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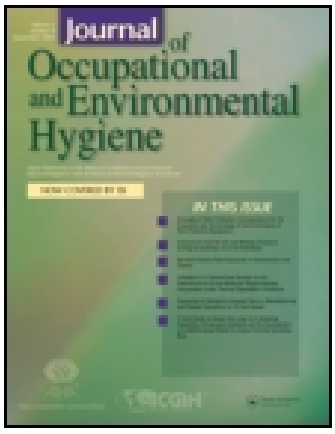

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An Evaluation of an Aftermarket Local Exhaust Ventilation Device for Suppressing Respirable Dust and Respirable Crystalline Silica Dust from Powered Saws

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Case Study
An Evaluation of an Aftermarket Local Exhaust Ventilation Device for Suppressing Respirable Dust and Respirable Crystalline Silica Dust from Powered Saws

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The objective of this study was to quantify the respirable dust and respirable silica exposures of roofing workers using an electric-powered circular saw with an aftermarket local exhaust ventilation attachment to cut concrete roofing tiles. The study was conducted to determine whether the local exhaust ventilation attachment was able to control respirable dust and respirable silica exposure below occupational exposure limits (OELs). Time-integrated filter samples and direct reading respirable dust concentrations were evaluated. The local exhaust ventilation consisted of a shroud attached to the cutting plane of the saw; the shroud was then connected to a small electric axial fan, which is intended to collect dust at the point of generation. All sampling was conducted with the control in use.

Roofers are defined as those individuals who only lay tiles. Cutters/roofers are defined as those workers who operate the powered saw to cut tiles and also lay tiles. Respirable dust from this evaluation ranged from 0.13 to 6.59 milligrams per cubic meter (mg/m^3) with a geometric mean of 0.38 mg/m^3 for roofers and from 0.45 to 3.82 mg/m^3 with a geometric mean of 1.84 mg/m^3 for cutters/roofers. Cutters/roofers usually handle areas close to crevices, edges, or tips of the roof whereas roofers handle areas where complete tiles can be placed. The respirable dust exposures for all cutters/roofers indicated concentrations exceeding the Occupational Safety and Health Administration's (OSHA) permissible exposure limit (PEL) for respirable dust containing silica; it was also exceeded for some of the roofers. The respirable silica concentrations ranged from 0.04 to 0.15 mg/m^3 with a geometric mean of 0.09 mg/m^3 for roofers, and from 0.13 to 1.21 mg/m^3 with a geometric mean of 0.48 mg/m^3 for cutters/roofers. As with respirable dust, the respirable silica exposures for cutters/roofers were higher than the exposures for roofers.

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INTRODUCTION

Silicosis is an occupational respiratory disease caused by inhaling respirable crystalline silica dust. Silicosis is irreversible, often progressive (even after exposure has ceased), and potentially fatal.[1] Because no effective treatment exists for silicosis, prevention through exposure control is essential. Exposure to respirable crystalline silica dust occurs in many occupations including construction. Crystalline silica refers to a group of minerals composed of silicon and oxygen; a crystalline structure is one in which the atoms are arranged in a repeating three-dimensional pattern. The three major forms of crystalline silica are quartz, cristobalite, and tridymite. Quartz is the most common form of crystalline silica.[2] Respirable refers to that portion of airborne crystalline silica that is capable of entering the gas-exchange

regions of the lungs if inhaled; this includes particles with aerodynamic diameters of less than approximately 10 micrometers (μm).[1]

Many construction tasks have been associated with overexposures and most recently, a series of NIOSH Health Hazard Evaluations has highlighted a newly recognized hazard resulting from cutting concrete tiles in the residential roofing industry.[3–5] Roofers, who cut these tiles using tools such as gasoline-powered saws, are exposed to high concentrations of respirable crystalline silica and noise. Because of the intrinsically hazardous nature of work on pitched roofs and the characteristics of the material, traditional engineering control solutions such as local exhaust ventilation (LEV) or water suppression are not viewed favorably due to potential slipping and tripping hazards.

