



# Atlas Fade-Ometer® Identifies Cause of Degradation and Sets Standard for Firefighter's Turnout Gear.

## The Problem:

Lion Apparel, a manufacturer of firefighting gear, needed to find the cause of the moisture barrier degradation in its firefighting turnout gear. They suspected the degradation was due to exposure to ultraviolet rays because of color changes in the moisture barrier lining. They also knew that the linings of the suits were exposed to the sun because the suits were stored over the boots and rolled open so that the firefighters could quickly don their gear when responding to a call. Lion's R&D department, based in Ohio, turned to the University of Kentucky Textile Testing Department in 2002 for help.

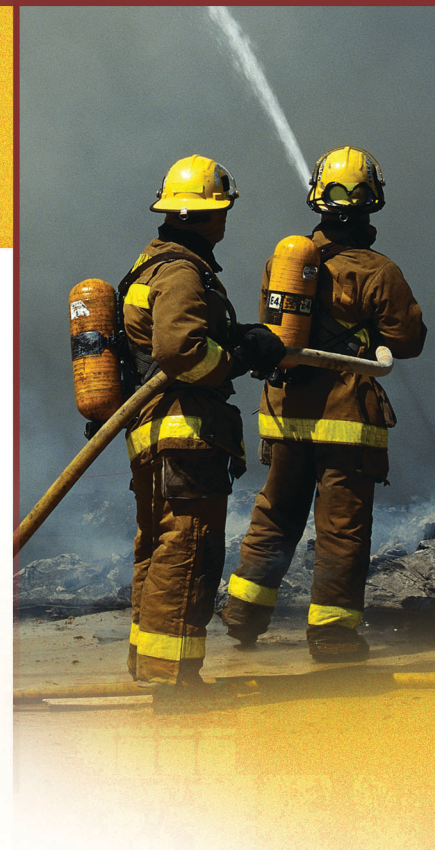
## The Process:

Lion funded a graduate student research fellowship that allowed the University of Kentucky to conduct moisture barrier testing using an older Atlas Weather-Ometer®. Because of its age and frequent use it was difficult to schedule testing time and maintain. Through an educational equipment grant, Atlas Material Testing Technology donated a Ci3000 Fade-Ometer®. The Ci3000 Fade-Ometer uses a xenon-arc lamp that can simulate UV and visible solar radiation more closely than any other light source. It is the most widely preferred light source when the end use environment of the material to be tested will be natural sunlight.

- This and other research projects enable Lion Apparel to develop the industry's safest turnout gear. Furthermore, the research has allowed the National Fire Protection Association (NFPA) to develop a standard test method to predict rates of degradation in moisture barriers.



Ci3000 Fade-Ometer®





## Test Program:

Graduate students at the University of Kentucky used the Ci3000 Fade-Ometer to re-create the moisture barrier degradation that had been seen in the field. Six brands of moisture barrier fabrics were continuously exposed to the xenon light source for up to 95 hours and then tested for water leaks using a Gore-Low Pressure Hydrostatic Tester.

## Test Conditions:

The test protocol was based on ASTM G155 Standard Practice for Operating/Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials. A 340 nm light sensor filter was used along with Borosilicate "S" inner and outer filter, 50% relative humidity and a 43°C black panel temperature.

## Exposure:

Samples were either tested as a single layer, or as a three-piece ensemble with the film layer of the sample facing the light source. Three-piece ensembles were tested with the face of the thermal liner facing the light source and the outer shell furthest from the light source to replicate the exposure seen at firehouses around the world.

## Hydrostatic Testing of Exposed Samples:

After samples are exposed, conditioned and examined using a microscope, the moisture barrier is ready to be tested for water penetration. Moisture barriers are placed in the Hydrostatic Tester with the film face exposed and tested for one minute at 2 psi. Any water leak is considered a failure.

## Test Results:

The entire turnout gear ensemble required over 3000 hours of testing because of the multiple layers of the gear. Results of this testing showed that some single layer moisture barrier samples leaked after 30 hours while others lasted through 95 hours of exposure.

## The Solution:

As a result of the testing, Lion Apparel conducted a major notification program to inform customers of the possibility of degradation to the moisture barrier and replaced all degraded turnout gear barriers that were under warranty. Lion has since developed a new line of turnout gear with a more resilient moisture barrier.

- **These findings were presented to the NFPA Durability Task Force in December of 2002 and are being used along with findings from other laboratories to establish a standard test method for moisture barriers. Lion Apparel is committed to supplying the firefighting industry with the safest and best quality products.**
- **The University of Kentucky continues to use the Ci3000 Fade-Ometer to test colorfastness and durability for many other textile manufacturers.**

### Fabric Samples Loaded in Holders



Fabric Samples Exposed in the Ci3000 Fade-Ometer

### Examples of Leakage



Water Leakage in the Hydrostatic Tester