Dust Management Report – March 2012

Training for Hire Limited a company registered in England and Wales
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Overview

This document is for use by those with an interest in occupational health including workers, safety officers and representatives and equipment specifiers and users.

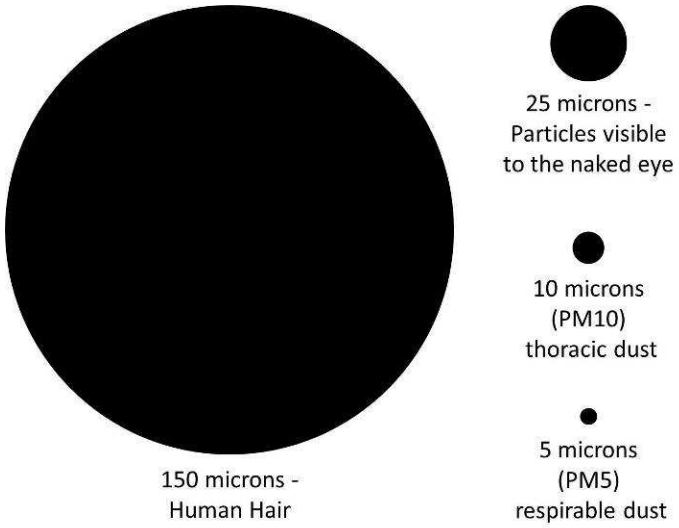
Management of inhalable and respirable dust on UK construction sites is an area under close scrutiny with 4,000 to 6,000 deaths per annum being attributed to COPD as a result of occupational exposure to dust. (http://www.hazards.org/dust/dust.htm) Current practice includes use of RPE, suppression and / or extraction. Enforcement action includes the issuing of Prohibition Notices where occupational exposure is over the WEL (Workplace Exposure Limit) which is being publicised in layman's terms as "dry cutting is banned".

WEL's

Workplace Exposure Limits for materials commonly being cut on UK sites includes:

- Silica, respirable crystalline: 0.1 $mg.m^3$
- wood dust 5 $mg.m^3$

Dust Particle Size



Background

During a Site Management Safety Training Scheme course, delegate Andrew Hirst, MD of A&T Joinery Limited delivered a toolbox talk to other delegates on COSHH and specifically dust management. Andrew reviewed the current practice on sites focussing on extraction using vacuums and RPE. A great deal of interest was generated and opportunities to further improve were discussed. On this basis, an exercise to quantify exposure and to reduce "**so far as is reasonably practicable**" has been completed and the results follow.

Date and Location

24th February 2012 – Miller Homes – Bingham, Nottingham – 2nd fix in a new build property:

Circulation

Caroline Haslam – H&S Manager – Miller Homes, Jim Maccall – Consultant – Training for Hire, Andrew Hirst – MD – A&T Joinery, Phil Haskins – Sales Engineer – DustControl (UK) Ltd

Equipment Used

- Makita slide compound saw 110v
- Bosch GAS25 vacuum – HEPA M rated vacuum with auto-start
- HAVi – Hand Arm Vibration indicator tool
- DC500 AirCube– DustControl HEPA H13 rated air cleaner
- DC2900 Vacuum – DustControl HEPA H13 vacuum
- TSi Sidepak – personal aerosol dust monitor – PM10 filters used – intake adjacent to face
- Bosch grinder and 6kN concrete block
- Dust Lamp – 55 watt 12 volt narrow beam lamp
- Screens – 2 x black screens

Method

Room set up to include cutting area and dust lamp (as per MDHS 82).

Equipment included addition of HAVi to act as a tool timer for the tests. Cutting was completed for a total of 3 minutes. Room volume: 34 cubic metres. All cuts completed using combinations of equipment as per findings and fitted RPE was worn by all attendees for duration of testing.

