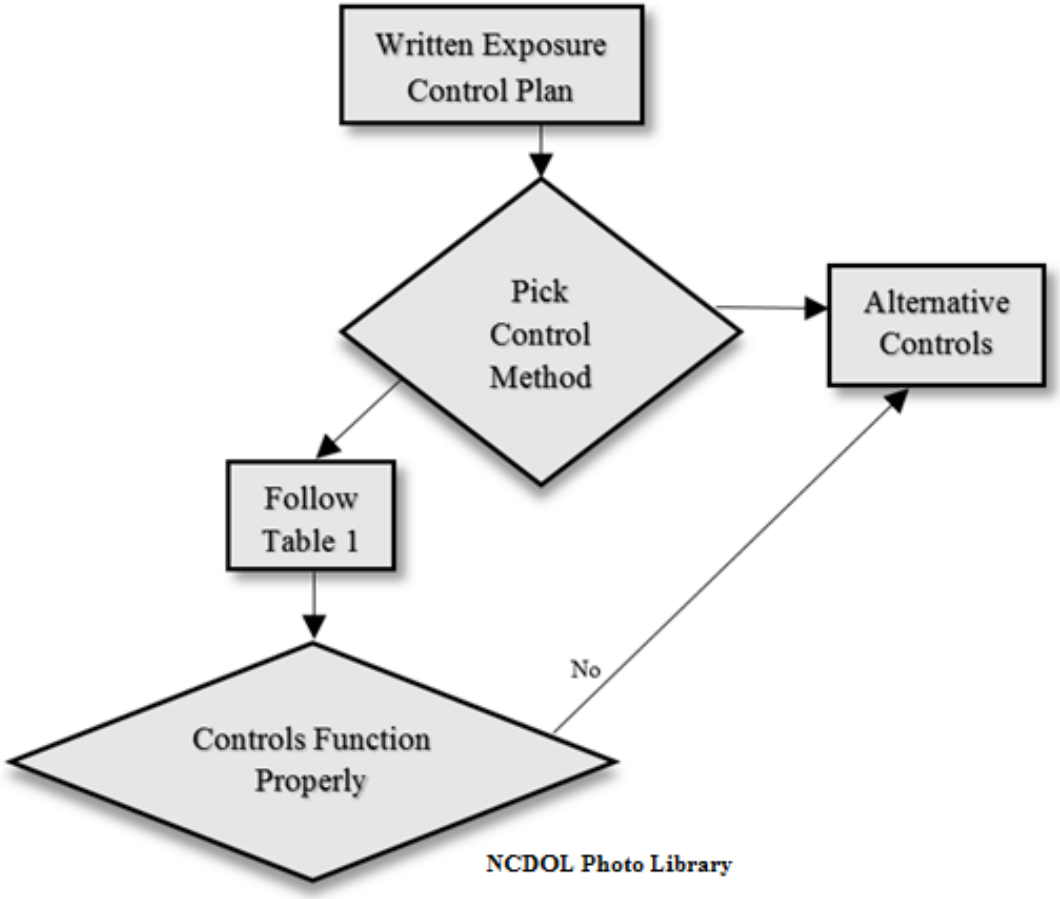
Develop and implement a written exposure control plan to minimize or eliminate exposure to silica, which contains information on the following:

- Procedures used to restrict access to work areas, when necessary, to minimize the number of employees exposed

Written Exposure Control Plan 1926.1153(g)(2)-(3)

- Must be reviewed and evaluated at least **annually** and update when necessary
- Must be readily available for examination and copying, upon request, to:
  - Each employee covered by this section
  - Designated employee representatives
  - Assistant Secretary, and
  - Director (of NIOSH)

Written Exposure Control Plan 1926.1153(g)



Specified Exposure Control Methods 1926.1153(c)(1)

- Table 1 – Specified Exposure Control Methods; when working with materials containing crystalline silica

- Lists 18 tasks with engineering and work practice control methods, and respirator requirements

Table 1 – Tasks

1926.1153(c)(1)

- Stationary masonry saws
- Handheld power saws (any blade diameter)
- Handheld power saws for cutting fiber-cement board (with blade diameter of 8 inches or less)
- Handheld grinders for uses other than mortar removal
- Walk-behind milling machines and floor grinders
- Small drivable milling machines (less than half-lane)

Table 1 – Tasks

1926.1153(c)(1)

- Walk-behind saws
- Drivable saws
- Rig-mounted core saws or drills
- Handheld and stand-mounted drills (including impact and rotary hammer drills)
- Dowel drilling rigs for concrete
- Handheld grinders for mortar removal
- Large drivable milling machines (half-lane and larger)
- Crushing machines
- Vehicle-mounted drilling rigs for rock and concrete
- Jackhammers and handheld powered chipping tools

Table 1 – Tasks

1926.1153(c)(1)

- Heavy equipment and utility vehicles for tasks such as grading and excavating but not including:
  - Demolishing, abrading, or fracturing silica-containing materials
- Heavy equipment and utility vehicles used to abrade or fracture silica-containing materials or used during demolition activities involving silica-containing materials

Table 1 – Example 1

1926.1153(c)(1)

Equipment/Task	Engineering and work Practice control methods	Required respiratory protection and minimum assigned protection factor (APF)	
		≤4 hours/shift	>4 hours/shift
Stationary masonry saws	Use saw equipped with integrated water delivery system that continuously feeds water to the blade	None.	None.

Table 1 – Example 2

1926.1153(c)(1)

Equipment/Task	Engineering and work Practice control methods	Required respiratory protection and minimum assigned protection factor (APF)	
		≤4 hours/shift	>4 hours/shift
Handheld power saws (any blade diameter)	Use saw equipped with integrated water delivery system that continuously feeds water to the blade. Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions: -When used outdoors…… -When used indoors or in an enclosed area..	 None…… APF 10……	 APF 10. APF 10.

Example 2

Table 1 – Example 3

1926.1153(c)(1)

Equipment/Task	Engineering and work Practice control methods	Required respiratory protection and minimum assigned protection factor (APF)	
		≤4 hours/shift	>4 hours/shift
Walk-behind saws	Use saw equipped with integrated water delivery system that continuously feeds water to the blade. Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions: -When used outdoors ……... -When used indoors or in an enclosed area	None…….. APF 10 …….	None. APF 10.

