

Dust Protection

(as opposed to dust collection)

A. Sutton March 2019

Wood Dust Hazards

“the biggest threat to a woodworker comes not in the form of bodily injury from a power tool, but from WOOD DUST”

- Irritants:
 - Itching, sneezing, coughing, runny nose, rashes asthma-like breathing problems.
- Sensitizers:
 - Progressive sensitivity on each exposure to that specific wood dust.
 - Strong eventual reaction resulting in rashes, boils, severe sinus or respiratory pain and inflammation.
- Toxins:
 - Some woods are directly toxic. Tambootie, Sassafras, Oleander, Yew.
- Carcinogens:
 - Some wood species have been shown to cause nasopharyngeal cancer. Beach, Oak, Walnut and Cedar species!!!

Wood Dust Hazards

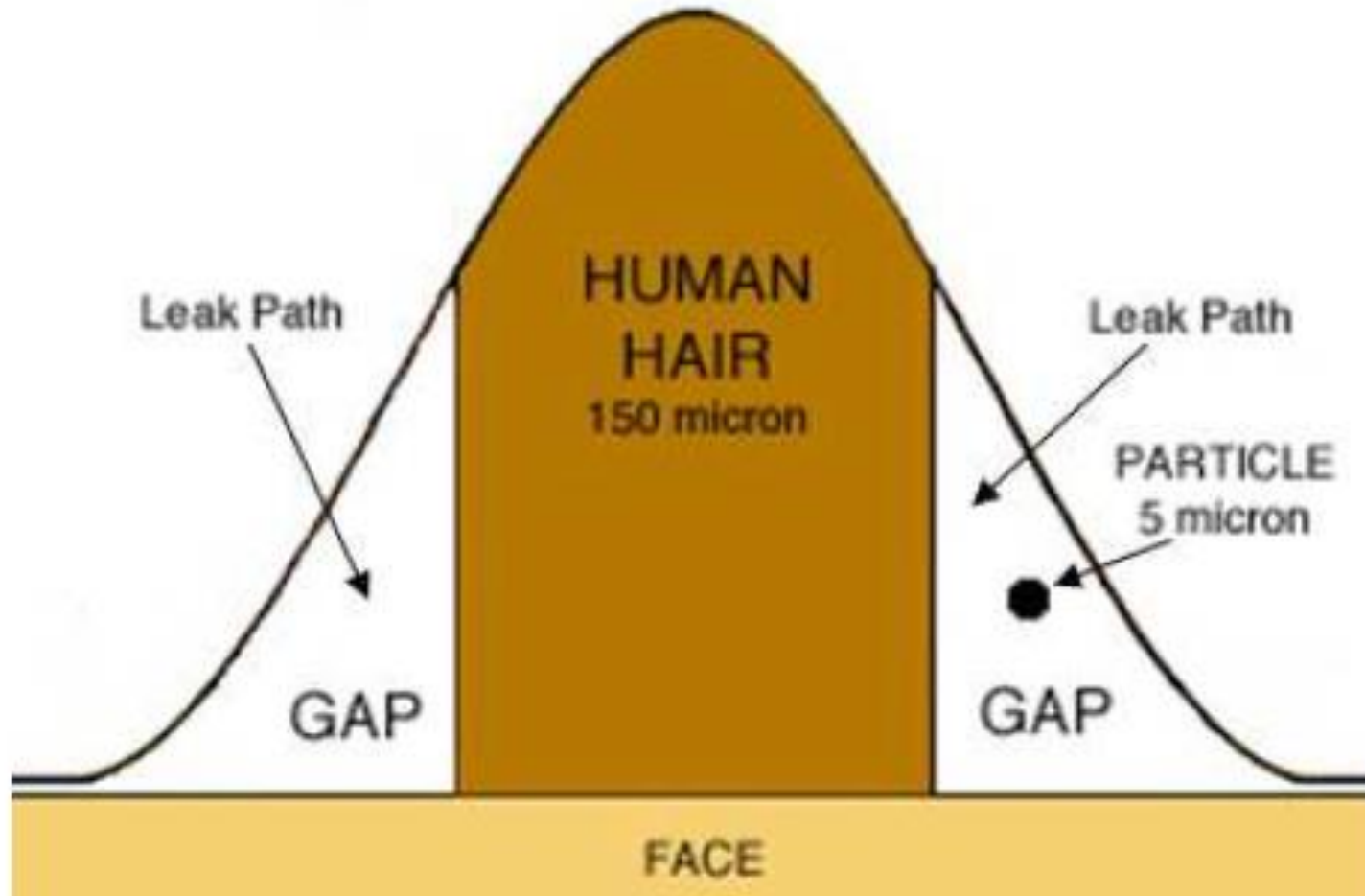
- Long-Term Damage:
 - The most damaging is the invisible fine dust less than 10 microns.
 - When inhaled they cause tiny wounds and scarring to our lungs.
 - Results in slow accumulation of irreversible damage.
 - Immediate effect is not noticeable but over time will result in significantly reduced lung capacity.

