

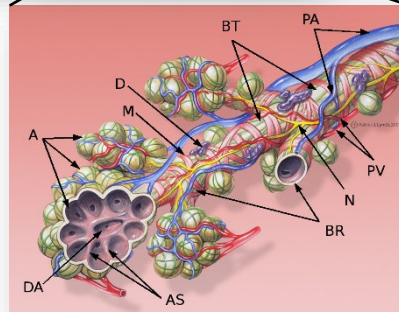
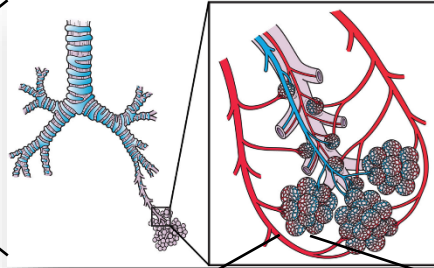
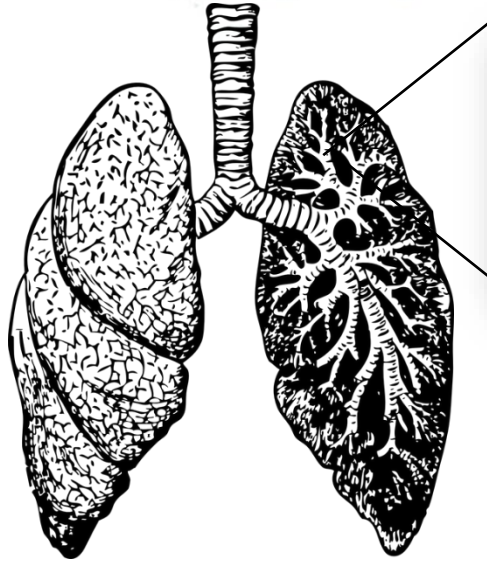
Respirable Silica

Johannes Doemer PhD, ROH



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Respirable – Deep into Our Lungs



< 100 μm
'Inhalable' fraction.
Can enter the throat:
Irritation

< 10 μm
'Thoracic' fraction.
Past the bronchus:
Acute disease

< 4 μm
'Respirable' fraction.
Can reach the alveoli:
Chronic disease

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- Dr Claire Horwell, Durham University UK

Silica



- Silica (SiO_2) – highly common natural mineral
- Crystalline Silica / Quartz (most common form of crystalline silica)
 - Granite (~70%)
 - Concrete (25 – 75%)
 - Sand (up to 100%)
 - Brick (~30%)
 - Asphalt (5-25%)
 - Engineered / Artificial Stone (up to 90%)

Respirable Silica – Making it Airborne

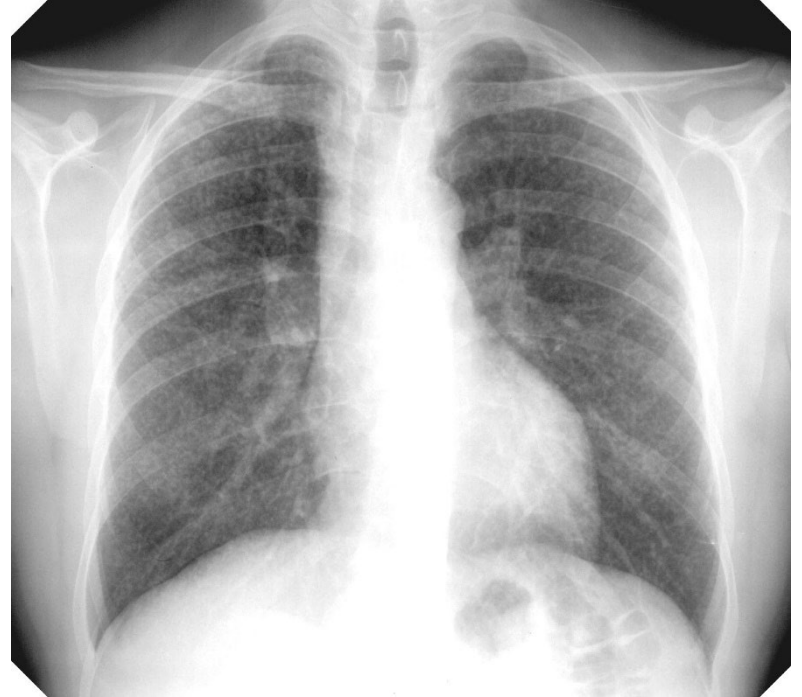


Health Effects – Silicosis

- Caused by scarring of the lung tissue by silica particles
- Higher exposure = higher risk
- Breathing becomes difficult
- No known cure
- Fatal, depending on severity

- Chronic Silicosis (10–20 yrs)
- Accelerated Silicosis (5–10 yrs)
- Acute Silicosis (0–5 yrs)

- Lung cancer etc.