Example 3

Table 1 – Example 4

1926.1153(c)(1)

Equipment/Task	Engineering and work Practice control methods	Required respiratory protection and minimum assigned protection factor (APF)	
		≤4 hours/shift	>4 hours/shift
Handheld and stand-mounted drills (including impact and rotary hammer drills).	Use drill equipped with commercially available shroud or cowling with dust collection system Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions. Dust collector must provide the air flow recommended by the tool manufacturer, or greater, and have a filter with 99% or greater efficiency and a filter-cleaning mechanism. Use a HEPA-filtered vacuum when cleaning holes	None.	None.

Example 4

Table 1 – Example 5

1926.1153(c)(1)

Equipment/Task	Engineering and work Practice control methods	Required respiratory protection and minimum assigned protection factor (APF)	
		≤4 hours/shift	>4 hours/shift
Jackhammers and handheld powered chipping tools	Use tool with water delivery system that supplies a continuous stream or spray of water at the point of impact: -When used outdoors…… -When used indoors or in an enclosed area…….. OR	None…….. APF 10……..	APF 10. APF 10.

Table 1 – Example 5

1926.1153(c)(1)

Equipment/Task	Engineering and work Practice control methods	Required respiratory protection and minimum assigned protection factor (APF)	
		≤4 hours/shift	>4 hours/shift
Jackhammers and handheld powered chipping tools	Use tool equipped with commercially available shroud and dust collection system. Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions Dust collector must provide the air flow recommended by the tool manufacturer, or greater, and have a filter with 99% or greater efficiency and a filter-cleaning mechanism -When used outdoors…….. -When used indoors or in an enclosed area……	 None…… APF 10……	 APF 10. APF 10.

Example 5

Table 1 – Example 6

1926.1153(c)(1)

Equipment/Task	Engineering and work Practice control methods	Required respiratory protection and minimum assigned protection factor (APF)	
		≤4 hours/shift	>4 hours/shift
Handheld grinders for mortar removal	Use grinder equipped with commercially available shroud and dust collection system Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions Dust collector must provide 25 cubic feet per minute (cfm) or greater of airflow per inch of wheel diameter and have a filter with 99% or greater efficiency and a cyclonic pre-separator or filter-cleaning mechanism	APF 10.	APF 25.

Example 6

Table 1 – Example 7

1926.1153(c)(1)

Equipment/Task	Engineering and work Practice control methods	Required respiratory protection and minimum assigned protection factor (APF)	
		≤4 hours/shift	>4 hours/shift
Handheld grinders for uses other than mortar removal	For tasks performed outdoors only: Use grinder equipped with integrated water delivery system that continuously feeds water to the grinding surface Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions. OR	None.	None.

Table 1 – Example 7

1926.1153

Equipment/Task	Engineering and work Practice control methods	Required respiratory protection and minimum assigned protection factor (APF)	
		≤4 hours/shift	>4 hours/shift
Handheld grinders for uses other than mortar removal	Use grinder equipped with commercially available shroud and dust collection system Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions Dust collector must provide 25 cubic feet per minute (cfm) or greater of airflow per inch of wheel diameter and have a filter with 99% or greater efficiency and a cyclonic pre-separator or filter-cleaning mechanism -When used outdoors……... -When used indoors or in an enclosed area…….	 None……. None…….	 None. APF 10.

Example 7

Example 7

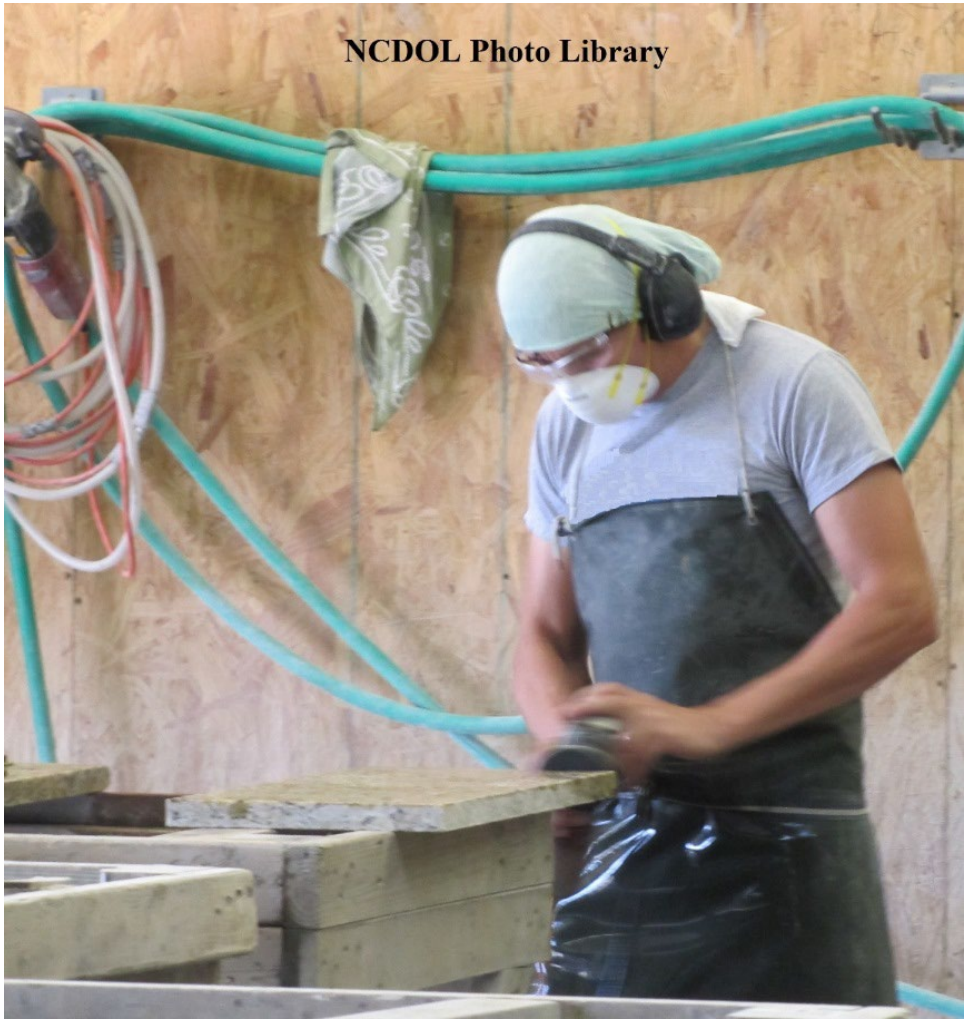


Table 1 – Example 8

1926.1153(c)(1)

