

## The Advantages of Real-Time Personal Aerosol Monitoring for DPM

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## Real-Time Exposure Monitoring



# Real-Time Exposure Monitoring - Overview

Provides more data, deeper analysis and faster decision making:

- Precise exposure data, faster, immediate graphing and analysis of data logs
- Quickly drive corrective actions
- Cost effective for repeat monitoring to validate changes to engineering controls
- Present 'data-driven' recommendations to managers
- Fewer surprises when doing gravimetric reference samples.



## Example: Lab Analysis of Sample Pump Data - Silica

2 Samples Sent to a Lab...

**Quartz = 57  $\mu\text{g}/\text{m}^3$**

| Sample ID | Lab ID | Analyte      | Air Vol (l) | mg   | $\mu\text{g}/\text{m}^3$ |
|-----------|--------|--------------|-------------|------|--------------------------|
|           |        | Quartz       | 1044        | 61   | 57                       |
|           |        | Cristobalite | 1044        | <1.0 | <1.0                     |
|           |        | Tridymite    | 1044        | <20  | <19                      |
|           |        | RCS          | 1044        | 61   | 57                       |

| Sample ID | Lab ID | Analyte      | Air Vol (l) | mg   | $\mu\text{g}/\text{m}^3$ |
|-----------|--------|--------------|-------------|------|--------------------------|
|           |        | Quartz       | 1072        | 98   | 92                       |
|           |        | Cristobalite | 1072        | <5.0 | <5.0                     |
|           |        | Tridymite    | 1072        | <20  | <19                      |
|           |        | RCS          | 1072        | 98   | 92                       |

**OSHA PEL : 50  $\mu\text{g}/\text{m}^3$  RCS**

**Results:**

Both Samples Are Over OSHA PEL of 50  $\mu\text{g}/\text{m}^3$  for the sample period

**Good Solid Data – “Daily Average” Does Not Tell the Whole Story**



## Sample Pump and Lab Analysis

### Many Questions Remain:

- What were the worker exposure levels during the day?
- When did higher exposure occur during the day?
- What were exposure levels before or after the peaks
- Where should we focus our corrective corrections or implementing controls?
- How can we quickly verify the effectiveness of any adjustments and ensure we stay on track?

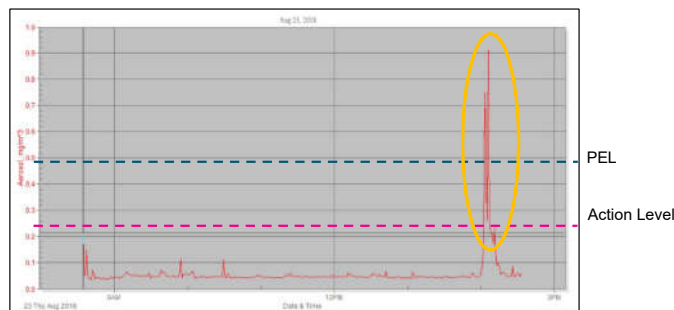
**Real-Time Exposure Monitoring Provides  
Insights into These Questions...**



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## Where should we focus our corrective corrections or implement new controls?

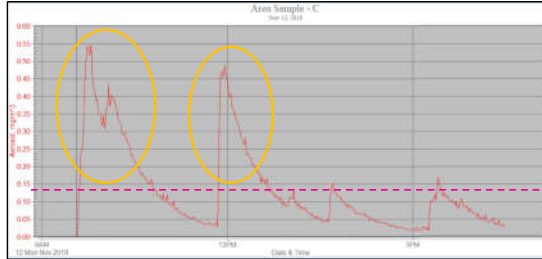


- Although the TWA was below the Action Level, the data clearly shows an exposure issue while cleaning at the end of the shift.



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## How can we verify and maintain effective engineering controls?



