

Worker Exposure to Methanol Vapors During Cleaning of Semiconductor Wafers in a Manufacturing Setting

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An exposure simulation was conducted to characterize methanol exposure of workers who cleaned wafers in quality control departments within the semiconductor industry. Short-term (15 min) and long-term (2–4 hr) personal and area samples (at distances of 1 m and 3–6 m from the source) were collected during the 2-day simulation. On the first day, 45 mL of methanol were used per hour by a single worker washing wafers in a 102 m³ room with a ventilation rate of about 10 air changes per hour (ACH). Virtually all methanol volatilized. To assess exposures under conditions associated with higher productivity, on the second day, two workers cleaned wafers simultaneously, together using methanol at over twice the rate of the first day (95 mL/hr). On this day, the ventilation rate was halved (5 ACH). Personal concentrations on the first day averaged 60 ppm (SD = 46 ppm) and ranged from 10–140 ppm. On the second day, personal concentrations for both workers averaged 118 ppm (SD = 50 ppm; range: 64–270 ppm). Area concentrations measured on the first day at 1 m from the source and throughout the balance of the room averaged 29 ppm (SD = 19 ppm; range: 4–83 ppm) and 18 ppm (SD = 12 ppm; range: 3–42 ppm), respectively. As expected, area concentrations measured on the second day were higher than the first and averaged 73 ppm (SD = 25 ppm; range: 27–140 ppm) at 1 meter and 48 ppm (SD = 13 ppm; range: 21–67 ppm) throughout the balance of the room. The results of this simulation suggest that the use of methanol to clean semiconductor wafers without the use of local exhaust ventilation and with relatively low room ventilation rates is unlikely to result in worker exposures exceeding the current ACGIH® threshold limit value of 200 ppm. This study also confirmed prior studies suggesting that when a relatively volatile chemical is located within arm's length (near field), breathing zone concentrations will be about two- to threefold greater than the room concentration when the air exchange rate is 5–10 ACH.

Keywords exposure assessment, methanol, semiconductor