The goal of this investigation was to quantify the exposures to respirable crystalline silica when using a powered saw with aftermarket local exhaust ventilation while cutting concrete roofing tiles. In this case, the LEV consisted of a shroud attached to the cutting section; the shroud was connected to a small electric axial fan with a short flexible hose. The dust was then collected in a dust bag for removal. The system was permanently attached to the saw.

The control technology examined in this survey was evaluated previously at other roofing sites by OSHA (on two occasions), by an insurance company, and by a local university.[6–9] The results of the personal exposure monitoring performed during these evaluations are reported in Table I.

Occupational Exposure to Respirable Crystalline Silica

When proper practices are not followed or controls are not maintained, respirable crystalline silica exposures can exceed the NIOSH REL, the OSHA PEL, or the American Conference of Governmental Industrial Hygienists (ACGIH®) threshold limit value (TLV®).[1,10] NIOSH recommends an exposure limit of 0.05 mg/m^3 for a 10-hr time-weighted average (TWA) for respirable crystalline silica to reduce the risk of developing silicosis, lung cancer, and other adverse health effects.

The current OSHA PEL for a 8-hr TWA for respirable dust containing crystalline silica (quartz) for the construction industry is expressed in millions of particles per cubic foot (mppcf) and is calculated using the following formula:[11]

$$\text{Respirable PEL} = \frac{250 \text{ mppcf}}{\% \text{ Silica} + 5} \quad \textbf{(1)}$$

Since the PEL was adopted, the impinger sampling method that was used to evaluate silica exposures in mppcf has been rendered obsolete by gravimetric sampling.[12] OSHA is not aware of any government agency or employers in this country that are currently using impinger sampling to assess worker exposure to dust containing crystalline silica, and impinger samples are generally recognized as being less reliable than gravimetric samples. OSHA currently instructs its compliance officers to apply a conversion factor of 0.1 mg/m^3 per mppcf when converting between gravimetric sampling and particle count standard when characterizing construction operation exposures.[12] The ACGIH TLV for cristobalite and quartz is 0.025 mg/m^3 for an 8-hr TWA.[10]

METHODS

Study Location

Dust control evaluations were conducted at three different construction sites near Denver, Colorado. All buildings were residential houses with two or more stories. Evaluations were conducted outdoors with no mechanical general dilution ventilation present at any of the sites during monitoring.

Three construction sites were identified through contacts between NIOSH and a roofing contractor who developed the engineering control. A site was selected if a minimum of 4 hours of roofing activities was planned for any set day. A typical sampling day was usually 8 hours of sampling, including 30 minutes for a lunch break. Worker participation was voluntary.

Exposure Assessment

Full-shift sampling was conducted to determine the respirable dust and silica exposures of two roofers and two cutter/roofers at each site. Personal breathing zone samples (PBZ) were collected on 37- mm diameter polyvinyl chloride (PVC) filters with a 5- μm pore size at a flow rate of 1.7 liters per min (LPM). A 10-mm nylon cyclone pre-selector was used to limit the collected particles to respirable sizes.

Gravimetric analysis for respirable particulate was carried out following NIOSH Method 0600. The limit of detection for this method was 0.01 mg and the limit of quantitation was 0.03 mg. Crystalline silica analysis of filter and bulk samples was performed using X-ray diffraction following NIOSH Method 7500. These samples were analyzed for quartz and cristobalite. The limits of detection for quartz and cristobalite on filters were 0.01 and 0.02 mg, respectively. The limit of quantitation was 0.03 mg for both quartz and cristobalite. The limits of detection in bulk samples were 0.8% for quartz and 1% for cristobalite. The limit of quantitation was 2% for both forms of crystalline silica in bulk samples.

