

Comparison of settled dust gravimetric measurements to percent coverage of a surface: A practical correlation based on school classroom measurements

Richard J Shaughnessy, PhD¹ *, Hai Chi Vu¹

¹ University of Tulsa, Department of Chemical Engineering, Tulsa, OK, USA

*rjstulsau@aol.com

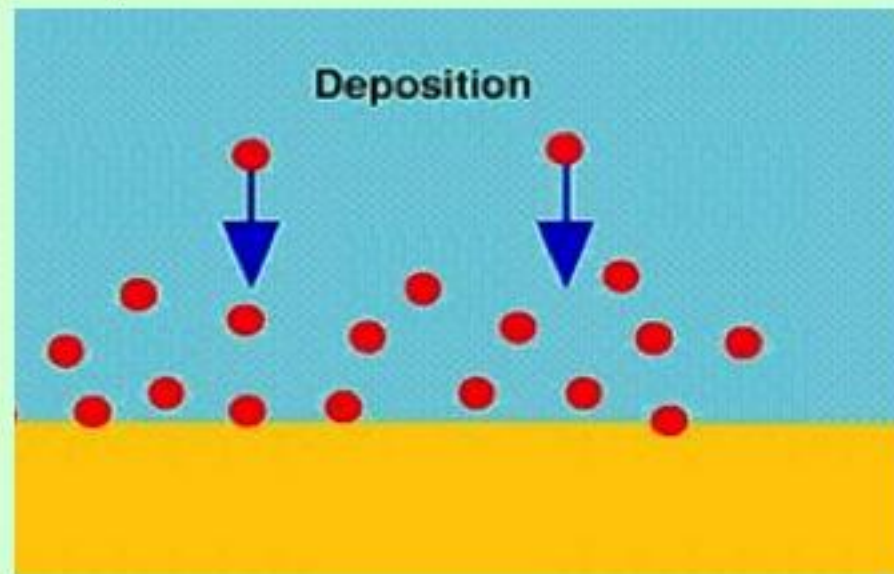


SETTLED DUST

❖ *Particle settling or particle deposition* is defined as a process by which suspended particles will deposit or settle onto indoor surfaces and subsequently decrease their concentration in the air (Thatcher et al., 1995; Hinds, 1999)

❖ *Particle deposition is a function of:*

- Surface types
- Particle size
- Air flow velocity



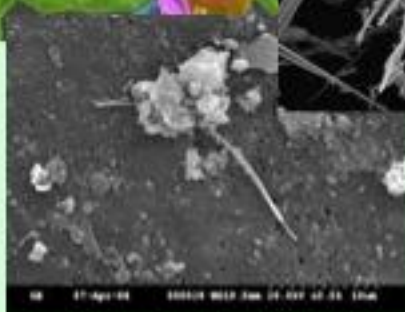
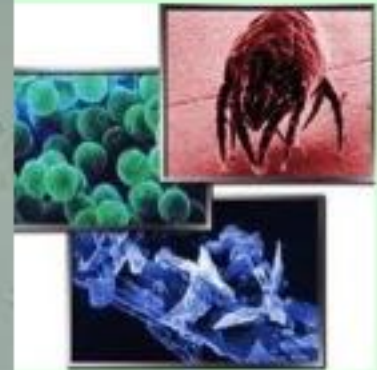
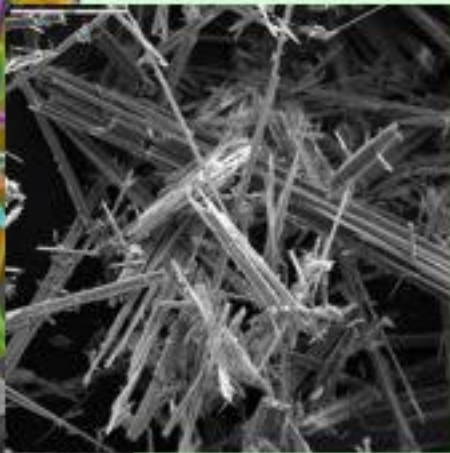
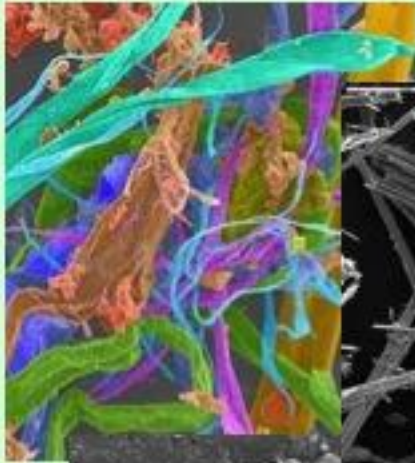
Settled Dust in Schools