Definitions and Standards

- **NIOSH and European Norms (ENs)** specify overall effectiveness of protection devices. This includes the mask/ face shield and filters working as a unit.
- The **FIT** of the device to the face **IS ABSOLUTELY CRITICAL** to ensure proper sealing so that all air being breathed has come through the filter and has not leaked in from the edges of the mask/ face shield.
- **Assigned Protection Factor (APF)**. The minimum anticipated (estimated) protection provided by a properly functioning respirator or class of respirators when properly fitted and used by trained users.
- An **APF of 10 means** that no more than **one-tenth** of the contaminants to which the worker is exposed to, leak into the mask.

Definitions and Standards

The Effect of Facial Hair on Respirator Sealing



Definitions and Standards

Respiratory Protection Devices Applicable to Woodworking			
Standard Name	National Institute for Occupational Safety and Health	European Norms (Conformite European)	
Regions	USA, Canada, Mexico, Chile	UK, Europe	
Std Name Abbreviation	NIOSH	ENs (CE)	
Particulate Filter Classes Applicable to Woodworking	<p>N</p> <ul style="list-style-type: none"> - Any solid or liquid airborne particulate hazard. NOT resistant to oil aerosols. - Reuse subject to hygiene, damage or increased breathing resistance. 		N/A
	<p>R</p> <ul style="list-style-type: none"> - Any solid or liquid particulate airborne hazard and RESISTANT to oil aerosols. - Limited to 8hrs use if oils present. - If oil not present reuse subject to hygiene, damage or increased breathing resistance. 		N/A
	<p>P</p> <ul style="list-style-type: none"> - Any solid or liquid particulate airborne hazards. PROOF against oil aerosols. - Reuse subject to hygiene, damage or increased breathing resistance even with oil aerosols present. 		<p>P</p> <ul style="list-style-type: none"> - All forms of dust particles, solid and liquid aerosols including oils. - Reuse subject to hygiene, damage, or increased breathing resistance. - Similar to NIOSH "P" class.

Definitions and Standards

Test Standard	NIOSH 42 CFR 84		EN143/ EN149/ EN 1822:2009	
Filter Efficiency Designations	N/A		P1 (80% of particles \geq 0.6 microns)	
	95 (95% of particles \geq 0.3 microns)		P2 (94% of particles \geq 0.6 microns)	
	99 (99% of Particles \geq 0.3 microns)		N/A	
	100 (99.97% of particles \geq 0.3 microns)		P3 (99.95% of particles \geq 0.6 microns)	
	HEPA (99.97% of particles \geq 0.3 microns) High Efficiency Particulate Air		HEPA H13 (99.95% of particles \geq 0.3 microns)	

Masks and Respirators

Dust Masks Conforming to No Recognised Standard

Pros	Cons
Much cheaper than Respirators	Does not conform to any recognised standard. You do not know what protection you are getting
	No NIOSH or EN (CE) approval marks
	Generally poor sealing to the face even without facial hair
	Hot and Sweaty
	Causes spectacles to steam up

In an emergency they are better than nothing for woodworking.