Health Effects – Silicosis

- WorkSafe BC Video: https://www.youtube.com/watch?v=R_sC2wX9Uwc

Silica Dust Exposure

HOW much is TOO much?

The amount of silica dust that can fit on Abraham Lincoln's forehead on a penny would leave your workers overexposed in a 10x10 foot room.

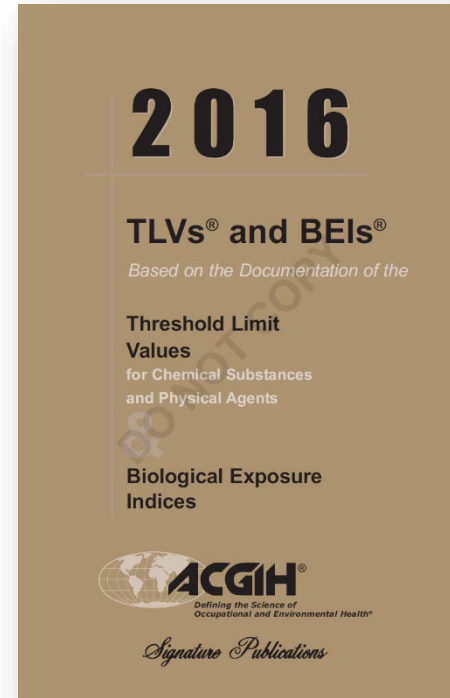


NE SiLEX
Silica Dust Suppressant

Respirable Silica – Occupational Exposure Limit

Per ACGIH 2016 Publication

- Crystalline Silica (Respirable) 0.025 mg/m³ (as TWA)



Classical Approach



The Silica Control Tool

- An online risk assessment tool created by BCCSA
- Based on model derived from > 5000 personal silica measurements
- Creates task-specific silica exposure estimates (controlled and uncontrolled)



The Silica Control Tool

- Enables employers to easily access and use existing exposure data
- Educate employers and workers
- Produces Exposure Control Plans (ECP)
- Every association member will have access

- Resulting ECP can be used for compliance verification



Silica Tool – Getting Started



Exposure Control Planning

INTRODUCTION

SILICA PROCESS

Get prepared

Jobsite details

Work activity

Work area & duration

Silica process summary

SILICA EXPOSURE (NO CONTROLS)

EXPOSURE CONTROL

SILICA EXPOSURE (WITH CONTROLS)

RESIDUAL EXPOSURE CONTROL

DOCUMENTATION

Jobsite Details

The **jobsite** is the location where your workers will be performing the work activity. The location and jobsite characteristics can impact the amount of predicted airborne dust. In addition to helping identify the risk, the jobsite details you enter below will also be included in your ECP document.

Jobsite Name:

NBCSA

Jobsite Sector:

Civil Engineering & Roadwork

Jobsite Address:

123 Everywhere Rd

Construction Project Type:

Renovation

City:

Fredericton

Province:

BC

Postal Code:

E2L 3X9

Start Date:

11/2/2023

End Date:

12/6/2023

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Silica Tool – Task Input



Exposure Control Planning

Jobsite at
NBCSA
November 2nd, 2023 to December 6th, 2023

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Jobsite details

Work activity

Work area & duration

Silica process summary

- SILICA EXPOSURE (NO CONTROLS)
- EXPOSURE CONTROL
- SILICA EXPOSURE (WITH CONTROLS)
- RESIDUAL EXPOSURE CONTROL
- DOCUMENTATION

Work Activity

The **work activity** is the combination of *material*, *task* and *tool* that will be performed. Basically, (1) the *material* determines how much crystalline silica is present and how easily dust can be created when disturbed; and (2) the *task/tool* determines how much energy is exerted into the material. The combination of (1) and (2) determines how much airborne RCS dust is predicted as a result of the nature of the work activity.

