

PT-01-26 | TESTING XD1+ AGAINST CONTROLLED SAMPLES

Gravimetric indicated 0.5 mg/m³

The purpose of this testing is to establish the following understandings:

- A. The testing protocol meets an accepted repeatability vs known methodology (gravimetric/XRD analysis) over numerous tests.
- B. The XD1+ monitor demonstrates consistent results under the same conditions.
- C. Under controlled conditions XD1+ meets the standards set out in the manufacturer's information.
- D. Confidence in the average measurement despite inherent variability in the characteristics of particulate including but not limited
- E. to size distribution compound composition.
- F. To provide information relevant to use applications to allow users to make considered decisions based on a local environment.

1. Testing environment methodology

Test chamber has a volume of 1 m³. A simple schematic to show its design is provided in Figure 1.

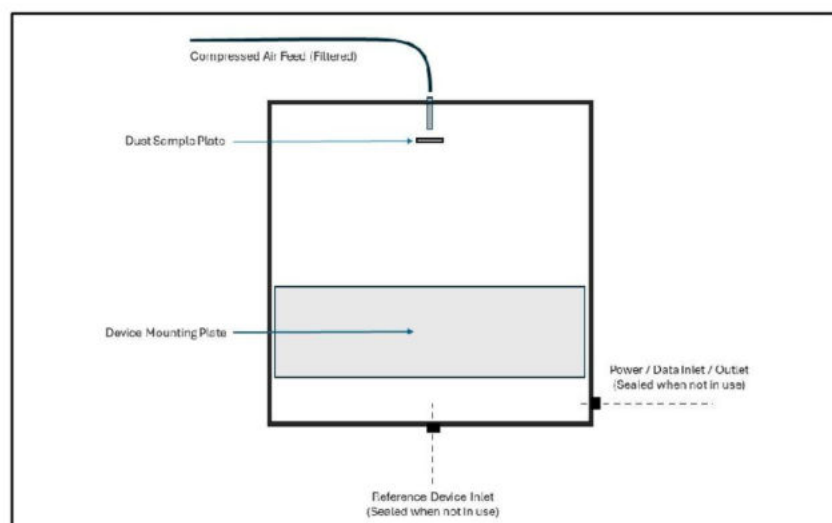


Figure 1. Schematic to show general design layout of Trolex Test Chamber.

An air compressor, controllable via a ball valve, was connected to the chamber delivering 6 bar of clean air supply, filtered for moisture and additional particulates (2 x High Efficiency Particulate Air [HEPA] filters in line with a moisture and oil trap).

The test chamber has the facility to mount multiple XD1+ devices and multiple active pumped samplers (cyclone samplers) on the device mounting plate within it. The design of the Trolex Test Chamber allows for an 'ambient to peak' dose followed by a transient return to ambient conditions.

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A single dose or periodic single doses (every 2 hours) are introduced with 2 hours as being approximately the decay window for the dust to return to ambient conditions, The test chamber was sealed during test operations, temperature and RH are monitored but not controlled at ambient levels.

The XD1+ unit was installed elevated above the chamber floor to prevent any restriction to airflow movement.

Industry standard reference material was selected as “Arizona Test Dust” (ATD) nominal 0 to 10 μm , supplied by Powder Technology INC. (PTI). The dust was stored in a controlled manner, dedicated container and consistently re-sealed to prevent moisture ingress. Two independent batches of ATD were used throughout testing. Before weighing out the particulate, the container was gently 'tumbled' to reagituate the dust and encourage an even distribution of particle sizes (as recommended by the supplier).

Particulate was weighed onto a sample disc prior to being manually transferred to the dust chamber funnel. The funnel was then charged with the dust onto a circular collection plate. The collection plate was then subject to a 3-second burst of compressed air for omni-directional distribution/dispersion of the dust.

2. Establishing the expected average reading

Current methodology for establishing a mass reading of particulates utilises sampling pumps with corrected flow rates (dependent on manufacturer). The recognised inherent accuracy of this methodology at this level of loading is typically between $\pm 30\%$ and $\pm 50\%$ (dependent on loading region study, technology and environment).

Throughout Gravimetric testing up to three (3) static cyclone samplers were placed into the test chamber at set locations to sample for the period.

All reading devices were positioned to ensure there was no bias/hot spots. The samplers were located at a suitable distance from each other and any other real-time device to prevent air flow interference as reasonably possible but still representative of the same air space.

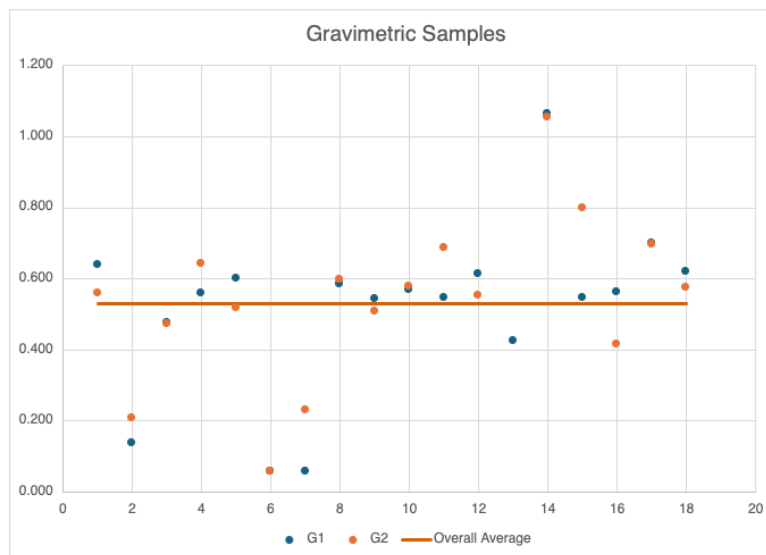
It was noted that sampling heads less than 30 cm from each other or other devices resulted in the device with a lower flow rate being significantly effected $\sim \pm 20\%$.

