Silica Control Tool®: A Risk Assessment Tool

Step-by-step guidance for silica dust compliance on construction sites

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Abstract

Respirable crystalline silica is a known lung carcinogen and is associated with respiratory illnesses such as silicosis, chronic obstructive pulmonary disease (COPD), and pulmonary fibrosis. Nearly half a million Canadians[1] and 2.3 million Americans[2] are occupationally exposed to respirable crystalline silica. Construction is the largest exposed industry. Construction environments are fast paced with continuously changing work activities. It can be costly and time-consuming to complete traditional air monitoring for silica. In addition, different jurisdictions have varying occupational exposure levels for silica, making compliance a challenge. The Silica Control Tool® is an online risk assessment tool created to help control silica exposures on construction sites.

Introduction

High levels of respirable crystalline silica are common in the construction industry due to the elevated silica content of construction materials, and the nature of tasks employed on a job site. The Silica Control Tool® uses a predictive regression model to generate exposure risk estimates (in mg/m^3). The Silica Control Tool® is an online risk assessment tool designed to be practical for non-OHS professionals. The work activity is determined by combining the material (e.g., concrete, mortar, tiles), the task (e.g., breaking, coring, grinding) and the tool (e.g., power drill, hand saw, portable saw). The material selected will determine the silica content and the ease with which dust can be created when disturbed. The task and tool will determine the extent of energy which will be exerted into the material. The combination of these selections will determine how much airborne respirable crystalline silica dust is estimated to be released due of the nature of the work activity.

Material + Task + Tool = Work Activity

Other predictor variables are considered such as industry sector (e.g., residential, industrial, civil); project type (e.g., new, renovation, demolition); sample/work duration, and work environment (e.g., indoor or outdoor, restricted space, confined space). A respirable crystalline silica exposure estimate is calculated based on the inputted variables. For clarity, the output provided is a single value reflective of the upper 95th percentile. Using a multiple probability simulation, each model variable is described by a coefficient as the mean and a standard error as the standard deviation[3].

Methods and Materials

Various sources of respirable crystalline silica data were used to create the Silica Control Tool® including published literature, databases, data sharing and exposure monitoring by health and safety professionals. The retrieved exposure data was assessed and validated following these criteria: the analyte was respirable crystalline silica; a standard method was used (e.g., NIOSH 7500, OSHA ID-142); key sampling parameters were available (e.g., flow rate, duration); adequate original quality control data was provided (e.g., calibration, field blanks, sample volume, etc.); and the data was personal sampling[3].

The database powering the Silica Control Tool® is designed to be continually updated with new data measurements. In 2026, around 5,000 individual exposure data points existed within this database.

There are limitations to the Silica Control Tool® to consider. It can only provide one estimate for one work activity at a time. It considers the worker completing the task and not those nearby. When a situation involves multiple work activities, each activity must be evaluated as a distinct task. Engineering controls are limited to those with available data in the database. If the user applies an alternative control, it may be entered manually; however, it will not be incorporated into the second exposure estimate calculation.

Any Material (Mechanical Street Sweeper)	Artificial Stone or Granite Countertop	Asphalt	Cementitious Material	Ceramic Tiles
Concrete	Concrete Masonry Unit	Construction Dust	Drywall	Fibre Cement Board
Gypcrete	Marble/ Granite	Mortar	Plaster	Rock (Drilling Machine)
	Rock/Sand/ Earth	Shotcrete	Tiles	

Figure 1. Material selections available in the Silica Control Tool®

Results

Four jurisdictions in Canada have each adopted a version of the Silica Control Tool®. Each version is tailored to the jurisdiction's specific occupational exposure limits and regulations. The primary output of the tool is an Exposure Control Plan. The Exposure Control Plan includes job site details, work activity, exposure analysis in mg/m^3, percentage exceedance as compared against the occupational exposure limit and action limit, appropriate controls recommended using the hierarchy of controls and residual controls (PPE). The Exposure Control Plan is automatically saved in the online application for future use or can be downloaded in PDF format.

Total Users	8,425
Exposure Control Plans Started	45,681
Exposure Control Plans Completed	23,980

Figure 2. Numbers are reflective of all accounts[4] across the four versions of the Silica Control Tool®

Discussion

Most industrial/occupational hygienists would agree that quantitative exposure measurements are important but access to relevant and valuable data is often limited. There are few risk assessment resources for the non-OHS professional. Respirable crystalline silica data collected by employers, consultants or regulators is typically kept in-house and not made available to the public. Companies wishing to control silica exposures need to employ costly methods such as hiring an external OHS professional or completing on-site air monitoring.

The Silica Control Tool® can uniquely benefit small to medium sized companies with limited resources. It provides benefits by being easy to use by non-experts, allowing rapid silica risk assessments, and providing controls specific to the construction sector.

Silicosis is often regarded as an illness of the past; however, its burden remains substantial. It continues to be one of the most prevalent chronic occupational illnesses worldwide[5]. In Canada's most populous jurisdiction, the incidence of silicosis has been on the decline having dropped by 85% between 1996-2019. In contrast, the incidence of pulmonary fibrosis[6] has increased by nearly 200%. The observed trends suggest a potential association between these findings.

Silicosis is typically classified as acute, accelerated or chronic, but an accurate diagnosis depends on chest imaging, pulmonary function tests and occupational exposure history. An individual with silicosis may be asymptomatic or present with symptoms commonly associated with other illnesses (e.g. cough, fatigue or dyspnea). Higher compensation may be offered by insurance boards for use of other diagnostic codes. Perhaps an accurate and fulsome work history is not documented during a healthcare visit. Without these investigative tools, silica-related illnesses could easily be misclassified.



Image 1. Visual representation of the exposure analysis page.

Conclusions

The Silica Control Tool® is an effective risk assessment strategy to safeguard workers. It provides validated exposure estimates utilizing a database built on respirable crystalline silica air monitoring sourced from peer reviewed literature and technical reports. The validity of the exposure data was assessed using strict criteria prior to being entered into the database. Data sharing with the developers of the Silica Control Tool® is encouraged, and more data is added periodically.

Originally developed in British Columbia by the BC Construction Safety Alliance (BCCSA), tThe Silica Control Tool® is used in Ontario, Alberta and New Brunswick. Strong interest has been shown by other jurisdictions e.g. Nova Scotia (Canada) and WorkSafe Victoria (Australia). The Silica Control Tool® is an example of successful data sharing by means of an online risk assessment system providing accurate respirable crystalline silica exposure estimates.

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BCCSA BC Construction Safety Alliance

IHSA.ca Work Safe for Life

CCOHS Canadian Centre for Occupational Health and Safety

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For those interested in a trial account, please reach out to silicatool@bccsa.ca.

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