

Fine Dust Collection vs Traditional Dust Collection

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Bill Pentz

- www.billpentz.com
- A website with a wealth of information on fine dust collection
- Most of what will be discussed in this presentation comes from this website
- Unfortunately it is very poorly written with an excessive amount of repetition which makes it cumbersome to read
- Very controversial in the USA where manufacturers and suppliers of small shop or hobby type dust extraction equipment hate him????

What is Fine Dust in Woodworking?

- Airborne dust is particle matter (PM) less than 30 microns (0.030 mm)
- Fine dust comprises that fraction of airborne dust particles that are 10 microns (0.010 mm) or less
- Invisible to the naked eye
- Also called “Respirable Dust”

Fine Dust Hazards

- Fine Dust is particularly hazardous because it can enter deeper into the lungs and end in the alveoli, where the lungs do not have a mechanism to remove this dust
- Repeated exposure proportional to concentration levels and duration, leads to cumulative reduced lung functionality
- Fine Dust cannot be seen so is ignored by most small shop or hobby woodworkers. They concentrate on cleaning up the visible dust and chips (traditional dust collection).

Fine Dust Exposure Standards

- Permissible/ Recommended Exposure Limits of Fine Dust For a Time Waited Average of 8 hours/ day, 40 hours/ week
- Occupational Safety and Health Administration USA (OSHA) = 5 mg/m³
- American Conference of Governmental Industrial Hygienists (ACGIH) = 1 mg/m³
- USA Environmental Protection Agency (EPA) = 0.1 mg/m³
- European Union Standard (EN 16770) = 0.1 mg/m³

Quantifying This For The Hobby Woodworker

The table below uses an average sized double garage of 100 m³ to get a feel for an indicative amount of sawdust it requires to be made to approach the Standard upper limits

Standard	Max Allowable Fine Dust per Cubic Metre	Max Fine Dust Allowable in a 100 m ³ Double Garage	Amount of Sawdust to Produce the Maximum Allowable Amount of FINE Dust
OSHA	5 mg/m ³ (0.005 g)	500 mg (0.5 g)	30 g
ACGIH	1 mg/ m ³ (0.001 g)	100 mg (0.1 g)	6 g
EPA/ EN	0.1 mg/m ³ (0.0001 g)	10mg (0.01g)	0.6g

Quantifying This For The Hobby Woodworker

- Some Perspective
 - Hand sawing 175 mm of 20 mm thick wooden board will produce more than 10 mg of fine dust and just exceed the EPA/ EN Standard
 - Sawing 1750 mm will just exceed the ACGIH standard
 - Sawing 8750 mm will just exceed the OSHA standard
- Hand planing and similar types of wood removal producing shavings is not safe either but obviously less hazardous than an operation producing saw dust

Are These Standards Actually Good Enough?

“1 mg/m³ threshold (TABLE 3). Several studies evidenced an increase in the frequency of sino-nasal symptoms and effects on the lower respiratory tracts (cough, chest tightness, lung function impairment and asthma). Overall, workers exposed to wood dust concentrations of between 0.5 and 1 mg/m³ exhibited significant health impairments; this was demonstrated by several studies conducted among workers exposed to dust from various species of wood.” See Ref 1 pg 14. Scientific Committee on Occupational Exposure Limits

- This clearly shows that the 1 and 5 mg/m³ limits are too high and was a primary driver to getting the limit reduced to 0.1 mg/m³ by Europe and the EPA.

How Does This Affect The Hobby Woodworker?

- Manufacturers and suppliers of commercial dust extraction equipment and installations have to GUARENTEE that their products will meet the health and safety requirements.
- They have developed over time and with testing, design rules that will ensure that these requirements are met.
- The problem is that with the small shop or hobby equipment this is not the case. The equipment that we buy and the designs that we use are NOT REGULATED and do not meet the OSHA, EPA or EU standards (there are exceptions of course)
- The majority of our machinery, dust collection equipment and ducting installations do not protect us from fine dust. They leave our shops clear of wood chips and visible dust. This lulls us into a false sense of security, because our shops look clean but they DO NOT remove most of the fine, non visible, dangerous dust.

