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PROTECTION OF FIRST RESPONDERS AND MEDICAL PERSONNEL FOLLOWING CHEMICAL AND BIOLOGICAL TERRORISM ATTACKS. T. Mustard, Parsons Engineering Science, Inc., Denver, CO.

The use of weapons of mass destruction by terrorists has become an increasing concern during the past decade. The ready access that terrorists have to the materials and equipment necessary to produce chemical or biological (CB) weapons is particularly alarming. CB weapons have been referred to as "the poor man's atomic bomb" because they are relatively inexpensive. Small quantities of material can have a tremendous effect and their use may not be detected for several hours or days. This paper discusses the methods that emergency responders and medical personnel should follow to rapidly assess a CB terrorism incident and identify the agent involved, secure the scene, protect themselves from agent, decontaminate themselves and victims, and provide rescue and medical support. The effectiveness of commercially-available chemical protective clothing and air monitoring instrumentation during a CB incident is evaluated. General procedures for protection of medical staff, equipment, and facilities are presented. Mass decontamination of patients and patient triage are also discussed.

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THE ABILITY OF FIVE FIT-TEST METHODS TO SCREEN OUT POORLY FITTING N95 FILTERING-FACEPIECE RESPIRATORS. R. Lawrence, C. Coffey, Z. Zhuang, D. Campbell, NIOSH, Morgantown, WV.

Currently there are five fit-test methods which can be used for the fit-testing of N95 filtering-facepiece respirators. Two of these fit-test methods are qualitative (Bitrex and Saccharin) and three are quantitative (the PortaCount Plus corrected for filter penetration, the PortaCount Plus with the N95-Companion accessory (Companion), and generated aerosol). The purpose of this study was to determine the ability of each of these five fit-test methods to screen out poorly fitting N95 filtering-facepiece respirators. A panel of 25 subjects with varying face sizes tested eighteen different models of this type of respirator. The five fit tests were performed consecutively in a randomized order, with re-donning of the respirator occurring between each test. The results were compared to the 5th percentile of the simulated workplace protection factor (SWPF), an indicator of whether a respirator provided adequate protection to its wearer. The 5th percentile SWPF was determined from the total penetration (face seal leakage and filter penetration) of six tests using the PortaCount Plus, with re-donning between each test. A respirator was determined to provide adequate protection if the 5th percentile SWPF was greater than or equal to 10, the level of protection often expected for a half-mask respirator. The alpha (probability of rejecting an adequately fitting respirator) and beta (probability of accepting an inadequately fitting respirator) errors for each method were computed. The alpha error values ranged from 0.53 to 0.84 and the beta error values from 0.03 to 0.13. Based on these results, 3% of the subjects in this study passed the generated aerosol and PortaCount Plus tests with a 5th percentile SWPF of less than 10, 7% with the Saccharin, 12% with the Companion, and 13% with the Bitrex tests.

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EVALUATION OF NEW STRATEGIES FOR MEASURING FREON-113 EXPOSURE DOSE TO BE CORRELATED TO QUANTITATIVE FIT FACTOR. Z. Zhuang, C. Coffey, J. Nicholson, B. Lawrence, G. Qiao, D. Campbell, P. Jensen, NIOSH, Morgantown, WV.

Recent NIOSH research has found correlation between fit factors of the corn oil and ambient aerosol fit-test methods and the wearers' Freon-113 exposure doses while wearing negative-pressure, half-facepiece respirators (assigned protection factor=10). However, the biological monitoring strategies and methods for measuring exposure dose of Freon-113 need to be improved for similar correlation studies of respirators with assigned protection factors greater than 10. Thus, the purposes of this study were to develop improved biological monitoring strategies for measuring exposure dose of Freon and establish good subject characterization curves (relationship of end-exhaled air concentration to exposure dose). A new Freon-113 delivering and monitoring system was developed for this study. The system consists of three parts: a mixing chamber, a breathing mask with two-way breathing and three-way sliding valves, and an environmental chamber. Six subjects participated in this study. Freon-113 at concentrations of 0.5, 1, and 5 ppm were delivered to each subject through the breathing mask continuously for 30 minutes. Freon-113 at concentrations of 5 and 25 ppm were delivered to each subject intermittently (i.e., during the first two minutes, between 15 and 17 minutes, and between 28 and 30 minutes). End-exhaled air samples were collected from the mixing chamber every five minutes during the 30-minute exposure of Freon-113 and 80 minutes post exposure. Preliminary analyses of data indicated that more consistent end-exhaled air Freon-113 concentrations were obtained with the new system as compared to the original end-exhaled air samplers. End-exhaled Freon-113 concentration was not affected by the exposure scenarios (continuous and intermittent). The subject characterization curves were found to be improved as R-squre values were generally greater than 0.95. The new system is suitable for determining Freon-113 exposure dose while wearing respirators with assigned protection factors greater than 10.

