Dusty work and use of controls among construction workers

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EXECUTIVE SUMMARY

Respirable dust, including respirable crystalline silica (RCS), is a common risk to health for construction workers. Breathing in dust can cause a number of health conditions, including pneumoconioses (such as silicosis), lung cancer, asthma and chronic obstructive pulmonary disorder (COPD). New Zealand and international literature has shown that construction workers are likely exposed to high levels of dust in the performance of their work. However, very little is known about the prevalence of controls used to minimise this exposure.

This study reports the results of an in-person survey of construction workers in Waikato, New Zealand. Construction workers were asked about their performance of dusty work, the control measures employed to minimise exposure and their consideration of the risk of dust to their health.

Respondents were asked how frequently they completed any of six common high-risk activities for dust exposure:

1. cutting or drilling concrete
2. grinding or polishing concrete
3. jackhammering
4. crushing concrete
5. cutting or sanding wood
6. cutting or sanding plasterboard or fibre cement board.

For each activity completed more than once a month, workers were asked about the controls they used to minimise exposure to dust.

In total, 250 construction workers were recruited for this study through a mixture of in-person interviews at construction sites (n=164), in-person interviews at trade stores (n=46) and phone interviews (n=40).

The study had several key findings:

- Apprentices (97.9%) and builders (95.2%) were most likely to perform dusty work.
- Low use of dust suppression and extraction was reported, particularly for demolition and woodwork:
  - The majority of workers did not use water suppression when jackhammering (79.6%) or crushing concrete (56.3%).
  - Nearly two-thirds (62.8%) of workers did not use dry dust extraction when cutting or sanding wood.
  - Over a quarter of respondents used neither water suppression nor dry dust extraction when cutting/drilling concrete (30.1%) or grinding/polishing concrete (25.0%).
- Low use of controls was reported for clean-up processes:
  - Over three-quarters of workers (77.6%) usually used a dry broom to clean up dust.
  - More than 85% of respondents often or always wore their dusty clothes home, and more than 50% always did.
- High levels of respirator use were reported, but users were rarely clean shaven and had low levels of fit testing:
  - More than 70% of workers often or usually used a respirator when performing dusty work but only 28% always did.
  - The majority of wearers (61.8%) were not provided respirator fit testing before use, with a further 10% unsure.
  - Over half of wearers (52.2%) were usually not clean shaven.
  - The majority of wearers stored their respirators away from dust or dusty objects (82.7%).

- The provision of health monitoring for workers was also very rare:
  - Only 20% of workers were offered or provided with a lung function test by their employer in the last 12 months.
- Younger workers were less likely to consider the risks to their health and less likely to use respiratory protection:
  - Young workers (<25 years) were significantly less likely to consider risks to their health or wear a respirator compared to older workers (≥25 years).

This study provides an insight into the use of dust controls in the construction industry in Waikato, New Zealand. Future work should investigate how to encourage or enable uptake of stronger dust controls.

1.0 Introduction

IN THIS SECTION:

Dust is a common risk to health in the construction industry. Respirable dust is a cause of many lung and airway diseases, including pneumoconioses, lung cancer, asthma and chronic obstructive pulmonary disorder (COPD) (IOSH, 2014; Matheson et al., 2005; Si et al., 2016).

Dust from silica products is a particular risk for construction workers. Silica is a natural chemical compound found in many materials on construction sites, such as concrete, bricks, stone, sand and compressed fibre cement products (IOSH, 2014). A fine dust is created when these materials are cut, drilled, ground, crushed, sanded or otherwise disturbed. If the silica particles in the dust are small enough (known as respirable crystalline silica or RCS), they can be breathed deep into the lungs and cause damage. Silicosis, the particular pneumoconiosis caused by inhalation of RCS, leads to scarring of the lining of the lungs and fibrosis.

While silicosis is rarely diagnosed in New Zealand (WorkSafe New Zealand, 2014), internationally, the prevalence of silicosis and silica-related lung cancer is high among workers with high exposure to RCS. A Hong Kong study found that silicosis was the major cause of death (43%) among workers with silica-related non-malignant respiratory diseases (Tse, Yu, Leung, Tam, & Wong, 2007). RCS-induced lung cancer kills over 500 construction workers in Great Britain annually (IOSH, 2014).

Occupational exposure to dust and RCS in the construction industry in New Zealand is also thought to be high. The New Zealand workforce survey found that 29% of all respondents and 75% of trades workers (NZISCO7) were exposed to dust at work (Eng et al., 2010). A pilot study commissioned by WorkSafe New Zealand assessed personal respirable dust and RCS exposure levels in 39 construction workers involved in the Canterbury rebuild. The authors found that 44% of samples exceeded the New Zealand workplace exposure standard (Douwes, Glass, McLean, & t' Mannetje, 2015; McLean, Glass, & Andrea't Mannetje, 2017).

Using data from the Australian Work Exposures Study (AWES), it is estimated that 6.6% of Australian workers are exposed to RCS, and 3.7% are highly exposed (Si et al., 2016). Miners and construction workers had the highest estimated exposure, with approximately 80% of construction workers exposed to RCS and 62% with high exposure (Si et al., 2016). Similarly, it has been estimated that approximately 2.3% (3.2 million) European workers and 2.1% (349,000) of Canadian workers are exposed to RCS (Peters et al., 2011). In Italy, over 41,000 workers were estimated to have had high exposure to RCS from 1996 to 2012, with exposure prevalence highest among construction workers (36.4%) (Scarselli, Corfiati, Marzio, & Iavicoli, 2014).

With silica being present in a large number of materials found on a construction site, many tasks carry a risk of RCS exposure. An extensive international literature review of crystalline silica exposure studies identified 27 construction activities that were of high risk (Sauvé et al., 2012). The 10 tasks with the highest level of silica exposure were scabbling concrete, jackhammering, tunnel boring, abrasive blasting, tuck pointing, concrete road milling, surface grinding/finishing, masonry cutting, drilling concrete and moving soil/rock with heavy equipment (Sauvé et al., 2012). In Australia, the tasks most commonly associated with high-level RCS exposure were cutting, grinding or sanding concrete or mixing concrete or cement (Si et al., 2016).

No known studies have specifically explored how exposure to dust is controlled in the construction industry in New Zealand. Among a sample of Christchurch construction workers, it was observed that dust extraction was used irregularly, large numbers of construction workers did not wear respiratory protection and wearers were unaware of the need for it to be fit tested, for themselves to be clean shaven or for the respirator to be stored away from dust (Douwes et al., 2015). However, these observed behaviours were not quantified.

This study seeks to document the use of controls in the construction sector. Data were collected through an in-person survey of construction workers in Waikato, New Zealand. Respondents were asked about their performance of dusty work, the control measures employed and their consideration of the risk of dust to their health.

2.0 Methodology

IN THIS SECTION:

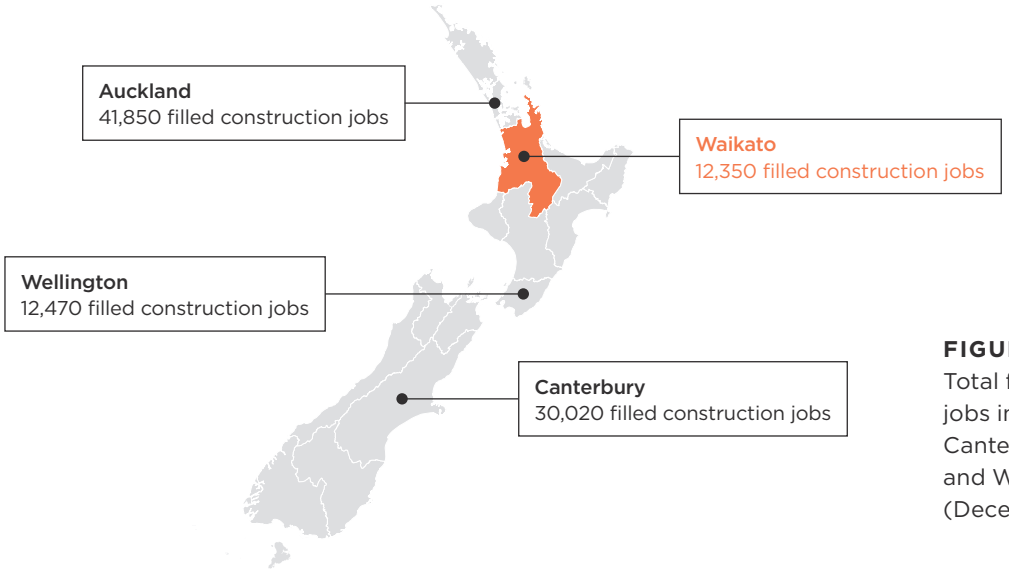
2.1 Study design

This cross-sectional descriptive study was undertaken by WorkSafe New Zealand, with data collection conducted by a local research agency. The study subjects were individuals working on construction sites in Waikato, New Zealand.

