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Fotometrix' analysis of possible differences, which would affect the photometer light scattering signal, between the aerosol produced with the GraviCal calibration system in the laboratory and that produced onsite during a typical filter leakage test.

This was extensively considered during the development of GraviCal with the design aim for the calibration system aerosol to be as representative as possible to that produced onsite during a typical filter leak test, therefore minimising or eliminating any potential differences. To that end the aerosolisation process, the mixing chamber and the sampling mechanism were researched and closely reproduced. With the many years of filter testing experience and scientific instrument design experience within Fotometrix we know that all factors were considered, and the relevant uncertainties accounted for. The justification of this knowledge is further outlined below. This relies on peer reviewed papers and research papers from reference and high-level research organisations.

The filter leak testing procedure defined in AS1807 specifies the use of a submerged nozzle in oil operated at a specific pressure (Model III-A).

From the US Naval Research Report Laboratory NRL Report 5929 "Studies of portable air-operated aerosol generators" by Echols & Young 1963, using the same nozzle as specified in AS1807, they have reported in Appendix A the Light-scattering geometric mean diameter (LSGMD) at different concentrations showing a difference of 0.05µm for mass concentrations from 2.63 to 5.00 mg/L. The crude (by today's standards) measurement methods used in 1963 must be considered when using this data.

Another technical report "LA-UR-14-25489 - Evaluating the use of PAO4 instead of DOP for measuring the aerosol capture of nuclear canister filters" by Murray E. Moore Los Alamos National Laboratory in March 27 2014, also references the NRL Report 5929 data but in Appendix A. FAQ's from the Atitest.com website, #31, pages 14 and 15 include an excellent description of the aerosol generator process involved.

The key points from this are the words:

> *"Further studies by Dr. Melvin First at the Harvard School of Public Health and Wendell Anderson at the Naval Research Laboratory have shown that varying the pressure up and down on the Laskin Nozzle, the aerosol size distribution is not significantly affected"*, form "Size Distribution of Aerosols Produced by the Laskin Aerosol Generator Using Substitute Materials for DOP".
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> The report further states:
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> *"ATI presented a paper to the Institute of Environmental Sciences and Technology (IEST) in 1993 which confirmed that the liquid level did not have significant effect on aerosol concentration"*.
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> The final paragraph, page 8, in conclusion states:
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> *"Due to the physics of the oil droplet formation, since the aerosol is created by bursting bubbles of air that have risen through a pool of liquid oil, the produced aerosol size distribution is independent of the air pressure used to operate the Laskin Nozzle aerosol generator (Hinds et al 1983)"*.

Our basic testing and repeatability and reproducibility studies for this calibration activity confirmed this finding during prototype development.

From the above-mentioned research reports and other publications we have read, it is obvious the actual particle size distribution does not significantly impact the calibration, despite being still unknown in any accurate and precise format because of limitations with measurement technology. Each "mean" particle size reported is substantially different. This is undoubtably due to the different measurement techniques (and data interpretation) used at the time.

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Since 1987, the specialists in calibration of particle counters and aerosol photometers.