Weight correction is made based on “blank” samples also sent, in some cases “blank” samples have no material weight therefore no corrections are made, in other examples there can be a mass of up to $\sim \pm 30\%$ of the total reading at this level, this is considered good practice under industry standards.

These variability factors are widely known and accepted in the industry.

32 Gravimetric tests were performed with the same methodology, the average reading of Respirable Particulate reported back at 0.529 mg/m^3 of respirable particulate as per graph A.

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Graph A.

3. XD1+ testing

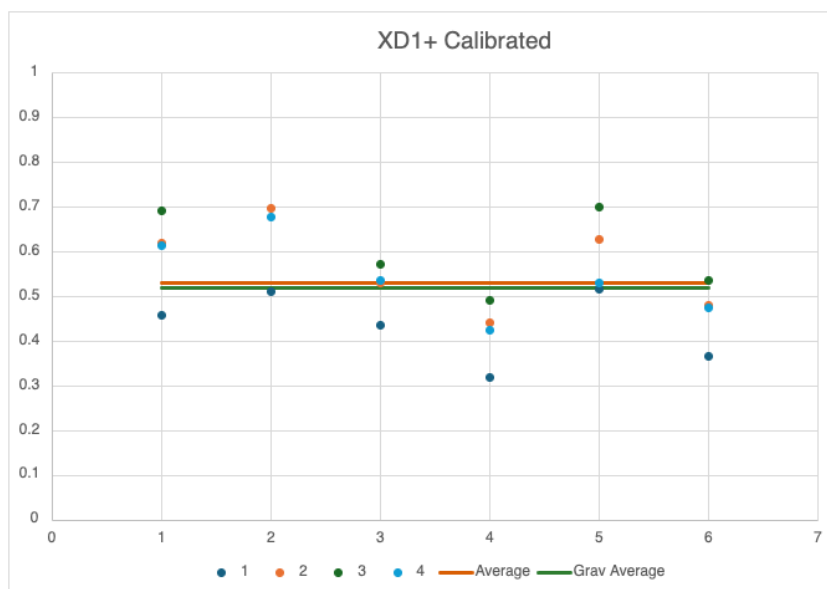
A total of 4 Standard XD1+ devices were used, these devices contain a pre-calibrated OPC with a “Base Calibration”, where sensors are individually calibrated with respect to a reference instrument, GRIMM 11D (laboratory grade real-time instrument) using a standard calibration aerosol particle mixture utilising over 60 different calibration factors to align appropriate sizing and mass performance.

Once installed into the Trolex product a further Industrial calibration factor is introduced (October 2026) to align the sensing to the common industry standard calibration particulate, ATD 10 (see section 2) for a typical application environment.

No pumped samplers were used in the testing chamber whilst XD1+ was being tested in the results shown below (see section 3 on interference between sampling devices).

Graph B below shows the results for XD1+ the average being 0.531 mg/m³.

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Graph B.

4. Summary

Average values remain directionally aligned with gravimetric reference measurements.

Under strict and reasonably practicable controlled testing conditions using currently available controlled particle “Accuracy” in any single test can produce a wide spread of results for both existing and new technologies, this is expected due the following aspects.

- Particle size control
- Particle sample control
- Particle distribution control
- Air flow control
- Reference sample control
- Inherent detection capabilities

All testing was performed under strict conditions with skilled, trained operatives following documented protocols under common scientific expectations, and inline, where applicable with industry practice. Therefore, the above are considered variables controlled as reasonably practicable.

Averages for both detection methodologies delivered around the expectations of 0.5mg/m³ (±30%), despite spread in minimum and maximum readings on single occasions.

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	Average reading (mg/m ³)
XD1+	0.531
Pumped sampler/XRD	0.529

XD1+ real time detection indicates higher reading on average by 0.002 mg/m³ (compared to Gravimetric Average). Real-time delivered a spread between its lowest and highest readings of 0.382 mg/m³, compared to Gravimetric at 1.008 mg/m³.

	Highest reported RCS (mg/m ³)	Lowest reported RCS (mg/m ³)	Range (mg/m ³)
XD1+	0.699	0.317	0.382
Pumped sampler/XRD	1.066	0.058	1.008

Limitations

- Chamber conditions represent controlled calm air environments and may not replicate dynamic occupational exposure scenarios
- Small data sets can be misinterpreted to both benchmarking and testing results
- Variable readings even with 1 m³ chamber can occur due to dust flow and dispersion

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Please see product user manual (TX8061-UM-EN · P5650.1600) for product specificities which should be considered relevant to application.

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