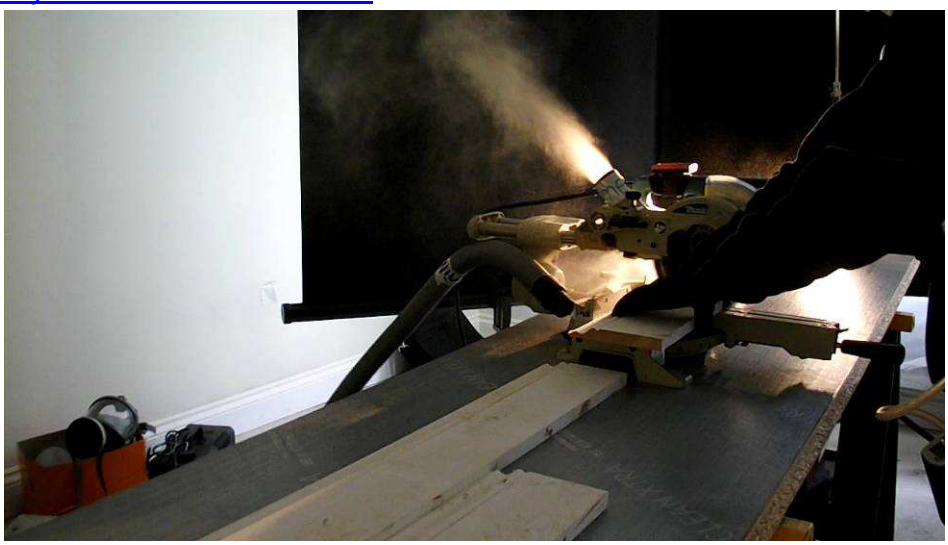
Findings

Result	1	2	3	4	5	6
Equipment	**MDF and Bosch**	**MDF no Vac**	**MDF and DC2900**	**MDF DC2900 + DC500**	**MDF Bosch + DC500**	**Cutting Concrete – DC2900 & DC500**
Average	**0.224**	**0.155**	**0.193**	**0.078**	**0.211**	**0.072**
Lowest	0.014	0.023	0.006	0.007	0.037	0.016
Highest	**5.653**	3.726	3.508	1.934	**9.939**	**0.656**

in mg/m^3 (milligrams per cubic metre) – figures in red could take operation over WEL

1. **MDF cutting with Bosch GAS25 vacuum** - Exposure average of 0.224 mg/m^3
Video links: http://youtu.be/OdxxDvsTGFs http://youtu.be/aY7HhxadaJM

2. **MDF cutting without extraction** – Exposure average of 0.155 mg/m^3
Video links: http://youtu.be/1ZORZ9kJSos



Findings (continued)

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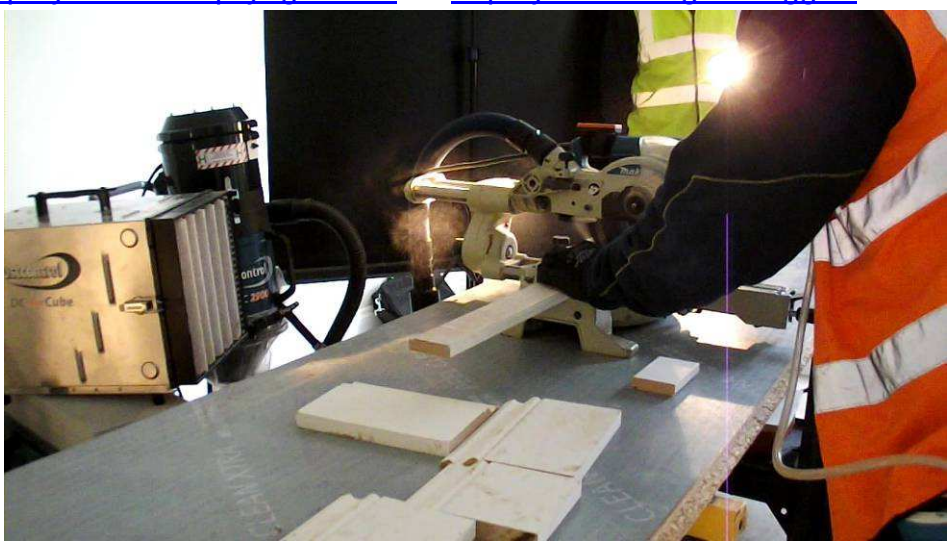
3. **MDF cutting with DustControl DC2900 vacuum** - Exposure average of 0.193 mg/m^3