Study population

The construction sector is one of New Zealand's largest employers. Waikato has the fourth largest construction sector in New Zealand behind Auckland, Canterbury and Wellington, with 12,350 filled construction jobs in December 2015 (Figure 1) and an estimated 75,000 people employed in construction-related occupations (Waikato and Bay of Plenty combined) (MBIE, 2016).

Total filled construction jobs in Auckland, Canterbury, Waikato and Wellington (December 2015)



Source: Statistics New Zealand, Linked Employer-Employee Data (Statistics New Zealand, 2017)

FIGURE 1:
Total filled construction jobs in Auckland, Canterbury, Waikato and Wellington (December 2015)

The study population was defined as individuals working on construction sites within a 20 kilometre radius of the city of Hamilton in Waikato, New Zealand. It was assumed that the requirement to be working on site naturally excluded a proportion of the construction population with lower exposure to RCS and other dusts. As such, any measures of prevalence among construction site-based workers would highly likely overestimate for the construction population as whole. Therefore, this study should not be used to model prevalence of dust exposure or dust-related behaviours among the broader construction sector.

Measures

The study sought to measure the prevalence of dust isolation or minimisation controls among workers performing dusty work. The study did not attempt to quantify exposure to construction dusts.

Six common activities associated with high dust exposure were selected from the literature and current WorkSafe guidance:

1. cutting or drilling concrete
2. grinding or polishing concrete
3. jackhammering
4. crushing concrete
5. cutting or sanding wood
6. cutting or sanding plasterboard or fibre cement board (Flanagan, Seixas, Majar, Camp, & Morgan, 2003; Sauvé et al., 2012; Si et al., 2016; WorkSafe New Zealand, 2017).

Identified isolation and minimisation controls were water-based dust suppression, dry dust extraction, respirator use, safely cleaning dust from the worksite and changing out of dusty clothes before going home. The study did not differentiate between different water suppression methods (ie handheld hose, spray nozzles) or different dry dust extraction methods (ie local exhaust ventilation, on-tool extraction).

Questionnaire

A questionnaire was used to collect workers' self-reported exposure to dust, the control measures employed to minimise exposure, and their consideration of the risk of dust to their health. Respondents were asked how frequently they completed any of six common high-risk activities for dust exposure:

1. cutting or drilling concrete
2. grinding or polishing concrete
3. jackhammering
4. crushing concrete
5. cutting or sanding wood
6. cutting or sanding plasterboard or fibre cement board.

For each activity completed more than once a month, workers were asked about practices they used to minimise exposure to dust. The questionnaire also asked about their consideration of the health effects of dust exposure and general information on demographic and occupational characteristics of the study population.

Questions asked were generally radio-type, with the occasional 'Other (please state)' option. The survey took around ten minutes to complete if all questions were applicable to the respondent (ie respondent had high exposure). By design, respondents without exposure finished the survey considerably faster than those with exposure.

Sampling frame

To determine the number of in-person interviews required to get a sufficient sample, a target sample size was calculated using the formula:

$n = (Z^2 P(1-P))/d^2$

Where:

n = sample size,

Z = statistic for a level of confidence,

P = expected prevalence or proportion

d = precision.

The 2015 Health and Safety Attitudes and Behaviours survey found that 79% of construction workers had a self-reported exposure to dust when working (Nielsen, 2016). This figure was comparable to the findings of the Australian Work Exposures Study, which found about 80% of respondents working in construction were likely to be exposed to RCS (Si et al., 2016). From this, it was assumed that the expected prevalence P was 0.8. For the level of confidence of 95%, Z value is 1.96. Desired level of precision is ±5% (or d= 0.05).

Sample size was therefore calculated as follow:

n = (1.96)^2×0.8(1-0.8)/(0.05)^2 = 246

The returned sample size of 246 was rounded up to 250. As the calculated sample size was smaller than 5% of the construction population size (n=12,350 construction workers in Waikato) (Statistics New Zealand, 2015), finite population correction was not employed.

2.2 Data collection

Data collection was completed by Versus Research[1] over three months from June to August 2017. The initial contacts for recruitment to this study were purchased from a privacy-compliant sample provider. The purchased contacts were from businesses around Hamilton and working within the construction/building sector. A total of 340 telephone numbers matched these parameters.

It was initially intended to conduct all the data collection using in-person questionnaires at each site. Difficulties in recruiting (subcontractors and tradespeople in particular) meant that supplementary telephone interviews and intercept interviews at trade stores were used to reach the targeted sample size. The data collection process is summarised in Table 1.

METHOD	PROCESS	PRIMARY AUDIENCE
In-person questionnaire at construction sites n=164	Call building company to recruit a site visit Schedule site visit (15 site visits completed in total) Site induction for interviewers Interview respondents (combination of approaching those on the tools or interviewing in a group setting eg in lunch room)	Large construction sites, particularly commercial or civil sites
In-person intercept questionnaire at trade stores n=46	Call trade store Schedule time to interview Set up desk on site Approach tradespeople and request interview	Residential tradespeople
Phone interviews n=40	Use purchased list to contact and schedule the interview to be completed over the phone	Subcontractors

Source: Versus Research

TABLE 1: Data collection summary

2.3 Data entry

Multiple answers for ethnicity and construction site type (ie civil, commercial or residential) were eligible. All free-text responses were entered exactly as written. Respondents could select more than one answer for Q3, Q8, Q10, Q14, Q17 and Q25 (see appendix for questionnaire).

[1] www.versus.co.nz

2.4 Data analysis

Data were analysed using analytic software R version 3.3.2. Descriptive analysis included calculating frequency and percentage across demographic and occupational characteristics. The associations between performing dusty tasks, protective measures to minimise dust exposure and the awareness of risks to health from breathing in dust and demographic and occupational characteristics were examined by the two-sample proportions test. Two proportional rates were considered significantly different if p-value was smaller than 0.05.

3.0 Results

IN THIS SECTION:

3.1 Description of study population

In total, 250 respondents participated in this study. Under half (41.2%) worked in residential construction. Nearly all respondents were male (96.8%), 70.4% were New Zealand European, 23.6% were Māori and the majority (85.6%) were born in New Zealand. Carpenters/builders (25.2%) and apprentices (19.2%) were the most commonly reported occupations.

The largest cohort of workers were aged 25–34 years (26.8%), although the proportion of workers aged 18–24 years (18.8%), 35–44 years (16.8%) and 45–54 years (16.4%) were all very similar. Over half had worked in the construction industry for 10 or more years (51.6%).

The full demographic characteristics of the study population are shown in Table 2.

