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CENTRE FOR PUBLIC HEALTH RESEARCH

WORKPLACE INTERVENTIONS TO REDUCE EXPOSURES TO CARCINOGENS

Forum on
Workplace Carcinogens

EXPOSURE SURVEY

- 2008 – Exposure survey of inhalable dust, respirable dust, and formaldehyde.
- Wellington, Auckland, Hastings.
- 22 joineries (96 joiners) and 8 furniture factories (74 furniture makers).

WOOD DUST AND FORMALDEHYDE

Wood Dust	Cancer	OR	95% CI
Demers et al., 1995	Sino-nasal	3.1	1.6 – 5.6
	Nasopharyngeal	2.4	1.1 – 4.5

Formaldehyde	Cancer	SMR	95% CI
Hauptman et al., 2004	Nasopharyngeal	2.10	1.05 – 4.21

EXPOSURE SURVEY RESULTS

	Inhalable Dust (mg/m^3)	Respirable Dust (mg/m^3)	Formaldehyde (ppm)
Joineries	2.48	0.27	0.014
Furniture Makers	1.22	0.12	0.012
All Workers	1.82	0.18	0.013

- Workplace exposure standard was 5 mg/m^3.
- ACGIH standard - 1 mg/m^3.
- From Dec 2010, WES lowered to 2 mg/m^3.

WOOD DUST INTERVENTION STUDY

Pre-intervention

PAS-6 sampling

6 joineries
1 high control
1 low control
2 high exposed
2 low exposed

Video Exposure Monitoring (VEM)