Equipment/Task	Engineering and work Practice control methods	Required respiratory protection and minimum assigned protection factor (APF)	
		≤4 hours/shift	>4 hours/shift
Walk-behind milling machines and floor grinders.	Use machine equipped with integrated water delivery system that continuously feeds water to the cutting surface. Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions OR	None.	None.

Table 1 – Example 8

1926.1153(c)(1)

Equipment/Task	Engineering and work Practice control methods	Required respiratory protection and minimum assigned protection factor (APF)	
		≤4 hours/shift	>4 hours/shift
Walk-behind milling machines and floor grinders.	Use machine equipped with dust collection system recommended by the manufacturer Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions Dust collector must provide the air flow recommended by the manufacturer, or greater, and have a filter with 99% or greater efficiency and a filter-cleaning mechanism When used indoors or in an enclosed area, use a HEPA-filtered vacuum to remove loose dust in between passes.	None.	None.

Example 8

Specified Exposure Control Methods 1926.1153(c)

- Where an employee performs more than one task on Table 1 during the course of a shift, and the total duration of all tasks combined is more than four hours, the required respiratory protection for each task is the **respiratory protection specified for more than four hours per shift.**

Specified Exposure Control Methods 1926.1153(c)

- If the total duration of all tasks on Table 1 combined is less than four hours, the required respiratory protection for each task is the **respiratory protection specified for less than four hours per shift**.

Specified Exposure Control Methods 1926.1153(c)

- For each employee engaged in a task identified on Table 1, the employer shall fully and properly implement the engineering controls, work practices, and respiratory protection specified for the task on Table 1.

Specified Exposure Control Methods

1926.1153(c)

When implementing the control measures specified in Table 1, each employer shall:

- For tasks performed indoors or in enclosed areas, provide a means of exhaust as needed to minimize the accumulation of visible airborne dust
- For tasks performed using wet methods, apply water at flow rates sufficient to minimize release of visible dust

Specified Exposure Control Methods

1926.1153(c)

When controls are fully and properly implemented according to Table 1

- **Do not have to comply with PEL**
- **Do not have to conduct exposure assessments for employees engaged in those tasks**

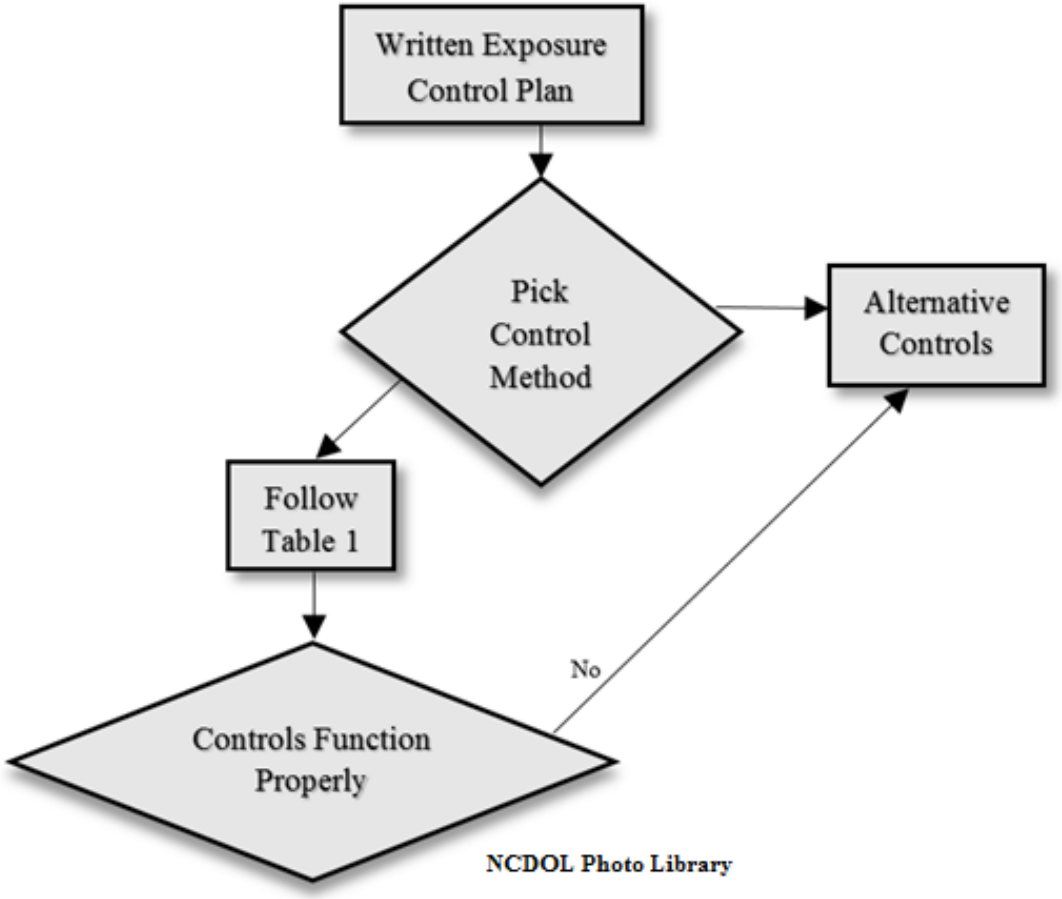
Alternative Control Methods 1926.1153(d)

For tasks not listed in Table 1

or

where the employer **does not fully** and **properly implement** the engineering controls, work practices, and respiratory protection described in Table 1

Written Exposure Control Plan 1926.1153(g)

