An Evaluation of the Performance of Post-Use Firefighter Turnout Gear Using NFPA Standards

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My project looks to improve firefighter safety by studying the performance characteristics of firefighter protective clothing called turnout gear that has reached the end of its mandated life cycle. The National Fire Protection Association (NFPA) mandates that turnout gear be retired from firefighting after 10 years from date of manufacture. This study seeks to determine whether random samples of firefighter turnout gear that have been taken out of service due to age still meet moisture absorption and leakage evaluation standards using NFPA, American Society for Testing and Materials (ASTM), and American Association for Textile Chemists and Colorists (AATCC) test procedures. 156 pieces of turnout gear were collected and tested from 18 fire departments for this study. The first test assessed the moisture absorption of the outer fabric material of the aged-out turnout gear. To pass, the material must not absorb more than 15% moisture absorption to meet performance standards. For the second test, the inner quilted liner/vapor barrier was tested for leakage. Failure rate of the rates were much higher than I predicted. Test #1 showed a 96% failure rate of the outer shell material samples. Results of test #2 showed a 24% failure rate of the turnout gear moisture barrier regarding moisture leakage. The high moisture penetration and the excessive leakage of these tests shows the inability for the aged-out turnout gear to protect its wearer from moisture. Test #3 was a “flash-fire” test performed at a university textile laboratory that evaluated life threatening “flash-fire” conditions. Wet turnout gear was placed on a burn manikin that has 122 thermal sensors. Test three showed that wet turnout gear resulted in significantly higher 2nd and 3rd degree burns.

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