Masks and Respirators

Disposable Filtering Face Pieces/ Respirators

3M 8810

EN149

FFP2

SABS Marking

W/O ventilator



Masks and Respirators

Disposable Filtering Face Pieces/ Respirators

Disposable Filtering Face Pieces/ Respirators	N/A		FFP1 (max leakage 22%, APF 4)	Red
	N, R or P95 (APF 10)	Yellow	FFP2 (max leakage 8%, APF 10)	Yellow
	N, R or P99 (APF 10)	Green	N/A	Black
	N, R or P100 (APF 10)	Green	FFP3 (max leakage 2%, APF 20)	Green

Masks and Respirators

Disposable Filtering Face Pieces/ Respirators

Pros	Cons
Conforms to NIOSH or EN Standards therefore providing protection against a known standard	Generally sealing to the face is less effective than with Half Mask Respirators
Must have NIOSH or EN (CE) marking therefore easily identifiable	Effective sealing is reduced with facial hair
Designed for better sealing to the face than dust masks	Hot, sweaty and causes spectacles to steam up although this is better when there is an exhalation valve
Probably more cost effective for occasional use	

Good option for general woodworking provided that the recommended type and minimum protection efficiency is met

Masks and Respirators

Half Mask/ Full Face Mask Respirators

3M 6220



3M 6800



Masks and Respirators

Half Mask/ Full Face Mask Respirators

Half Masks/ Full Face Masks	N/A		P1 (APF 4/ 4)	Red
	N, R or P95 (APF 10)	Yellow	P2 (APF 10/ 10)	Yellow
	N, R or P99 (APF 10)	Green	N/A	Black
	N, R or P100 (APF 10/50)	Green	P3 (APF 20/ 40)	Green

Masks and Respirators

Half Mask/ Full Face Mask Respirators

Pros	Cons
Conforms to NIOSH or EN Standards therefore providing protection against a known standard	Effective sealing is reduced with facial hair
Must have NIOSH or EN (CE) marking therefore easily identifiable	Hot and Sweaty and causes spectacles to steam up
Flexible rubber or silicone masks providing more effective sealing than disposable when sized and fitted correctly	
Application specific filter cartridges can be fitted according to the requirements	
More economical than disposables where regular use is required	

Best option for general woodworking provided that the recommended type and minimum protection efficiency is met and the user has no facial hair

Masks and Respirators

Powered Respirators with Hoods/ Helmets



Masks and Respirators

Powered Respirators with Hoods/ Helmets

Powered Respirators With Hoods/ Helmets	??		TH1P (Inward Leakage <10%, APF 10)	Yellow
	??		TH2P (Inward Leakage <2%, APF 20)	Light Green
	N, R or P100 (APF 25)	Light Green	TH3P (Inward Leakage <0.2%, AFP 40)	Light Green

Masks and Respirators

Powered Respirators with Hoods/ Helmets

Pros	Cons
The Pros for the half mask and full face shields wrt known standards, markings, replaceable filter cartridges and application specific cartridges are all applicable	Additional weight on ones head depending on the design
Sealing to the face is not as critical due to filtered air blowing into the face shield creating a positive pressure at all times	Requires recharging after use
Facial hair does not significantly reduce sealing	SIGNIFICANTLY MORE EXPENSIVE
Cool non sweaty face and spectacles do not steam up	
Comfortable face shield protection	
Some makes provide integral head protection	

Best option for turning due to the integral face shield provided that the recommended type and minimum protection efficiency is met. Best option for those with facial hair

