The Inhalable Dust & Particulate Sampling Head

For years industrial hygienists have conducted dust sampling following two basic sampling methods as outlined by NIOSH; total dust sampling and respirable dust sampling. For total dust sampling, we used a standard 37 mm cassette with a PVC filter membrane, which would collect any particulate that was both light-weight enough to be airborne and small enough to fit through the cassette’s inlet opening of approximately 4 mm diameter. For respirable dust sampling, we placed a cyclone ahead of the cassette, so as to only collect particles small enough to enter the lungs. The respirable dust sampling made sense from a toxicity standpoint, but the total dust sample really wasn’t toxicity based, at least not from an inhalation toxicity standpoint.

The ACGIH makes the following statement in the TLVs and BEIs publications in recent years:

*For chemical substances present in inhaled air as suspensions of solid particles or droplets, the potential hazard depends on particle size as well as mass concentration because of 1) effects of particle size on the deposition site within the respiratory tract and 2) the tendency for many occupational diseases to be associated with material deposited in particular regions of the respiratory tract.*

The ACGIH goes on to describe particle size selection in three different forms as indicated below:

- **Respirable Particulate Matter**: Those materials that are hazardous when deposited in the gas exchange region (50% cut point at 4 microns).
- **Thoracic Particulate Matter**: Those materials that are hazardous when deposited anywhere within the lung airways and in the gas exchange region (50% cut point at 10 microns).
- **Inhalable Particulate Matter**: Those materials that are hazardous when deposited anywhere in the respiratory tract (50% cut point at 100 microns).

Sampling for inhalable particulate matter is a better application from a toxicity standpoint than was the old total dust sampling method, since inhalable particulate sampling targets particulates in a size range that affect specific regions in the body. When used at 2 LPM the Inhalable Dust sampling head collects a particle size distribution that includes particle sizes of 100 microns and smaller, which meets the ACGIH definition inhalable particulate. The Inhalable Dust sampler complies with or meets the requirements of the sampling applications listed below.

- ACGIH definition of inhalable particulate matter
- NIOSH Method 5700 for particulate formaldehyde
- British Method MDHS 14/3 for inhalable dust in air
- British Method MDHS 25/3 for organic isocyanates in air
- British Method MDHS 6/3 for lead in air
- Australian standard for inhalable particulate

The Inhalable Dust sampling head is small and light weight. The cassette is designed for 25 mm filter membranes and is reusable after cleaning. It comes with a cap for secure handling and a transport clip that secures it for shipping.
Inhalable Dust Sampling Head

- Meets ACGIH and MDHS 14/3 requirements for inhalable particulate
- 50% cut point at 100 microns when used at 2 LPM
- Small (128 x 33 x 25 mm) including lapel clip
- Light weight (< 1 ounce or about 25 grams)

When operated at 2 LPM the Inhalable Dust sampling head collects a dust sample that follows the particle size distribution as described by the ACGIH for inhalable particulate. The ACGIH descriptions applied to particle size selective TLVs are presented below.

**Respirable Particulate Matter:** Those materials that are hazardous when deposited in the gas exchange region (50% cut point at 4 microns).

**Thoracic Particulate Matter:** Those materials that are hazardous when deposited anywhere within the lung airways and in the gas exchange region (50% cut point at 10 microns).

**Inhalable Particulate Matter:** Those materials that are hazardous when deposited anywhere in the respiratory tract (50% cut point at 100 microns).

The inhalable fraction size distribution is described by the following table. For particles of 1 micron diameter, nearly all (97%) are captured by the sampler and collected onto the filter. For particles of 100 microns in diameter, 50% are collected onto the filter. This approximates the size distribution in the respiratory tract.

<table>
<thead>
<tr>
<th>Particle Aerodynamic Diameter (µm)</th>
<th>Inhalable Particulate Matter Fraction Collected (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>1</td>
<td>97</td>
</tr>
<tr>
<td>2</td>
<td>94</td>
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</tr>
<tr>
<td>50</td>
<td>52.5</td>
</tr>
<tr>
<td>100</td>
<td>50</td>
</tr>
</tbody>
</table>

**Inhalable Dust Sampling Head P/N: 811-9909-01**
**Inhalable Dust Cassette P/N: 811-9910-01**

The Inhalable Dust sampling head is assembled as above. A filter membrane is placed inside the cassette and the cassette cap is removed. The cassette seals against an o-ring inside the sampler body and attaches to the worker’s shirt collar via the lapel clip. The sampler is attached to the sampling pump via the hose barb using flexible tubing of ¼ inch ID. Airflow calibration is accomplished by placing the sampler inside a calibration jar. The full sampling method is described in MDHS 14/3.