Identify the planned work activity to be performed at this jobsite. In some cases, note that the combination of *material* and *task* (without further identifying the *tool*) is enough to make a determination of how much energy is expected to be exerted into the material.

1. Select Material:

2. Select Task:



3. Select Tool:

Can't find your Material, Task or Tool? [Click here.](#)

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Silica Tool – Task Input



Exposure Control Planning

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November 2nd, 2023 to December 6th, 2023

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 - Jobsite details
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 - Work area & duration
 - Silica process summary

SILICA EXPOSURE (NO CONTROLS)

EXPOSURE CONTROL

SILICA EXPOSURE (WITH CONTROLS)

RESIDUAL EXPOSURE CONTROL

DOCUMENTATION

Work Activity

The **work activity** is the combination of *material*, *task* and *tool* that will be performed. Basically, (1) the *material* determines how much crystalline silica is present and how easily dust can be created when disturbed; and (2) the *task/tool* determines how much energy is exerted into the material. The combination of (1) and (2) determines how much airborne RCS dust is predicted as a result of the nature of the work activity.

Identify the planned work activity to be performed at this jobsite. In some cases, note that the combination of *material* and *task* (without further identifying the *tool*) is enough to make a determination of how much energy is expected to be exerted into the material.

1. Select Material:
Concrete

2. Select Task:
Breaking (Excavator)
Breaking (Jackhammer)
Breaking (Excavator with Jackhammer Attachment)
Ceiling Grinding
Chipping

3. Select Tool:

Can't find your Material, Task or Tool? [Click here](#)

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Silica Tool – Task Input



Exposure Control Planning

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Work Activity

The **work activity** is the combination of *material*, *task* and *tool* that will be performed. Basically, (1) the *material* determines how much crystalline silica is present and how easily dust can be created when disturbed; and (2) the *task/tool* determines how much energy is exerted into the material. The combination of (1) and (2) determines how much airborne RCS dust is predicted as a result of the nature of the work activity.

Identify the planned work activity to be performed at this jobsite. In some cases, note that the combination of *material* and *task* (without further identifying the *tool*) is enough to make a determination of how much energy is expected to be exerted into the material.

1. Select Material:

Concrete

2. Select Task:

Cutting (Power Saw)

3. Select Tool:

Powered saw

Can't find your Material, Task or Tool? [Click here.](#)

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Silica Tool – Task Input



Exposure Control Planning

Cutting Concrete with a Saw

Jobsite at
NBCSA
November 2nd, 2023 to December 6th, 2023

✔ INTRODUCTION

📍 SILICA PROCESS

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- ✔ Jobsite details
- ✔ Work activity
- **Work area & duration**
- Silica process summary

↓ SILICA EXPOSURE (NO CONTROLS)

↓ EXPOSURE CONTROL

↓ SILICA EXPOSURE WITH CONTROLS

Work Area & Duration

Where and how long the work activity takes place can amplify the exposure risk.

Identify the work area and work activity duration for **Cutting Concrete with a Saw** at **NBCSA**.

1. Select Work Area:

Outside

2. Select Work Activity Duration (avg. per shift):

4 to 8 hours

Note: For a work activity that moves between inside and outside, select *Inside* when at least 25% of the time is spent inside.

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Silica Tool – Exposure (No Controls)



Exposure Control Planning

Cutting Concrete with a Saw

Outside for 4 to 8 hours

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Exposure analysis (No Controls)

EXPOSURE CONTROL

SILICA EXPOSURE (WITH CONTROLS)

RESIDUAL EXPOSURE CONTROL

Exposure Analysis (No Controls)

RESULTS DETAILS SAVE



EXPOSURE MONITORING DATA EQUIVALENT

Est. Exposure Level (No Controls)	Exposure Limit	Action Level
0.829 mg/m³	0.025 mg/m³ Est. Exposure Level exceeds by 3316%	0.0125 mg/m³ Est. Exposure Level exceeds by 6632%

Risk Classification

HAZARDOUS LEVEL

We recommend to proceed as HAZARDOUS exposure level or perform an air sampling test.