Full work shift and task based samples

Analysis of data identified activities with highest dust exposures

Occupational Hygiene Assessment

Hygiene survey of workshops in current study and previous exposure survey

Helped drive interventions

Intervention Experiments

Cleaning, Routing, Orbital sanding

Implementation of interventions

Post-intervention

PAS-6 sampling in the same 6 joineries

Study start

Time

Study end

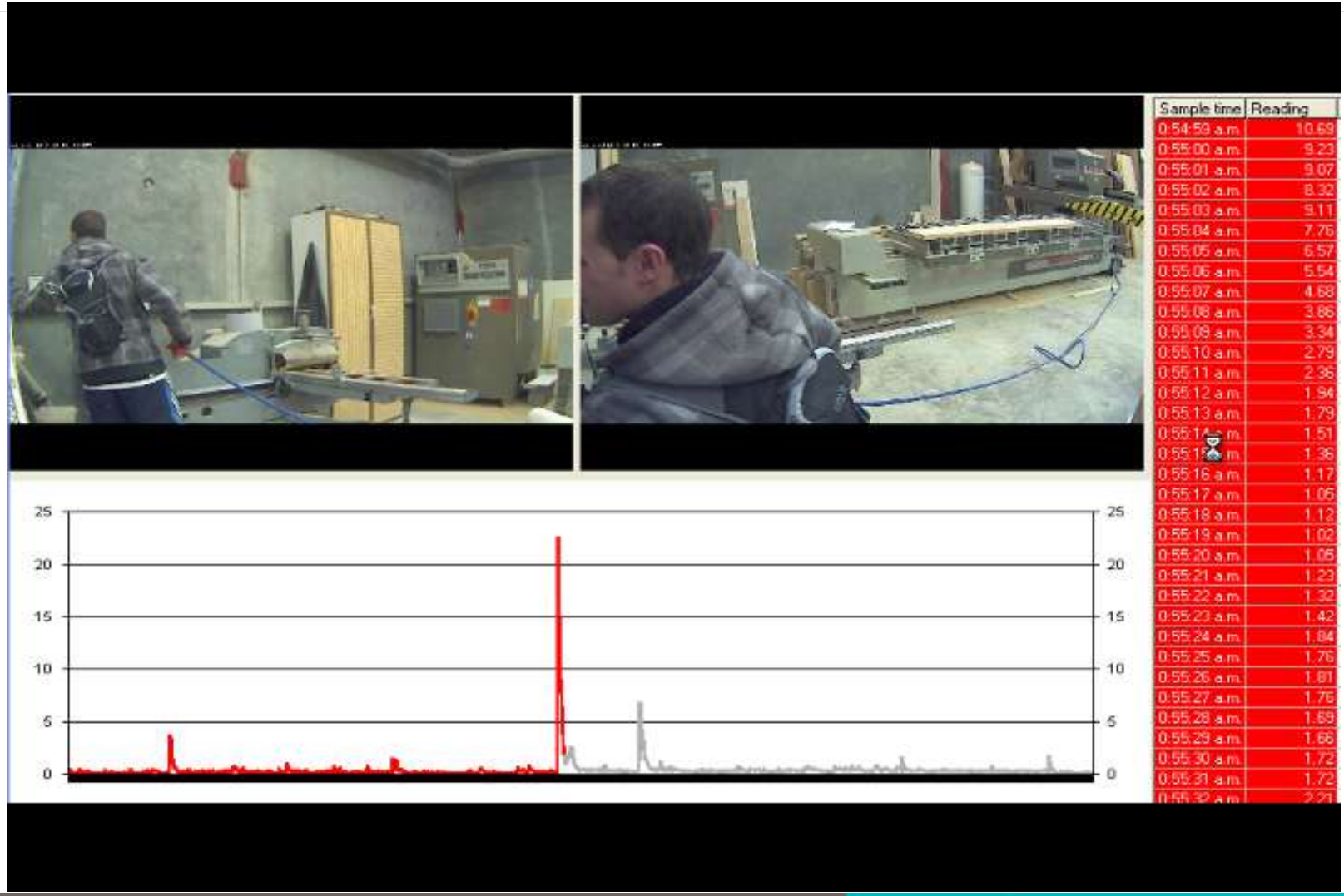
TIME SPENT ON TASKS

	% time allocated to each task	
Tasks and activities	Joiners	Furniture makers
Assembly	21.5%	14.8%
CNC	12.1%	73.6%
Cleaning	**0.7%**	1.9%
Edge banding	1.2%	2.9%
Miscellaneous	27.3%	5.9%
Mortissing	0.5%	
Planing (electric hand-held)	0.4%	
Routing	**6.5%**	0.7%
Sanding (hand)	5.3%	0.0%
Sanding (hand-held orbital)	**1.4%**	
Sanding (machine belt sander)	9.0%	
Sawing (band saw)	1.2%	
Sawing (mitre saw)	0.6%	
Sawing (rip saw - for timber)	0.1%	
Sawing (table saw/circular saw)	4.2%	0.1%
Sawing (traditional hand)	0.2%	
Spindle moulding (table mounted router)	4.6	
Tennoning	1.1%	
Total	100%	100%

EXPOSURE DETERMINANTS

Determinants	Exposure ratios (95% CL)	
	Joiners[1]	Furniture makers[2]
Tasks/activities		
Miscellaneous	2.1 (1.9-2.2)	4.0 (3.5-4.5)
Cleaning	**8.4 (7.7-9.2)**	5.0 (4.4-5.7)
CNC	2.6 (2.4-2.9)	1.7 (1.6-1.8)
Biscuit cutting	3.2 (2.9-3.5)	-
Tennoning	8.6 (7.9-9.3)	-
Mortissing	2.7 (2.4-2.9)	-
Routing	**3.5 (3.3-3.8)**	1.2 (1.2-1.3)
Spindle moulder	2.6 (2.4-2.9)	-
Sanding (hand)	6.0 (5.6-6.4)	1.6 (1.1-2.3)
Sanding (hand-held orbital)	**11.1 (10.3-12.0)**	-
Sanding (machine belt sander)	6.0 (5.5-6.4)	-
Edge banding	1.5 (1.4-1.6)	1.5 (1.5-1.5)
Buzzing	1.0 (0.8-1.1)	-
Thicknessing	2.1 (1.9-2.3)	-
Planing (traditional)	2.2 (2.1-2.4)	-
Planing (electric hand-held)	23.9 (22.1-25.9)	-
Sawing (band saw)	4.6 (4.2-5.0)	-
Sawing (mitre saw)	2.7 (2.5-3.0)	-
Sawing (rip saw)	1.0 (0.8-1.3)	-
Sawing (hand saw)	8.8 (5.9-7.8)	-
Sawing (circular saw)	2.4 (2.3-2.6)	6.8 (6.0 – 7.8)
Assembly	2.6 (2.42.8)	Reference
Gluing	Reference	