Video links: http://youtu.be/9LPiw45Xtqc http://youtu.be/DgZaPk6FeuY
http://youtu.be/JwXJv2lnwzY http://youtu.be/MsuZ_frPJqw

4. **MDF cutting DustControl DC2900 and DC500 AirCube** – Exposure average of 0.078 mg/m^3

Video links: http://youtu.be/YqGyLg15Bw4 http://youtu.be/6gF4JfSggDc



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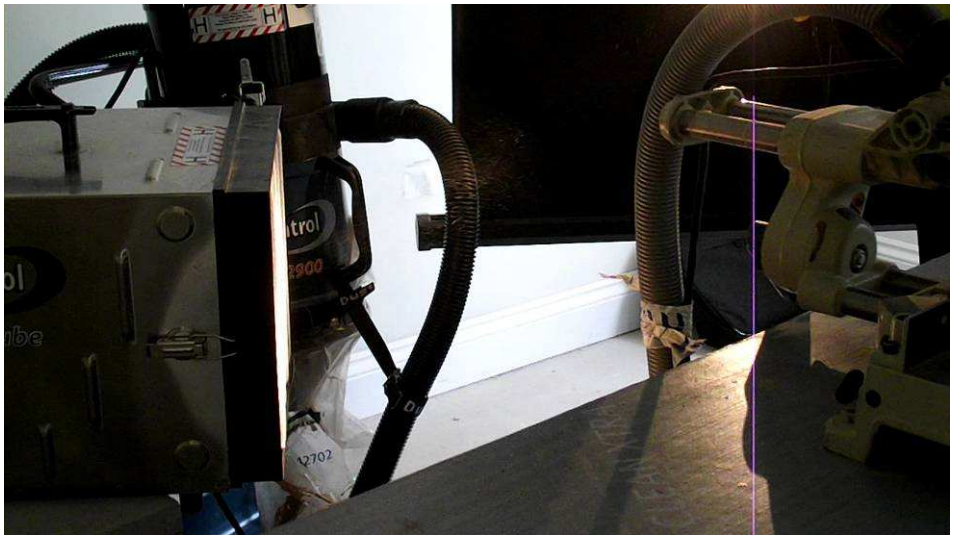
in mg/m^3 (milligrams per cubic metre) – figures in red could take operation over WEL

5. **MDF cutting with Bosch GAS25 and DC500 Aircube** - Exposure average of 0.211 mg/m^3
Video links: http://youtu.be/VJn9pKV7ls0 http://youtu.be/iZEQbOMOgC0



6. **Concrete cutting DustControl DC2900 and DC500** – Exposure average of 0.072 mg/m^3
Video links: http://youtu.be/6Mqe4iT0Qw8 http://youtu.be/uienFiuMhTM

Significant Findings

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Higher PM10 dust Level when vacuum was used!: It was expected that exposure levels with no vacuum would have been significantly higher than with the other control measures i.e. vacuum and air cleaners. However, 'Result 2' average result was below that of both tests with the Bosch GAS25 Vacuum. Respirable dust can take up to 8 hours to settle, possible cause of increased levels of PM10 dust reaching the operator are additional air flow within the room when any air movers are in operation i.e. vacuums and air cleaners.

Compounding issue may be filter / bag efficiency of the Bosch GAS25 as it relies on bag performance and integrity. Operators report bag failure resulting in contents being ejected from the vacuum exhaust. Preventing this relies on operators checking bags before use and replacing before failure, so a training issue and a weakness of this item.

Air Cleaning: The Aircube is a HEPA H13 air cleaner and basically circulates air through the filter at a rate of 500 m^3 / hour. The room volume was 34 m^3 so this unit is capable of over 14 air changes per hour. A minimum of 10 air changes per hour is recommended by DustControl, so this unit was fine. A DC2000 Aircube is also available (1800 m^3 / hour) and units can be used in multiples.

The room being used was not entirely representative of real work as doors would normally be hung before architrave and skirtings are cut / fitted. During tests we took a 20 minute break and returned to the "cutting room" having left the DC500 AirCube running for the duration. We all noticed that the room "smelt like fresh air" and respirable dust was not evident in the dust lamp beam.

Machine Design: As can be seen in all images, dust capture from the top of the blade results in a large quantity of dust being ejected during initial cutting. Other machines have additional collection stages and deflectors to catch all cutting debris.