- Settled dust: a defined contributor to sick building complaints.
- Health impact proportional to amount of dust



(Skov, 1987, 1990; Gyntelberg, 2004; WHO, 2010)

Settled dust microscopic (allergens, SVOCs, fibers)



Fibers

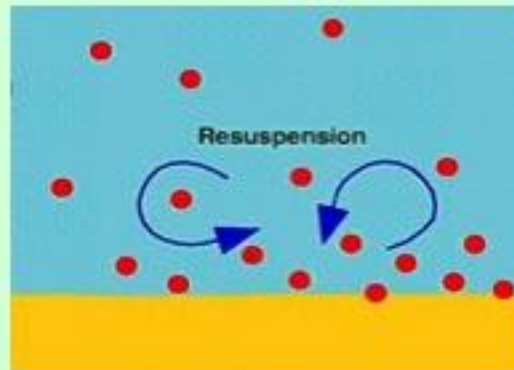


Dust mites



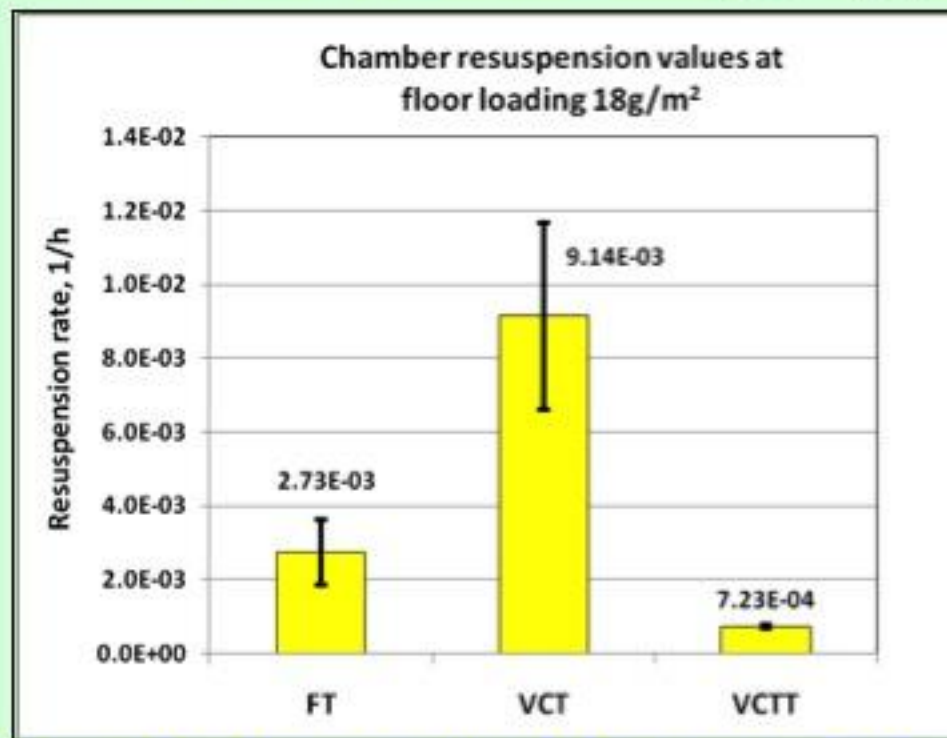
Clutter Factor (allergen buildup)





Particle resuspension: Major source of indoor pollutant hazard for human health (Rosati et al., 2008).

Resuspension rates based on flooring type



- At same floor loading, *VCT Resuspension of particles is 3 to 12 times greater than that from a textile floor*

Shaughnessy & Vu, 2012, "PARTICLE LOADINGS AND RESUSPENSION RELATED TO FLOOR COVERINGS IN CHAMBER AND IN OCCUPIED SCHOOL ENVIRONMENTS", *Atmospheric Environment*, 10.1016/j.atmosenv.2012.04.008

Settled dust protocol

- Test data from 426 school classrooms
- Paired sets (textile and hard surfaced rooms; limited data on mass of dust on textile flooring)
- Standardized placement of collection containers in rooms; 2 month minimum collection
- Gravimetric determination/dust detector (% of dust coverage) of accumulated dust
- Checklist of classroom visuals/details



Settled Dust Box Placement

Settled dust boxes placed in both primary and secondary 5th grade classrooms.