EXAMPLE OF VEM



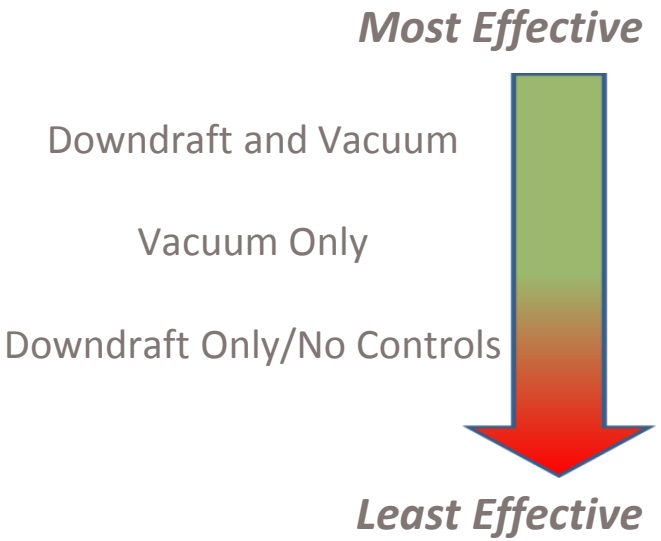
RESULTS – OCC HYGIENE ASSESSMENT

- Hygiene assessments were not correlated with the dust exposures measured in joineries in:
  - the exposure survey (P=0.16)
  - this study (P=0.8)

RESULTS – ROUTER INTERVENTION

Controls	N	GM (GSD)	% difference (95% CL)
No controls	4	0.6 mg/m^3 (1.2)	-
Downdraft table	4	0.8 mg/m^3 (1.2)	34 (-29.5; 155.5)
Vacuum	4	0.4 mg/m^3 (1.2)	-28 (-62.0; 37.7)
Downdraft + Vac	4	0.3 mg/m^3 (1.2)	-43 (-69.8; 9.4)[#]