Additionally, for the two cutter/roofers who were mainly responsible for cutting the tiles, direct reading PBZ respirable dust sampling was conducted concurrently using an active sampling portable laser photometer (MIE personal DataRAM model pDR1200, Thermo Electron Corporation, Waltham, Mass.). The calibrated direct reading instruments were zeroed at the beginning of each sampling period according to the manufacturer's recommendations. Downstream from the photometer, a 37-mm PVC filter with 5-μm pore size was fitted connected via Tygon tubing to a sampling pump calibrated to a flow rate of 2.2 LPM to provide simultaneous collection of the analyzed dust. By fitting the photometer with a BGI4L metal cyclone (BGI Inc. Waltham, Mass) dust pre-selector, a calibration filter was used to determine the concentration of sampled respirable dust (Figure 1). This was conducted to compare real-time and filter-based exposure estimates and to

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TABLE I. Summary of Previous Saw Evaluation Results

Evaluation	Sampling time (min)	8-hr TWA respirable dust (mg/m^3)	TWA Respirable dust (mg/m^3)	% silica in sample	8-hr TWA crystalline silica (mg/m^3)	TWA crystalline silica (mg/m^3)
OSHA	443	1.67	1.81	15	0.25	0.27
	446	0.418	0.45	16	0.063	0.068
	339	0.25	0.35	16	0.04	0.057
Insurance Company	235	0.087	0.18	23	0.02	0.041
	232	0.568	1.18	26	0.15	0.31
Local College	335	0.22	0.32	24	0.053	0.076
	96	0.14	0.7	33	0.046	0.23

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FIGURE 1. Cutter/Roofer wearing the sampling equipment. (color figure available online)

FIGURE 3. Circular saw with aftermarket local exhaust ventilation. (color figure available online)

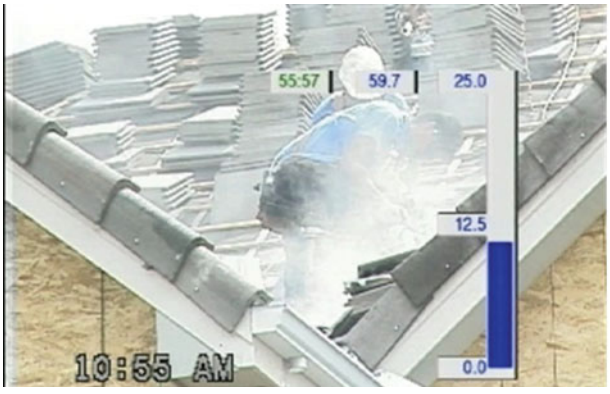

FIGURE 2. Video exposure monitoring screen shot. (color figure available online)

FIGURE 4. Workers using a leaf blower to clean dust from tiles. (color figure available online)

TABLE II. Respirable Dust Containing Silica Calculations

	Job Description	Worker	Respirable Dust Concentration (mg/m^3)	TWA (mg/m^3)	8-hr TWA (mg/m^3)	Respirable Dust Concentration (mppcf)	OSHA Construction Std PEL (mppcf)
				DAY 1			
10 mm nylon cyclone	cutter/roofer	1	1.12	0.77	0.58	5.85	8.21
	cutter/roofer	1	0.45				
	roofer	3	0.40	0.38	0.28	2.76	6.96
	roofer	3	0.36				
	roofer	4	0.23	0.18	0.13	1.30	11.67
	roofer	4	0.13				
	cutter/roofer	2	1.77	1.43	1.08	10.80	7.51
	cutter/roofer	2	1.14				
MIE PDR + BGI4L cyclone	cutter/roofer	1	3.23	2.03	1.53	15.30	7.96
	cutter/roofer	1	0.91				
	cutter/roofer	2	3.65	3.14	1.57	15.72	7.78
	cutter/roofer	2	1.99				
				DAY 2			
10 mm nylon cyclone	roofer	3	0.46	0.39	0.34	3.38	7.79
	roofer	3	0.30				
	cutter/roofer	2	2.56	2.23	1.91	19.15	10.91
	cutter/roofer	2	1.72				
	cutter/roofer	1	1.44	1.70	1.45	14.49	10.41
	cutter/roofer	1	2.09				
	roofer	4	0.38	0.38	0.32	3.23	9.57
	roofer	4	0.38				
MIE PDR + BGI4L cyclone	cutter/roofer	2	3.82	3.06	2.62	26.24	10.26
	cutter/roofer	2	1.90				
	cutter/roofer	1	2.50	2.22	1.90	18.99	8.76
	cutter/roofer	1	1.78				
				DAY 3			
10 mm nylon cyclone	cutter/roofer	2	1.09	1.39	1.17	11.74	8.96
	cutter/roofer	2	1.76				
	roofer	4	0.30	3.11	2.70	27.00	29.06
	roofer	4	6.59				
	roofer	3	0.19	0.25	0.21	2.13	7.45
	roofer	3	0.32				
	cutter/roofer	1	1.48	2.07	1.78	17.76	7.59
	cutter/roofer	1	2.81				
MIE PDR + BGI4L cyclone	cutter/roofer	2	2.73	2.73	1.03	10.28	7.53
	cutter/roofer	1	2.14	2.49	2.12	21.24	9.35
	cutter/roofer	1	2.92				
	cutter/roofer	2	Excluded				