The Hobby Woodworker's Delusion

- The standards discussed so far are for a Time Weighted Average (TWA) exposure i.e. working 8 hours per day for 40 hours per week
- In addition to the TWA there is a Short Term Exposure Limit (STEL). This restricts the exposure to dust, to a maximum of $15\text{mg}/\text{m}^3$ for a maximum of 15 minutes (OSHA)
- STEL's were specifically developed because exposure to high concentrations of dust even for short periods of time have been shown to be detrimental to one's health and this effect is cumulative.
- Even with these standards in place there is extensive scientific research which shows that the OSHA ($5\text{mg}/\text{m}^3$) and ACGIH ($1\text{mg}/\text{m}^3$) standards do not adequately protect all production workers (see Ref.1). Hence the EPA and EU standards ($0.1\text{mg}/\text{m}^3$) being tightened so significantly

The Hobby Woodworkers Delusion

- The average hobbyist is exposed to dust levels and durations significantly higher than those prescribed in the STEL's because they do not have the industrial type equipment designed to meet the safety standards, so even if they are only doing this occasionally, they are still exposing themselves to fine dust concentrations and durations well in excess of the STEL's
- **THEY CANNOT USE THE ARGUMENT, THAT BECAUSE THEY ARE ONLY EXPOSED TO FINE DUST FOR SHORTER PERIODS, THAT THEY ARE SAFE AND DO NOT NEED TO TAKE ADEQUATE PRECAUTIONS**

Requirements for Fine Dust Collection

- Air Speed. Mostly required to pick up and transport the heavier wood chips.
 - 2500 to 2700 FPM in horizontal ducting
 - 3800 FPM for vertical ducting
 - 4000 FPM is used by engineers designing collection systems
- Air Volume

Equipment	Trad Dust or Chip Collection Exhaust CFM	OSHA 5 mg/m ³ Exhaust CFM <	ACGIH 1mg/m ³ Exhaust CFM <	EAP or Euro 0.1mg/m ³ Exhaust CFM <
Table Saw	350-400	790	890	990
Band Saw	400	700	790	880

This table assumes replacement of stock dust hoods and tool ports with upgraded designs and sizes. See later.

Requirements for Fine Dust Collection

- Ducting and Tool Outlet Port Size
 - Most hobby equipment and installations have as standard 4" outlet ports and ducting.
 - Calculation ($CFM = FPM \times AREA$) and testing shows that this will only give 349 CFM which is only good for Traditional or Chip dust collection
 - To achieve 800 CFM, calculation shows that 6" ports and Ducting are required
- Ducting Design
 - Large commercial installations use graduated designs with smaller diameter pipes feeding into progressively large pipes as the Dust Collector is approached.
 - This works because they use blowers (impeller and motors) big enough to move the volume and velocity of air required.
 - This does not work for hobby installations where we generally use blast gates and only hook up one machine at a time using the 4" port and ducting at the machine.
 - This then throttles the airflow and reduces the airspeed in the larger ducting.

Requirements for Fine Dust Collection

- Tool Design
 - Dust hood design on hobby machines and especially older machines is inadequate to trap the fine dust
 - Outlet ports at 4" throttle the airflow and only allow up to 400 CFM
 - These will require upgrading by modifying, rebuilding or replacing
- Blower Sizing if Using an Installed Ducting System in a Double Garage Exhausting Indoors Through a 5 micron Appropriately Sized Filter
 - 3 hp with 14" impeller for single stage dust collector
 - 5 hp for a cyclone type dust collector
 - 1.5 hp if moving the dust collector from machine to machine with short ducting

Requirements for Fine Dust Collection

- Filtering Basics

- Filters should be at least down to 0.5 microns but 0.3 micron HEPA types are better
- Must be ADEQUATELY SIZED to prevent clogging. Most small shop/ hobby types are too small. If too small they will block within a few hours and require very regular cleaning. Regular cleaning causes the filter material to get damaged which then results in loss of cleaning efficiency
- Be Careful. There is much false or “liberal with the truth” advertising out there. Always ensure reputable manufacturers with industry standard tested filters

Protecting Yourself From Fine Dust

- It is not necessary to spend many ten's of thousands of Rand to install state of the art dust control equipment to PROTECT yourself. Most of us cannot afford it anyway.
- Buy a good quality dust mask that fits you properly and ideally get a professional to do the fitting for you
- Use at least P3 (EN Spec) filter cartridges (see my presentation done in 2019)
- If you have a beard get rid of it. Face masks do not seal against beards. Or invest in one of the powered respirators
- If using a dust collector and exhausting inside with a bag type filter STOP. Ideally these must be ducted to exhaust outdoors. Otherwise you are just making a dust pump

Protecting Yourself From Fine Dust

- If indoors have a strong fan blowing out a window or door and have openings opposite the fan to create a cross flow
- Fine dust in a workshop does not breakdown and keeps building up unless removed. The best way to do this is to keep your shop well ventilated as described above.
- Air cleaners are less effective than good ventilation because they take too long
- Put your dust mask on and turn the ventilation fan on BEFORE creating any fine dust and leave these on for at least 30 minutes after making fine dust.
- If you can, work outside with a fan blowing dust away from you

References

1. Recommendation from the Scientific Committee on Occupational Exposure Limits: Risk assessment for Wood Dust. SCOEL/SUM/102 final December 2003
2. Bill Pentz. www.billpentz.com Cyclone and Dust Collection Research