

# OCCUPATIONAL EXPOSURE AS A FIREFIGHTER

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ON THE IDENTIFICATION  
OF CARCINOGENIC HAZARDS  
TO HUMANS

# LIST OF ABBREVIATIONS

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AAS	atomic absorption spectrophotometry
AAS-HG	atomic absorption spectrophotometry-hydride vapour generator method
AFFF	aqueous film-forming foam
AhR	aryl hydrocarbon receptor
AHRR	aryl hydrocarbon receptor repressor
AMPK	AMP-activated protein kinase
AOPP	advanced oxidation protein products
APF	assigned protection factor
APGC-MS/MS	atmospheric pressure gas chromatography-tandem mass spectrometry
ApoA1	apolipoprotein-AI
ARR	adjusted relative risk
B[a]P	benzo[a]pyrene
BBLV	binding biological limit value
BCEtP	bis-2-chloroethyl phosphate
BDCPP	bis(1,3-dichloro-2-propyl) phosphate
BEI	biological exposure index
BEV	battery electric vehicle
BLV	biological limit value
BMI	body mass index
BTEX	benzene, toluene, ethylbenzene, and xylene
CanCHEC	Canadian Census Health and Environment Cohort
CAT	catalase
CC16	Club cell secretory protein
CD	conjugated diene
CFHS	Career Firefighter Health Study
CI	confidence interval
COPD	chronic obstructive pulmonary disease
COSMIC	Catalogue Of Somatic Mutations In Cancer
CT	computerized tomography
CYP	cytochrome P450

DCF	dichlorofluorescein
DPhP	diphenyl phosphate
EBC	exhaled breath condensate
ECHA	European Chemicals Agency
ECP	eosinophil cationic protein
EdU	5-ethynyl-2'-deoxyuridine
EH-TBB	2-ethylhexyl-2,3,4,5-tetrabromobenzoate
ELISA	enzyme-linked immunosorbent assay
EOM	extractable organic material
EWAS	epigenome-wide association study
FDNY	Fire Department of the City of New York
FEF	forced expiratory flow
FEV <sub>1</sub>	forced expiratory volume in 1 second
FEV <sub>1,%Predicted</sub>	predicted forced expiratory volume in 1 second
Fpg	formamidopyrimidine DNA glycosylase
FTIR	Fourier transform infrared spectroscopy
FVC	forced vital capacity
GC-FID	gas chromatography-flame ionization detection
GC-HRMS	gas chromatography-high-resolution mass spectrometry
GC-MS	gas chromatography-mass spectrometry
GC-NPD	gas chromatography-nitrogen-phosphorus detection
GGT	gamma glutamyl transpeptidase
GM-CSF	granulocyte/macrophage colony-stimulating factor
GR	glutathione reductase
GSH	glutathione
GSH-Px	glutathione peroxidase
GSSG	oxidized glutathione
HBCDD	hexabromocyclododecane
HBr	hydrogen bromide
HBV	hepatitis B virus
HCl	hydrogen chloride
HCN	hydrogen cyanide
HCV	hepatitis C virus
HFPO-DA	hexafluoropropylene oxide-dimer acid
HIV	human immunodeficiency virus
HpCDD	1,2,3,4,6,7,8-heptachlorodibenzo- <i>para</i> -dioxin
HPIC	high-performance liquid chromatography
HPLC-MS/MS	high-performance liquid chromatography coupled with tandem mass spectrometry
HPLC-UV-DAD	high-performance liquid chromatography coupled with ultraviolet or diode-array detection
HPLC-UV-FL	high-performance liquid chromatography with ultraviolet or fluorescence detection
HR	hazard ratio
HRGC-HRMS	high-resolution gas chromatography-high-resolution mass spectrometry
HxCDF	hexachlorodibenzofuran
ICD	International Classification of Diseases
ICD-O	International Classification of Diseases for Oncology