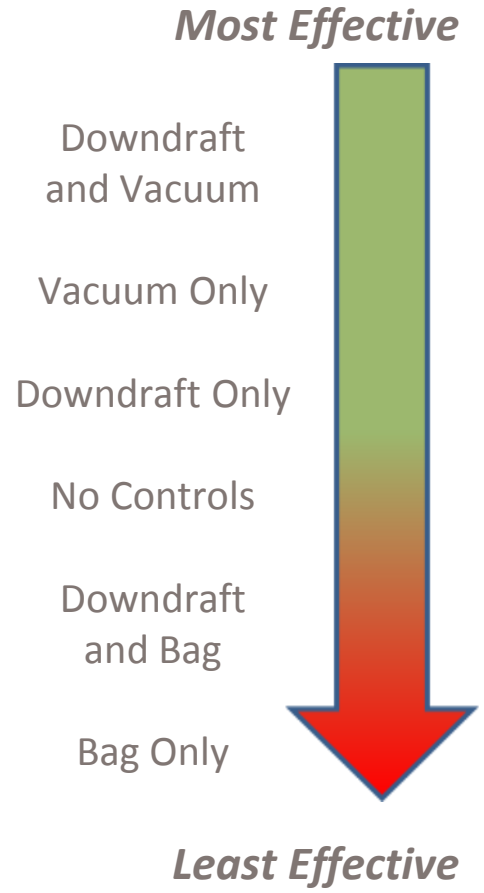
[#]P<0.10



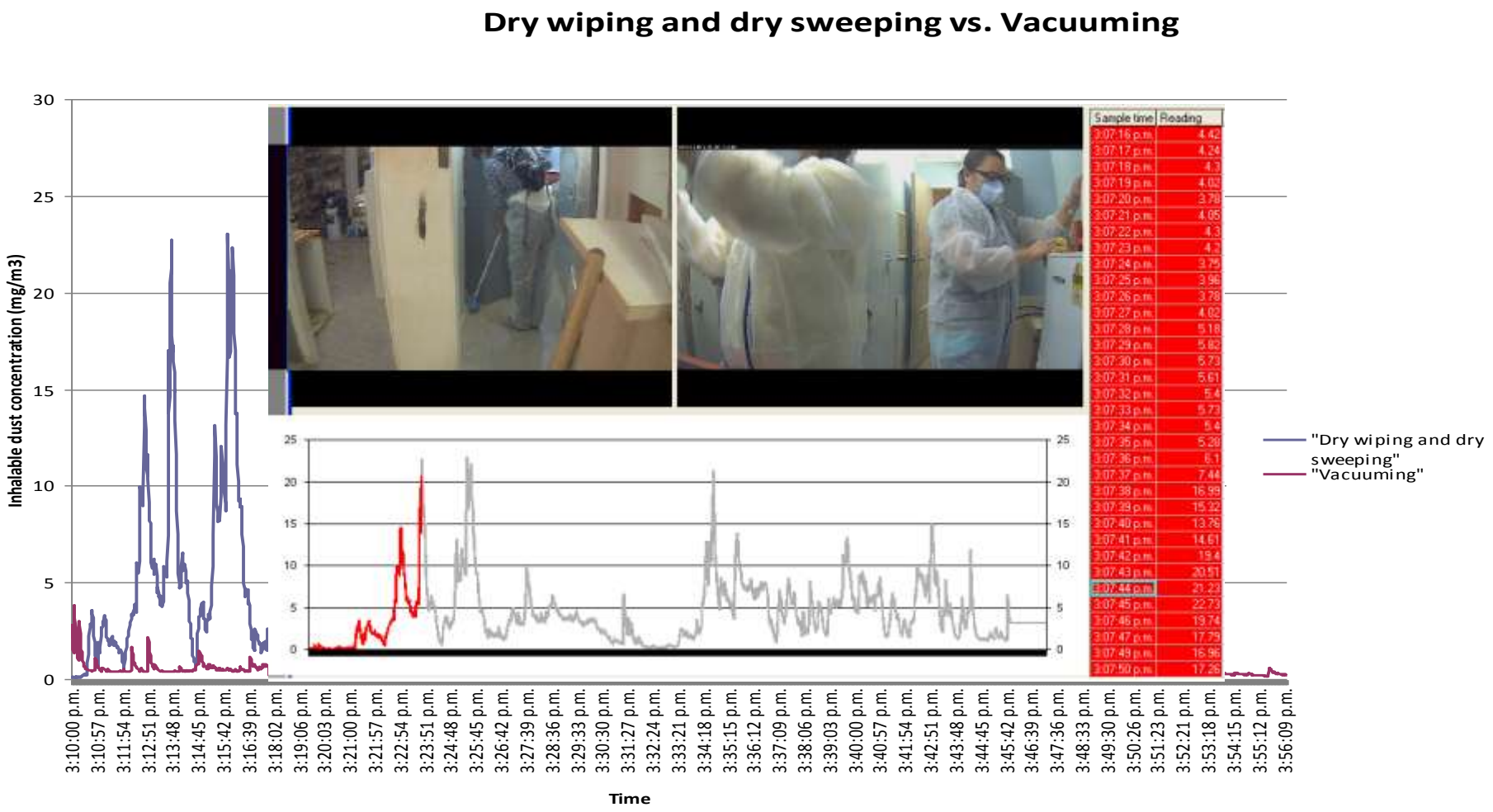
RESULTS – SANDER INTERVENTION

Controls	N	GM (GSD)	% difference (95% CL)
No controls	6	0.8 mg/m^3 (1.2)	-
Downdraft table	6	0.8 mg/m^3 (1.2)	-8.3 (-46.2; 56.5)
Vacuum	**7**	**0.2 mg/m^3 (1.2)**	**-75.0 (-85.1; -58.2)*** **
Bag	6	1.5 mg/m^3 (1.2)	73.6 (-0.9; 204.0)#
Downdraft + Vac	**6**	**0.1 mg/m^3 (1.2)**	**-83.5 (-90.3; -71.9)*** **
Downdraft + Bag	6	0.8 mg/m^3 (1.2)	-3.3 (-44.9; 69.2)