DEMOGRAPHIC CHARACTERISTICS	n=250	%
Kind of work		
All	6	2.4
Civil only	42	16.8
Civil or commercial	3	1.2
Commercial and residential	26	10.4
Commercial only	65	26.0
Residential only	104	41.6
No response	4	1.6
Sex		
Male	238	96.8
Female	2	0.8
Gender diverse	2	0.8
No response	8	3.2
Ethnicity (total)		
NZ European	176	70.4
Māori	59	23.6
Pacific Islander	10	4.0
Asian	3	1.2
Other ethnicity	15	6.0
No response	8	3.2
Age group		
≤18	6	2.4
18–24	47	18.8
25–34	67	26.8
35–44	42	16.8
45–54	41	16.4
≥55	39	15.6
No response	8	3.2

DEMOGRAPHIC CHARACTERISTICS	n=250	%
Location of birth		
New Zealand	214	85.6
Outside of New Zealand	28	11.2
No response	8	3.2
Occupation		
Apprentice	48	19.2
Carpenter/builder	63	25.2
Electrician	10	4.0
Engineer	11	4.4
Joiner	4	1.6
Labourer	29	11.6
Painter	2	0.8
Plasterer	8	3.2
Plumber	1	0.4
Supervisor/foreman/manager	35	14.0
Other	35	14.4
No response	4	1.6
Length of working time in the construction industry		
<1 year	29	11.6
1–2 years	31	12.4
3–5 years	31	12.4
6–9 years	26	10.4
10–19 years	51	20.4
≥20 years	78	31.2
No response	4	1.6

TABLE 2: Demographic and occupational characteristics of study population

3.2 Activities with dust exposure

The majority of workers cut/drilled concrete (57.2%) and cut/sanded wood (68.8%) at least once a month. Smaller proportions responded that they used a jackhammer (19.6%), ground/polished concrete (12.8%), crushed concrete (6.4%) and cut/sanded plasterboard or fibre cement board (31.2%) at least once a month (Table 3).

	CUTTING OR DRILLING CONCRETE		GRINDING OR POLISHING CONCRETE		JACKHAMMERING		CRUSHING CONCRETE		CUTTING OR SANDING WOOD		CUTTING OR SANDING PLASTERBOARD OR FIBRE CEMENT BOARD	
	n	%	n	%	n	%	n	%	n	%	n	%
Once a day	34	13.6	1	0.4	4	1.6	2	0.8	109	43.6	13	5.2
Once a week	53	21.2	6	2.4	9	3.6	7	2.8	38	15.2	22	8.8
Once a month	56	22.4	25	10	36	14.4	7	2.8	25	10	43	17.2
Less than once a month	62	24.8	82	32.8	93	37.2	74	29.6	20	8	59	23.6
Don't know	6	2.4	15	6	12	4.8	24	9.6	7	2.8	14	5.6
No response*	39	15.6	121	48.4	96	38.4	136	54.4	51	20.4	99	39.6

TABLE 3: Performance of dusty tasks (frequency)

	CUTTING OR DRILLING CONCRETE	GRINDING OR POLISHING CONCRETE	JACKHAMMERING	CRUSHING CONCRETE	CUTTING OR SANDING WOOD	CUTTING OR SANDING PLASTERBOARD OR FIBRE CEMENT BOARD	PERFORMING ANY TASK
	%	%	%	%	%	%	%
Apprentice (n=48)	66.7	25.0	22.9	10.4	91.7	50.0	97.9
Carpenter/builder (n=63)	73.0	12.7	28.6	1.6	95.2	47.6	95.2
Supervisor/foreman/ manager (n=35)	54.3	5.7	17.1	2.9	62.9	17.1	77.1
Other (n=100)	43.3	9.6	13.5	8.7	47.1	17.3	68.3
Total (n=250)	57.2	12.8	19.6	6.4	68.8	31.2	82

Note: Total may exceed 100% because workers can perform more than one high-dust task

TABLE 4: Performance of task by occupation

* Includes respondents who never perform the task.

3.3 Use of controls

The proportions of workers using water suppression or dry dust extraction when cutting or drilling concrete were 37.1% and 29.4%, respectively. Among those grinding or polishing concrete, the same proportions used either water suppression or dry dust extraction (34.4% each). Notably, a large proportion of respondents used neither method when cutting/drilling concrete (30.1%) or grinding/polishing concrete (25%) (Table 5).

	CUTTING OR DRILLING CONCRETE (n=143)		GRINDING OR POLISHING CONCRETE (n =32*)	
	n	%	n	%
Water suppression	53	37.1	11	34.4
Dry dust extraction	42	29.4	11	34.4
Neither wet method nor dry dust extraction	43	30.1	8	25.0
Don't know	2	1.4	-	-
No response	3	2.1	2	6.3

Note: Among respondents who performed the high-exposure activity at least once a month

TABLE 5: Method used when cutting or drilling concrete/grinding or polishing concrete

The majority of workers did not use water suppression when jackhammering (79.6%) or crushing concrete (56.3%) (Table 6).

	JACKHAMMERING (n=49*)		CRUSHING CONCRETE (n=16*)	
	n	%	n	%
Yes	7	14.3	3	18.8
No	39	79.6	9	56.3
Don't know	1	2.0	2	12.5
No response	2	4.1	2	12.5

Note: Among respondents who performed the high-exposure activity at least once a month

TABLE 6: Use of water suppression when jackhammering or crushing concrete

Respondents not using water suppression when working with concrete were asked why they did not. Figure 2 describes reasons for not using water suppression by tasks. *Water is not suitable for the environment* was the most commonly reported reason when cutting/drilling concrete and jackhammering. Other stated reasons included *lazy, annoying to clean, not needed, never been told to use that, use masks and no dust emissions*.

* Caution: Due to the small sub-sample of respondents, results are indicative only.

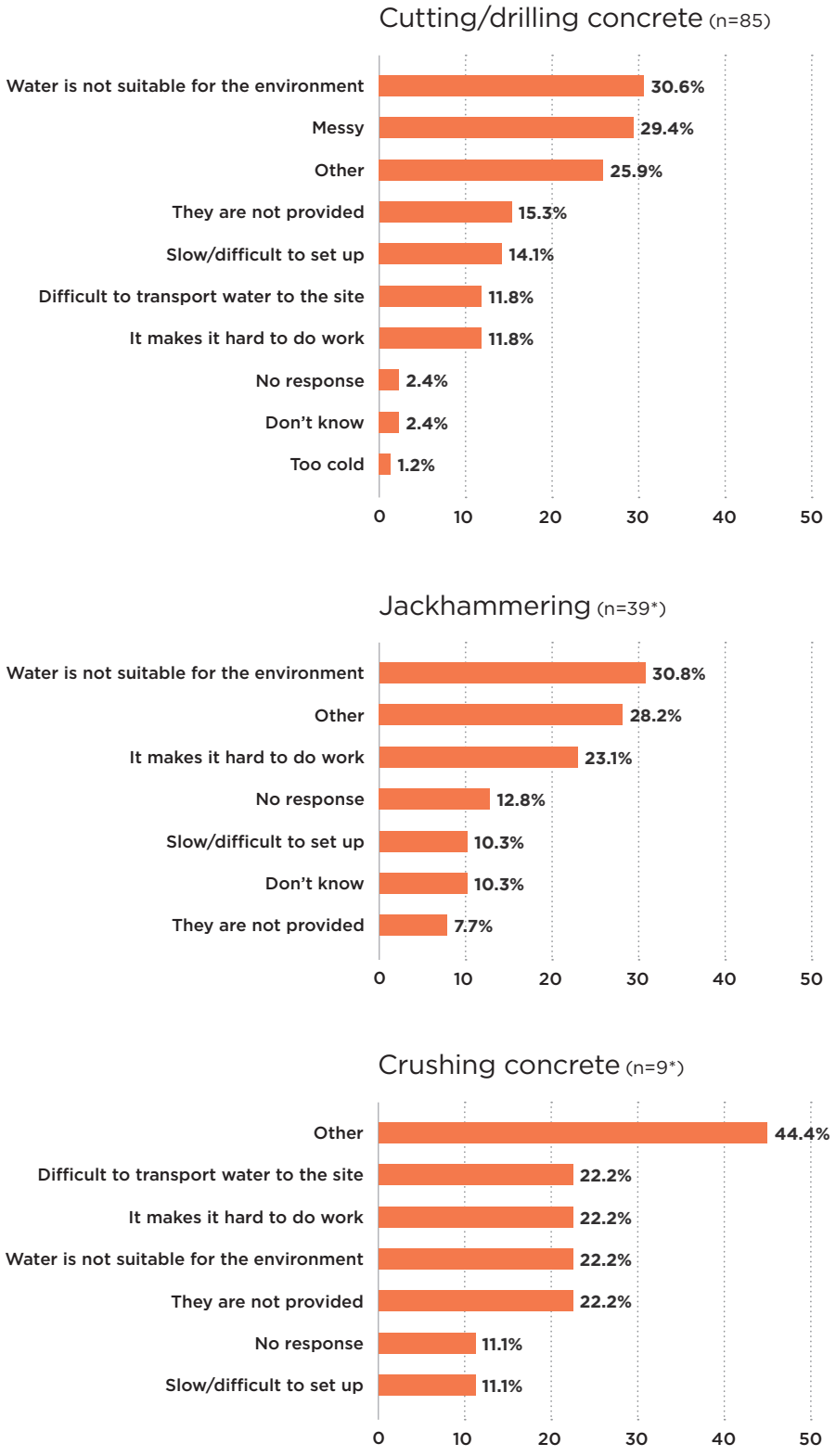


FIGURE 2: Reasons for not using water suppression by task (%)

Note: Among respondents who performed the task at least once a month
Multiple responses allowed, total may exceed 100%

Nearly two-thirds (62.8%) of workers did not use dry dust extraction when cutting or sanding wood. For those cutting/sanding plasterboard or fibre cement board, the proportions using and not using dry dust extraction were more even (50% using, 42.3% not using) (Table 7).