- Cycle testing of engineering controls
- Same-day verification of controls

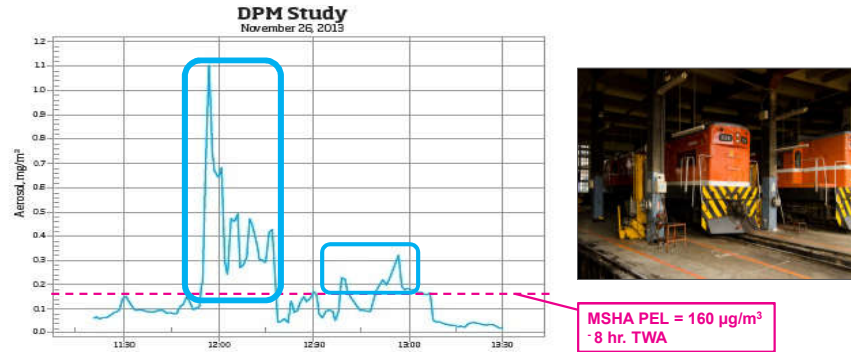


## Real-Time Monitoring for Diesel Particulate



## What Were the Worker Exposure Levels During the Day?

- + Detailed Exposure Data will define the time and duration of exposure ...

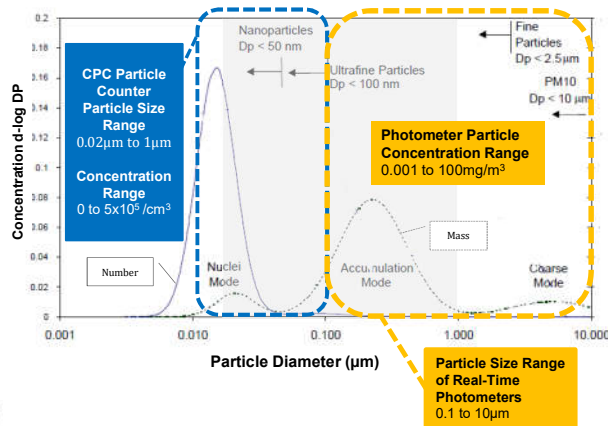


Better Data on When to Take Corrective Actions

## Particle Size and Concentration

Typical Size Distribution for DPM:

- Most particulates are less than  $1 \mu\text{m}$  (mix of fine, ultrafine and nanoparticles)
- Concentration can contain carbon, ash, condensed hydrocarbons, water, sulfuric acid



# Real-Time Aerosol measurement instruments

## Condensation Particle Counters (CPC)

- + Counts number of ultra fine and Nano-particles
- + Smaller size range than Photometers (0.02µm to 1µm)
- + Lower concentration range than photometers (0 to 5x10<sup>5</sup> Particles/cm<sup>3</sup>)
- + Data logging in a hand-held instrument.

- + Handheld for Short-term only: 'spot / source' monitoring

## + Portable Emissions Testing

- Smaller particles 0.0023µm to 1µm
- Higher Concentrations
  - 2,000 to 1 x 10<sup>8</sup> particles/cm<sup>3</sup>



Handheld P-Trak



High-Concentration Nanoparticle Emission Tester



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# Real-Time Aerosol Measurement Instruments

## Light scattering photometers

- + Hand held, desk top, portable belt-mount.
- + Measures light scattering of aerosol cloud
- + Measures mass of aerosol based on known calibration to that aerosol
- + Provide concentration results quickly in real-time
- + Logs data: trends, averages and alarms.



Personal Monitoring SidePak AM520



Area Monitoring DustTrak DRX Aerosol Monitor

## Limitations:

- + Not a compliance reference method
- + Does not Speciate
- + Particle Size and Concentration limits