Masks and Respirators

Powered Respirators Comparisons				
	3M	Trend	Axminster	JSP
	Versaflow M-307 and TR-315E+	Airshield Pro	APF 10 Evolution	Powercap Infinity
Efficiency	TH3P	TH2P	TH1P	TH3P
Assigned Protection Factor (APF)	40	20	10	40
Price to Get Started (Rand)	R21 934	R5 900	N/A	N/A
Price to Get Started (Pounds)	978	278	230	916
Replacement Filter Price R	R430	R1 200		
Head Piece Mass (g)	832	995	680	1200
Battery type Ni-cad/ Li-ion	Li-ion	Ni-MH	Li-ion	??
Run Time (hrs)	12	8	8	8
Motor Compensation	Yes @ with 2 settings. Min 160l/m	No. Initial flow @ 200 drops to 160 l/m	Yes @ 160l/m	Yes @ 160l/m
Shield Impact Protection	EN 166 Medium Impact Energy	EN 166 Medium Impact Energy	EN 166 Medium Impact Energy	EN 166 Medium Impact Energy
Head Protection	High Impact Rating	High Impact Rating	Bump Cap EN 812	High Impact Rating
Weight Distribution	Low on head. Balanced front and back.	High on head. Biased to the rear	Low on head. Balanced front and back.	Low on head. Balanced front and back.

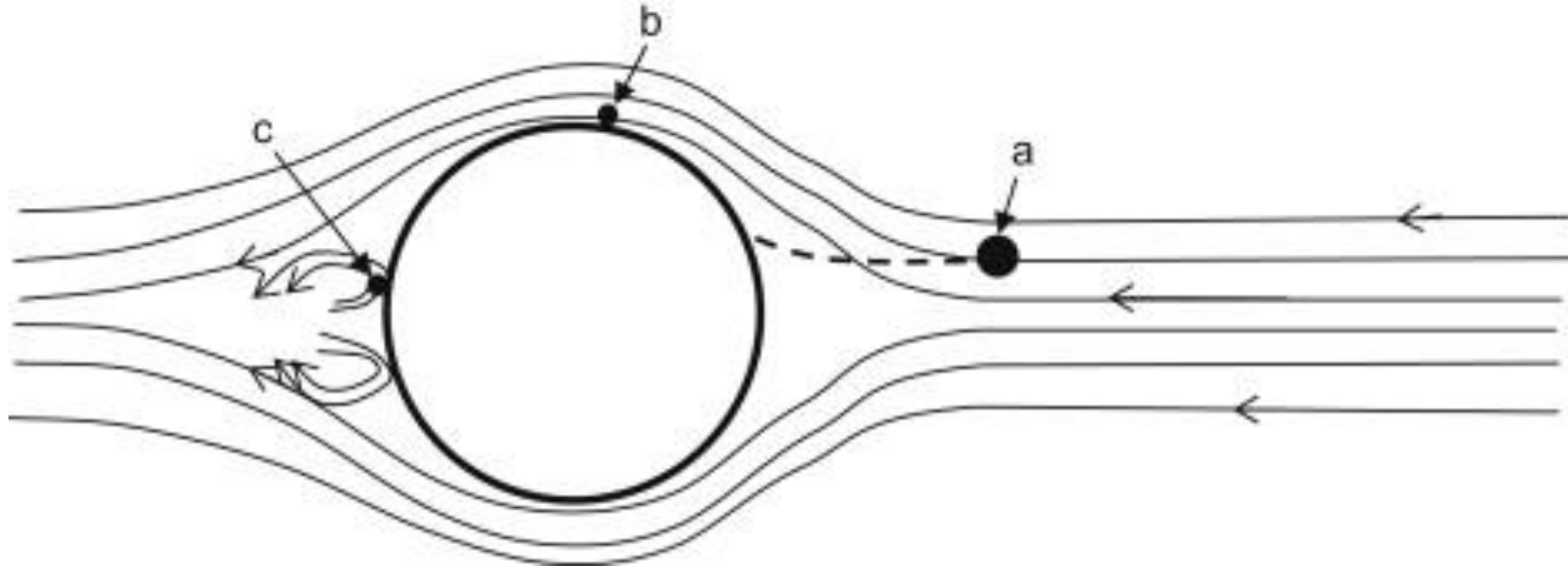
Filter and Respirator Standards and Classes

