Exposure Monitoring Report Summary EMRS 1

Cutting Fiber Cement with Handheld Circular Saw using a Fan to Disperse Dust

IMPORTANT NOTICE

The exposure results presented in this report are only valid for the specific test conditions and equipment described herein. James Hardie cannot anticipate all possible conditions on a jobsite and makes no warranty that actual worker exposure results will duplicate the results presented herein. **Employers using this report for the purpose of complying with applicable laws remain responsible for ensuring that the conditions and results described in this report accurately characterize each employee's current exposures. It is the employer's responsibility to ensure that any equipment used to control silica dust is in good working order and employees are trained to use it according the equipment manufacturer's instructions.**

This report summarizes a monitoring study conducted by James Hardie to determine Respirable Crystalline Silica (RCS) dust concentrations of a Cut Station Operator where Fiber Cement (FC) siding and trim are being cut with circular saws and a fan is used to minimize breathing zone RCS. The purpose of this report is to provide employers with objective data[1] that may be used to assess employee exposure to RCS under the performance option of OSHA's Silica Rule for Construction 29 CFR §1926.1153(d)(2)(ii). This report should only be used to assess employee exposure if the tasks, tools and monitoring conditions described herein are substantially similar to the conditions on your jobsite. Monitoring for this report was conducted per NIOSH Method 7500 using a size-selective cyclone for respirable dust, with sample analysis conducted by a laboratory accredited by the American Industrial Hygiene Association.

Testing Conditions

A. Tools

- 7¼ in. Circular Saws including a Makita® 5007F,saw a SkilSaw 15 AMP Sidewinder™ saw, and a Dewalt DWE575 saw.
- All Saws were equipped with Diablo® 7¼ in. 4-Tooth Polycrystalline Diamond (PCD) HardieBlade® sawblades
- Various fans were used at cut stations as a control to disperse RCS dust generated and minimize worker exposures to RCS and included:
    - Floor Fans (Vent® VP25 900 CFM and Ridgid® AM2560 - 1625 CFM)
    - Circular Fans (Utilitech® 20-in. 3-Speed - 6000 CFM and Utilitech® 30-in. Pedestal Fan 8700 CFM)

[1] The term "objective data" means information, such as air monitoring data from industry-wide surveys or calculations based on the composition of a substance, demonstrating employee exposure to silica associated with a particular product or material or a specific process, task, or activity. The data must reflect workplace conditions closely resembling, or with a higher exposure potential than, the processes, types of material, control methods, work practices, and environmental conditions in the employer's current operations. Objective data reflecting "worst case" conditions, in particular, may be helpful in characterizing exposures for purposes of determining coverage under the standard.
From Occupational Exposure to Respirable Crystalline Silica 29 C.F.R. § 1910.1053; Frequently Asked Questions for General Industry; https://www.osha.gov/dsg/topics/silicacrystalline/SilicaGeneralIndustryFAQs.pdf

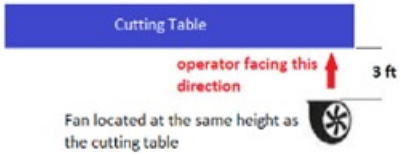
B. Weather (environmental conditions)

- All samples were collected outside to simulate typical construction scenarios
- Wind varied during monitoring events from calm (0 to 2 mph) to moderately windy (15 to 21 mph)
- Relative Humidity varied from 8 to 88 %, and Temperature ranged from 59 to 85 ^{o}F

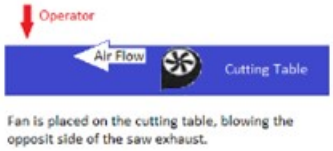
C. Other Conditions

- Circular saws were used to cut James Hardie fiber cement siding and trim using 2 different Cut Station configurations shown in **Figure 1.**
- The Cut Stations were set up and operated to in a manner typical for cutting fiber cement siding and trim in residential construction jobsite settings
- A typical mixture of 10% fiber cement trim boards (>3/4 in. thick) and 90% lap siding (5/16 in. thick) were cut. Lap siding was cut both singly and in a stacked configuration
- Total cutting rates of 50 to 60 linear feet per hour were used.
- Fans were placed 3 to 7 ft. from the saw, and aligned with prevailing wind directions to direct dust away from saw Operator
- Exposures were monitored over a 2 to 4 hour period.

