

Protective Garment Testing



RTI International offers unmatched capabilities and professional experience in the evaluation of aerosol penetration of protective garments. Our unique facilities combine an aerosol wind tunnel with in-depth expertise in aerosol generation, measurement, and analysis. RTI's Protective Garment Testing Program supports the military and first responder communities by measuring the level of aerosol protection afforded by their protective clothing.

RTI provides recognized leadership and expertise in aerosol challenge tests of protective garments, having developed the aerosol systems and swatch test methodologies now specified for aerosol challenge tests by the U.S. Department of Defense (DoD) and the National Fire Protection Association (NFPA). Program personnel continue to be actively engaged with DoD and NFPA in test methods development and garment evaluation studies.

Full-Scale Test Procedures

- DoD test operating procedure (TOP) 10-2-0022 aerosol system test (AST)
- NFPA Class 4 particle inward leakage test

Developmental Procedures

- Fluorescent aerosol screening test (FAST)
- Visual outward aerosol leakage test (VOALT)
- Aerosol "swatch" test for penetration properties of fabric samples—the test apparatus operates at controlled temperature and humidity conditions (typically 90°F and 60% RH), constant 0.1" H₂O pressure drop, and constant face velocity modes. The test encompasses TOP 8-2-501 and measures aerosol penetrations from 10 nm to 5 µm.

Case Study in Aerosol Systems Test

Client Problem: Compare the level of aerosol protection afforded by several candidate prototype chemical/biological protective ensembles.

RTI Solution: RTI performed a series of full-scale aerosol challenge tests of the ensembles following DoD test procedures. Fluorescently generated aerosols were used to provide quantitative measurements of deposition under the suit. In combination with black light photography, these data provided information on sources of aerosol infiltration and patterns of aerosol deposition, allowing comparisons of garment performance.

Aerosol Challenge Test Capabilities

RTI offers extensive capabilities and facilities to support aerosol challenge research and testing of chemical protective fabrics and ensembles. These include

- Full-scale aerosol exposure chamber/wind tunnel for human-subject testing of chemical protective ensembles under controlled temperature, relative humidity, wind speed, and aerosol conditions. Direct quantification of aerosol deposition on skin and clothing is possible

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- DoD TOP 10-2-022 and NFPA 1994 Class 4 particle inward leakage testing
- Swatch test apparatus for the aerosol challenge of fabric samples
- The ability to generate and measure a range of fluorescently tagged challenge aerosols
- Separate bioaerosol test facilities for fabric sample evaluation.

Case Study in Fabric Development

Client Problem: Development of an aerosol-protective, air-permeable fabric.

RTI Solution: RTI used its fabric swatch test apparatus to evaluate candidate samples. Measurements of aerosol penetration covered a 0.3 µm to 3 µm range. To better represent true levels of aerosol protection, RTI also measured volumetric flow through the swatch and combined that with penetration to yield the "penetration velocity," a parameter closely related to the rate of aerosol flow through the fabric.

More Information

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