*** P<0.001; #P<0.10



RESULTS – INTERVENTION EXPERIMENTS



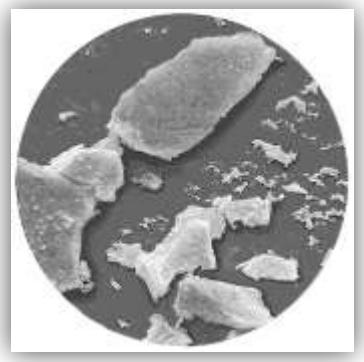
RESULTS – PRE & POST INTERVENTION

Joineries	N	Pre-intervention average concentration (mg/m^3) GM (GSD)	N	Post-intervention average concentration (mg/m^3) GM (GSD)	Post-Pre intervention Difference (95% CL) %
Low Control	6	1.7 (1.8)	6	1.3 (2.4)	-22.2 (-70.1; 32.6)
Low 2	7	4.9 (2.1)	6	2.4 (2.6)	-49.9 (-82.4; 42.7)
Low 1	8	1.6 (2.1)	14	1.5 (2.2)	-8.8 (-55.7; 87.7)
High Control	15	5.7 (2.6)	14	3.8 (2.4)	-34.7 (-67.7; 32.6)
High 2	**12**	**4.2 (1.5)**	**8**	**1.9 (2.0)**	**-55.0 (-72.6; -26.3)****
High 1	**6**	**6.2 (1.6)**	**6**	**2.4 (2.1)**	**-61.8 (-82.4; -17.0)***

* P<0.05; **P<0.01

SILICA IN CONSTRUCTION AND DEMOLITION

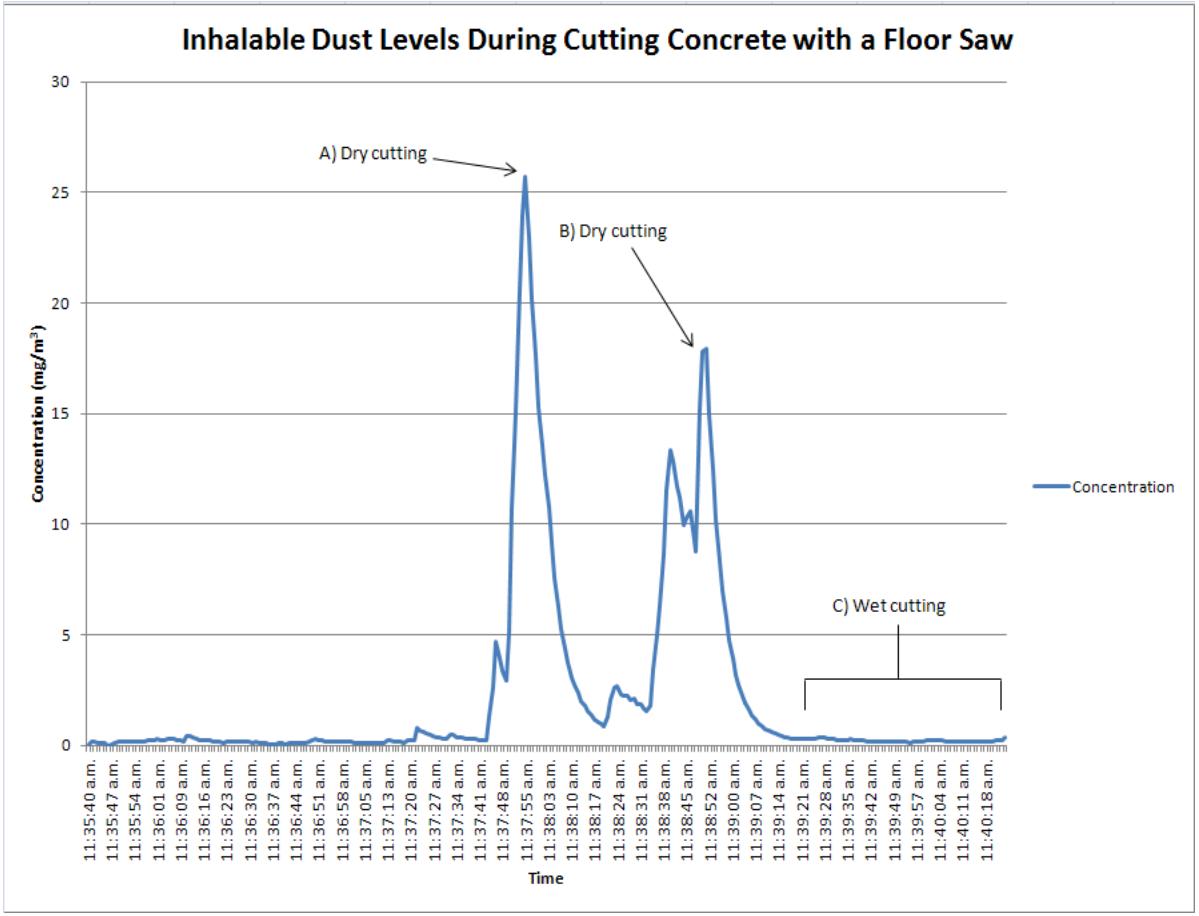
- Rebuilding and demolition activities
  - Concrete cutting/sawing
  - Concrete drilling
  - Demolition hammering
- Produces dust which can contain silica
- Causes diseases such as:
  - Silicosis
  - Chronic obstructive pulmonary disease (COPD)
  - Lung cancer



