

Test Device

Protector® Stainless Steel ULPA Filtered Glove Box, Manufactured by Labconco (Kansas City, MO)

Overview

NanoSafe evaluated the containment of aerosolized nanoparticles by a Labconco Protector® Stainless Steel ULPA Filtered Glove box (Fig. 1). Testing was adapted from ASHRAE 110-1995, and involved traverse-testing of the glove box window, ULPA exhaust, valves, and transfer chamber doors during aerosolization of SiO₂ nanoparticles with a geometric mean diameter of 26 nm (Fig. 2). The test provides a useful measure of an enclosure's ability to contain aerosolized nanomaterials.



Fig. 1. Labconco Protector® Stainless Steel ULPA Filtered Glove Box

Results

Comparing measurements of the glove box interior and exterior (window, joints, valves, ULPA exhaust), containment of aerosolized SiO₂ nanoparticles could conservatively be expressed as greater than 99.99% (Table 1). Within the sensitivity of the test, these results indicate no leakage of particles from the glove box. The glove box showed no evidence of particle leakage when operated in a fail-safe condition as well (high concentration of SiO₂ nanoparticles in the enclosure with blowers off, initially). When the glove box was tested with the transfer chamber doors open, SiO₂ nanoparticle concentrations decreased to below instrument detection limits (<0.10 particles/cm³) within 504 sec for all blower speeds tested (Fig. 3). When operated at the manufacturer's recommended 50 CFM, the average evacuation time (to <0.10 particles/cm³) was 271 sec.

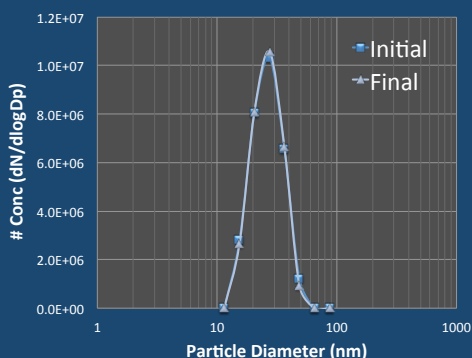


Fig. 2. Challenge aerosol size distribution

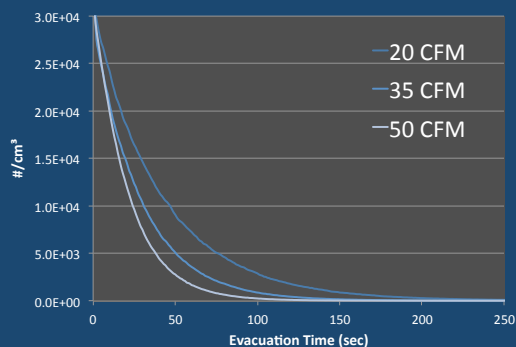


Fig. 3. Evacuation of challenge aerosol.

Table 1. Summary of enclosure performance.

Description	Nanoparticle Challenge (particles/cm ³)
Challenge concentration at 4 LPM	1.0 × 10 ⁷
Mid to top-height in-enclosure particle concentration	8,000 – 10,000
Max. concentration observed during all exterior traverses	1.20
Avg. maximum from aerosol challenge exterior traverse tests	0.51
Max. concentration observed during open door tests	0.78
Avg. Max. concentration observed during open door tests	0.56
Max. concentration observed during fail safe traverse tests	0.48
Avg. Max. from aerosol challenge fail safe traverse tests	0.40
Max. concentration observed during ULPA exhaust tests	0.23
Estimate of particle containment (Exterior Traverse) – Avg. Max. concentration from exterior traverse tests (0.51) / challenge concentration (8,000)	> 99.99%
Estimate of particle containment (ULPA Exhaust) – Avg. Max. concentration from exterior traverse tests (0.23) / challenge concentration (8,000)	> 99.99%

Disclaimer. Due to the developmental nature of nanotechnology products and associated standards, NanoSafe Tested™ means only that a client's product has been subjected to the testing criteria. It does not mean that a particular product is safe for human, animal, or plant interaction nor that the product will satisfy governmental standards of safety or compliance. Additional restrictions may apply.