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

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**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

Settled dust microscopic (allergens, SVOCs, fibers)
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

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

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