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How to Prevent PPI Overloading

When conducting sampling, certain environmental conditions and procedural factors may affect the accuracy and reliability of collected samples. Two specific scenarios should be considered:

1. **Extreme overloading due to very high concentrations of large particles**
2. **Particles breaking off from collection substrates during handling or shipping**

Below are suggestions for addressing each situation.

1. Extreme overloading due to very high concentrations of large particles.

In environments with extremely high particulate concentrations, the PPI may become overloaded. While it is difficult to completely prevent sampler overloading in such conditions, it is important to note that the Occupational Safety and Health Administration (OSHA) has established a Permissible Exposure Limit (PEL) of 5 mg/m³ for respirable dust.

The table below outlines the approximate amount of respirable dust a 2 L/min sampler would collect over 8, 10, and 12-hour sampling periods at the OSHA PEL:

	8 hrs		10 hrs		12 hrs	
2 L/min	960 L	4.8 mg	1200 L	6 mg	1440 L	7.2 mg

Given that the respirable fraction in normal conditions comprises approximately 50% of all particles, a 2 L/min PPI should be capable of handling the allowable dust concentration. If overloading occurs, it is likely that the actual respirable concentration far exceeds the 5 mg/m³ limit.

During examination of overloaded samplers, large loose particles have been found on the PPI filter and inside the collection stage. These particles can be identified by the naked eye as being larger than the respirable fraction. Further investigation of overloaded samples indicates that loose particles found on the filter and the impaction plates usually range from 50 to 400 μm.

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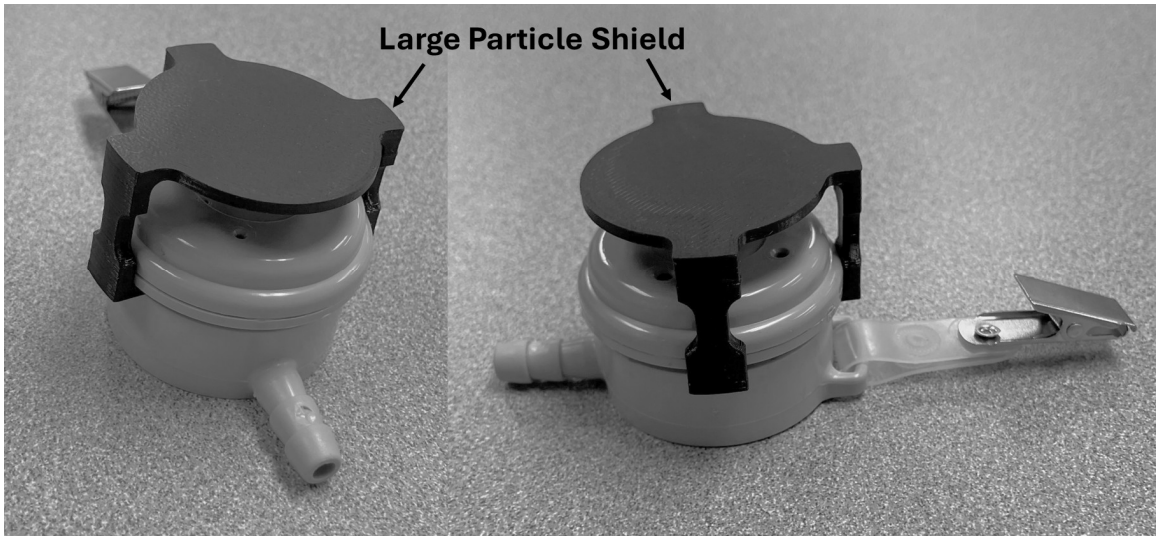
In normal conditions, particles larger than 50 μm stay airborne for a very short time (seconds), hence there is a low probability of them entering any personal sampler. However, in certain situations or processes where particles larger than 50 μm are generated into high wind environments and/or become projectiles (for example, cutting, grinding, and sandblasting), those very large particles can enter the PPI inlet; they may quickly build up significant deposits on the PPI collection substrates and increase the risk of particles breaking off.