Silica Tool – Controls



Exposure Control Planning

Cutting Concrete with a Saw

Outside for 4 to 8 hours

Jobsite at
NBCSA

November 2nd, 2023 to December 6th, 2023

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SILICA EXPOSURE (NO CONTROLS)

EXPOSURE CONTROL

Get prepared

Risk elimination & substitution

Engineering controls

Administrative controls

Exposure control summary

SILICA EXPOSURE (WITH CONTROLS)

Risk Elimination & Substitution

Please answer the question below about exposure elimination and substitution.

If you're not sure how to answer, click INFORMATION for guidelines and tips. Also, you can click YES to see details. You can always change your answer to NO later.

Elimination and Substitution

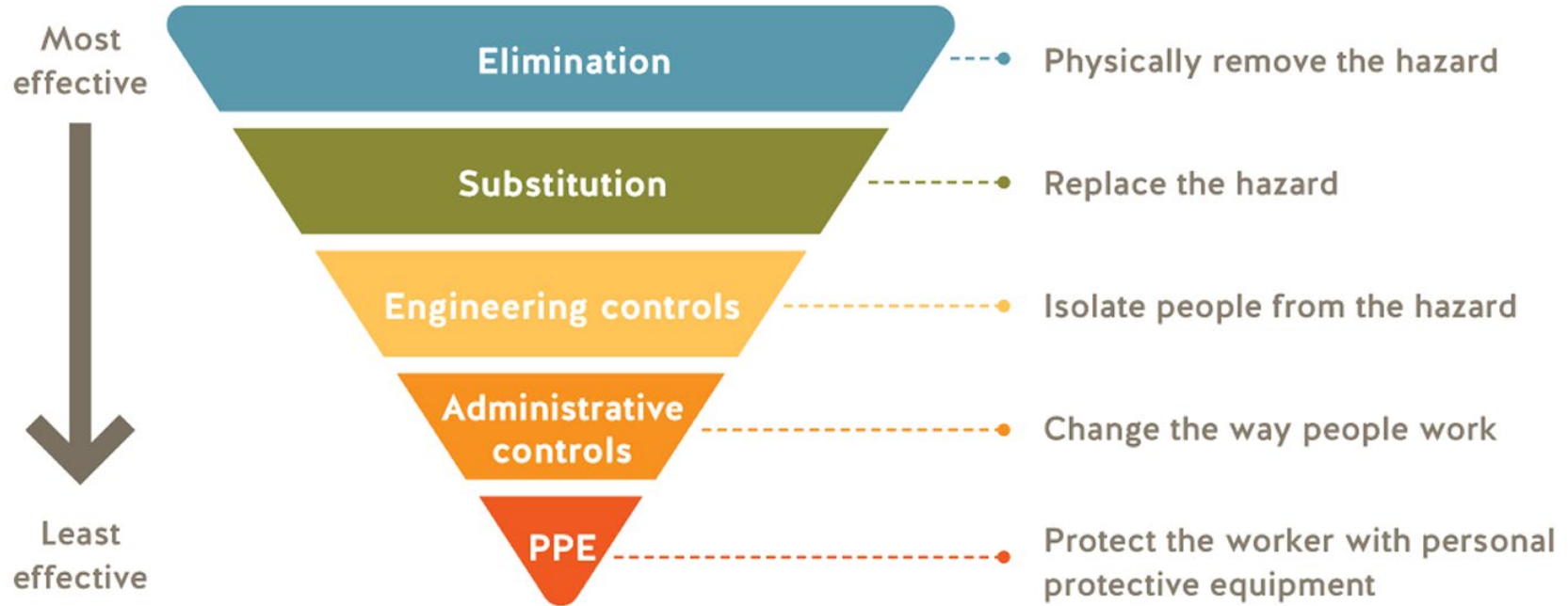
QUESTION INFORMATION

1. Can you eliminate the need for Cutting Concrete with a Saw ?

YES NO

Now, we'll ask questions about your available engineering controls.