Best Result: The maximum improvement achieved when cutting MDF was between Result 1 and Result 4, 0.224 mg/m^3 to 0.078 mg/m^3 representing a 65% reduction in PM10 dust levels or a 287% improvement.

To draw a conclusion based on what "so far as is reasonably practicable" represents we must review life costings of this equipment.

Costings

Make	Model	Description	Purchase	Residual value	Net cost inc. 4 year Running - residual value
Bosch	GAS25	Vacuum HEPA M rated	£260	£80	£340
Bosch	GAS25	Polyester Bellows Filter - 6 month life maximum	£45	£0	£315
Bosch	GAS25	Paper filter bags - 10 day average life - price for 5 bags	£33	£0	£581
Bosch	**GAS25**	**Total Cost - 4 years**	**£338**	**£80**	**£1,156**
DustControl	DC1800	HEPA H rated vacuum - equivalent to Bosch GAS 25	£705	£288	£780
DustControl	DC1800	Pre-filter - cleaned using reverse pulse - replacement at > 6 monthly	£38		£266
DustControl	DC1800	HEPA H rated filter - annual replacement depending on usage and other equipment used	£61		£0
DustControl	DC1800	Bags - disposable to capture large debris - 5 day life - price for 10 bags	£7		£140
DustControl	**DC1800**	**Total Cost - 4 years**		**£288**	**£898**
DustControl	DC2900	HEPA H rated vacuum	£952	£390	£1,152
DustControl	DC2900	Pre-filter - cleaned using reverse pulse - replacement at > 6 monthly	£38		£266
DustControl	DC2900	HEPA H rated filter - annual replacement depending on usage and other equipment used	£61		£0
DustControl	DC2900	Bags - disposable to capture large debris - 5 day life - price for 50 bags	£27		£106
DustControl	**DC2900**	**Total Cost - 4 years**		**£390**	**£1,134**
DustControl	DC500	AirCube - air cleaner - 110v cleans 500 cu metres per hour to HEPA H rating	£605	£247	£765
DustControl	DC500	Pre-filters - supplied in packs of 10 - filter life approx. 30 days based on running maintenance e.g. vacuuming	£47	£0	£228
DustControl	DC500	HEPA H rated filter - annual replacement depending on usage and other extraction equipment used	£142.50	0	£428
DustControl	**DC500**	**Total Cost - 4 years**	**£795**	**£251**	**£1,169**
Makita	LS0714	Sliding compound mitre saw	£450	£140	**£510**
Festool	KAPEX KS 88	Sliding compound mitre saw	£710	£224	**£646**

Costings (Continued)

Result	Make	Model	Description	Purchase	Residual value	Net cost inc. 4 year Running - residual value
1 & 5	Bosch	GAS25	Total Cost - 4 years	£338	£80	**£1,156**
	DustControl	DC1800	Total Cost - 4 years		£288	**£898**
3 & 4	DustControl	DC2900	Total Cost - 4 years		£390	**£1,134**
4 & 5	DustControl	DC500	Total Cost - 4 years	£795	£251	**£1,169**
1, 2, 3, 4 & 5	Makita	LS0714	Sliding compound mitre saw	£450	£140	**£510**
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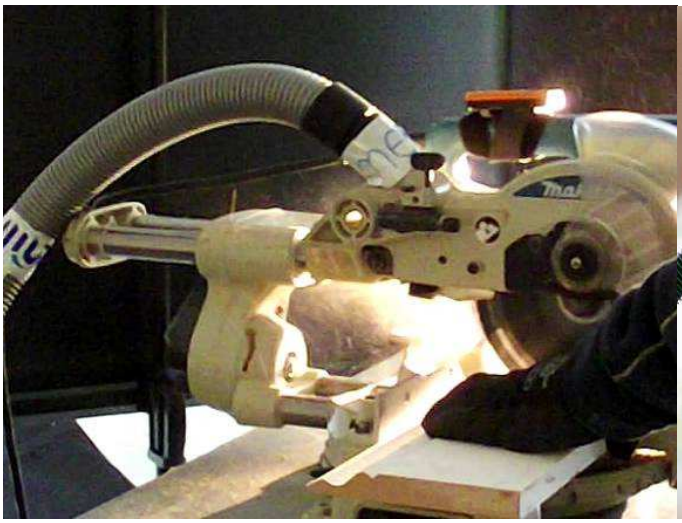
Cost vs. Benefit

Vacuum cost difference is insignificant when compared over four years. Bosch initial purchase price is attractive and DustControl vacuums benefit from increased residual values. Depreciation of DustControl products being pegged at 25% reducing balance whereas other vacuum products are depreciated at 25% straight line, as per top 5 UK hire companies.