Note: Excluded: filter cassette disconnected from respirable dust pre-separator during sampling.

calculate the respirable silica content of the real-time exposures. Real-time sampling was stopped during the workers' lunch break to limit the analysis to time spent performing roofing activities. The filter samples from the photometers were analyzed for respirable dust and for silica using the modified NIOSH analytical methods discussed previously.

The photometers measured respirable dust concentrations once per second. Because of data storage limitations of the instrument, the respirable dust concentration readings were averaged over a 5-sec interval and logged. The logged data were used to calculate 8-hr TWA respirable dust exposures. The real-time data were also overlaid onto the video recordings of the roofers cutting and laying tiles for video exposure monitoring (VEM). VEM provided a visual representation of the respirable dust concentration during roofing activities in the form of a bar on the side of the video image (Figure 2).

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TABLE III. Respirable Silica Calculations

	Job Description	Worker	Filter Mass of Quartz (mg/sample)	Respirable Silica Concentration (mg/m^3)	TWA (mg/m^3)	8-hr TWA (mg/m^3)	Sampling Duration (min)
				DAY 1			
10mm nylon cyclone	cutter/roofer	1	0.08	0.27	0.20	0.15	174
	cutter/roofer	1	0.04	0.13			190
	roofer	3	0.04	0.14	0.12	0.09	165
	roofer	3	0.03	0.10			184
	roofer	4	0.01	0.04	0.03	0.02	165
	roofer	4	ND	0.02			187
	cutter/roofer	2	0.16	0.57	0.41	0.31	166
	cutter/roofer	2	0.09	0.27			196
MIE PDR + BGI4L cyclone	cutter/roofer	1	0.32	0.86	0.54	0.40	175
	cutter/roofer	1	0.09	0.23			187
	cutter/roofer	2	0.43	1.21	0.85	0.43	167
	cutter/roofer	2	ND	0.05			73
				DAY 2			
10mm nylon cyclone	roofer	3	0.06	0.13	0.11	0.09	244
	roofer	3	0.02	0.07			171
	cutter/roofer	2	0.20	0.47	0.40	0.34	250
	cutter/roofer	2	0.08	0.30			162
	cutter/roofer	1	0.12	0.28	0.32	0.28	248
	cutter/roofer	1	0.11	0.39			162
	roofer	4	0.04	0.09	0.08	0.07	243
	roofer	4	0.02	0.07			168
MIE PDR + BGI4L cyclone	cutter/roofer	2	0.40	0.73	0.59	0.51	248
	cutter/roofer	2	0.14	0.39			164
	cutter/roofer	1	0.36	0.64	0.52	0.45	250
	cutter/roofer	1	0.12	0.33			161
				DAY 3			
10mm nylon cyclone	cutter/roofer	2	0.09	0.24	0.32	0.27	226
	cutter/roofer	2	0.13	0.42			180
	roofer	4	0.03	0.08	0.11	0.10	231
	roofer	4	0.05	0.15			186
	roofer	3	0.03	0.08	0.07	0.06	231
	roofer	3	0.02	0.06			185
	cutter/roofer	1	0.13	0.32	0.51	0.43	228
	cutter/roofer	1	0.30	0.74			183
MIE PDR + BGI4L cyclone	cutter/roofer	2	0.31	0.77	0.60	0.51	181
	cutter/roofer	1	0.24	0.47	0.54	0.46	228
	cutter/roofer	1	0.26	0.63			182
	cutter/roofer	2	0.02				

Note: Excluded: filter cassette disconnected from respirable dust pre-separator during sampling.