ICP-MS	inductively coupled plasma-mass spectrometry
IDLH	immediately dangerous to life or health
IDR	incidence density ratio
Ig	immunoglobulin
IL	interleukin
IL-1RA	interleukin-1 receptor antagonist
indel	small insertions and deletions
8-iso-PGF <sub>2α</sub>	8-iso-prostaglandin F <sub>2α</sub>
KEGG	Kyoto Encyclopedia of Genes and Genomes
LC-MGUS	light-chain monoclonal gammopathy of undetermined significance
LC-MS/MS	liquid chromatography-tandem mass spectrometry
LOD	limit of detection
LOOH	lipid hydroperoxides
LOQ	limit of quantification
LPA	lysophosphatidic acid
MCP-1	monocyte chemoattractant protein 1
MDA	malondialdehyde
meta-RR	meta-rate ratio
meta-SIR	meta-standardized incidence ratio
meta-SMR	meta-standardized mortality ratio
MGUS	monoclonal gammopathy of undetermined significance
MIP-1α	macrophage inflammatory protein 1 alpha
MN	micronucleus, micronuclei
MOR	mortality odds ratio
MPO	myeloperoxidase
MRR	mortality rate ratio
NF-κB	nuclear factor kappa-light-chain-enhancer of activated B-cells
NFPA	National Fire Protection Association
NHL	non-Hodgkin lymphoma
NIOSH	National Institute for Occupational Safety and Health
NK	natural killer
NOCCA	Nordic Occupational Cancer
NO <sub>x</sub>	nitrogen oxides
3-NT	3-nitrotyrosine
OEL	occupational exposure limit
3-OH-BaP	3-hydroxybenzo[ <i>a</i> ]pyrene
8-OHdG	8-hydroxy-2'-deoxyguanosine
8-OHG	8-hydroxyguanosine
8-OHGua	8-hydroxyguanine
1-OHP	1-hydroxypyrene
OPFR	organophosphate flame retardant
OR	odds ratio
OSHA	Occupational Safety and Health Administration
Ox-GS	oxidized guanine species
8-oxodG	8-oxo-7,8-dihydro-2'-deoxyguanosine

PAH	polycyclic aromatic hydrocarbon
PAH-CALUX	polycyclic aromatic hydrocarbon-chemical activated luciferase gene expression
p-Akt	protein kinase B
PBDD/Fs	polybrominated dibenzo- <i>para</i> -dioxins and dibenzofurans
PBDE	polybrominated diphenyl ether
PBDF	polybrominated dibenzofurans
PBL	peripheral blood lymphocytes
PBMCs	peripheral blood mononuclear cells
PC	protein carbonyls
PCA	principal component analysis
PCB	polychlorinated biphenyl
PCDD/Fs	polychlorinated dibenzo- <i>para</i> -dioxins and dibenzofurans
PCDF	polychlorinated dibenzofurans
PCG-1 $\alpha$	plasma peroxisome proliferator-activated receptor $\gamma$ coactivator-1 $\alpha$
PeCDF	2,3,4,7,8-pentachlorodibenzofuran
PFAS	per- and polyfluoroalkyl substances
PFBS	perfluorobutanesulfonic acid
PFDA	perfluorodecanoic acid
PFDoA	perfluorododecanoic acid
PFHxS	perfluorohexanesulfonic acid
PFNA	perfluorononanoic acid
PFOA	perfluorooctanoic acid
<i>n</i> -PFOS	linear perfluorooctanesulfonic acid
PFOS	perfluorooctanesulfonic acid
PM	particulate matter
PM <sub>10</sub>	particulate matter with a diameter of 10 $\mu$ m or less
PM <sub>2.5</sub>	particulate matter with a diameter of 2.5 $\mu$ m or less
PMN	polymorphonuclear neutrophils
PMR	proportionate mortality ratio
PPE	personal protective equipment
PTH	parathyroid hormone
PVC	polyvinyl chloride
PXDFs	mixed halogenated dibenzofurans
QTOF-MS/MS	quadrupole time-of-flight tandem mass spectrometry
RAGE	receptor for advanced glycation end-products
RAL	relative adduct labelling
RIR	relative incidence ratio [equivalent to rate ratio]
ROS	reactive oxygen species
RR	rate ratio
S9	9000 $\times$ g supernatant
SCBA	self-contained breathing apparatus
SCC	squamous cell carcinoma
SCE	sister-chromatid exchange
SEER	Surveillance, Epidemiology, and End Results
SIR	standardized incidence ratio
SIRE	summary of incidence risk estimate
SMR	standardized mortality ratio

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SMBOR	standardized morbidity odds ratio
SMOR	standardized mortality odds ratio
SMRE	summary of mortality risk estimate
SNP	single nucleotide polymorphism
SOD	superoxide dismutase
SP-A	surfactant-associated protein A
SRR	standardized rate ratio
STEL	short-term exposure limit
sVOC	semi-volatile organic compound
T3	triiodothyronine
T4	thyroxine
TBBA	2,3,4,5-tetrabromobenzoic acid
TBBPA	tetrabromobisphenol A
TDCPP	tris(1,3-dichloro-2-propyl) phosphate
TEAC	trolox equivalent antioxidant capacity
TGF $\beta$	transforming growth factor beta
Th	T-helper
TNF $\alpha$	tumour necrosis factor alpha
TRAP	total radical-trapping antioxidant potential
Treg	T-regulatory
TSH	thyroid-stimulating hormone
UA	uric acid
UPLC-MS/MS	ultra-performance liquid chromatography-tandem mass spectrometry
US EPA	United States Environmental Protection Agency
UV	ultraviolet
VEGF	vascular endothelial growth factor
VOC	volatile organic compound
WTC	World Trade Center
WUI	wildland-urban interface
XRE	xenobiotic response element