* Caution: Due to the small sub-sample of respondents, results are indicative only.

	CUTTING OR SANDING WOOD (n=172)		CUTTING OR SANDING PLASTERBOARD OR FIBRE CEMENT BOARD (n=78)	
	n	%	n	%
Yes	55	32.0	39	50.0
No	108	62.8	33	42.3
Don't know	3	1.7	-	-
No response	6	3.5	6	7.7

Note: Among respondents who performed the high-exposure activity at least once a month

TABLE 7:
Use of dry dust extraction when cutting or sanding wood/plasterboard or fibre cement board

Respondents not using dry dust extraction methods when working with wood, plasterboard or fibre cement board were asked why this was not the case. The three most frequently identified answers were *it is not necessary* (45.4%), *it is not provided* (20.4%), and other (18.5%). As shown in Figure 3, the proportion of those responding that it is not necessary for cutting/sanding wood was significantly higher than that for those cutting/sanding plasterboard or fibre cement board. Free-text reasons included *using a dust mask, never seen it done, don't have the equipment, not practical, taking too long to do, too nasty and horrible and working outdoors.*

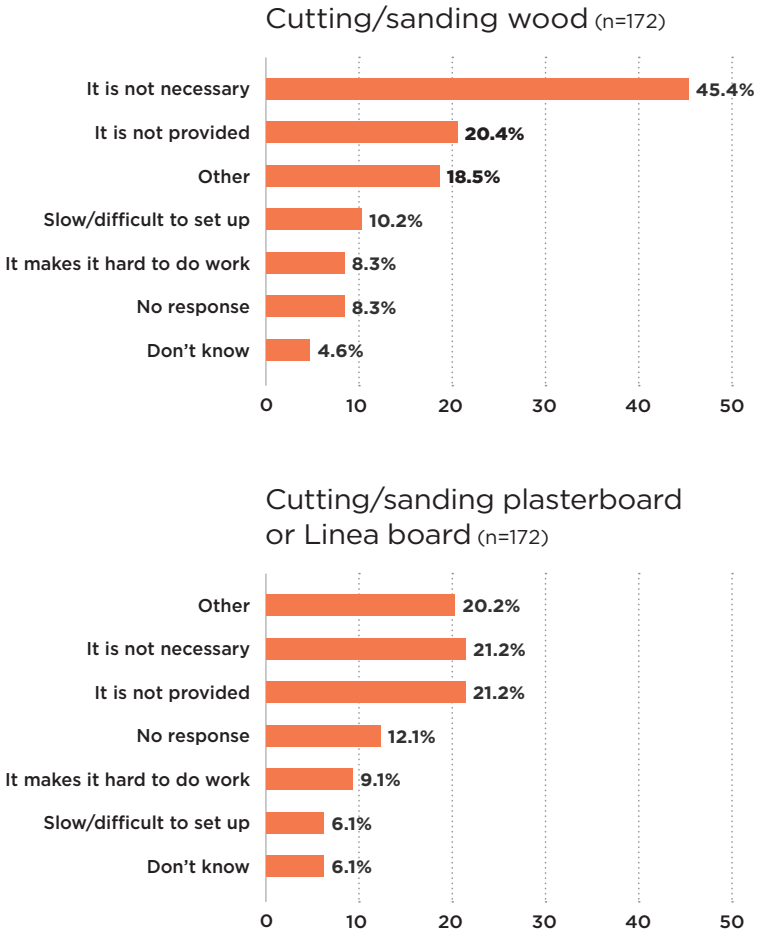


FIGURE 3:
Reasons for not using dry dust extraction by task (%)

Note: Among respondents who performed the task at least once a month

* Caution: Due to the small sub-sample of respondents, results are indicative only.

Respondents were asked how they cleaned up dust left on the worksite. Over three-quarters of workers (82.9%) who performed a high-dust task at least once a month used a dry broom to clean up the dust. The proportion who used a dry broom varied by tasks and ranged from 81.4% for cutting/sanding wood to 93.8% for grinding/polishing concrete. Using a vacuum cleaner was the second most common approach (22.4%). Other stated methods included *wet broom, blower, hearth brush and shovel, watercart and hose* (Table 8).

	CUTTING OR DRILLING CONCRETE (n=143*)	GRINDING OR POLISHING CONCRETE (n=32*)	JACKHAMMERING (n=49*)	CRUSHING CONCRETE (n=16*)	CUTTING OR SANDING WOOD (n=172)	CUTTING OR SANDING PLASTERBOARD OR FIBRE CEMENT BOARD (N=78)	TOTAL (ANY TASK) (n=250)
	%	%	%	%	%	%	%
Dry broom	83.9	93.8	83.7	93.8	81.4	82.1	82.9
Wet broom	4.9	3.1	10.2	6.3	5.2	3.9	4.8
Vacuum cleaner	34.3	34.4	44.9	37.5	34.3	46.2	22.4
Other	4.9	9.4	8.2	0	4.7	7.7	14.8
Don't know	0.7	0	0.0	0	0	0	0.5
No response	4.2	0	2.0	0	2.3	1.3	3.3

Note: Among respondents who performed the high-exposure activity at least once a month. Multiple response allowed, total may exceed 100%

TABLE 8: Method used to clean up dust by task

More than 85% of respondents who performed a high-dust task at least once a month sometimes, often or always wore their dusty clothes home. More than 50% of workers *always* wore their dusty clothes home. The frequency with which respondents reported wearing their dusty clothes home was similar across all tasks (Table 9).

	CUTTING OR DRILLING CONCRETE (n=143)	GRINDING OR POLISHING CONCRETE (n=32*)	JACKHAMMERING (n=49*)	CRUSHING CONCRETE (n=16*)	CUTTING OR SANDING WOOD (n=172)	CUTTING OR SANDING PLASTERBOARD OR FIBRE CEMENT BOARD (n=78)	TOTAL (n=250)
	%	%	%	%	%	%	%
Always	58.7	68.8	63.3	68.8	57.0	65.4	57.1
Often	21.0	18.8	18.4	18.8	19.8	18.0	19.5
Sometimes	10.5	6.3	4.1	12.5	12.2	3.9	12.4
Rarely	2.8	3.1	4.1	0	4.7	3.9	4.3
Never	3.5	3.1	6.1	0	4.1	6.4	4.3
No response	3.5	0	4.1	0	2.3	2.6	2.4

Note: Among respondents who performed a high-dust task at least once a month

TABLE 9: Proportion wearing dusty clothes home by task

* Caution: Due to the small sub-sample of respondents, results are indicative only.

More than 75% of workers who performed a high-dust task at least once a month sometimes, often or always used a respirator when performing dusty work. However, only 23.8% *always* used a mask when performing these tasks. The proportion of workers always using a respirator varied by tasks and ranged from 18.8% for crushing concrete to 36.7% for jackhammering (Table 10).