AirCube on-cost equates to £1.32 per day based on 220 working days per annum.

Using alternative cutting equipment may give increased benefits but this has not been proven during this exercise. e.g. Festool claim 91% dust capture due to the design of the saw. As can be seen, a deflector directs air-flow and particles.



Costings (Continued)
Power Supply Requirements

Item	Consumption (watts)
Vacuums: Bosch GAS25, DC1800, DC2900	1200
Air cleaner: DustControl DC500	145
Saw – Festool KAPEX KX88	1600
Saw – Makita	1650

Total consumption current arrangement is: 2850 watts.
Using combination of Vacuum, Air Cleaner and Makita Saw: 2945 watts.

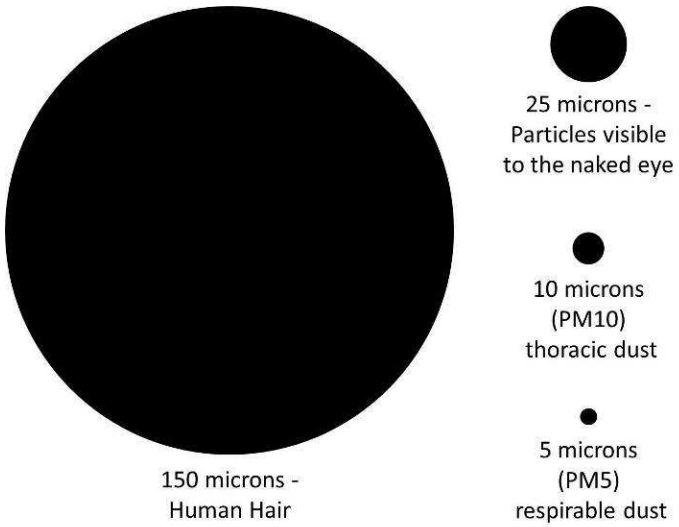
Power supply would either need to be a generator (rated in kVA) of 5kVA with continuous rating of 4kVA or a suitable power supply from mains via a transformer rated at 5kVA with a continuous rating of not less than 3kVA.

RPE / Masks

Workers are currently using FFP3 rated dust masks with a daily cost per worker of £4 based on two masks per day. Cost per annum being £880 per worker.

Face-fit testing is also a requirement taking the annual cost to £1,000 per worker for provision of RPE.

Reminder: Mask fit is affected by facial hair as below



Conclusion / Recommendations

1. Vacuum performance is key, moving air around can increase the operators exposure. Use of HEPA H13 rated vacuum can be achieved without additional cost.

2. Achieving a **287%** improvement in air quality was achieved using a combination of H13 rated vacuum and air cleaner.

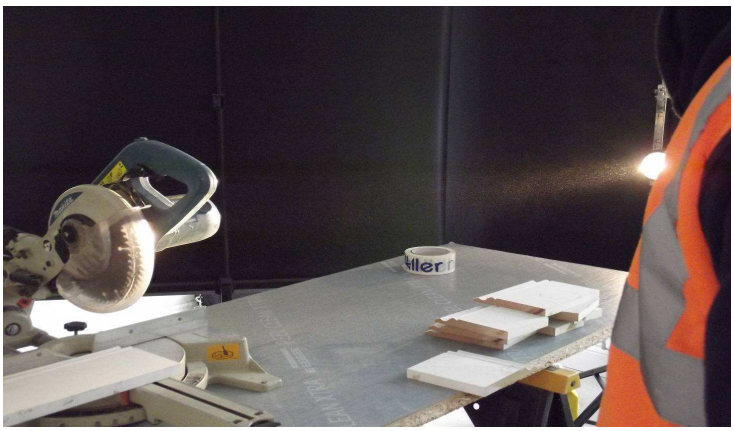
3. An air cleaner will clean the air present in the workplace and this could include debris for other works e.g. plastering, plumbing, electrics and brick and blockwork. Essentially, use would rely on all contractors adopting the system to ensure the job starts and stays clean.