Figure 1



Circular Saw Setup 1

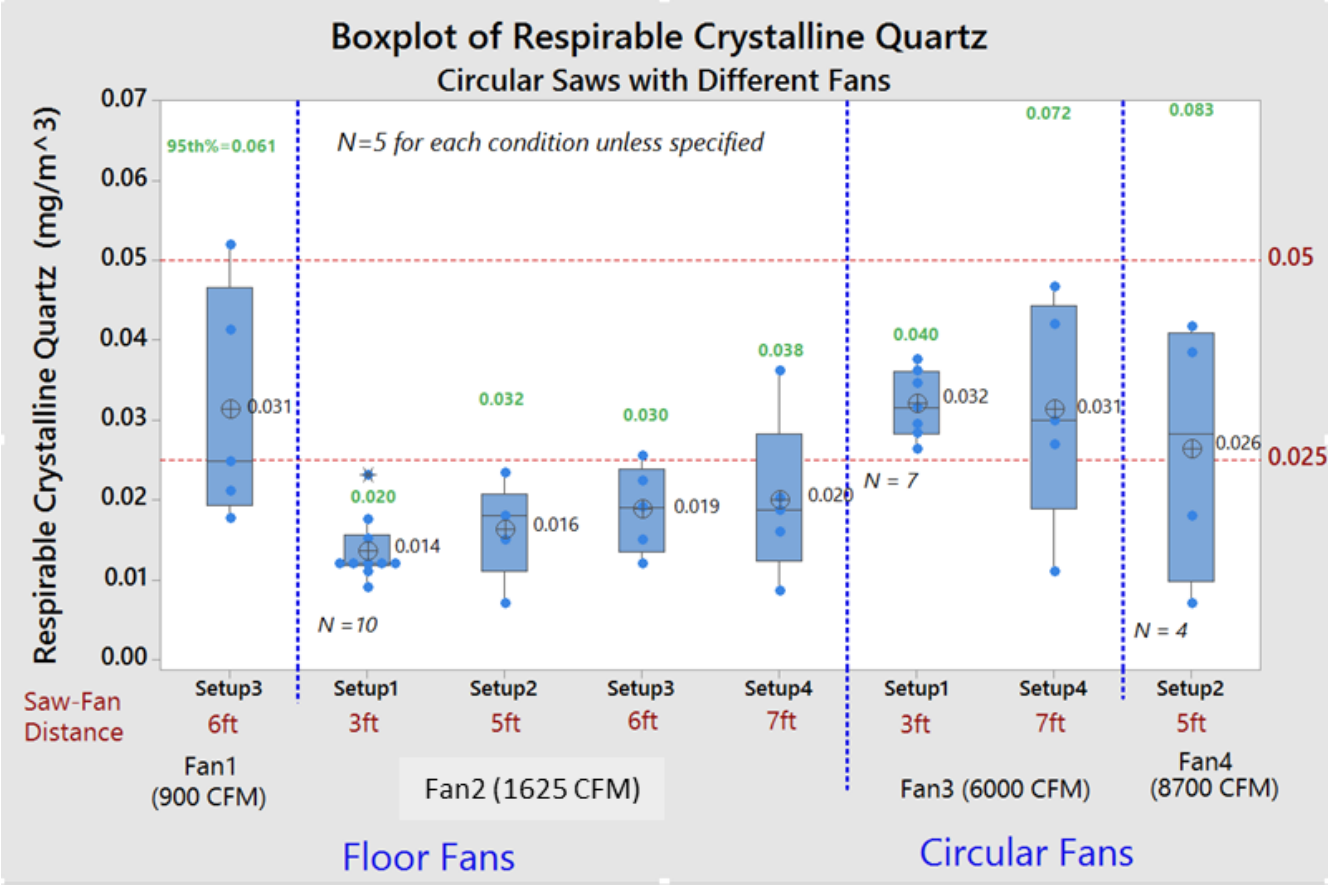


Circular Saw Setup 2

Fiber cement cutting typically takes place over 4 to 6 hours on a typical jobsite. The exposure results reported below assume the same cutting rate of 50 to 60 linear feet per hour for an entire eight hour period. This approach was utilized to best determine the effectiveness of fans under “worst-case” scenario.