The Tool Integrates the Hierarchy of Controls



Silica Tool – Engineering Controls

Exposure Control Planning

Cutting Concrete with a Saw

Outside for 4 to 8 hours

Jobsite at

NBCSA

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✔ SILICA PROCESS

✔ SILICA EXPOSURE (NO CONTROLS)

📍 EXPOSURE CONTROL

✔ Get prepared

✔ Risk elimination & substitution

● Engineering controls

● Administrative controls

● Exposure control summary

🔒 SILICA EXPOSURE (WITH CONTROLS)

🔒 RESIDUAL EXPOSURE CONTROL

🔒 DOCUMENTATION

🔒 CONCLUSION

Engineering Controls

Engineering controls are engineered methods that are built into the design of equipment, process, or plant to minimize a hazardous exposure.

Select the engineering control option you will be implementing for *Cutting concrete using a powered saw* at this jobsite.

If you're not sure which option to select, click DETAILS for (1) CRITERIA to see what the researchers envision for the control; (2) PROPER PRACTICES to see how the control is expected to be used; and (3) INFORMATION for control guidelines & tips.

Wetting integrated to tool [Details](#)

Wetting separate from tool [Details](#)

+ Wetting separate from tool will be added to your ECP.

CRITERIA

PROPER PRACTICES

INFORMATION

Your wetting system must meet the following criteria:

- Sufficient water flow volume.
- Sufficient water spray or distribution at point of origin.
- Sufficient uninterrupted water source.
- A means to collect contaminated water so as to avoid secondary exposures.

350×350

Silica Tool – Administrative Controls



Exposure Control Planning

Cutting Concrete with a Saw

Outside for 4 to 8 hours

Jobsite at
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- ✔ SILICA EXPOSURE (NO CONTROLS)

EXPOSURE CONTROL

- ✔ Get prepared
- ✔ Risk elimination & substitution
- ✔ Engineering controls
- Administrative controls
- Exposure control summary

SILICA EXPOSURE (WITH CONTROLS)

Administrative Controls

Administrative controls are work practices and policies planned and implemented with the goal to reduce the risk of RCS dust exposure.

Answer the questions below about the administrative controls you will be implementing.

Correct use & maintenance

1. Inspections & Maintenance

ANSWER CRITERIA PROPER PRACTICES INFORMATION

Will you be implementing scheduled inspections and maintenance of engineering controls to ensure they are kept in good working order?

YES NO

Administrative Controls

- Inspection and Maintenance of Tools / Controls
- Housekeeping
- Decontamination
- Silica safety instruction & training
- Emergency Preparedness
- Work shift scheduling
- Barriers
- Enclosures



Silica Tool – Exposure Analysis



Exposure Control Planning

Cutting Concrete with a Saw

Outside for 4 to 8 hours

Jobsite at
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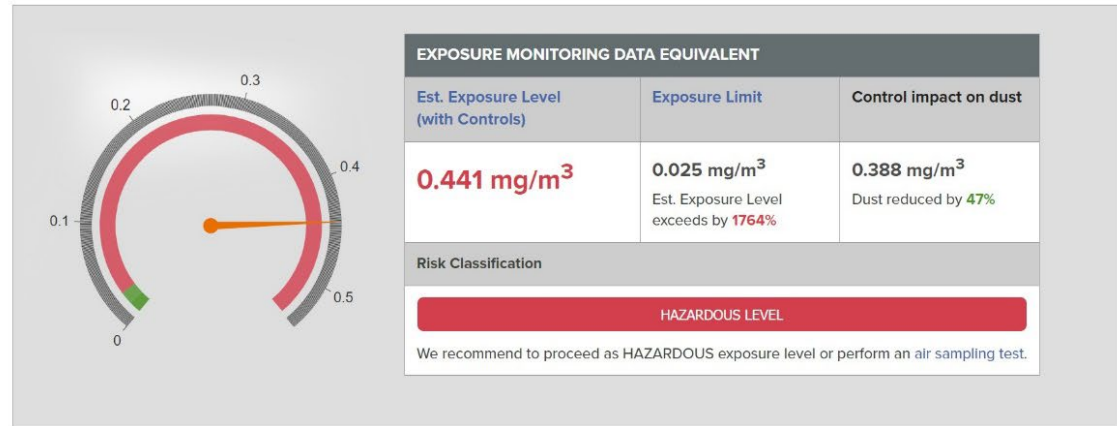
📍 SILICA EXPOSURE (WITH CONTROLS)