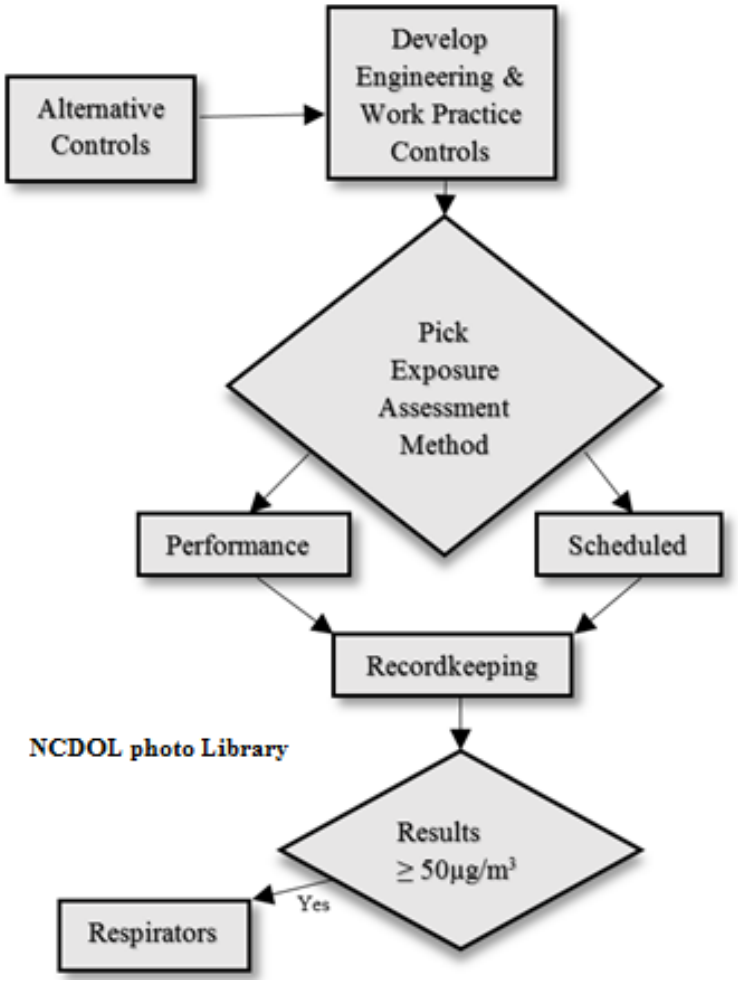


Controls Not Functioning Properly

Controls Not Functioning Properly

Alternative Control Methods

1926.1153(d)



Alternative Control Methods 1926.1153(d)

- Permissible Exposure Limit (PEL)

- Employer shall ensure that no employee is exposed to an airborne concentration of respirable crystalline silica in excess of 50 µg/m^3, calculated as an 8-hour Time Weighted Average (TWA)

Alternative Control Methods 1926.1153(d)

Engineering and work practice controls

- Shall be used to reduce and maintain employee exposure to respirable crystalline silica to or below the PEL, unless the employer can demonstrate that such controls are not feasible
- Wherever feasible engineering and work practice controls are not sufficient to reduce employee exposure to or below the PEL
  - Must be used to reduce employee exposure to the lowest feasible level, *and*
  - Supplement with the use of respiratory protection

Alternative Control Methods

1926.1153(d)

Engineering and work practice controls

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- Wherever feasible engineering and work practice controls are not sufficient to reduce employee exposure to or below the PEL
  - Must be used to reduce employee exposure to the lowest feasible level, *and*
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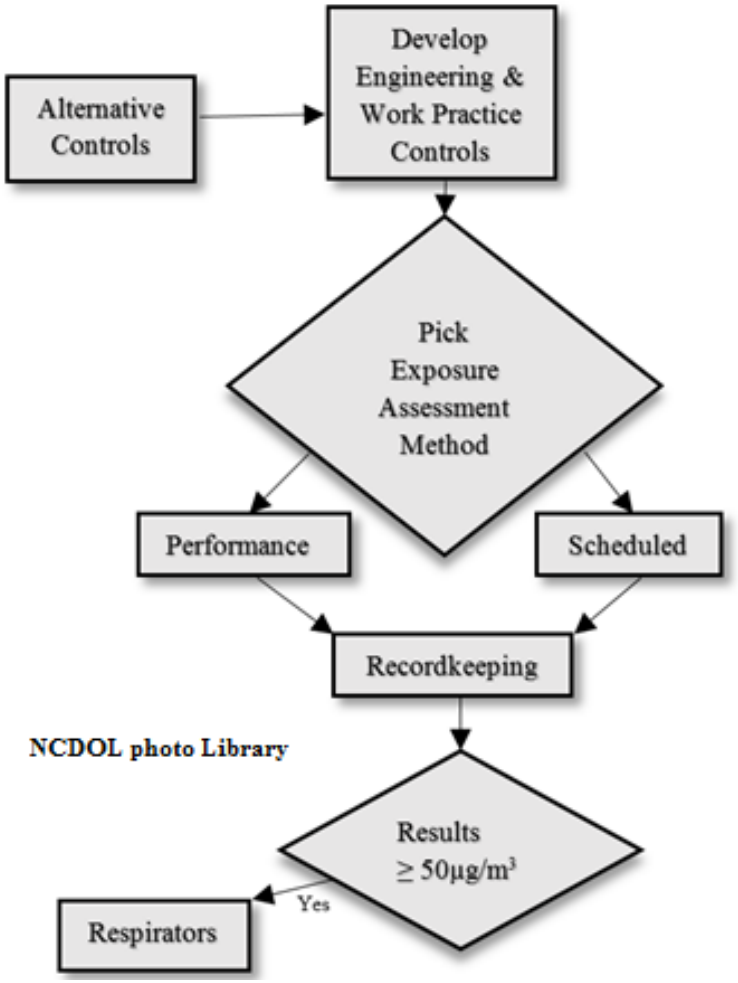
Alternative Control Methods

1926.1153(d)



Alternative Control Methods 1926.1153(d)

