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# Inhaled Carbon Dioxide and Oxygen Concentrations During Rest and Exercise of Three Air-Purifying Escape Hoods

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Public agencies and private businesses have purchased air-purifying escape hood respirators (APEHR) for employee use during future acts of chemical, biological, radiological and nuclear terrorism. NIOSH has initiated the development of performance standards for these escape-only respirators. **PURPOSE:** Three APEHR models (Models A, B, and C) were evaluated for inhaled carbon dioxide ($CO_2$) and oxygen ($O_2$) concentrations on four men and three women. **METHODS:** A breathing gas sample line was inserted through each escape hood into the nosecup or mouthpiece and positioned 0.5–1.0 cm from the subjects' lips. Treadmill testing was performed for 10 minutes each at standing rest, walking at 2.5 mph, and walking at 3.5 mph.

**RESULTS:** During the treadmill testing of four men (mean body weight = 94.8 kg, range = 82.3–115.2 kg), minimum inhaled $CO_2$ concentration ($F_1CO_2$ min) was 0.023 for Model A during rest. $F_1CO_2$ min did not exceed 0.016 and maximum inhaled $O_2$ concentration ($F_1O_2$ max) did not fall below 0.192 for Models B and C at any work rate. For women wearing Models A and C (mean body weight = 60.6 kg, range = 58.5–63.4 kg), $F_1CO_2$ min was 0.04 and 0.029, estimated average inhaled $CO_2$ concentration ($F_1CO_2$ ave) was 0.051 and 0.041, and $F_1O_2$ max was 0.172 and 0.178, respectively, at rest. For women wearing Model B, $F_1CO_2$ min never exceeded 0.015, $F_1CO_2$ ave never exceeded 0.04, and $F_1O_2$ max never fell below 0.193 at any work rate. One man could not wear Model A beyond minute two of the standing period, due to a gagging sensation caused by the mouth-piece. One woman was not able to wear Model A beyond minute two of the standing period or Model C beyond minute two of the 2.5 mph walking period. $F_1CO_2$ min was 0.044, $F_1CO_2$ ave was 0.052, and $F_1O_2$ max was 0.164 when this subject discontinued the test of Model A during the standing period. $F_1CO_2$ min was 0.044, $F_1CO_2$ ave was 0.055, and $F_1O_2$ max was 0.18 when this subject discontinued the test of Model C during the 2.5 mph walk. The neck dam of one APEHR model had to be cut for several subjects due to tightness. **CONCLUSION:** Compared to heavier body weights (>= 82.3 kg), APEHR use in lighter subjects (<= 63.4 kg) produced higher inhaled concentrations of CO2 and lower inhaled $O_2$ concentrations, especially at rest.