The VEM recording was then used to identify the tasks or work practices that resulted in high exposures to respirable dust.

To isolate exposures from the use of the saw, the logged photometer data were also paired with the video recordings of the work shift and used to determine task-based exposure levels. A task-based TWA exposure was calculated by excluding times that the task was not performed. This process effectively removed potential confounding exposures to provide a better description of the effectiveness of the LEV installed on the circular saw. To avoid overloading the filter media, the full shift sampling was split into two samples per worker per shift; one sample was collected during the morning and a second during the afternoon. To allow comparison to OSHA, NIOSH, and ACGIH exposure criteria, the results of the morning and

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TABLE IV. Comparison of 8-hr TWA Exposures to Standards

Grouping	Total Number of 8-hr TWA Exposures	Exceeded NIOSH REL/ ACGIH® TLV for Respirable Quartz Number (%)	Exceeded OSHA General Industry Respirable Dust PEL Number (%)	Exceeded OSHA Construction Industry Respirable Dust PEL Number (%)
Roofers	6	5 (83%)	1 (17%)	0 (0%)
Cutters/Roofers	12	12 (100%)	12 (100%)	11 (92%)
All Roofers	18	17 (94%)	13 (72%)	11 (61%)

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afternoon were combined to generate an 8-hr TWA) exposure to respirable dust or respirable silica. The average percent quartz of the two samples was calculated to determine the appropriate OSHA PEL using the following equation as recommended by OSHA:

$$\text{Percent Quartz} = \frac{Quartz1 + Quartz2}{Dust1 + Dust2} x100 \qquad \textbf{(2)}$$

where Quartz1 and Quartz2 are the mass of quartz in samples 1 and 2, respectively, and Dust1 and Dust2 are the total mass of respirable dust in samples 1 and 2, respectively.[13]

Description of controls

This study evaluated the exposures when using a 7-1/4 inch worm-drive electric circular saw (model hd 77 m, Skil®, Mississagua, Ontario, Canada), with aftermarket LEV installed. The LEV consisted of a shroud attached to the cutting plane of the saw; the shroud was then connected to a small electric axial fan (Pneo model 77 mag), which is intended to collect dust at the point of generation (Figure 3). After passing through the fan, the dust is collected on a cloth bag which also serves as a filter media. The bag material was laboratory tested by NIOSH using a characteristic aerosol typically used for testing respirator filter media efficiency. The aerosol size is within the most penetrating size range for respirator filters. When tested, the LEV control bag had penetration values between 55% and 61% over a flow rate range of 80–100 LPM.

The fan flow rate was determined in laboratory trials. An air flow meter and mass flow sensor (Sierra Flo-Box series 900 model 904M flow meter and Sierra model 730-N5-1 sensor, Sierra Instruments Inc., Monterey, Calif.) were installed at the outlet of the fan (with the collection bag removed) following a 1-1/2 to 2-inch flexible coupling and a 2-feet length of 2-inch diameter galvanized steel pipe. The connection between the fan outlet and flexible coupling was wrapped in parafilm to make an airtight seal. The fan was capable of pulling an average flow rate of 1056 LPM or 37.3 cubic feet per minute, with the saw on, no blade and no load on the system. An attempt was made to repeat this measurement in the field at the end of the workday but the dust from the roofing tiles in the air stream prohibited its completion as it clogged the sensing unit of the air flow meter.