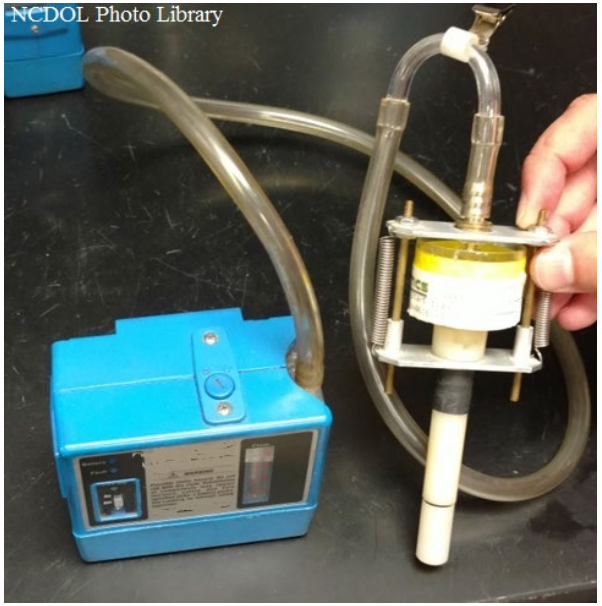
- Exposure assessment - assess the exposure of **each employee who is or may reasonably be expected** to be exposed to respirable crystalline silica at or above the action level (25 µg/m^3)
  - Performance Option
  - Scheduled Option

Scheduled Option

1926.1153(d)(2)

Exposure assessment

- Initial monitoring
  - < Action Level (25 µg/m^3)
    - Monitoring may be discontinued



Scheduled Option

1926.1153(d)(2)

- Most recent monitoring
  - ≥ AL (25 µg/m^3) but < the PEL (50 µg/m^3)
    - Repeat monitoring within six (6) months
  - > PEL
    - Repeat monitoring within three (3) months
  - < AL (25 µg/m^3)
    - Repeat such monitoring within six (6) months of the most recent monitoring until two (2) consecutive measurements, taken seven (7) or more days apart, are < AL (25 µg/m^3), at which time the monitoring maybe discontinued

Alternative Control Methods 1926.1153(d)(2)(vi)

Employee notification of assessment results

- Within five (5) working days after completing an exposure assessment
  - Notify each affected employee in writing of the results of that assessment, *or*
  - Post the results in an appropriate location accessible to all affected employees

- Whenever an exposure assessment indicates that employee exposure is above the PEL (50 µg/m^3), the employer shall describe in the written notification the corrective action being taken to reduce employee exposure to or below the PEL

Alternative Control Methods 1926.1153(d)(2)(iv)

Exposure reassessment

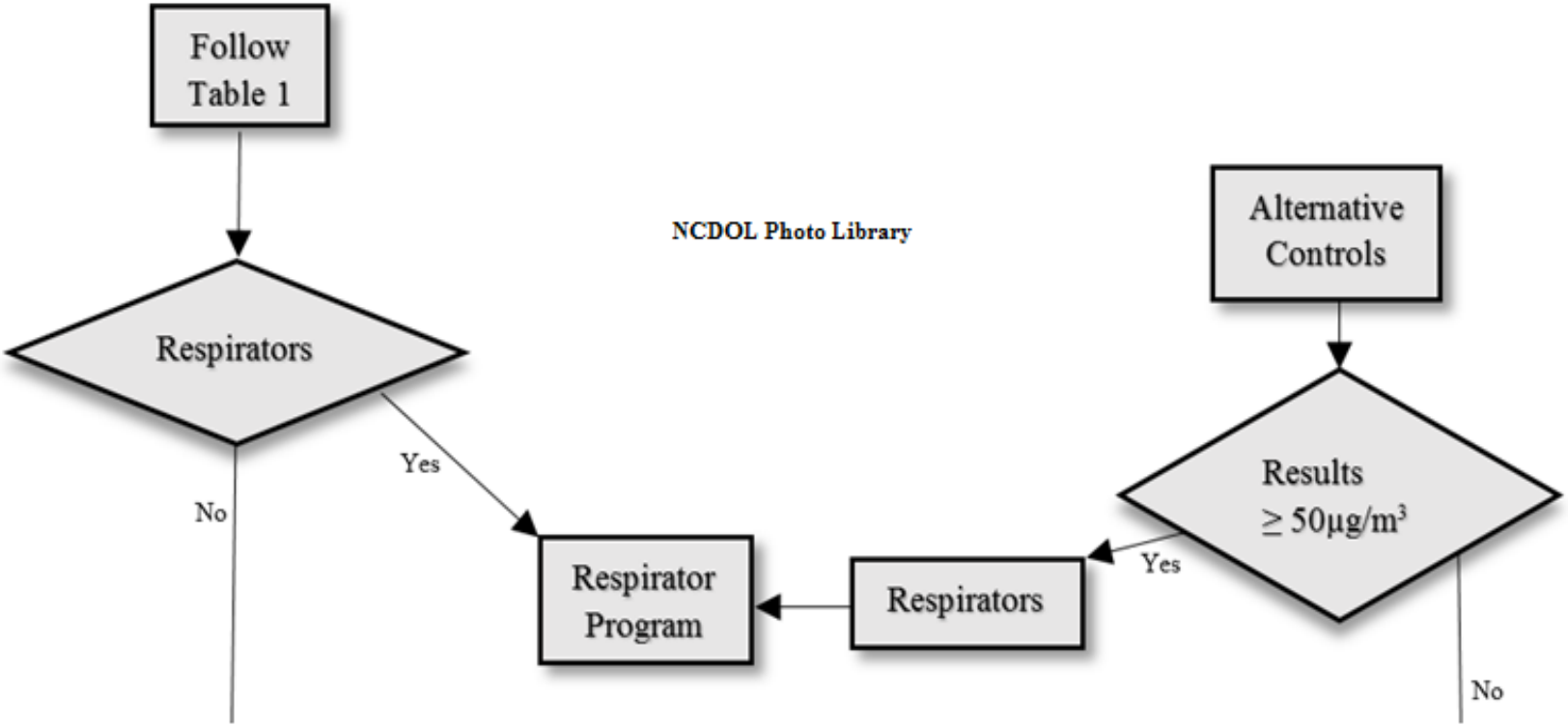
- Whenever a change in the production, process, control equipment, **personnel**, or work practices may reasonable be expected to result in new or additional exposures at or above the action level