- Get prepared
- Exposure Analysis (With Controls)**

- RESIDUAL EXPOSURE CONTROL
- DOCUMENTATION
- CONCLUSION

Exposure Analysis (with Controls)

RESULTS DETAILS



Silica Tool – Respiratory Protection



Exposure Control Planning

Cutting Concrete with a Saw

Outside for 4 to 8 hours

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November 2nd, 2023 to December 6th, 2023

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RESIDUAL EXPOSURE CONTROL

Get prepared

Respirators & other PPE

DOCUMENTATION

CONCLUSION

Respirators & Other PPE

Personal Protective Equipment (PPE) is equipment worn by workers to reduce exposure.

Answer these questions below about the PPE controls you have available for this jobsite.

Respiratory Protective Equipment (RPE)

RESPIRATOR SELECTION

Respirator Usage	Required Protection Factor	Respirator Type & Filter
PROTECTION REQUIRED	25	<p>Loose-fitting facepiece, powered (PAPR), equipped with N100 filter</p> <ul style="list-style-type: none">Please note, the respirator type above is an example of a respirator type that may meet the required protection factor. Users may elect to use alternate respiratory protection equipment that meets the required protection factor rating.Any respirator choice must be fitted an N100, P100 or R100 filter. Respirators and filters must be NIOSH approved.

Respirator Selection Example – Air Purifying



**Half Face
Respirator**

P100

Protection Factor **10**

**Full Face
Respirator**

P100

Protection Factor **50**

**Loose Fitting
Powered Air Purifying
Respirator (PAPR)**

P100

Protection Factor **25**

- Based on *CSA Z94.4-11 (R 2016) Selection, use, and care of respirators*

Silica Tool – Exposure Control Plan

Exposure Control Plan (ECP) Page 1 of 12

B.C. CONSTRUCTION SAFETY ALLIANCE
BC

ECP CONTACT:
Johannes Doemer
johannes.doemer@wso-bc.ca

Exposure Control Plan (ECP)

Cutting Concrete with a Saw

Outside for 4 to 8 hours (avg.) per work shift

JOB SITE:
NBCSA
November 2nd, 2023 to December 6th, 2023
123 Everywhere Rd
Fredericton, BC E2L 3X9

Jobsite Sector:
Civil Engineering & Roadwork

Project Type:
Renovation

⚠ Cutting Concrete with a Saw without proper dust controls can generate high levels of hazardous RCS dust. Breathing in this fine dust can cause serious lung diseases such as silicosis, lung cancer, pulmonary tuberculosis, and chronic pulmonary disease. Exposures may also be related to the development of autoimmune disorders, chronic renal diseases, and other adverse health effects. Acute silicosis can occur just weeks or months after a high exposure, and can be fatal. The other delayed health effects can appear years later.

Each year, more workers in BC workplaces are exposed to RCS dust than to asbestos or lead.

For more information on the RCS dust exposure risk, see **section 1.0 EXPOSURE HEALTH RISKS.**

--- ECP SUMMARY

- 1.0 EXPOSURE HEALTH RISKS
- 2.0 ECP PURPOSE
- 3.0 RESPONSIBILITIES
- 4.0 EXPOSURE (NO CONTROLS)
- 5.0 EXPOSURE PREVENTION & CONTROL
- 6.0 EXPOSURE (WITH CONTROLS)
- 7.0 RESIDUAL EXPOSURE CONTROL (PPE)
- 8.0 DOCUMENTATION

--- SITE-SPECIFIC WORK PROCEDURES

BCCSA **UBC** **UBC**
BC Construction Safety Alliance UBC UBC
SPPM

Logo: SILICA TOOL

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Data Version: 6.0
http://www.bccsa.com/ehc.html

Exposure Control Plan (ECP) Page 2 of 12

EXPOSURE ANALYSIS (NO CONTROLS)

Est. Exposure Level (No Controls)	Exposure Limit	Action Level
0.829 mg/m³	0.025 mg/m ³ Est. Exposure Level exceeds by 3316%	0.0125 mg/m ³ Est. Exposure Level exceeds by 6632%

Risk Classification
HAZARDOUS LEVEL

We recommend to proceed as HAZARDOUS exposure level or perform an air sampling test.

