the test statistical power and further investigate the respirator performance for different users. **Conclusions:** Fit factors for the strapless FFPR utilizing peripheral adhesive were significantly greater than levels typically observed for conventional FFPRs.

PO 116-2
Head-and-Face Shape Variations of U.S. Civilian Workers

Z. Zhuang, NIOSH, Pittsburgh, PA; C. Shu, P. Xi, National Research Council of Canada, Institute for Information Technology, Ottawa, ON, Canada; M. Bergman, URS, Corp., Pittsburgh, PA.

Objective: In a recent anthropometric survey by the National Institute for Occupational Safety and Health (NIOSH), 3,997 subjects were measured using traditional methods and 953 of them were also scanned using a 3D head scanner. The subjects were representative of the current U.S. civilian population of respirator wearers age 18 to 66. The objective of this study was to quantify head-and-face shape variations of the U.S. civilian workers using modern methods of shape analysis. **Methods:** The raw 3D scan data for the 953 workers were parameterized using geometric processing techniques. This process allowed the individual scans to be put in correspondence with each other in such a way that statistical shape analysis could be performed on a dense set of 3D points. This process also cleaned up the original scan data such that the noise was reduced and holes were filled in. The next step, statistical analysis of the variability of the head-and-face shape in the 3D database, was conducted using Principal Component Analysis (PCA) techniques. **Results:** Through these analyses, it was shown that the space of the head-and-face shape was spanned by a small number of basis vectors. Less than 50 components explained more than 90% of the variability. Furthermore, the main mode of variations could be visualized through animating the shape changes along the PCA axes with computer software in executable form for Windows XP. **Conclusions:** The results from this study could be used for respirator design to achieve safer, more efficient product style and sizing. Future study is needed to determine the overall utility of the point cloud-based approach for the quantification of facial morphology variation and its relationship to respirator performance

PO 116-3
Total Inward Leakage—An Assessment of Variation in Implementation of Anthropometric Marking and Measurement Techniques

A. Quiring, Scott Health & Safety, Monroe, NC.

Objective: In order to address questions regarding the Total Inward Leakage draft concept published by National Institute for Occupational Safety and Health (NIOSH), a study was initiated to assess respirator fit and variability in anthropometric landmarking and measurement for facial dimensions described in the Principle Component Analysis panel and NIOSH's new Bivariate Panel for quantitative fit testing. **Methods:** One hundred subjects will be manually measured using 2D anthropometric landmarking and measurement techniques by three different operators trained in fit test administration on three separate visits. 3D scans will also be taken of the subjects during their initial visit to compare with manual measurement. A quantitative fit test of subjects in elastomeric half masks utilizing Portacount will be conducted following each subject's measurement per OSHA 1910.134. **Results:** Variation in measurement and panel size determination will be assessed visit to visit, within subject and within operators. Geometric mean of quantitative fit tests will be evaluated to determine statistical significance. **Conclusion:** This study seeks to assess the gage repeatability and reproducibility of the anthropometric measurements required to carry out total inward leakage testing on elastomeric half masks per the NIOSH protocol

PO 116-4
Adsorption Characteristics of Activated Carbon Fibers for Toluene: Application on Respiratory Protection

J. Balanay, C. Lungu, University of Alabama at Birmingham, Birmingham, AL.

Objective: Granular activated carbon, the standard adsorbent in respirators against gases and vapors, needs containment due to its granular form. This makes respirators bulky and uncomfortable to wear, resulting to poor compliance in its use. Activated carbon fibers (ACF) are considered viable alternative adsorbent materials for developing thinner, light-weight and efficient respirators because of their larger surface area, lighter weight and fabric form. This study determined the critical bed depth and adsorption capacity of different ACF types for toluene to understand how thin a respirator can be and the service life of the adsorbents, respectively. The D-R equation was also assessed to predict the adsorption capacity for toluene at low concentrations. **Methods:** ACF in cloth (ACFC) and felt (ACFF) forms with three different surface areas per form were tested. Each ACF type was challenged with six toluene concentrations (50-500 ppm) at constant air temperature (23°C), relative humidity (50%) and air flow (16 LPM) at different adsorbent bed depths. For each adsorbent, breakthrough data were obtained using gas chromatography, and surface area using an automatic physisorption analyzer. **Results:** ACFC has a lower critical bed depth and higher adsorption capacity compared to ACFF with similar surface area for each toluene concentration. Among the ACF types, ACFC 2000 (highest BET surface area = 1614±5 m^2/g) has one of the lowest critical bed depths (ranging from 0.11-0.22 cm) and has the highest adsorption capacity (ranging from 595-878 mg/g) for toluene. When the experimental adsorption capacity was compared with predicted, ACFs with lower surface area had the smallest difference. **Conclusion:** ACF has great potential for application in respiratory protection, particularly the ACFC 2000, which is the best candidate for developing thinner and efficient respirators. The D-R equation may need to be modified to better predict the adsorption capacity at low toluene concentrations

PO 116-5
Advances in Mask Integrity Testing

E. Hanson, M. Serach, Air Techniques International, Owings Mills, MD.

Situation/problem: Mask integrity testing goes beyond traditional fit testing and is now utilized as a critical element of respirator protection programs, particularly within the DoD and DoE. The mask integrity tests include a variety of leakage tests on protective masks in addition to fit tests. These tests are conducted on masks directly without the individual present. This testing has historically been somewhat limited due to compatibility with the test heads that were originally developed for military masks.

AIHce2011

The Premier Conference & Expo for
Occupational & Environmental Health & Safety Professionals

May 14-19, 2011 + Oregon Convention Center + Portland, Oregon + www.aihce2011.org
2nd International Symposium on Wood Dust + May 17-18, 2011

aihce
co-sponsored by
AIHA® & ACGIH®

Abstract Book