	CUTTING OR DRILLING CONCRETE (n=143)	GRINDING OR POLISHING CONCRETE (n=32*)	JACKHAMMERING (n=49*)	CRUSHING CONCRETE (n=16*)	CUTTING OR SANDING WOOD (n=172)	CUTTING OR SANDING PLASTERBOARD OR FIBRE CEMENT BOARD (n=78)	TOTAL (n=250)
	%	%	%	%	%	%	%
Always	27.3	28.1	36.7	18.8	22.1	30.8	23.8
Often	25.2	28.1	22.5	18.8	27.3	21.8	26.2
Sometimes	25.2	34.8	30.6	12.5	29.1	23.1	27.1
Rarely	9.1	3.1	4.1	18.8	9.3	6.4	9.0
Never	11.2	3.1	4.1	25	11.1	16.7	11.9
Don't know	0	0	0	0	0	0	0
No response	2.1	3.1	2.0	6.3	1.2	1.3	1.9

Note: Among respondents who performed a high-dust task at least once a month

TABLE 10: Frequency of respirator use by task

Respirator use was more commonly reported among workers who also used either water suppression or dry dust extraction (83.3%) when compared to those not using either dust control. However, this difference was not statistically significant (p>0.05) (Table 11).

	WEARING RESPIRATOR		NOT WEARING RESPIRATOR		TOTAL	P-VALUE
	n	%	n	%		
Using suppression or extraction	184	83.3	37	16.7	221	>0.05
Using neither suppression nor extraction	181	75.4	59	24.6	240	

Note: Respondents can perform multiple tasks, therefore the total dust control measures might exceed total number of respondents

* Caution: Due to the small sub-sample of respondents, results are indicative only.

TABLE 11: Frequency of respirator use by suppression/ extraction use

As Figure 4 shows, nearly one in three (32.2%) workers did not give a reason for not wearing a respirator when doing dusty work. *Respirator not provided* was the stated reason for 20.3% of respondents. Other stated reasons included *lazy, not needed, I have glasses so I have issues when I use a respirator and relying on the environment to blow it away*.

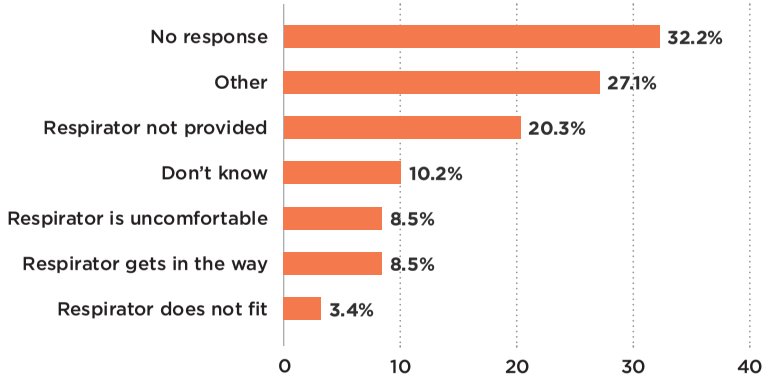


FIGURE 4: Reason for not wearing a respirator (n=59*)

Note: Among respondents who performed a high-dust task at least once a month and did not use a respirator

Respirator wearers who performed a high-dust task at least once a month were asked to identify the type they usually used. Disposable respirators were used by the majority (59.9%). Disposable respirators were the most common type used for all tasks except crushing concrete where half-face respirators were the most common (62.5%) (Table 12).

	CUTTING OR DRILLING CONCRETE (n=111) %	GRINDING OR POLISHING CONCRETE (n=29*) %	JACKHAMMERING (n=44*) %	CRUSHING CONCRETE (n=8*) %	CUTTING OR SANDING WOOD (n=135) %	CUTTING OR SANDING PLASTERBOARD OR FIBRE CEMENT BOARD (n=59) %	TOTAL (ANY TASK) (n=162) %
Full-face respirator	5.4	6.9	6.8	25.0	3.7	8.5	5.6
Half-face respirator	38.7	44.8	27.3	62.5	32.6	39.0	34.6
Disposable respirator	55.9	48.3	65.9	12.5	63.7	52.5	59.9

TABLE 12: Type of respirator used by task (%)

* Caution: Due to the small sub-sample of respondents, results are indicative only.

The majority of workers (61.8%) were not provided respirator fit testing before use. Approximately a quarter (27.2%) of respondents were tested for respiratory fit (Figure 5).

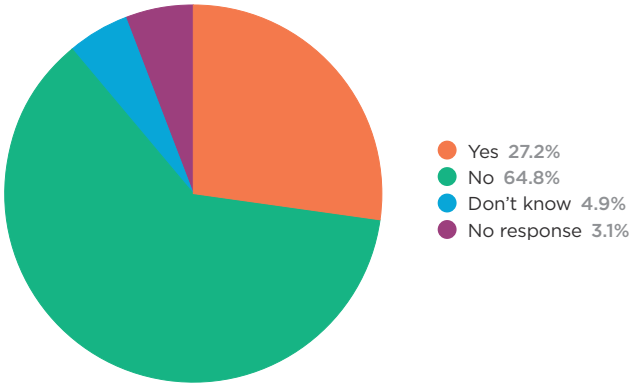


FIGURE 5:
Proportion of respirator wearers tested for respirator fit (%) (n=162)

Note: Among respondents who performed a high-dust task at least once a month and used a respirator

There was no significant difference in fit testing by type of respirator (p>0.05) (Table 13).

	FIT TESTED		NOT FIT TESTED		P-VALUE
	n	%	n	%	
Full-face (n=9*)	4	44.4	5	55.6	
Half-face (n=53)	19	35.8	34	64.2	>0.05
Disposable (n=87)	21	24.1	66	75.9	>0.05

Note: Among respondents who performed a high-dust task at least once a month and used a respirator

One-third (34%) of respirator wearers were always clean shaven, and only 8.9% more were clean shaven when using a respirator. More than half of respirator wearers (52.4%) were not usually clean shaven, even when using a respirator (Figure 6).

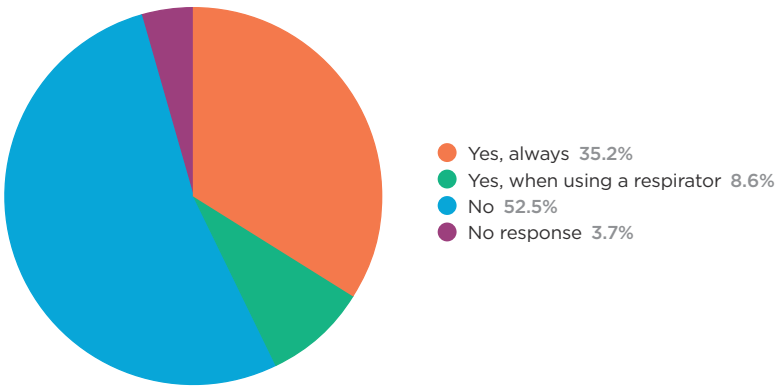


FIGURE 6:
Clean shaven when wearing a respirator (%) (n=162)

Note: Among respondents who performed a high-dust task at least once a month and used a respirator

Respondents were asked if they stored their respirators away from dust or dusty objects. The majority of workers (82.7%) responded that they did (Figure 7).

* Reference group.

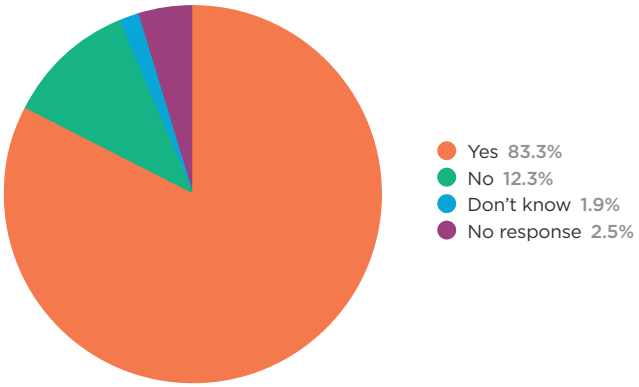


FIGURE 7: Proportion who store respirator away from dust and dusty objects (%) (n=162)

Note: Among respondents who performed a high-dust task at least once a month and used a respirator

3.4 Provision of health monitoring

Nearly three-quarters (77.6%) of workers were not offered or provided a lung function test by their employer over the previous 12 months. Only two in 10 (20%) said they were, and a further 7.2% were either unsure or did not answer (Figure 8).

