

## Exposure Assessment-1

### 01D.1 DERMAL PAH EXPOSURE IN SWEDISH FIREFIGHTERS AND POLICE FORENSIC INVESTIGATORS – PRELIMINARY RESULTS FROM TAPE STRIPPING ON WRIST AND COLLARBONE

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**Objectives** Firefighters (FFs) and police forensic investigators (PFI) may be exposed to a wide range of particles and combustion products, such as the carcinogenic benzo(a)pyrene and other polycyclic aromatic hydrocarbons (PAHs). The aim of this study was to evaluate the dermal exposure to 32 different PAHs for FFs and PFIs.

**Methods** The skin was sampled by tape stripping (three consecutive tapes) on lower wrist and collarbone area after end of work shift of 7 FFs (fire starters; team leaders inside the burning house; team leaders outside the burning house) during training fires (14 samples), 9 PFIs investigating the aftermath of fire events (10 samples) and 7 office workers/control persons (7 samples). We used semipermeable membrane dialysis for clean-up of the tape strip extracts and analysed the PAHs by gas chromatography mass spectrometry.

**Results** The median sum 32 PAH dermal exposure of the measured groups was in the range of 2 to 16 ng/cm<sup>2</sup> on the wrist and 2 to 4.6 ng/cm<sup>2</sup> on the collarbone area. Both gaseous and particle-associated PAHs were present on skin with large variability in levels between specific PAHs. The most abundant PAHs were phenanthrene, fluoranthene, and chrysene. For sum 32 PAHs the exposure of the wrist was statistically significantly higher for FF fire starters and PFIs than for controls. FF fire starters had the highest exposure for benzo(a)pyrene. For the collarbone area, the FFs and PFIs had lower exposures than on the wrist and similar to the levels for control persons.

**Conclusions** The dermal occupational PAH exposure for FFs and PFIs was generally higher on the wrist than on the collarbone area. Thus, the wrists seem to be less well protected by personal protective equipment than the collarbone area. On the collarbone area, the dermal PAH exposure levels were similar between FFs, PFIs and control persons.

### 01D.2 OBJECTIVE MEASUREMENT OF WORK-ENVIRONMENT CARCINOGENIC EXPOSURES IN FLORIDA FIREFIGHTERS USING SILICONE-BASED PASSIVE SAMPLING WRISTBANDS

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Firefighters are likely to be exposed to many toxic chemicals in the performance of their work duties such as polycyclic

aromatic hydrocarbons (PAHs). Chemical exposures may occur through dermal, oral, or inhalation pathways. Passive sampling devices are used to sequester organic molecules through passive diffusion and provide time-weighted averages of chemical concentrations. This pilot study uses silicone-based wristbands as a personal passive sampler to detect known carcinogens during a 24 hour work shift. Twenty-four wristbands were deployed across various fire services throughout South Florida. Prior to deployment, bands were cleaned using a standardized cleaning protocol to remove contamination and optimize the surface for absorption. Wristbands were then packaged in airtight bags to prevent contamination. Wristbands were worn on fire service personnel and collected at the end of a 24 hour work shift. Chemical contaminants were then extracted from the wristband and analyzed for PAHs—identified using the EPA IRIS, California Proposition 65, and IRAC datasets—using gas chromatography-mass spectrometry. The average number of chemicals found across all wristbands (n=24) was 23 with 4 categorized as carcinogenic to humans (i.e., Benzo [b]fluoranthene, Benzo[j]fluoranthene, Chrysene, and Naphthalene). All bands had at least one PAH present, specifically, 87.5% contained Benzo[b]fluoranthene (mean=5.23 ng/band), 50% contained Benzo[j]fluoranthene (mean=2.05 ng/band), 79.2% contained Chrysene (mean=9.55 ng/band), and 100% contained Naphthalene (mean=176.53 ng/band). Actual types of exposure compounds is likely to be larger than the observed data as the group of PAHs detected was limited to three existing datasets. Silicone-based wristbands are feasible to use within the fire service to detect and characterize ambient hazardous chemical compounds. These personal self-samplers used during a 24 hour collection period identified various PAHs in the firefighter work environment. Objective measures of harmful chemical exposures in the fire service should be monitored with a comprehensive surveillance system that includes personal sampler devices.

### 01D.3 FUMIGANT AND CHEMICAL RESIDUE 8-HOUR EXPOSURES IN WORKERS HANDLING CARGO FROM SHIPPING CONTAINERS AND EXPORT LOGS IN NEW ZEALAND

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**Background** Previous studies found elevated concentrations of fumigants and other chemicals in the air of unopened shipping containers, which led to the assumption that workers were likely to be highly exposed. This study assessed personal 8 hour exposures in workers handling cargo from shipping containers or export logs, which were fumigated prior to loading.

**Methods** 193 personal 8 hour air samples were collected and analysed for 1,2-dibromoethane, chloropicrin, ethylene oxide, hydrogen cyanide, hydrogen phosphide and methyl bromide, 1,2-dichloroethane, C2-alkylbenzenes, acetaldehyde, ammonia, benzene, formaldehyde, methanol, styrene and toluene. Additive Mixture Values were calculated using the Work Exposure (WES) standard set by Worksafe NZ and the Threshold Limit Values (TLV) set by the ACGIH. Linear regression was conducted to assess associations between time spent inside shipping containers and exposure (n=98).