Abstract Book

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sensation responses were observed between conditions.

Conclusions: These findings suggest that the EF-APR concept provided respiratory protection levels comparable to a commercial PAPR system without compromising comfort and thermal sensation advantages associated with PAPRs. Additionally, the EF-APR design was better at maintaining positive pressures within the respirator facepiece at all times despite the substantially lower air flow rates compared to the CA-PAPR. The primary advantage of the facepiece-embedded fan design is a significant reduction in size, weight, required fan power and bulkiness compared to traditional PAPR motor-blowers and hoses.

SR-122-06

Respiratory Protection for Firefighters—Evaluation of CBRN Canisters for Use During Overhaul II: In Mask Analyte Sampling with Integrated Dynamic Breathing Machine

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Objective: This study expands on previous work by introducing the use of a dynamic breathing machine that accurately simulates the rate, volume, and oscillation of normal breathing patterns. It is hypothesized that the introduction of the breathing machine combined with in-mask analyte sampling will better demonstrate the protectiveness of CBRN canisters and their potential use as an alternative to SCBAs to protect firefighters during post fire operations.

Methods: To determine analyte reduction effectiveness of CBRN canisters/cartridges a series of 12 burns with associated sampling durations was conducted at the Northwest Fire Districts training center. Measured quantities of common household items were used during burns to simulate actual overhaul environments. Three commercially available NIOSH approved CBRN canisters and one non-CBRN cartridge were used during testing. Each head form was drilled to allow insertion of five Tygon tubes around the nose and mouth area to allow for in-mask sampling, as well as a large stainless steel pipe for attachment to the breathing machine. The sampling system was placed inside the burn room via a wheeled cart approximately one meter from the smoldering materials in a position that approximated a firefighters working breathing zone. Sampling durations were randomized for each test iteration (15 minutes or 60 minutes).

Results: Sampling indicated the presence of 10 of the 55 analytes were detected above the level of quantification. Of the 10 analytes detected above the LOQ in the post-fire overhaul ambient environment, acetaldehyde and formaldehyde were the only analytes to be detected downstream of any filters on a fairly consistent basis. Benzene was detected downstream of one filter on the last burn cycle. All filters appreciably reduced concentrations of acetaldehyde and formaldehyde during all test iterations.

Conclusions: At the ambient analyte concentrations generated during this study, the CBRN filters evaluated effectively reduced levels of hazardous chemicals and respirable particulates to below occupational exposure limits during simulated overhaul. Although reduced to below occupational exposure limits at the currently tested ambient levels, the carcinogenicity of formaldehyde combined with breakthrough observed at higher concentrations, warrants the recommendation that firefighters continue to use SCBAs during post-fire activities.

SR-122-07

Inter-Laboratory Comparison of the Performance of Firefighting Self-Contained Breathing Apparatus

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Objective: The objective of this study is to compare the performance of all available NIOSH and NFPA approved firefighting SCBAs in two NIOSH laboratories when tested against the major NIOSH certification tests and the NFPA air flow performance test.

Methods: Testing was performed on eight NIOSH approved SCBAs that also meet the requirements of NFPA 1981 Standard on Open-Circuit Self-Contained Breathing Apparatus (SCBA) for Emergency Services, 2007 edition. NIOSH certification tests for positive pressure, rated service time (duration), exhalation resistance, static pressure, remaining service-life indicator, and gas flow at zero facepiece pressure were conducted. The NFPA air flow performance test at maximum work rate was also performed. For comparing the Morgantown Laboratory measurements to the Pittsburgh Laboratory measurements, the difference measured within each "Run" was used for statistical analysis. Because of the small sample sizes (n=3) for each system, the Wilcoxon Signed Rank (WSR) test was used to test if the difference is zero, and p-values were calculated. The Kruskal-Wallis test and the sign test were also used to test if the results are different.

Results: For the rated service time test, no statistically significant differences comparing Morgantown to Pittsburgh results were found. For the positive pressure test, the results indicated that Morgantown results are higher than the Pittsburgh results. For the remaining service-life indicator test, the static pressure test and the exhalation resistance test, the results indicated no statistically significant differences between the Morgantown results and the Pittsburgh results. For the positive pressure, gas flow and NFPA tests, the results indicated a statistically significant difference between the Morgantown results and the Pittsburgh results.

Conclusions: There is good agreement between the test labs for all tests except for positive pressure, gas flow and NFPA tests. The differences in the positive pressure test were attributed to differences in the equipment, which have been eliminated, and further testing has shown no significant differences. New equipment has been ordered for the gas flow and NFPA tests. Agreement in test results between the laboratories contributes to the validation of the test methods.

SR-122-08

Do P100 FFRs Perform Better than N95 FFRs When Faceseal Leakage Presents?

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Objective: The NIOSH approved P100 Filtering Facepiece Respirators (FFRs) have a higher filter efficiency than that of N95 FFRs. However, P100 filters are typically associated with higher flow resistance than N95 filters. Consequently, when