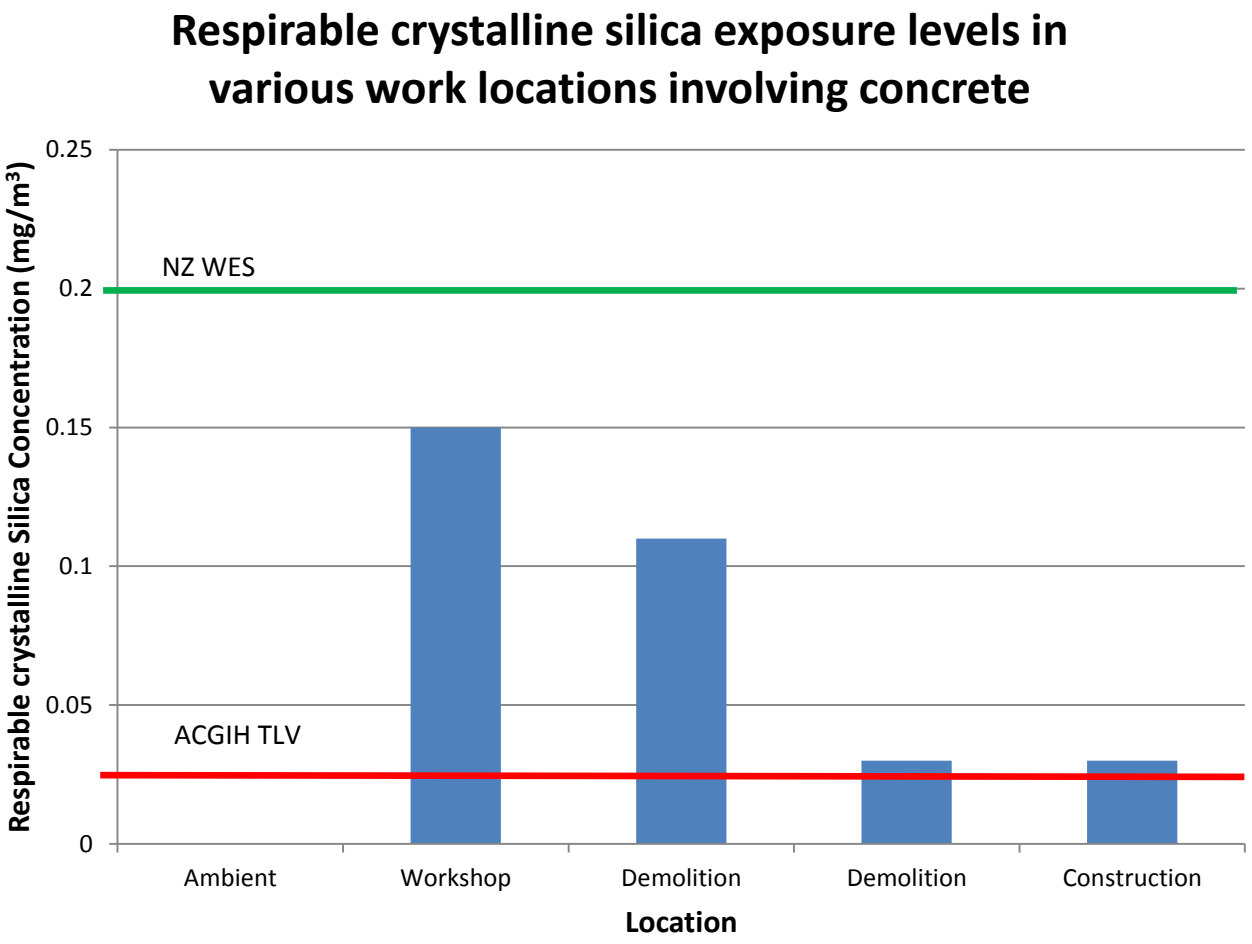
VEM - RESULTS

Task	Dry	Wet	Average reduction in peak exposure (wet vs. dry)
	Average inhalable dust concentration (mg/m^3)	Average inhalable dust concentration (mg/m^3)	
Remote-controlled wet concrete wall cutting (1)	n/a	0.40	n/a
Remote-controlled wet concrete wall cutting (2)	n/a	0.45	n/a
Dry concrete demolition hammering	5.41	n/a	n/a
Experiments			
Concrete wall drilling	8.89	0.57 (-94%)	54%
Floor sawing concrete	5.83	0.21 (-96%)	100%
Hand-held sawing concrete	0.69	0.73 (+5%)	31%

VEM - RESULTS


Inhalable Dust Levels During Cutting Concrete with a Floor Saw
Concentration (mg/m³)
30
25
20
15
10
5
0
A) Dry cutting
B) Dry cutting
C) Wet cutting
Concentration
11:35:40 a.m.
11:35:47 a.m.
11:35:54 a.m.
11:36:01 a.m.
11:36:09 a.m.
11:36:16 a.m.
11:36:23 a.m.
11:36:30 a.m.
11:36:37 a.m.
11:36:44 a.m.
11:36:51 a.m.
11:36:58 a.m.
11:37:05 a.m.
11:37:13 a.m.
11:37:20 a.m.
11:37:27 a.m.
11:37:34 a.m.
11:37:41 a.m.
11:37:48 a.m.
11:37:55 a.m.
11:38:03 a.m.
11:38:10 a.m.
11:38:17 a.m.
11:38:24 a.m.
11:38:31 a.m.
11:38:38 a.m.
11:38:45 a.m.
11:38:52 a.m.
11:39:00 a.m.
11:39:07 a.m.
11:39:14 a.m.
11:39:21 a.m.
11:39:28 a.m.
11:39:35 a.m.
11:39:42 a.m.
11:39:49 a.m.
11:39:57 a.m.
11:40:04 a.m.
11:40:11 a.m.
11:40:18 a.m.
Time

8 HOUR-TWA RESPIRABLE SILICA - RESULTS



NZ WES VERSUS OECD COUNTRIES

Rank	Country	Exposure limit for crystalline silica (mg/m^3)