OR

- When employer has reason to believe there are new or additional exposures at or above the action level have occurred

Respiratory Protection

1926.1153(e)



Respiratory Protection

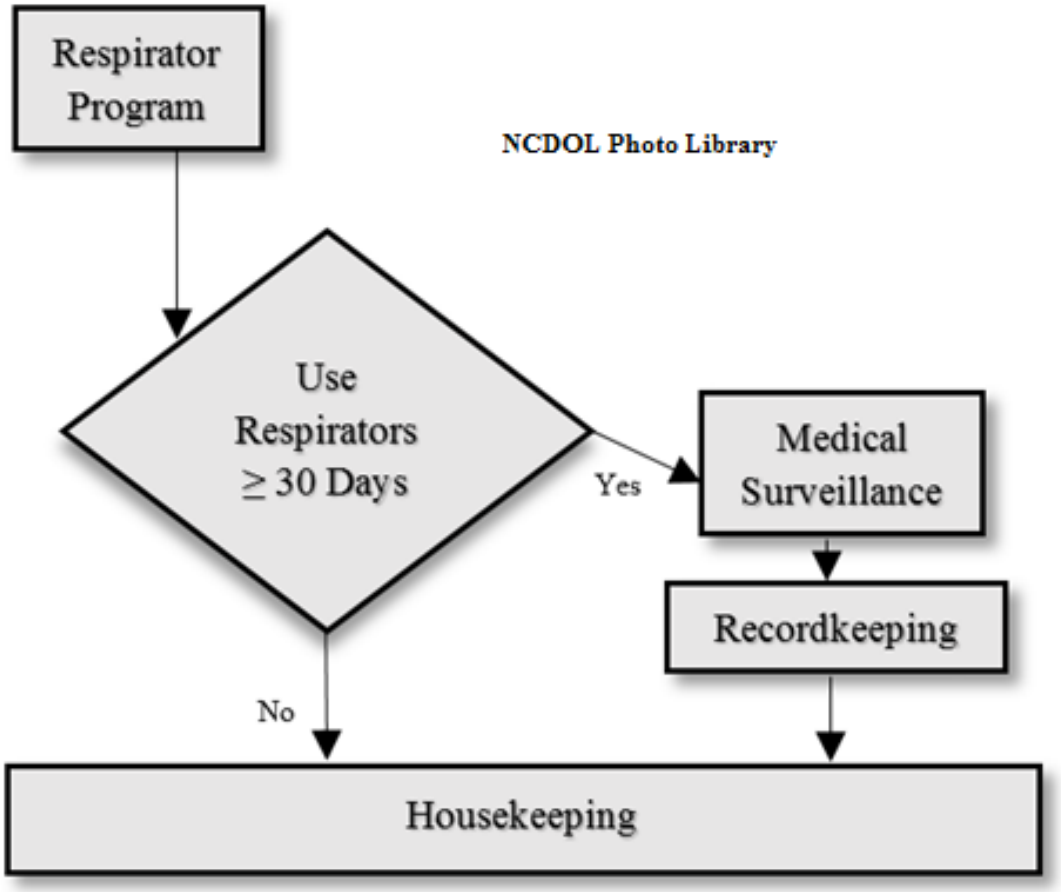
1926.1153(e)

Where respiratory protection is **required**, the employer must provide each employee an appropriate respirator that complies with the requirements of paragraph (e) and 29 CFR 1910.134

- Written Respiratory Protection Program
- Medical evaluation
- Fit testing
- Training
  - Proper use
    - » Limitations/capabilities
    - » Maintenance/care/storage

Medical Surveillance

1926.1153(h)



Medical Surveillance

1926.1153(h)(2)

Initial (baseline) examination

- Must be made available within 30 days after initial assignment, *unless*
- Employee received a medical examination that meets the requirements of this section within the last three (3) years

Medical Surveillance

1926.1153(h)(3)

Periodic examination

- At least every three (3) years, or more frequently if recommended by the physician or other licensed health care professional (PLHCP)

- Exam includes medical and work history, physical examination (emphasis on respiratory system), chest X-ray, pulmonary function test (PFT), and tuberculosis (TB) test

Medical Surveillance: Employee 1926.1153(h)(5)

PLHCP's written medical opinion

- Receive a written medical report within 30 days after the medical examination

Report includes the results of the medical examination:

- Recommendations for limitations on respirator use
- Recommendations for limitations on exposure to silica
- Recommendations for further evaluation or treatment
- Examination by a specialist

Medical Surveillance: Employer 1926.1153(h)(6)

PLHCP's written medical opinion

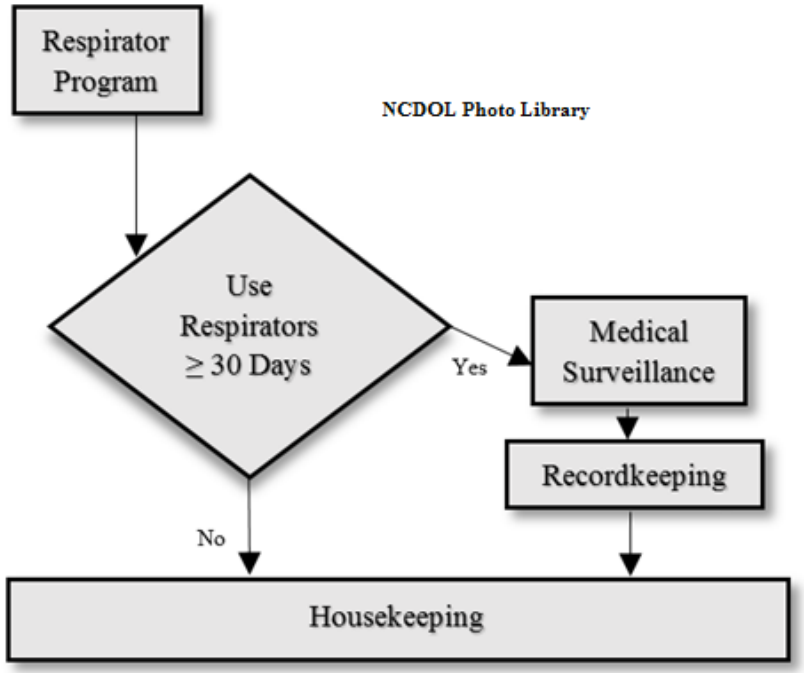
- Can only describe limitations on respirator use