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Powered Respirators With Hoods/ Helmets	??		TH1P (Inward Leakage <10%, APF 10)
	??		TH2P (Inward Leakage <2%, APF 20)
	N, R or P100 (APF 25)		TH3P (Inward Leakage <0.2%, APF 40)
APF = Assigned Protection Factor		Key:	
HEPA = High Efficiency Particulate Air			Not recommended
FFP = Filtering Face piece Particulate			Minimum recommended protection but is marginal for hardwoods and MDF
TH = Turbo Hood			Recommended protection where hardwoods and MDF are being processed
Prepared by: A. Sutton 27/03/2019			

How HEPA Filters Work

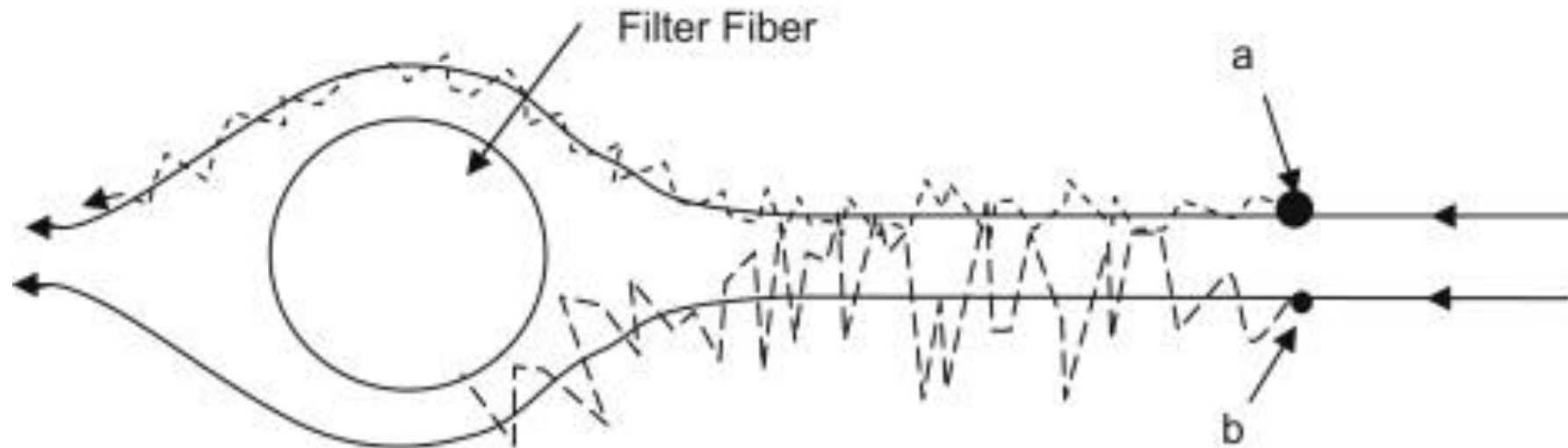
Made up of Fibre Glass Fibres between 0.5 and 2.0 microns

1. Sieving. Mechanical blockage
2. Impaction of larger particles. van der Waals force
3. Impingement of smaller particles. van der Waals force