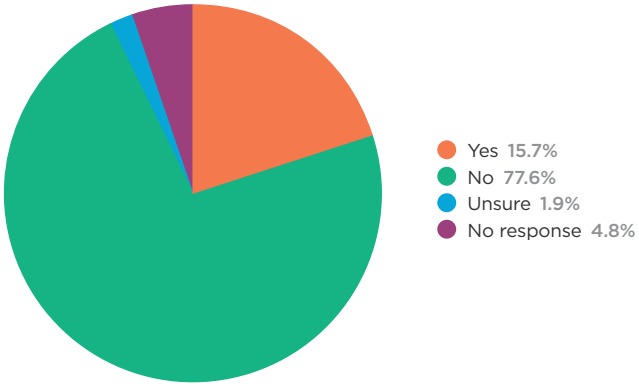


FIGURE 8: Lung function test offered by employer (%) (n=210)

Note: Among respondents who performed a high-dust task at least once a month and used a respirator

3.5 Consideration of health risk

Nearly nine in 10 (87.1%) workers sometimes, often or always considered the risks to health from breathing in dust when deciding how to do dusty jobs. Half of respondents (44.3%) always considered the risk to health from breathing dust (Figure 9).

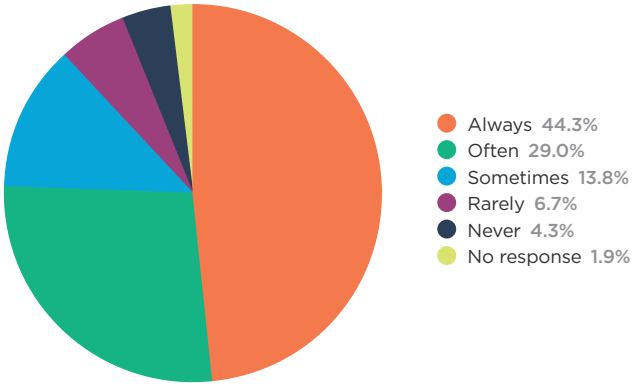


FIGURE 9: Consideration of risk to health from breathing in dust (%) (n=210)

Note: Among respondents who performed a high-dust task at least once a month

3.6 Potential factors contributing to workers' use of controls

Carpenters/builders were considerably less likely to use either wet or dry methods of dust control than they were to use neither (28.8% compared to 40.3%) (Table 14).

	USE OF EITHER WET OR DRY DUST CONTROL (n=240)		USE OF NEITHER WET NOR DRY DUST CONTROL (n=219)		P-VALUE
	n	%	n	%	
Apprentice	69	28.8	51	23.1	>0.05
Carpenter/builder	**69**	**28.8**	**89**	**40.3**	**<0.01**
Supervisor/foreman/manager	26	10.8	27	12.2	>0.05
Other	76	31.7	52	23.5	>0.05

Note: Among respondents who performed a high-dust task at least once a month. Respondents can perform multiple tasks, therefore the total dust control measures might exceed total number of respondents

TABLE 14: Use of any type of dust control by occupation

Table 15 presents the likelihood of wearing dusty clothes home, wearing a respirator and consideration of the risks to health by construction type. No significant differences were seen in respirator use or in the wearing of dusty clothing home. Those working in civil construction only (100%) were significantly more likely than those working in non-civil construction only (85.3%) to consider the risks to their health. Similarly, workers in non-commercial construction only (91.7%) were significantly more likely than those working in commercial construction only (76.9%) to consider the risks to their health.

	WEARING DUSTY CLOTHES HOME		RESPIRATOR USE		CONSIDERATION OF RISKS TO HEALTH	
	%	p-value	%	p-value	%	p-value
Residential only (n=108)	87.5	>0.05	78.8	>0.05	88.5	>0.05
Non-residential only (n=142)	83.1		75.4		87.3	
Civil only (n=42)	83.3	>0.05	71.4	>0.05	100	**<0.01**
Non-civil only (n=204)	85.3		77.9		85.3	
Commercial only (n=65)	86.2	>0.05	70.8	>0.05	76.9	**<0.01**
Non-commercial only (n=181)	84.5		79.0		91.7	

TABLE 15: Wearing dusty clothes home, wearing a respirator and consideration of the risks to health by construction type

Respirator use and the consideration of risks to health from breathing in dust were significantly more common among workers aged 25 years and above (79.4% and 92.6%, respectively) compared to younger workers (<25 years) (66.0% and 71.7%, respectively). No statistically significant differences in the wearing of dusty clothes home, respirator use or consideration of risks to health were observed across sex, ethnicity or country of birth (Table 16).

	WEARING DUSTY CLOTHES HOME		RESPIRATOR USE		AWARENESS OF RISKS TO HEALTH	
	%	p-value	%	p-value	%	p-value
Sex						
Male (n=238)	84.9	>0.05	76.1	>0.05	87.8	>0.05
Female (n=2)*	100		100		100	
Ethnicity						
NZ European (n=176)	85.8	>0.05	76.1	>0.05	88.1	>0.05
Non-NZ European (n=87)	85.1		77		90.8	
Māori (n=59)*	88.1	>0.05	76.3	>0.05	91.5	>0.05
Non-Māori (n=204)	84.8		76.4		88.2	
Age group						
≤24 (n=53)	86.8	>0.05	66.0	**<0.05**	71.7	**<0.01**
>24 (n=189)	85.7		79.4		92.6	
Country of birth						
New Zealand (n=214)	86.5	>0.05	77.6	>0.05	88.3	>0.05
Outside New Zealand (n=28)*	82.1		67.9		89.3	

TABLE 16: Wearing dusty clothes home, respirator use and consideration of the risks to health from breathing in dust by demographic characteristics

When viewed by occupation, wearing dusty clothes home was significantly more common among carpenters/builders (88.9%) than joiners (50%). By task, those cutting/drilling concrete (93.8%) were significantly more likely than those cutting/sanding wood (78.5%) to wear their dusty clothes home.

Wearing a respirator when doing dusty work was statistically more common among carpenters/builders (90.5%) when compared to apprentices (70.8%) and supervisors/foremen/managers (65.7%). Respirator use was also significantly more common among workers cutting/drilling concrete than for people crushing concrete.

Respondents with more than 20 working years in the construction industry were less likely to wear dusty clothes home (84.6%), more likely to use a respirator (80.8%) and more likely to consider risks to their health from dust (91.0%) than those with less than 20 years' experience (85.1%, 74.4% and 86.3%, respectively). However, none of these differences were statistically significant (Table 17).

* Caution: Due to the small sub-sample of respondents, results are indicative only. Multiple ethnic groups applied.

	WEARING DUSTY CLOTHES HOME		RESPIRATOR USE		AWARENESS OF RISKS TO HEALTH	
	%	p-value	%	p-value	%	p-value
Construction role						
Apprentice (n=48)	89.6	>0.05	70.8	**<0.01**	77.1	>0.05
Carpenter/builder (n=63)^	88.9		90.5		90.5	
Supervisor/foreman/manager (n=35)*	77.1	>0.05	65.7	**<0.01**	88.6	>0.05
Other (n=100)	85.0	>0.05	74.0	**<0.01**	94.0	>0.05
Length of working time in the construction industry (years)						
<1 year (n=29)^*	79.3		75.9		79.3	
≥1 year (n=217)	85.7	>0.05	76.5	>0.05	88.9	>0.05
<20 years (n=168)	85.1	>0.05	74.4	>0.05	86.3	>0.05
≥20 years (n=78)^	84.6		80.8		91.0	
Tasks						
Cutting/drilling concrete (n=143)^	90.2		77.6		88.8	
Grinding/polishing concrete (n=32)*	93.8	>0.05	90.6	>0.05	93.8	>0.05
Jackhammering (n=49)*	85.7	>0.05	89.8	>0.05	93.9	>0.05
Crushing concrete (n=16)*	100.0	>0.05	50.0	**<0.05**	81.3	>0.05
Cutting/sanding wood (n=172)	78.5	**<0.01**	78.5	>0.05	87.2	>0.05
Cutting/sanding plasterboard or fibre cement board (n=78)	87.2	>0.05	75.6	>0.05	84.6	>0.05

TABLE 17: Wearing dusty clothes home, wearing a respirator and consideration of the risks to health across occupational characteristics (n=250)

^ Reference group.