1	Canada	0.025
..		
8	Ireland	0.05
..		
10	Netherlands	0.075
11	Australia	0.1
..		
24	Austria	0.15
..		
30	**New Zealand**	**0.2**
31	Poland	0.3

OCCUPATIONAL HEALTH RESEARCHER'S ROLE

- Exposures to occupational carcinogens are often preventable.
- Occupational epidemiologists should contribute not only to identifying problems, but also have an obligation to contribute towards solutions
- More research into interventions are required even if they do not involve state-of-the art methods
- We cannot simply rely on government agencies and industry to solve the problems we identified
- Olaus Magnus (1555)
  - "When sifting the chaff from the wheat, one must carefully consider the time when a suitable wind is available that sweeps away the harmful dust, so that it will not damage the vital organs of the threshers. This dust is so fine that it will almost unnoticeably penetrate into the mouth and accumulate in the throat.
  - If this is not quickly dealt with by drinking fresh ale the thresher may never again or only for a short period eat what he has threshed"

THANK YOU

- Participants:
  - Joiners, furniture makers, construction and demolition workers.
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  - HRC, ACC, and MBIE.
- Researchers:
  - Jeroen Douwes, Bill Glass, Bradley Prezant, Dave McLean, Khoon Wong, Neil Pearce, Jim McGlothlin, Mark Sharp