shops. This study was designed to assess the workplace protection factor (WPF) of half-facepiece cartridge respirators with paint filters in spray paintings as part of the Yale SPRAY study. Twenty-two auto body shops participated in the assessment with 30 inside-outside respirator sample pairs collected. Respirators assessed were from 3M and Survivair companies as used by shop workers. Air sampling and analysis was performed according to the NIOSH MAP draft method. The ambient air samples were collected using a 25-mm IOM sampler with a single quartz fiber filter operated at 2 l/min. The inside-respirator samples were taken using a Delrin cassette and the same filter with a probe mounted into the respirator facepiece. Filters were impregnated with 500ug MAP and field extracted with 10 ml 1x10-4 M MAP in acetonitrile. Samples were analyzed on HPLC. The monomer ($\mu g/m^3$) of hexamethylene diisocyanate (HDI), and oligomers ($\mu g/m^3$) of HDI and isophorone diisocyanate (IPDI) were quantified and total number of isocyanate reactive groups (TRIG: µgNCO/m3) calculated. WPF was calculated as the ambient concentration divided by the inside-respirator concentration. Results showed that geometric mean (geometric standard deviation) and range of WPF were 17.8 (5.1) and 1.0 to 204.0 for HDI monomer, 310.5 (6.9) and 6.8 to 9777.0 for HDI oligomers, 233.9 (12.2) and 1.0 to 85783.0 for IPDI oligomers, and 274.2 (6.0) and 0.6 to 5335.2 for TRIG. Average WPF of TRIG was 253.8 (6.5) for clear coating (N=25) and 403.8 (4.3) for priming (N=5) tasks without statistical significance. No significant difference was observed of WPF between respirator brands. These results provided essential data for assigning protection factors to these respirators when used in spray operations and for adjusting internal exposures to isocyanates in the SPRAY epidemiologic study of health effects.

227.

AUTOMATED BREATHING AND METABOLIC SIMULATOR (ABMS) CO_2 TEST FOR POWERED AND NON-POWERED AIR-PURIFYING RESPIRATORS, AIRLINE RESPIRATORS, AND GAS MASK. E. Sinkule, N. Turner, S. Hota, NIOSH, Pittsburgh, PA.

There is currently no NIOSH certification test for CO_2 concentrations in air-purifying respirators. The Automated Breathing and Metabolic Simulator (ABMS), which simulates human metabolism, minute ventilation, and breathing waveforms, was used to characterize average inhaled CO_2 in a variety of NIOSH-approved air-purifying respirators. An ABMS CO_2 test protocol was developed to test 11 powered air-purifying respirators (PAPRs), 20 airline respirators (SARs), six gas masks, 27 P-100 air-purifying respirators (APRs), and 26 filtering-facepiece N95 respirators (N95s). The ABMS CO_2 protocol consisted of the following levels of O_2 consumption, CO_2 production, and minute ventilation performed consecutively for a minimum of five minutes each: 0.5, 0.4, and 10 L/min STPD; 1.0, 0.8, and 25 L/min STPD; 1.5, 1.3, and 38 L/min STPD; 2.0, 1.9, and 62 L/min STPD; 2.5, 2.5, and 70 L/min STPD; and 3.0, 3.1, and 80 L/min STPD, respectively. The mean across all PAPR models for average inhaled CO_2 and O_2 ranged from 0.2% and 20.7%, respectively, for the lowest metabolic rate to 0.9% and 20.0%, respectively, for the greatest metabolic rate. The mean across all SARs for average inhaled CO_2 and O_2 ranged from 0.5% and 20.3%, respectively, for the lowest metabolic rate to 0.4% and 20.5%, respectively, for the greatest metabolic rate. The mean across all gas masks and APRs for average inhaled CO_2 and O_2 ranged from 2.6% and 17.5%, respectively, for the lowest metabolic rate to 0.7% and 20.4%, respectively, for the greatest metabolic rate. The mean across all N95s for average inhaled CO_2 and O_2 ranged from 3.5% and 16.8%, respectively, for the lowest metabolic rate to 2.7% and 18.6%, respectively, for the greatest metabolic rate. These data demonstrate the wide range of average inhaled CO_2 concentrations across respirator types and the utility of the ABMS in conducting CO_2 testing.

228.

NIOSH CBRN RESPIRATORY PROTECTION STANDARDS UPDATE. J. Dower, L. Boord, NIOSH, Pittsburgh, PA.

Emergency response forces in the United States are required under federal regulations to provide NIOSH approved respirators appropriate for the expected hazards. NIOSH's National Personal Protective Technology Laboratory (NPPTL) is developing respirator standards for use in chemical, biological, radiological, and nuclear (CBRN) terrorism events. These efforts to develop appropriate respiratory protection standards started with an assessment of potential CBRN terrorism agents and a review of national and international respiratory protection standards. Based on results of the threat assessment and standards review a comprehensive program to develop CBRN standards for each class of respiratory protection. In December 2001, NIOSH announced the first CBRN respirator standard for compressed air self-contained breathing apparatus (SCBA). This standard combines a three-tier approval structure: NIOSH industrial SCBA approval, National Fire Protection Association (NFPA) 1981 Standard compliance, and special performance tests against chemical warfare agents and facepiece protection levels. Continuing standards development efforts have focused on the full-facepiece air-purifying respirator standard and an air-purifying escape respirator standard. Standards concepts and future standards schedules will be discussed.

229.

THE RELIANCE ON MATERIAL SAFETY DATA SHEETS FOR RESPIRATOR SELECTION. T. Towers, U.S. DOL/OSHA, Washington, DC.

In March of 2002 the U.S. Department of Labor's Bureau of Labor Statistics published a report on the use of respiratory protection in industry, titled *Survey of Respirator Use and Practices*. Of companies surveyed, 57% reported using Material Safety Data Sheet (MSDS) information for guidance in respirator selection.

A 1991 GAO report, *The Accuracy of Material Safety Data Sheets* reported that the accuracy of MSDSs in four areas: health effects, first aid, personal protective equipment, and exposure limits was 11% of the sampled MSDSs. Information on personal protective equipment was judged accurate in 47% of the MSDSs, inaccurate in 22% of the MSDSs, and partially accurate in 31%.

Concerned that as many as 57% of American companies whose employees rely on respiratory protection may be ill-advised when making respirator selection decisions, a study was conducted to determine the accuracy of respiratory protection information contained in a small sample of MSDSs obtained from sources on the Internet.

One hundred MSDSs which met the following criteria were examined. MSDSs would be (1) selected from a website linked to OSHA's website, (2) for a chemical with a known exposure limit: PEL, TLV, REL, etc, and (3) dated after the publication of OSHA's Respiratory Protection Standard, 29 CFR 1910.134.

Once the MSDSs were selected, they were evaluated according to the amount and type of respiratory protection information contained therein. The MSDS information was then categorized in one of three ways: (1) Accurately recommended a respirator. May have included NIOSH approval, APF, ESLI, changeout recommendation, warning properties, IDLH, respirator type according to contaminant concentration, etc. (2) Recommended a respirator, but did not elaborate enough to aid in proper selection. (3) Did not recommend respirator when one was indicated by the NIOSH Pocket Guide; or stated that "approved respirator" should be used.

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295.

CDC/NIOSH EMERGENCY RESPONSE: THE WORLD TRADE CENTER DISASTER—A LOOK AT THE CHAOTIC CONDITIONS AND RESCUE WORKERS' EXPOSURES. D. Mattorano, G. Burr, K. Wallingford, E. Synder, B. Bernard, E.

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