The dust collection system was activated automatically when the trigger switch on the saw was depressed, and shut down when the trigger was released. The local exhaust ventilation was installed as a permanent attachment which added to the weight of the tool. In addition, the installation of the dust collector required the saw to be used by the worker pulling the saw toward himself, necessitating the removal of the lower blade guard. A leaf blower was used to clean the tiles to prevent staining from water or moisture (Figure 4). This process generated a considerable amount of visible airborne concrete dust, comparable to or even greater than the dust created when cutting the tiles.

RESULTS AND DISCUSSION

A total of 35 samples were collected at three different sampling locations over a three-day period. During the installation of the concrete roofing tiles, employees cut the tiles to accommodate the shape of the roof structure (e.g., peaks, hips, and valleys). During cutting activities, exposures to respirable crystalline silica exceeded OEL's such as the OSHA PEL, NIOSH REL, and ACGIH TLV. The two cutters/roofers had higher peak exposure than the roofers.

Respirable Crystalline Silica and Respirable Dust Containing Silica Exposures

The results of the PBZ samples collected using the cyclones are presented in Tables II and III. The 8-hr TWA respirable dust exposures for the cutters/roofers ranged from 0.58 mg/m^3

TABLE V. Eight-hr TWA Respirable Dust Exposure Calculated from Direct Reading Data

Saw Operator	Elapsed Time (min)	8-hr TWA Respirable Dust Exposure (mg/m^3)
1	363	1.53
	409	2.03
	483	2.21
2	238	1.41
	414	2.53
	181	0.84

TABLE VI. Summary of Task-Based Respirable Dust Results from Real-Time Monitoring

	Tile Cutting		Cleaning Tiles with a Blower	
Saw Operator	Elapsed Time (min)	TWA Concentration (mg/m^3)	Elapsed Time (min)	TWA Concentration (mg/m^3)
1	64.7	17.40	10.7	2.24
	61.3	10.97	17.2	4.78
	73.8	6.04	10.2	2.66
2	46.7	10.42	1.2	2.16
	58.8	14.92	9.8	5.39
	36.7	6.88	2.4	4.92

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to 2.62 mg/m^3 with a geometric mean of 1.46 mg/m^3. The geometric mean for the roofers' 8-hr TWA for respirable dust exposure was 0.36 mg/m^3, but ranged from 0.13 mg/m^3 to 2.70 mg/m^3. The 8-hr TWA was calculated assuming that no further exposure occurred during the unsampled period. The respirable dust containing silica exposures exceeded the OSHA PEL for all cutter/roofers, and this limit was also exceeded for some of the roofers. The fact that not all roofers were overexposed may be due to several factors including wind conditions, silica generation rate, and proximity to the cutter or to the person using the leaf blower. In general, exposures to cutters/roofers were higher than for roofers. The leaf blower was operated by any of the workers. There was not a set person to complete this task.

Table IV shows the concentrations of silica dust for roofers and cutters/roofers. Respirable silica concentration 8-hr TWA exposures ranged from 0.02 mg/m^3 to 0.51 mg/m^3, with a geometric mean exposure of 0.28 mg/m^3. The exposures to cutters/roofers were higher with an 8-hr TWA silica exposure of 0.38 mg/m^3, compared to an 8-hr TWA respirable silica exposure of 0.07 mg/m^3 for the tile layers. All but one PBZ TWA sample for silica exceeded the NIOSH and/or ACGIH exposure criteria.

The 8-hr TWA exposures to respirable dust were compared to the OSHA PELs, and the respirable quartz 8-hr TWA exposures were compared to the NIOSH REL and ACGIH TLV. A summary of the comparisons is shown in Table IV. The real-time respirable dust data were also used to calculate 8-hr TWA exposures, which ranged from 0.84 mg/m^3 to 2.5 mg/m^3. The results of the direct reading sampling are summarized in Table V. The 8-hr TWA respirable dust exposure for Saw Operator #2 on the second day only includes afternoon sampling data. Due to a pump malfunction, the morning collection period was excluded from the analysis.

In general, the TWAs calculated from the direct reading instruments were higher than the corresponding gravimetric sampling results. There was no significant difference ($p = 0.4818$) between the TWA respirable dust exposures from the gravimetric data and the real-time sampling data.