Recommended Mitigation:

To prevent very large particles from being directly blown into the PPI inlets, SKC will offer a Large Particle Shield that can be easily mounted on any Disposable PPI when sampling in environments where high amounts of large particles are present. This shield will prevent particles larger than 50 μm from entering PPI inlets without any effect on sampling of respirable size particles, which are all smaller than 15 μm.



2. Particles breaking off from collection substrates during handling or shipping.

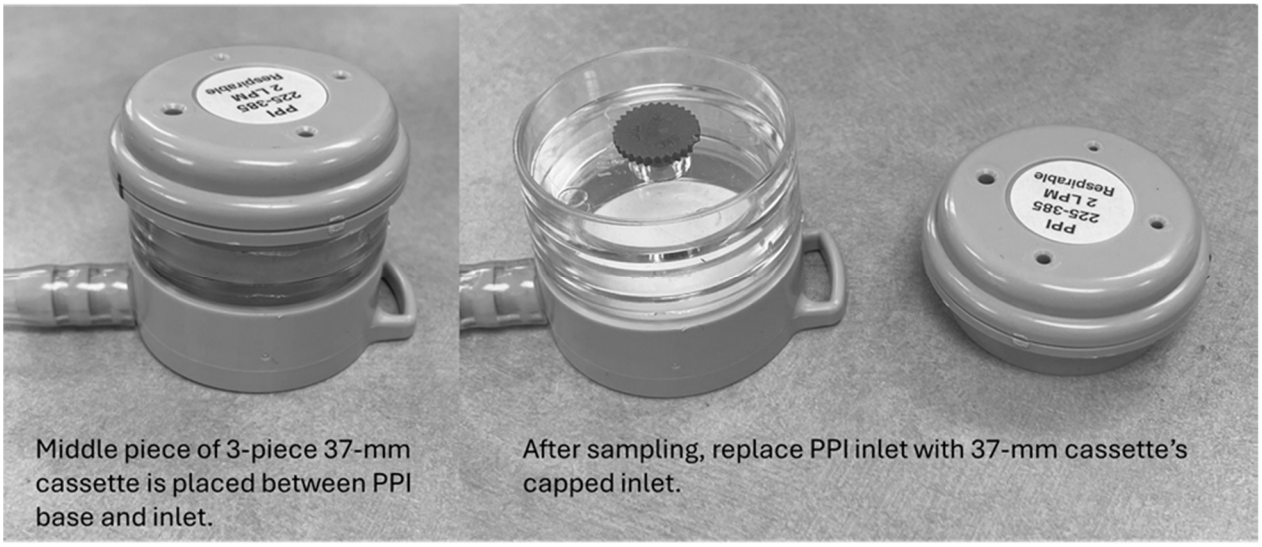
Particles can become detached from collection substrates during handling or transport, particularly when sampling in environments with high concentrations of large particles.

Recommended Mitigation:

Since most of the loose particles found on the filters of overloaded samplers are larger than the respirable fraction, we believe that using the Large Particle Shield as suggested above will prevent excessive buildup of particles on the collection substrate and, at the same time, particle detachment.

In addition, we recommend dividing longer sampling periods into shorter ones (e.g., two 4-hour intervals rather than one 8-hour session) to reduce the amount of collected particles and the potential for particles breaking off.

Finally, if the presence of loose large particles on the filter persists, the center ring of a three-piece 37-mm cassette can be inserted between the PPI outlet and inlet. After sampling, the PPI inlet can be replaced with the cassette's capped inlet as shown below, an option similar to standard cyclone sampler procedures.



Middle piece of 3-piece 37-mm cassette is placed between PPI base and inlet.

After sampling, replace PPI inlet with 37-mm cassette's capped inlet.