



OCCUPATIONAL EXPOSURE AS A FIREFIGHTER

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Table S1.11 Biomonitoring methods for chemical and physical agents excluding fire smoke components

Chemical component or agent	Biomarker and sample handling	Instrumentation (LOD or LOQ)	Comments and other relevant information	Reference
Asbestos	Asbestos fibres in bronchoalveolar lavage fluid macrophages	Zeiss EM-10 electron microscope (Zeiss, Thornwood, New York, USA) analysis of bronchoalveolar lavage cell pellet fixed with 2% glutaraldehyde in 0.1 M sodium cacodylate buffer, embedded in Eponate-12 resin (LOD, not reported)	Firefighter exposed to high concentrations of dust at the World Trade Center	Rom et al. (2002)
BDEs, PCBs, and organochlorine pesticides	Serum concentrations of 27 analytes, SPE used for extraction and clean-up	GC-HRMS using isotopic dilution (LOD, 0.003–0.04 ng/mL)	Firefighters Occupational Exposures study	Park et al. (2015)
PBDD/Fs and PCDD/Fs	Serum concentrations of 17 analytes	GC-IDHRMS (LOD ranging from 0.048 to 23 pg/g lipid, varying by analyte and sample amount)	Firefighter response to controlled residential fires	Mayer et al. (2021)
Other brominated compounds, plasticizers, OPFRs, and organophosphate pesticides	Urinary biomarkers of 16 substances, deconjugated and concentrated by SPE	HPLC-MS with multiple reaction monitoring (LOD, 0.05–0.5 ng/mL)	Based on method developed by Jayatilaka et al. (2017)	Jayatilaka et al. (2019)
PFAS ^a	Serum concentrations of 12 PFAS, SPE concentration	LC-MS/MS with multiple reaction monitoring (LOQ, 0.05–0.1 ng/mL)	Women Firefighters Biomonitoring Collaborative study	Trowbridge et al. (2020)
Metals	Whole blood concentrations of Hg, Mn, Cd, and Pb	ICP-MS (LOD, 0.02–0.54 ng/mL)	California Environmental Contaminant Biomonitoring Program	Dobraca et al. (2015)

BDEs, brominated diphenyl ethers; Cd, cadmium; GC-HRMS, gas chromatography-high resolution mass spectrometry; GC-IDHRMS, gas chromatography-isotope dilution high-resolution mass spectrometry; Hg, mercury; HPLC-MS/MS, high-performance liquid chromatography-tandem mass spectrometry; HPLC-ESI-MS/MS, high-performance liquid chromatography-electrospray triple-quadrupole mass spectrometer; ICP-MS, inductively coupled plasma-mass spectrometry; LC-MS/MS, liquid chromatography-tandem mass spectrometry; LOD, limit of detection; LOQ, limit of quantification; Mn, manganese; NHANES, National Health and Nutrition Examination Survey; OPFR, organophosphorus flame retardants; Pb, lead; PBDD/Fs, polybrominated dibenzo-*para*-dioxins and dibenzofurans; PCBs, polychlorinated biphenyls; PCDD/Fs, polychlorinated dibenzo-*para*-dioxins and dibenzofurans; PFAS, per- and polyfluoroalkyl substances; SPE, solid-phase extraction.

^a NHANES also carries out biomonitoring for these contaminants as follows: serum PFAS are measured using SPE coupled with isotope dilution HPLC-MS/MS ([Kato et al., 2018](#)).

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