The VEM data indicate that the two main respirable dust exposures occurred during tile cutting and tile cleaning tasks. The respirable dust exposure during cutting ranged from 6.04 mg/m^3 to 17.40 mg/m^3 with a TWA exposure of 11.95 mg/m^3. Each cut was approximately 10 to 20 sec in duration. On average, cutting tasks accounted for approximately 60 min (12.5%) of a full 8-hr work shift. Respirable dust exposures while cleaning the tiles with the leaf blower ranged from 2.16 mg/m^3 to 5.38 mg/m^3. The TWA for respirable dust exposure during cleaning was 3.44 mg/m^3. On average, the two saw operators spent 10 min using the leaf blower each shift. The mean respirable TWA dust exposures were significantly higher during cutting than during tile cleaning and were significantly higher than the overall TWA respirable dust exposure. Table VI presents a summary of task-based respirable dust results from real-time monitoring.

The video exposure monitoring images displayed more visible dust during tile cleaning than tile cutting, but the real-time monitoring indicated that higher respirable dust concentrations were observed during tile cutting. Also, the leaf blower is used to remove settled dust which will tend to have a larger particle size, hence the lower respirable concentrations.

Bulk Crystalline Silica Sampling Results

Analysis of the bulk samples (material obtained from dust collected on the filter bag) collected from three of the sampling locations indicated that they contained between 19% and 26% quartz (by weight). This variability may depend on whether the sample contained more aggregate.

CONCLUSIONS AND RECOMMENDATIONS

Both of the ventilated saw operators were overexposed to respirable dust containing silica and respirable silica during each shift sampled. The use of this tile saw equipped with local exhaust ventilation did not reduce exposures to respirable dust containing silica below the OELs. The local exhaust ventilation control should be modified to effectively control exposures to dust, or the company should seek other engineering controls proven to reduce exposures below the OELs. Removal of the lower blade guard is not acceptable and the modified ventilation control should accommodate proper installation and use of the guard. In the meantime, work

practice modifications, administrative controls, and a comprehensive respiratory protection program should be implemented to control respirable dust and respirable silica exposure.

This study demonstrated that exposures to employees cutting concrete roofing tiles exceeded the OSHA PEL, NIOSH REL, and the ACGIH TLV. Exposures to employees performing activities other than cutting tiles may also exceed the OSHA PEL, NIOSH REL, or the ACGIH TLV, depending on several factors such as weather and wind conditions, proximity to the source, generation rate, and work practices. Therefore, other methods to control respirable dust and silica exposures should be implemented to prevent these exposures.

A leaf blower was used to remove dust from the tiles. This process should be carefully reviewed as it creates an unnecessary exposure to all employees, whether they cut or lay the tiles. Alternative means of cleaning the tiles without making particles airborne should be used. The use of manual roofing tile cutters has proven to reduce exposures below the OSHA PEL and the NIOSH REL. Further investigation of manual cutters or improved local exhaust ventilation should be conducted. The results reported here indicate that workers should use respiratory protection when they are using the saw and/or the leaf blower.

Tile cutting activities produced higher TWA concentrations of respirable dust than leaf blowing activities. Therefore, work practice modifications and administrative controls should target the tile cutting activity. Work practice modifications could include a greater awareness of positioning when cutting tiles; workers should be encouraged to stay upwind of the cutting and cleaning operations whenever possible. NIOSH conducted laboratory studies to evaluate the reduction of crystalline silica dust when cutting concrete roofing tiles using a masonry saw with both the water and local exhaust ventilation from commercially available saws.[14]

All of the workers were exposed to respirable crystalline silica in excess of the NIOSH REL. While some of the tile layers' exposures to crystalline silica can be attributed to cleaning activities, working in close proximity to tile cutting also contributed to their exposures. At times, both of the tile saws were operating in the same area, providing a dual source of exposure to the roofers. Work practice changes such as distancing the saw operators from each other and from other roofers may also reduce exposures.

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