* Caution: Due to the small sub-sample of respondents, results are indicative only.

4.0 Discussion

IN THIS SECTION:

4.1 Main findings

Cutting or drilling concrete and cutting or sanding wood were the two most common high-dust tasks performed by workers in this study, the former being a particular risk for RCS exposure. This is comparable with data from the Australian Work Exposures Study (AWES), which showed that cutting, grinding or sanding concrete were the most common sources of RCS exposure among construction workers (Si et al., 2016). However, the proportion of workers who regularly cut or drilled concrete (57.2%) in this study was higher than the 48.5% from the AWES (Si et al., 2016). The targeted nature of this study (ie visiting construction sites) compared with the general population surveying of the AWES (ie including construction workers not based on site) likely contributes to some of this difference.

Many studies have highlighted the benefits of using water suppression or dry dust extraction to minimise dust exposure when doing dusty work (Beamer, Shulman, Maynard, Williams, & Watkins, 2005; Croteau, Flanagan, Camp, & Seixas, 2004; Echt et al., 2007; Pocock, 2012; Shepherd, Woskie, Holcroft, & Ellenbecker, 2008). While water suppression was the most common method used to minimise dust exposure when cutting/drilling or grinding/polishing concrete, more than a quarter of workers used neither water suppression nor dry dust extraction when performing these tasks. More dramatically, fewer than 15% of workers used water suppression when jackhammering. The impacts of not using either control are concerning, as Douwes and colleagues (2015) observed personal RCS samples among workers polishing or grinding concrete to be 50% and 230% higher than the New Zealand workplace exposure standard, respectively.

More than two-thirds of respondents reported wearing respirators when performing dusty jobs at least sometimes, but less than a third reported wearing them all the time. This too is comparable with the New Zealand workforce survey, which showed that two-thirds of trades workers reported using respirators (Eng et al., 2010). However, as Douwes et al. observed on their construction site visits, many workers wear respiratory protection in an ineffective manner (Douwes et al., 2015). Of the nearly one-quarter of respondents who reported that they did not wear respirators when doing dusty work, one in five reported that this was due to respirators not being provided.

Among respirator users, disposable masks were used by two-thirds and full-face and half-face respirators were used by the other third. However, most workers were not fit tested for a respirator, and over half were not clean shaven. Both of these factors have been shown to reduce the effectiveness of the respirators (Takemura et al., 2008).

Respirator use and awareness of risks to health from breathing in dust were markedly affected by respondent age. Young people aged 24 years and below were significantly less likely to consider risks to their health or wear a respirator, compared to those over 24 years ($p<0.05$). This correlation has been observed elsewhere. A recent survey of working adults in Canada reported that young workers were more likely to be exposed to occupational hazards and have a poorer awareness of health and safety compared to older workers (Lay et al., 2016). Similarly, qualitative research in construction has found that older and more experienced workers were more likely to adopt safer working methods than younger workers (Langford, Rowlinson, & Sawacha, 2000).

Lay et al. also found a strong negative correlation between length of time in the industry and exposure to hazards (Lay et al., 2016). This study, however, found no correlation between length of working time in the construction industry and workers' use of controls nor their consideration of the risks to their health. This mirrors similar findings from the Hong Kong construction industry (Fang, Chen, & Wong, 2006).

It has been demonstrated that using a combination of both respiratory protection (wearing a properly fitted mask) and dust control measures would more effectively minimise dust exposure than a single method alone (Tjoe Nij et al., 2003). This study found that respirator use was less common among workers not using dust control measures (supression or extraction) than among workers who did use dust control measures. However, these differences were not statistically significant ($p>0.05$).

This study also explored the frequency with which workers considered the risks of dust to their health when deciding how to do dusty jobs. Nearly half reported that they always considered their health when deciding how to perform dusty jobs. Despite this consideration for their health and the high-risk environment and mixed use of controls, very few of the respondents had been offered or provided with a lung function test by their employer.

4.2 Limitations

This is the first cross-sectional descriptive study exploring dust exposures and use of controls in the construction industry in New Zealand. It provides quantification of the prevalence of dust control measures in New Zealand's Waikato Region and contributes to the national and international literature on occupational health and safety.

However, the study also has several key limitations. Firstly, while the sample size is sufficient for the construction industry in Waikato, it is not sufficient to allow for extrapolation to all construction workers in New Zealand. Further, due to completing data collection in a single region and in a predominantly urban environment, the results are unlikely to be attributable to the national population as a whole.

Secondly, oversampling and undersampling of particular demographics (ie the low numbers of Asian respondents, a low number of subcontractors) likely mean the findings are not fully representative of the broader Waikato construction population. However, without accurate data on the demographic makeup of the Waikato construction industry, the impact of any sampling issues can not be quantified or corrected for. Similarly, the use of an on-site questionnaire also increases the potential for overestimating the frequency of performing tasks associated with high dust exposure by not sampling construction workers who are not on site (ie in other construction-related occupations).

The non-randomised on-site questionnaire method could also lead to participation and social desirability biases. The self-reported answers, the interview being conducted at the worksite and the knowledge that the questionnaire is being conducted on behalf of WorkSafe may have incentivised socially desirable responses. Further, the non-randomised approach and the potential for workers who are too busy, disintersted or otherwise unwilling likely creates a participation bias.

Finally, no effort was made to measure the levels of exposure to construction dusts on surveyed sites. For this reason and the sampling biases above, the frequencies with which respondents performed dusty tasks should not be taken as a measure of the prevalence of exposure to construction dusts in general.

4.3 Conclusions

The results of this study largely support the observation that construction workers performing dusty tasks, including when working with silica dust, employ limited dust controls. Low use of dust suppression or extraction was reported across occupations and tasks but particularly for demolition and working with wood. High levels of respirator use were reported, but users were rarely clean shaven and had low levels of fit testing. Of particular concern is the regular performance of dusty tasks by apprentices coupled with the finding that younger workers were significantly less likely to consider the risks to their health or to use respiratory protection. Future work should investigate how to encourage or enable uptake of dust controls in the construction sector, including among younger workers.

Appendices

IN THIS SECTION:

Appendix 1: References

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Appendix 2: Questionnaire

Q1.

At work, how often do you cut or drill concrete?

Respondent may answer immediately. If not, read out the time periods below (1–4) to prompt respondent.

1 At least once a day
2 At least once a week
3 At least once a month
4 Less than once a month (go to Q4)
98 Don't know (go to Q4)
99 No response (go to Q4)

Q2.

When cutting or drilling concrete do you usually:

Read out options 1-3.

1 Use wet methods (go to Q4)
2 Use dry dust extraction
3 Use neither method
98 Don't know (go to Q4)
99 No response (go to Q4)

If required:

- 'Wet methods' means using water to stop the dust getting into the air, either with a hose or water attachment on the tool.
- Dry dust extraction means using a vacuum attachment on (or close to) the tool to catch the dust before it is released into the air.

Q3.

Why don't you usually use wet methods when cutting or drilling concrete?

Let the respondent answer the question unprompted. Assign their response to one of the categories below.

1 It is not provided
2 Water is not suitable for the environment (eg inside)
3 Messy
4 It makes it hard to do work
5 Slow/difficult to set up
6 Water is not available
7 Too cold/too uncomfortable
97 Other (please state) _____
98 Don't know
99 No response

Q4.

At work, how often do you grind or polish concrete?

Respondent may answer immediately. If not, read out the time periods below (1–4) to prompt respondent.

1 At least once a day
2 At least once a week
3 At least once a month
4 Less than once a month (go to Q6)
98 Don't know (go to Q6)
99 No response (go to Q6)

Q5.