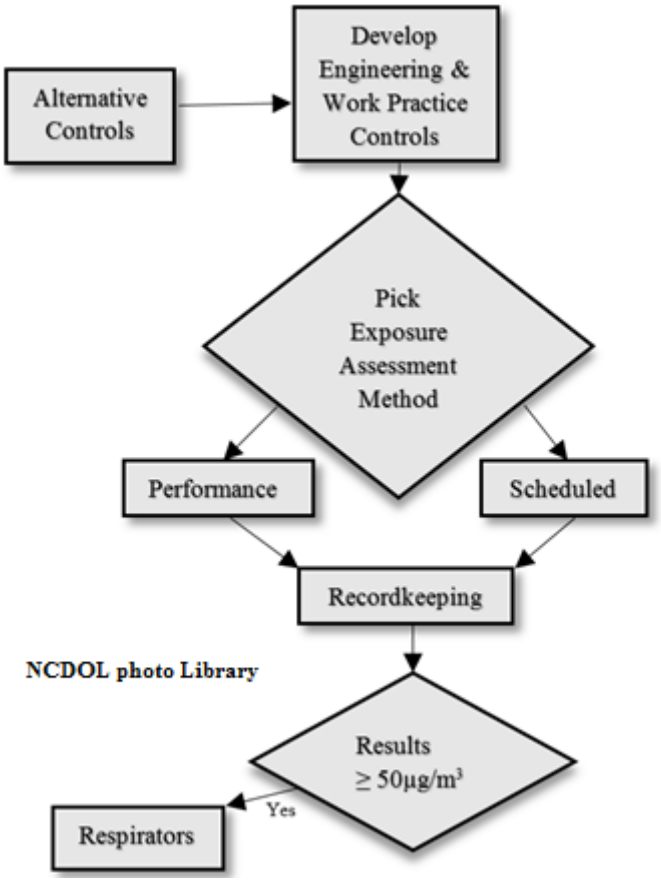
If employee **provides written authorization**, then the employer also receives:

- Any recommended limitations on the employee's exposure to respirable crystalline silica
- Recommendation for examination by a specialist

Recordkeeping

1926.1153(j)





Recordkeeping

1926.1153(j)(1)

Air monitoring

- Employer shall make and maintain an accurate record of all exposure measurements taken to assess employee and/or objective data relied upon to determine exposure to respirable crystalline silica
- All exposure records must be maintained and made available to employees, in accordance with 29 CFR 1910.1020

Recordkeeping

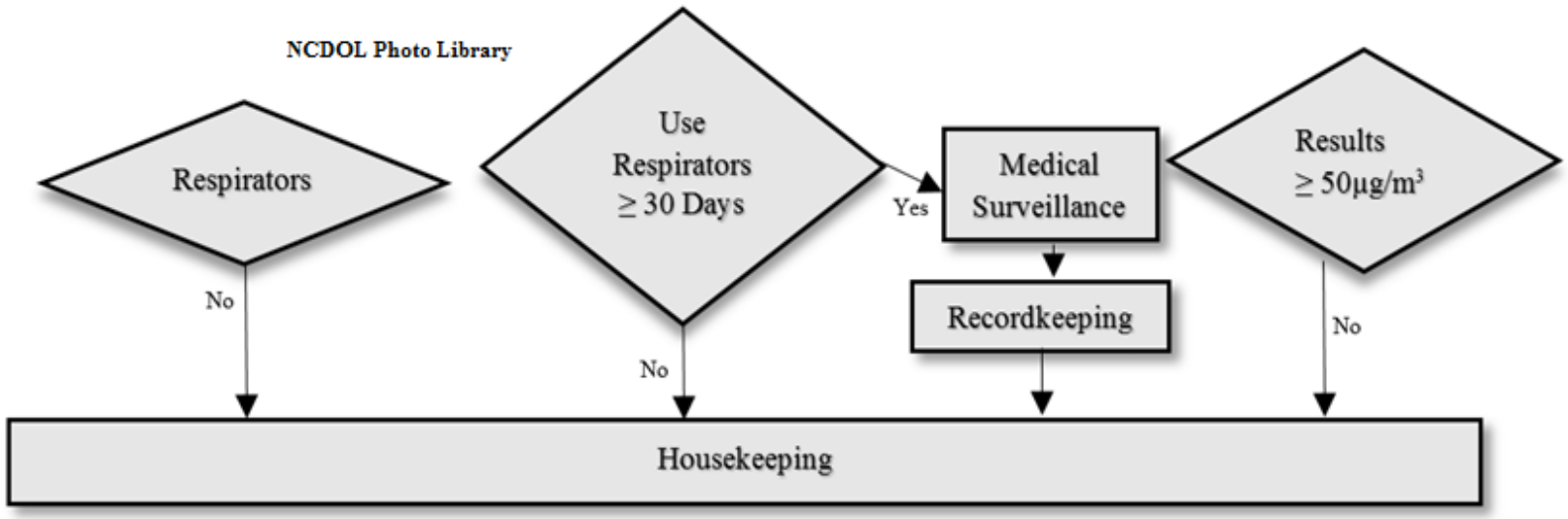
1926.1153(j)(3)

Medical Surveillance Program

- Make and maintain an accurate record for each employee covered by medical surveillance
- Medical records must be maintained and made available in accordance with 29 CFR 1910.1020

Housekeeping

1926.1153(f)



Housekeeping

1926.1153(f)(1)-(2)

Activities that could contribute to silica exposure are not allowed.

