The performance of two personalized ventilation systems supplying air at the breathing zone was tested in conjunction with underfloor ventilation generating two different airflow patterns in a full-scale test room. Two breathing thermal manikins were used to simulate occupants. The distribution of pollutants associated with exhaled air and floor material emissions was evaluated at various combinations of personalized and underfloor airflow rates. Compared to underfloor ventilation alone, personalized and underfloor ventilation provided excellent protection of seated occupants from any pollution, while the concentration of exhaled air pollution increased in the room. The two types of personalized ventilation performed differently. Subsequent analyses of airborne infection transmission risk indicated that personalized ventilation could become a supplement to traditional methods of infection control.