# P-TRAK™ ULTRAFINE PARTICLE COUNTER INDUSTRIAL HYGIENE INVESTIGATIVE METHODOLOGY

APPLICATION NOTE ITI-093

In the past the measurement and study of ultrafine particles (<0.1 µm) using condensation particle counters (CPC) has been focused around aerosol and particle research. More recently with the development of the TSI P-TRAK™ Ultrafine Particle Counter, a hand-held, battery powered CPC, it has found applications in indoor air quality studies by measuring the number concentration of ultrafine particles.

There is ever-increasing interest to develop nano-scale materials, structures and devices to take advantage of their unique physical, chemical and biological properties. However, the occupational health risks associated with the manufacturing and use of nanoparticles are not clearly understood. As a result, workers may be exposed to these nanoparticles through means of inhalation, dermal exposure and by ingestion. Traditionally, workplace aerosol exposure limits are based on mass per unit volume ($mg/m^3$ or $\mu g/m^3$). However, a growing number of experts argue that mass is not a good measure for nanoparticles because at their nano-scale size they have negligible mass. Aerosol research studies have shown that 86% of the particles in a unit volume of ambient outdoor air contain less than 1% of the mass. Therefore, a need has arisen to assess workplace conditions using a variety of new measurement metrics.

With nanotechnology emerging as a new industrial hygiene issue and the need to assess workplace conditions, the P-TRAK™ Ultrafine Particle Counter can be utilized to give quick qualitative baseline (screening/trending) assessments of workplace conditions based on number concentration of ultrafine particles or nanoparticles. The P-TRAK™ particle counter can be used to:

- Assess air handling systems filtration efficiency
- Investigate work areas and processes
- Recognize and qualitatively evaluate work areas
- Assess work areas and processes
  - Assess the need to implement engineering controls
  - Assess the failure of existing engineering controls
  - Assess the need to change work processes via worker interactions
- Implement corrective actions by adding or repairing engineering controls and or changing worker process interactions
- Validate corrective actions to ensure their effectiveness

The P-TRAK™ particle counter investigative methodology outlined above is basic industrial hygiene investigative practice and is quite easy to follow. Applications for this methodology include:

- Industrial hygiene surveys
- Production and work area monitoring
- Engineering studies
- Baseline screening and trending
- Point source location

The P-TRAK™ particle counter will provide qualitative number concentration readings that are used to look at relative differences in number concentrations for a given work area or process and comparing them to ambient particle concentrations from outdoors. Or, by what is provided by the HVAC system in the way of filtered supply air number concentrations. Work areas and processes should not exceed ambient conditions (ambient outdoor or HVAC system supply air) and if they do, use the industrial hygiene investigative process to locate the source and implement corrective actions, repair, remove or remediate the source.

## Detailed P-TRAK™ Particle Counter Investigative Methodology

- Seek information on HVAC system(s)
  - Filter type and rating to determine filter collection efficiency
  - Understand how multiple systems effect pressure differentials
  - Is the building/work area under positive or negative pressure?
- Measure outdoor ambient concentration
  - Upwind and downwind of facility
  - Look for surrounding sources (highways, loading docks, nearby sources, etc.)
- Measure HVAC system intake concentration
  - What should the reduction in number concentration be based on the filter rating and associated filter collection efficiency?
- Measure HVAC system downstream of filter
  - Does it get close to the reduction number based on filter collection efficiency?
  - If it does, you'll know your system is mechanically functioning the way it was designed
  - If not, look for bad gaskets or tears in the filter bank
- Measure supply air to work area
  - It should be the same as the filters downstream concentration
- Measure return air from work area
  - If it is higher than supply air then there is a source
- Measure work area
  - Use CPC like a Geiger counter to locate source
  - Target known or suspected problem areas
  - Map/grid out work area if necessary
- Implement corrective actions
  - Effect repairs to equipment or engineering controls
  - Remove source
  - Remediate source
  - Implement engineering controls
  - Change worker process interactions
  - Implement PPE
- Validate corrective actions

This investigative methodology is a basic industrial hygiene practice and is easy to follow. There are no regulations for nanoparticles and therefore, striving towards "as low as reasonably achievable" (ALARA) workplace conditions, is a best practice to follow.

UNDERSTANDING, ACCELERATED

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