

Monitoring of arsenic exposure with speciated urinary inorganic arsenic metabolites for ion implanter maintenance engineers

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摘要

Abstract

For wafer fabrication in the semiconductor industry, maintenance engineers are potentially exposed to hazards during their work of disassembling machine components for cleanup. One special concern is the presence of arsenic or arsenic compounds in the working environment. This study analyzed speciated urinary inorganic arsenic metabolites of the maintenance engineers using high-performance liquid chromatography-hydride generation atomic absorption spectrometry to study the potential arsenic exposure during their maintenance work. In total, from six wafer fabrication facilities, 30 maintenance engineers were recruited as the exposed group and another 12 office-based engineers served as the control group. First morning-voided urine samples of each study subject were collected for 7 consecutive days. The levels of total urinary inorganic arsenic metabolites for the exposed group were 1.7±1.4, 1.4±1.1, 6.2±6.7, 20.2±14.1, and 29.5±17.2 micro g/L for As³⁺, As⁵⁺, monomethylarsonic acid, dimethylarsinic acid, and total inorganic arsenic, respectively. Both the concentration of monomethylarsonic acid and its percentage in total urinary inorganic arsenic metabolites showed significantly ascending trends for the control group, for the engineers without preventative maintenance work prior to their urine sampling, and for the engineers with such work prior to their urine sampling ($P < 0.05$ and $P < 0.0005$, respectively). The data also suggested that, at low-level occupational arsenic exposure, the concentration of total urinary inorganic arsenic metabolites might be misleading due to the confounding effect resulting from intake of seafood, such as arsenosugars. Nevertheless, monitoring of urinary arsenic species by using the percentage change of monomethylarsonic acid in total urinary inorganic arsenic metabolites as an indicator for the verification of arsenic exposure is helpful and appropriate in such cases.