4. Clean air is a basic requirement for workers that must be considered alongside other welfare critical elements i.e. drinkable water and rest areas. On that basis, is it best practice to rely on each contractor to attack the problem in different ways or should the Client and Principal Contractor provide the air cleaning and vacuum systems? This would be a significant cost saving for the PC and Client as compared to each contractor providing their own system and passing on the cost to the PC.

5. Use of RPE presents a number of challenges, reliance on RPE alone would not suffice however, with methods tested, RPE is a suitable backup should other controls fail e.g. a bag burst on the GAS25. Care must be taken to ensure that RPE selected does not interfere with use of other PPE and does not require significant resource compared to more effective control measures i.e. masks at £4 per day per man is £880 per year that could be spent on more effective systems such as air cleaners, vacuums or other beneficial safety measures.

6. Giving operators an indication of exposure so they can choose the best control i.e. RPE / Air Cleaners is important, some form of low cost portable dust indicator requires further investigation.

7. The dust lamp proved to be an excellent way of highlighting the problem to workers and will be a useful training tool i.e. for Apprentices and experienced trades on safety training.



Construction Specific Legal Requirement

The Construction (Design and Management) Regulations 2007
Regulation 42 Fresh air

(1) Suitable and sufficient steps shall be taken to ensure, so far as is reasonably practicable, that every place of work or approach thereto has sufficient fresh or purified air to ensure that the place or approach is safe and without risks to health.
(2) Any plant used for the purpose of complying with paragraph (1) shall, where necessary for reasons of health or safety, include an effective device to give visible or audible warning of any failure of the plant.

Regulation 25 Application of Regulations 26 to 44

(1) Every contractor carrying out construction work shall comply with the requirements of regulations 26 to 44 insofar as they affect him or any person carrying out construction work under his control or relate to matters within his control.
(2) Every person (other than a contractor carrying out construction work) who controls the way in which any construction work is carried out by a person at work shall comply with the requirements of regulations 26 to 44 insofar as they relate to matters which are within his control.
(3) Every person at work on construction work under the control of another person shall report to that person any defect which he is aware may endanger the health and safety of himself or another person.

Further Reading / References

EH40 Workplace Exposure Limits 2005 http://www.hse.gov.uk/pubns/priced/eh40.pdf

Hazards Magazine Dust Up! in issue 116 http://www.hazards.org/dust/dust.htm

COSHH and the woodworking Industries http://www.hse.gov.uk/pubns/wis6.pdf

Urea Formaldehyde Resin: http://en.wikipedia.org/wiki/Urea_formaldehyde_resin

Wood Panel Industry Federation – MDF – Versatile and Safe:

http://www.wpif.org.uk/uploads/publications/MDF%20versatile%20and%20safe.pdf

HSE Document – The Dust Lamp http://www.hse.gov.uk/pubns/mdhs/pdfs/mdhs82.pdf

HSE Document – gravimetric analysis –dust http://www.hse.gov.uk/pubns/mdhs/pdfs/mdhs14-3.pdf

The HAVi – vibration management http://www.thehavi.com/

TSi Sidepak Personal Aerosol Monitor http://www.tsi.com/sidepak-personal-aerosol-monitor-am510/

HSE– CDM Regulations L144 http://www.hse.gov.uk/pubns/books/l144.htm

Makita slide compound saw 110v http://www.makitauk.com/products/front/?id=1291

Bosch GAS25 vacuum http://www.bosch-

professional.com/gb/en/ocs/tools/177543/6152/dust-extraction-systems/gas-25/

DC500 AirCube– DustControlair cleaner http://dustcontrol.com/category/16-air-cleaners.html

DC2900 Vacuum – DustControl vacuum http://dustcontrol.com/product/26-dc-2900c.html

TSi Sidepak – personal dust monitor http://www.tsi.com/sidepak-personal-aerosol-monitor-am510/