Point-Source Monitoring Hand Held DustTrak II



Incorporated 1/6/2020

# Making the Cut



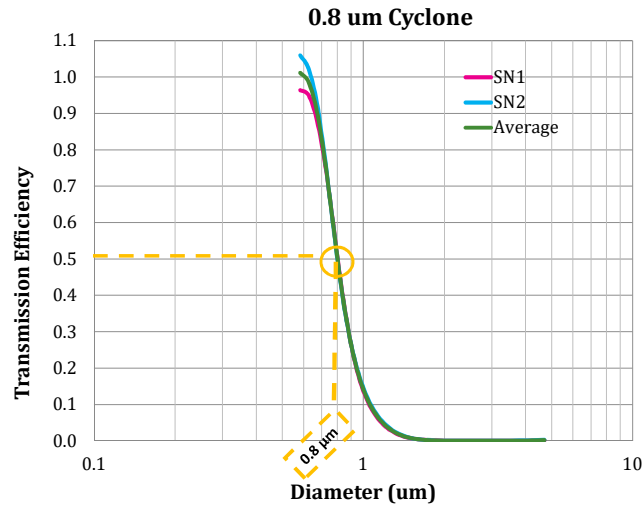
## TSI's Diesel Particulate Matter (DPM) Cyclone

### DPM Cyclone:

- + The size distribution of DPM  
0.8 $\mu$ m cut point (50%)
- + Exclusive TSI design for Diesel Particulate Matter (DPM) and fine particulate matter.
- + Specifically Designed to work with 4 $\mu$ m Dorr-Oliver cyclone



## 0.8µm Diesel Particulate Matter (DPM) Cyclone Performance



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## Photometers in Mines and Confined Spaces

Rigorous Instrument Requirements  
for Potentially Volatile or Explosive Environments





# SidePak AM520i Intrinsic Safety Rating

**Current Certifications:**

• **IECEX / ATEX**

- IECEX SIR18.0043X
- IECEX SIM19.0009X
- Sira 18ATEX2150X
  - II 1G
  - Ex ia IIC T4 : Ga
  - Ex IA : Ma



• **CSA**

- Certified to **Canadian Standards**
  - Class I: Division I, Groups A,B,C,D,
  - Class II: Division I, Groups E,F,G.
  - Class III: T4, Ex ia IIC T4 Ga



- Certified to **US Standards**
  - Class I, Division I, Groups A,B,C,D, T4
  - Class I, Zone 0, AEx ia IIC T4 Ga

**Certifications In Process (Pending):**

- MSHA Certification for Underground Mines



SidePak AM520i

**NEW!**  
Intrinsically Safe  
Design



# Real-Time Monitoring

**Things to Consider:**

- Direct reading instruments are not considered 'reference' instruments for meeting standards.
- Photometers are very precise instruments, however require calibration factors to be accurate.
- Not all direct reading / real-time instruments can monitor for all particle sizes and concentration ranges
- Photometers can not speciate contents of an aerosol
- Very few real-time monitors are Certified for Intrinsic Safety by IECEX/ATEX/CSA and MSHA



## Summary: Real-Time Monitoring for DPM

### More Data and Better Insights :

- *Monitor PDM and aerosols in real-time, log and graph detailed exposure data for analysis and insights*
- *Make immediate corrective actions to reduce exposure*
- *Quickly validate changes to engineering controls*
- *Cost effectively repeat DPM monitoring*
- *Present data-driven recommendations and analysis*
- *Reduce risk to workers and your company – Fewer surprises*



**Get Exposure Data in Hours, that Otherwise  
Could Take Days or Weeks.**

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## Questions?

## Thank you!

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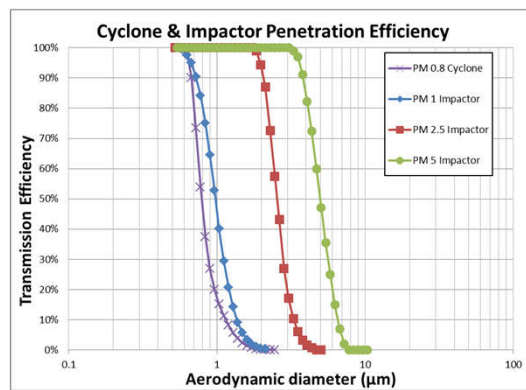
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# Background



App Note: EXPMN-012  
Cyclone and impactor penetration efficiency curves.



Step cut-point demonstrates good performance at selected size fraction.



# Concentration Range of Instruments