Figure 2 demonstrates that a floor fan with a minimum of 1625 CFM (Fan 2), placed at a distance from 3 to 7 ft. from the circular saw cutting operation, produced an average Respirable Crystalline Silica exposure below the OSHA PEL within a 95% confidence limit when considering monitoring period results as 8-hour TWAs.

Figure 2



Further investigation into these results indicates that the coherence and speed of the fan exhaust may impact reliability. Floor fans deliver a concentrated stream of exhaust from a relatively small outlet compared to circular fans. Air speed drops as a function of distance from the fan outlet for both fan types, but floor fan models maintain a higher exhaust air speed at a greater distance from the outlet. While the 1625 CFM floor fan reliably maintained exposure below the PEL, the 900 CFM fan did not at equivalent distance despite having similar air speed.

Based on these measurements, positioning a 1625 CFM floor fan between 3 and 7 feet from the cutting point such that air speed is greater than 15 mph between the cutting point and the saw operator's breathing zone should reliably maintain exposure below the PEL for high throughput cutting (> 50 linear ft. per hour) over an entire 8 hour shift.

Fan	CFM rating	Exhaust Area (ft^2)	Calculated speed at outlet (mph)	Measured airspeed (mph)[2]				
				0 ft	3 ft	5 ft	6 ft	7 ft
Floor Fan 1	1625	0.5	41	40	25	18	15	10
Circular Fan 3	6000	2.2	31	25	9	16	5	4
Floor Fan 2	900	0.3	34	39	22	16	14	12
Circular Fan 4	8700	4.9	20	12	11	10	9	9

While other types of fans may be suitable for lower fiber cement cutting rates (< 50 linear feet per day), employers should independently verify these fans and cut station set ups for effectiveness in reducing RCS exposure.

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Formula for TWA

The **Permissible Exposure Limit (PEL)** is a legal limit for permissible exposure of an employee to RCS. OSHA requires an employer to keep employee exposures at or below the PEL of 0.050 mg/m^3 or RCS calculated as an 8-hour TWA (29 CFR § 1926.1153(d)(1)). A TWA (time-weighted average) is the average exposure workers have to RCS over an 8-hour work period. This means the exposure level as an 8-hour TWA is ≤0.05 mg/m^3; and can be as high as 0.10 mg/m^3 over a 4 hour period if no exposure to RCS for the remaining 4 hours. Further, the 2-hour exposure can be as high as 0.20 mg/m^3 assuming no exposure for the remaining 6 hours of the shift.

Calculating the TWA: A TWA is equal to the sum of the various time periods in an 8-hour work day multiplied by the level of RCS dust exposure during each period, divided by the hours in the workday. Specifically,

$$\text{8-Hour TWA} = \frac{[t1c1 + t2c2 + \ldots tncn]}{8 \text{ hours}}$$

Where "t" represents the time for each period and "c" indicates the concentration of RCS exposure during that period in milligrams per cubic meter (mg/m^3). For example:

An employee is exposed to RCS during 3 separate periods during an 8-hour work day. Period 1 was performed for 1 hour with an RCS exposure of 0.20 mg/m^3; Period 2 was performed for 2 hours with an RCS exposure of 0.060 mg/m^3; and Period 3 was performed for 1.5 hours with an RCS exposure of 0.040 mg/m^3. The employee had no further RCS exposure for the remaining 3.5 hours of the shift.

8-hour TWA = $\frac{[(1 \text{ hour})(0.20 \text{ mg/m}^3) + (2 \text{ hours})(0.060 \text{ mg/m}^3) + (1.5 \text{ hours})(0.040 \text{ mg/m}^3) + (3.5 \text{ hours})(0 \text{ mg/m}^3)]}{8 \text{ hours}}$

8-hour TWA = [0.20 mg/m^3 + 0.12 mg/m^3 + 0.060 mg/m^3 + 0 mg/m^3]/8 hours

8-hour TWA = [0.380 mg/m^3] /8 hours

8 hour TWA = 0.0475 mg/m^3

In this example, the employee's TWA (0.0475 mg/m^3) is below the PEL of 0.0 50 mg/m^3.

[2] Airspeed may be measured using a commercially handheld anemometer, for example a BTMETER BT-100, DIgiSense Minivane anemometer