Dust Boxes typically 1.5 - 2 m² above floor to avoid being disturbed.



**Dust detector
Analysis onsite**



**Gravimetric
analysis
onsite**

Relationship between mass of settled dust and dust coverage

Settled dust data grouped based on the time dust boxes exposed in classrooms:

- 40 to 60 days (44-57 days).
- 61 to 90 days (64-90 days).
- 91 to 120 days (91-118 days).
- 121 to 150 days (127-147 days)

Table 7.12: Total mass collected based on varied duration of experiment study

Study periods, day	40-60	61-90	91-120	121-150
Number of observations	68	98	210	50
Total mass collected, mg/m²	181.98	305.41	392.97	611.31
C.I 95%	24.92	42.44	35.04	74.76

Quality of Relationship between mass of settled dust and dust coverage

- R-squared correlations ranged from 0.47 up to 0.813 for the various time exposure groupings
- For data collected < 60 days, the dust may not sufficiently accumulate for data analysis.
- Collection periods > 90 days increases potential for disturbance by school occupants and may “overexpose” the collection surface

Relationship between mass of settled dust and dust coverage

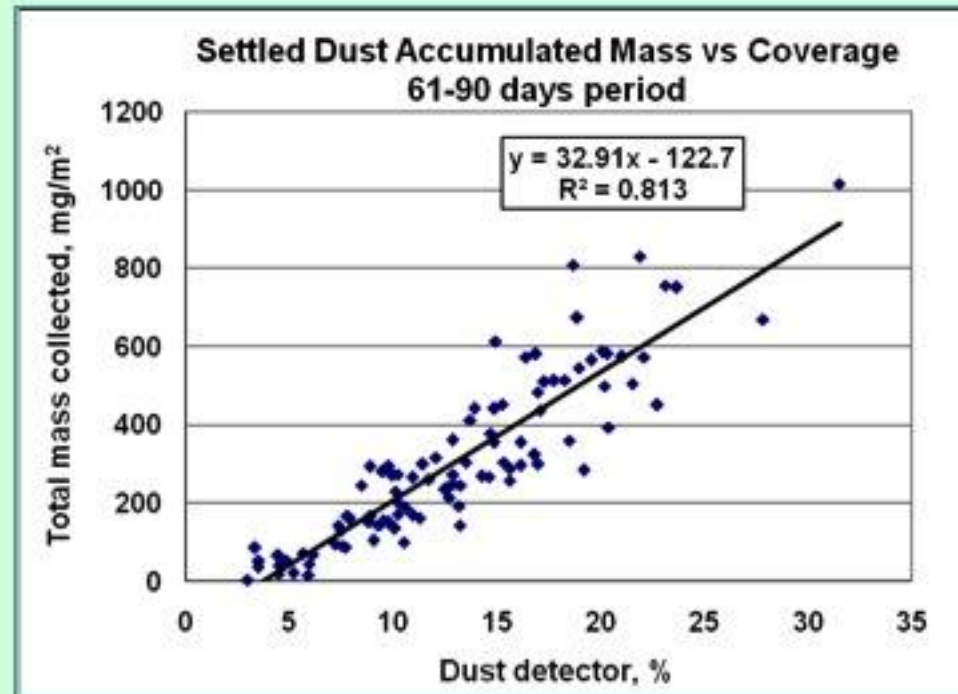


Figure 7.20: Total mass collected vs. DustDetector readings between 61 and 90 days of study periods

+ The mass of dust accumulation and dust detectors exhibits linear correlation ($R^2 = 0.813$) in a period at 61-90 days.

Conclusions

- The relationship between the mass of settled dust (the gravimetric mass) and the dust coverage (the DustDetector reading) exhibited a higher linear correlation in the dust collection period between 61 and 90 days
- The composite measurements presented in this paper provide a correlation between the gravimetric results and the % coverage results that may be of use in future school studies related to settled dust accumulation.

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