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IMPLEMENTATION OF VOLUNTARY USE OF DISPOSABLE DUST MASKS AT TWO RESEARCH SITES. A. Kreft, Rohm and Haas Company, Spring House, PA; K. Millison, Rohm and Haas, Philadelphia, PA.

The OSHA Respiratory Standard contains a provision which allows the employer to exclude individuals from the written respiratory protection program if they wear disposable dust masks voluntarily. We investigated dust mask use in detail, and we evaluated the cost and benefits of allowing the use of a disposable dust mask where no hazard existed. As a result, a win-win solution was developed and implemented within two laboratory facilities.

Twenty-seven percent of the population were respirator users. Almost half were dust mask users only. Evaluation of the tasks and a review of exposure monitoring data indicated a minimal risk of exposure for most of the operations where particulates were handled. We were confronted with training and fit-testing 200 dust mask users who were wearing dust masks where no hazard existed. A solution was developed that saved the company money, permitted efficient use of Staff resources, allowed employees to continue to wear dust masks, and utilized OSHA's voluntary use provision. A key piece of the solution was identifying criteria that defined voluntary use. Individuals are approved as "voluntary dust mask users" if review of the hazards revealed that no hazard was present, and the following additional criteria were met: 1) the wearing of a dust mask is not specified in the Standard Operating Procedure for routine or emergency use; and 2) monitoring data shows no hazard.

We implemented the changes in the respiratory program to allow voluntary use of disposable dust masks, and subsequently reduced the number of individuals in the respiratory protection program. This resulted in a cost savings of approximately $50,000 per year. In addition, employees haven't lost the benefit of wearing a dust mask if they choose, the hazard documentation has improved, and the employees are requesting exposure monitoring more often.

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EFFECT OF RESPIRATOR SPEECH TRANSMISSION DEVICE SURFACE AREA ON SPEECH INTELLIGIBILITY. D. Caretti, US Army Edgewood CB Center, Aberdeen Proving Ground, MD.

Verbal communication between individuals wearing respirators can be an arduous task due to the fact that they can muffle or distort speech. Without effective speech communication between co-workers, the quality of work may be reduced and safety may be compromised. Thus, it is common for respirator designs to include a device to enhance transmission of speech. However, having such a device occupy space on a respirator's facepiece means that less space is available for enlarging other components that may have a greater impact on worker performance, such as eyepieces and breathing valves. Therefore, a study was conducted to determine whether or not reducing the size of a respirator's speech device would adversely affect speech intelligibility during face-to-face communications. Nineteen speaker-listener pairs performed the Modified Rhyme Test (MRT), an objective test that assesses intelligibility of monosyllabic words, under the following conditions: wear of a U.S. military respirator with an unmodified speech device, and 3 conditions of respirator wear with reduced speech device surface areas of 25%, 50%, and 70% of the unmodified standard. Test results showed that MRT scores decreased linearly ($R2 = 0.82$, $p < 0.01$) with a decrease in speech transmission device surface area. No significant differences in MRT scores were observed between successive speech device surface area conditions; however, MRT scores differed significantly ($p < 0.05$) between the unmodified speech device (93.1±5.8%) and the 70% reduced surface area (87.6±6.3%) conditions. These findings indicate that speech intelligibility during respirator wear is linearly related to speech transmission device surface area and that intelligibility is not compromised until surface area is reduced by more than half its current size. This information provides respirator designers options for enlarging other respirator components with the potential to enhance work performance during respirator wear without impacting verbal communication between workers.

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ABSTRACTS