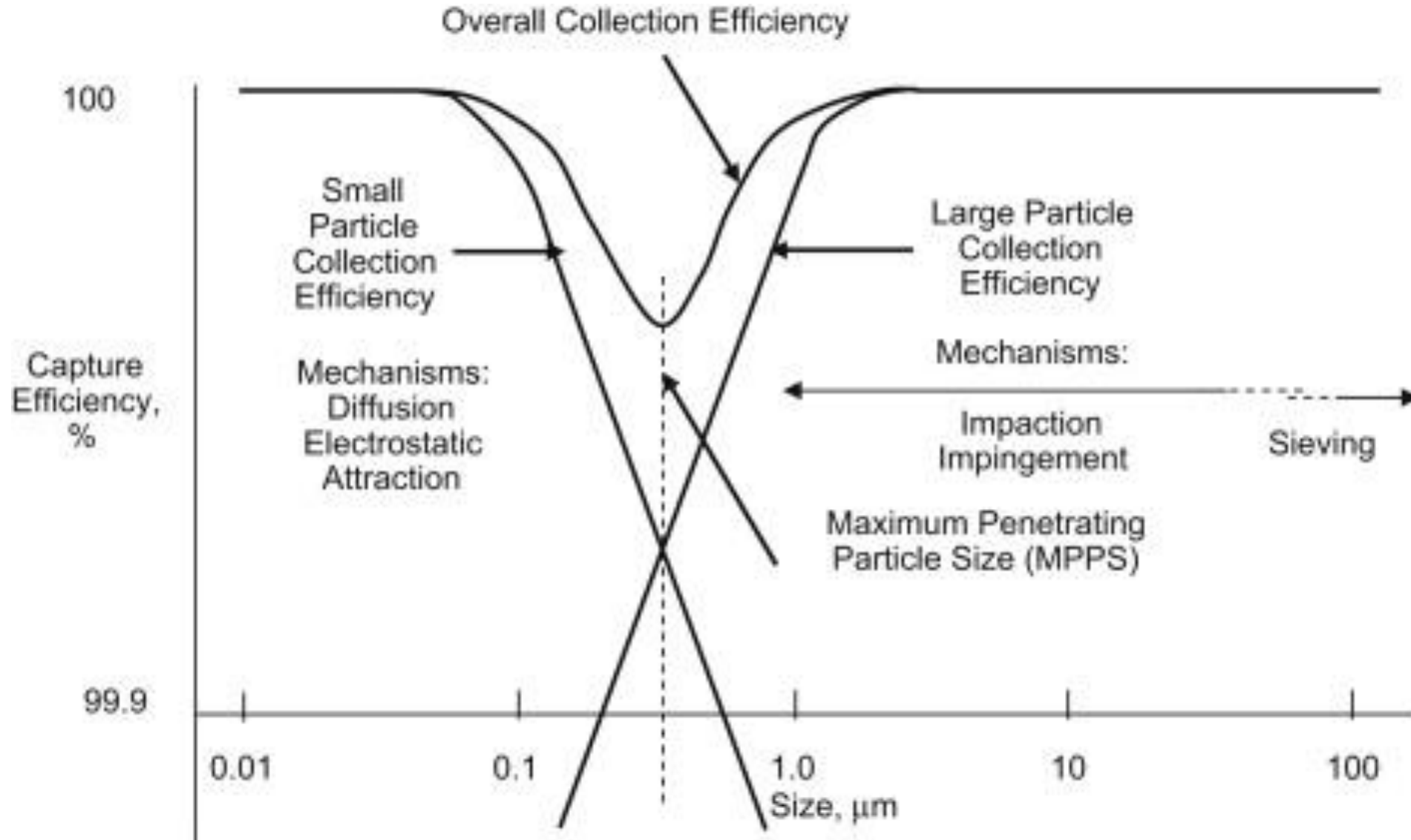


How HEPA Filters Work

4. Diffusion (Brownian motion). Van der Waals force.
5. Electrostatic Attraction. Oppositely charged particle attraction



How HEPA Filters Work



References

- University of Google
- 3M
- CEVA
- GlaxoSmithKline
- NIOSH Standards
- EN and BS Standards
- Delta Health and Safety Equipment
- Numerous scientific papers
- Wikipedia