When grinding or polishing concrete do you usually:

Read out options 1-3.

1 Use wet methods
2 Use dry dust extraction
3 Use neither method
98 Don't know
99 No response

If required:

- 'Wet methods' means using water to stop the dust getting into the air, either with a hose or water attachment on the tool.
- Dry dust extraction means using a vacuum attachment to (or close to) the tool to catch the dust before it is released into the air.

Q6.

At work, how often do you use a jackhammer?

Respondent may answer immediately. If not, read out the time periods below (1–4) to prompt respondent.

1 At least once a day
2 At least once a week
3 At least once a month
4 Less than once a month (go to Q9)
98 Don't know (go to Q9)
99 No response (go to Q9)

Q7.

Do you usually use wet methods when jackhammering?

Read out options 1-3.

1 Yes (go to Q9)
2 No
98 Don't know (go to Q9)
99 No response (go to Q9)

If required:

- 'Wet methods' means using water to stop the dust getting into the air, either with a hose or water attachment on the tool.

Q8.

Why don't you usually use wet methods when jackhammering?

Let the respondent answer the question unprompted. Assign their response to one of the categories below.

1 They are not provided
2 Water is not suitable for the environment (eg inside)
3 It makes it hard to do work
4 Slow/difficult to set up
5 Difficult to transport water to the site
6 Too cold
97 Other (please state) _____
98 Don't know
99 No response

Q9.

At work, how often do you crush concrete in other ways?

Respondent may answer immediately. If not, read out the time periods below (1–4) to prompt respondent.

1 At least once a day
2 At least once a week
3 At least once a month
4 Less than once a month (go to Q12)
98 Don't know (go to Q12)
99 No response (go to Q12)

Q10.

Do you usually use wet methods when crushing concrete?

Read out options 1-3.

1 Yes (go to Q12)
2 No
98 Don't know (go to Q12)
99 No response (go to Q12)

If required:

- 'Wet methods' means using water to stop the dust getting into the air, either with a hose or water attachment on the tool.

Q11.

Why don't you usually use wet methods when crushing concrete?

Let the respondent answer the question unprompted. Assign their response to one of the categories below.

1 They are not provided
2 Water is not suitable for the environment (eg inside)
3 It makes it hard to do work
4 Slow/difficult to set up
5 Difficult to transport water to the site
6 Too cold
97 Other (please state) _____
98 Don't know
99 No response

Q12.

At work, how often do you cut or sand wood?

Respondent may answer immediately. If not, read out the time periods below (1–4) to prompt respondent.

1 At least once a day
2 At least once a week
3 At least once a month
4 Less than once a month (go to Q15)
98 Don't know (go to Q15)
99 No response (go to Q15)

Q13.

Do you usually use dry dust extraction when cutting or sanding wood?

1 Yes (go to Q15)
2 No
98 Don't know (go to Q15)
99 No response (go to Q15)

If required:

- Dry dust extraction means using a vacuum attachment to (or close to) the tool to catch the dust before it is released into the air.

Q14.

Why don't you usually use dry dust extraction when cutting or sanding wood?

Let the respondent answer the question unprompted. Assign their response to one of the categories below.

1 It is not provided
2 It is not necessary
3 It makes it hard to do work
4 Slow/difficult to set up
97 Other (please state) _____
98 Don't know
99 No response

Q15.

At work, how often do you cut or sand plasterboard or fibre cement board?

Respondent may answer immediately. If not, read out the time periods below (1–4) to prompt respondent.

1 At least once a day
2 At least once a week
3 At least once a month
4 Less than once a month (go to Q18)
98 Don't know (go to Q18)
99 No response (go to Q18)

Q16.

Do you usually use dry dust extraction when cutting fibre cement board?

1 Yes (go to Q18)
2 No
99 No response (go to Q18)

If required:

- Dry dust extraction means using a vacuum attachment to (or close to) the tool to catch the dust before it is released into the air.

Q17.

Why don't you usually use dry dust extraction when cutting fibre cement board?

Let the respondent answer the question unprompted. Assign their response to one of the categories below.

1 It is not provided
2 It is not necessary
3 It makes it hard to do work
4 Slow/difficult to set up
97 Other (please state) _____
98 Don't know
99 No response

Q18.

When cleaning up a dusty worksite, what do you generally use to clean up the dust?

Read out options 1–3. If the respondent provides another answer, include under 'Other'.

1 Dry broom
2 Wet broom
3 Vacuum cleaner
97 Other (please state) _____
98 Don't know
99 No response

Q19.

After completing dusty jobs, how often would you wear dusty work clothes home?

Respondent may answer immediately. If not, read out the intervals below (1-5) to prompt respondent.

1 Always
2 Often
3 Sometimes
4 Rarely
5 Never
99 No response

Q20.

How often do you wear a respirator when doing dusty work?

Respondent may answer immediately. If not, read out the intervals below (1-5) to prompt respondent.

1 Always
2 Often
3 Sometimes
4 Rarely (go to Q26)
5 Never (go to Q26)
98 Don't know (go to Q26)
99 No response (go to Q26)

If the respondent is unsure what a respirator is, please show them this image:

Full face Half face Disposable respirator

Q21.

What type of respirator do you normally use?

Read out options 1-3.

1 Full-face
2 Half-face
3 Disposable
98 Don't know (go to 26)
99 No response (go to 26)

If the respondent needs further prompting, please show them this image:

Full face | Half face | Disposable respirator

Q22.

Was the respirator fit tested to you?

1 Yes
2 No
98 Don't know
99 No response

Fit testing is having someone test that the respondent is wearing a proper-fitting respirator.

Q23.

Do you store your respirator away from dust and dusty objects?

1 Yes
2 No
98 Don't know
99 No response

Q24.

Are you usually clean shaven?

1 Yes, always
2 Yes, when using a respirator
3 No
99 No response

If yes, clarify whether they are always clean shaven or always clean shaven when using the respirator.

Q25.

Why don't you always wear the respirator when doing dusty work?

Let the respondent answer the question unprompted. Assign their response to one of the categories below. Encourage them to give a reason.

1 Respirator not provided
2 Respirator does not fit
3 Respirator gets in the way
4 Respirator is uncomfortable
97 Other (please state) _____
98 Don't know
99 No response

Q26.

How often do you consider the risks to your health from breathing in dust when deciding how to do dusty jobs?

Respondent may answer immediately. If not, read out the intervals below (1-5) to prompt respondent.

1 Always
2 Often
3 Sometimes
4 Rarely
5 Never
99 No response

Q27.

In the last 12 months, did your employer offer you a lung function test?

1 Yes
2 No
3 Unsure
99 No response

A lung function test may be any test, usually by a health professional, to ascertain how well the respondent's lungs work or identify any issues with the lungs.

Q28.

What is your role?

Respondent should state their role and interviewer to classify under one of the sections. If their role is significantly different from those listed, please record under 'Other'.

1 Apprentice
2 Carpenter/builder
3 Electrician
4 Engineer
5 Joiner
6 Labourer
7 Painter
8 Plasterer
9 Plumber
10 Supervisor/foreman/manager
97 Other (please state) _____
99 No response

Q29.

What kind of work do you usually do?

Read out first four options.

1 Civil or heavy
2 Commercial
3 Residential
97 Other (please state) _____
99 No response

Q30.

How long have you been working in the construction industry?

Respondent may answer immediately. If not, read out the intervals below (1-6) to prompt respondent.

1 Less than 1 year
2 1-2 years
3 3-5 years
4 6-9 years
5 10-19 years
6 20 years or more
99 No response

Q31.

Are you?

Read out options 1-3.

1 Male
2 Female
3 Gender diverse
99 No response

Q32.

How old are you?

1 Under 18
2 18-24 years
3 25-34 years
4 35-44 years
5 45-54 years
6 55 years and over
99 No response

Q33.

What ethnic group or groups do you identify with?

Read out options 1-5.

1 New Zealand European
2 Māori
3 Pacific Islander
4 Asian
97 Other (please state) _____
99 No response

Q34.

Were you born in New Zealand?

1 Yes
2 No
99 No response

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