- Dry sweeping or dry brushing
- Compressed air to clean surfaces or cloths

Housekeeping

1926.1153(f)(1)

Approved activities

- Wet sweeping
- Vacuuming (HEPA-filter)
- Compressed air when used in conjunction with a ventilation system that effectively captures the dust cloud created
- Other methods that minimize the likelihood of exposure
- No alternative method is feasible
  - Dry sweeping or dry brushing
  - Compressed air

Housekeeping

1926.1153(f)(1)

Approved activities

- Wet sweeping
- Vacuuming (HEPA-filter)
- Compressed air when used in conjunction with a ventilation system that effectively captures the dust cloud created
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Vacuuming Without a Filter

Vacuuming Without a Filter

Vacuuming Without a Filter

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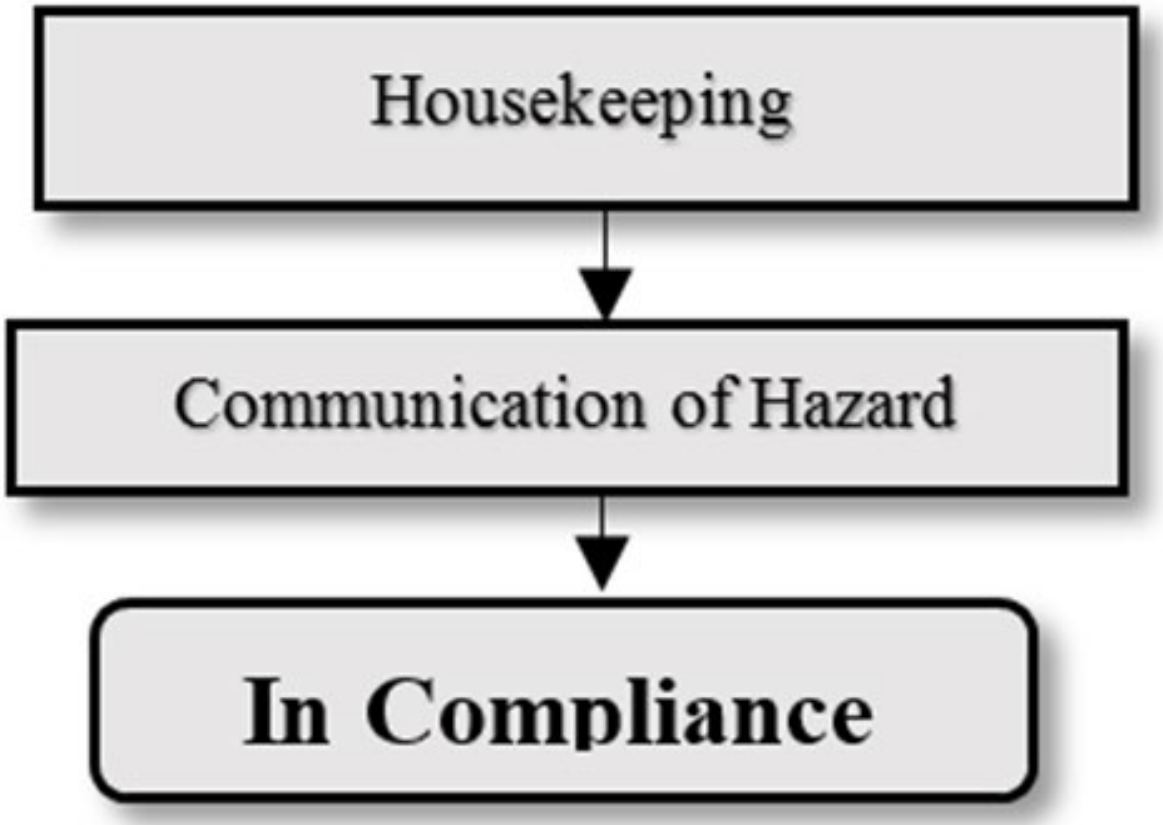
Vacuuming Without a Filter

Vacuuming Without a Filter

Vacuuming Without a Filter

Communication

1926.1153(i)



NCDOL Photo Library

Communication

1926.1153(i)(1)

- Hazard Communication Standard (HCS)
  - Address: Cancer, lung effects, immune system effects, and kidney effects
  - Safety Data Sheets (SDS)
  - Labels

Employee Information/Training 1926.1153(i)(2)

- Exposure to respirable crystalline silica
  - Associated health hazards
  - Specific Tasks in the working environment
  - Controls that minimize or eliminate exposure
- Explanation of the silica standard
- Identify the competent person
- Purpose and a description of the medical surveillance program

Review

Exposure to respirable crystalline silica has been linked to:

- Silicosis
- Lung cancer
- Chronic obstructive pulmonary disease
- Kidney disease

Silica Flow Chart

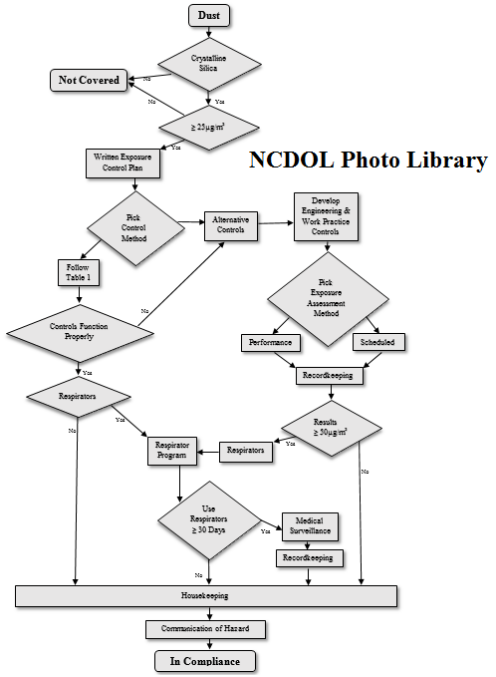
1926.1153

(a) Scope and application
(g) Written exposure control plan

(c) Specified exposure control methods
OR
(d) Alternative exposure control methods

Maybe
(e) Respiratory protection
(h) Medical surveillance

(j) Recordkeeping
(f) Housekeeping
(i) Communication



Review

- Dust generation and exposure
- Material composition
- Who is your competent person?

Protect yourself!

Summary

- Respirable crystalline silica – what it is, sources and health effects
- Identification/exposure controls – silica producing work processes and how to control it
- New OSHA regulatory requirements

Thank You For Attending!

Final Questions?

1-800-NC-LABOR

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