ENGINEERING CONTROLS	ADMINISTRATIVE CONTROLS
Wetting separate from tool	<ul style="list-style-type: none"> · Barriers · Exposure Emergency Preparedness · Housekeeping · Hygiene

INSPECTIONS & MAINTENANCE
· Silica Safety Instruction & Training

EXPOSURE ANALYSIS (WITH CONTROLS)

Est. Exposure Level (with Controls)	Exposure Limit	Control Impact on dust
0.441 mg/m³	0.025 mg/m ³ Est. Exposure Level exceeds by 1764%	0.388 mg/m ³ Dust reduced by 47%

Risk Classification
HAZARDOUS LEVEL

We recommend to proceed as HAZARDOUS exposure level or perform an air sampling test.

RESIDUAL EXPOSURE CONTROL (PPE)

Respirator Usage	Required Protection Factor	Respirator Type & Filter
PROTECTION REQUIRED	25	Loose-fitting facemasks, powered (PAPR), equipped with H100 filter Please note, the respirator type above is an example of a respirator type that may meet the required protection factor. Users may elect to use alternate respiratory protection equipment that meets the required protection factor rating. Any respirator choice must be fitted an N100, P100 or R100 filter. Respirators and filters must be NIOSH approved.

Other PPE

Risk Classification (Final)
LOW RISK LEVEL / PROCEED WITH CAUTION

We recommend to proceed as LOW risk level or perform an air sampling test. PROCEED WITH CAUTION ONLY USING REQUIRED PPE AND RESPIRATOR PROGRAM.

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Silica Tool – Cutting without Control



Exposure Control Planning

Cutting Concrete with a Saw

Outside for 4 to 8 hours

Jobsite at
NBCSA

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RESIDUAL EXPOSURE CONTROL

✔ Get prepared

● Respirators & other PPE

🔒 DOCUMENTATION

🔒 CONCLUSION

Respirators & Other PPE

Personal Protective Equipment (PPE) is equipment worn by workers to reduce exposure.

Answer these questions below about the PPE controls you have available for this jobsite.

Respiratory Protective Equipment (RPE)

RESPIRATOR SELECTION

Respirator Usage	Required Protection Factor	Respirator Type & Filter
PROTECTION REQUIRED	50	Full facepiece, non-powered, equipped with N100 filter <ul style="list-style-type: none">• Please note, the respirator type above is an example of a respirator type that may meet the required protection factor. Users may elect to use alternate respiratory protection equipment that meets the required protection factor rating.• Any respirator choice must be fitted an N100, P100 or R100 filter. Respirators and filters must be NIOSH approved.

Silica Tool – Cutting with LEV Control

ENGINEERING CONTROLS	ADMINISTRATIVE CONTROLS	
<ul style="list-style-type: none"> LEV integrated to tool 	<ul style="list-style-type: none"> Barriers Exposure Emergency Preparedness Housekeeping Hygiene 	<ul style="list-style-type: none"> Inspections & Maintenance Silica Safety Instruction & Training

EXPOSURE ANALYSIS (WITH CONTROLS)		
Est. Exposure Level (with Controls)	Exposure Limit	Control impact on dust
0.209 mg/m³	0.025 mg/m³ Est. Exposure Level exceeds by 836%	0.586 mg/m³ Dust reduced by 74%
Risk Classification		
<div style="background-color: red; color: white; padding: 5px; display: inline-block;">HAZARDOUS LEVEL</div>		
We recommend to proceed as HAZARDOUS exposure level or perform an air sampling test.		

RESIDUAL EXPOSURE CONTROL (PPE)		
Respirator Usage	Required Protection Factor	Respirator Type & Filter
PROTECTION REQUIRED	10	<p>Half facepiece, non powered with N100 filter</p> <ul style="list-style-type: none"> Please note, the respirator type above is an example of a respirator type that may meet the required protection factor. Users may elect to use alternate respiratory protection equipment that meets the required protection factor rating. Any respirator choice must be fitted an N100, P100 or R100 filter. Respirators and filters must be NIOSH approved.
Other PPE		

Questions & Feedback

- Thanks to BCCSA for demo access to the tool and special thanks to Katriona MacNeil, Occupational Hygienist with WCB PEI