Natural Hazards Research Australia

Workplace hazards of wildland firefighters in WA

A mixed-method investigation

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Recommendation 15.4 Enhance health and mental health datasets

Australian, state and territory governments should agree to:

(1) develop consistent and compatible methods and metrics to measure health impacts related to natural disasters, including mental health, and

(2) take steps to ensure the appropriate sharing of health and mental health datasets.

International Agency for Research on Cancer

World Health Organization

IARC MONOGRAPHS VOL. 132: OCCUPATIONAL EXPOSURE AS A FIREFIGHTER

Occupational exposure as a firefighter is *carcinogenic to humans* (Group 1)

on the basis of

sufficient evidence for cancer in humans

GROUP 1 | GROUP 2A | GROUP 2B | GROUP 3

The *IARC Monographs* classification indicates the level of certainty that an agent can cause cancer (*hazard identification*)

Higher level of certainty — Lower level of certainty

Cancer types with *sufficient evidence* for cancer in humans:

Mesothelioma | Bladder cancer

Cancer types with *limited evidence* for cancer in humans:

Colon cancer | Prostate cancer | Testicular cancer | Melanoma of the skin | Non-Hodgkin lymphoma

Strong mechanistic evidence in exposed firefighters

Genotoxicity | Epigenetic alterations | Oxidative stress | Chronic inflammation | Modulation of receptor-mediated effects

Exposures of firefighters include combustion products, diesel exhaust, building materials, asbestos, chemicals, shift work, ultraviolet radiation

Firefighters respond to various types of fire

Structure | Wildland | Vehicle

The research

Parallel mixed method design

→ 1. Qualitative investigation

→ 2. Occupational exposure monitoring

→ 3. PPE off-gassing

→ 4. Toxicology of bushfire smoke

Qualitative investigation

- → n=30 participants of both volunteer and forestry (DBCA) firefighters
- → Semi-structured interviews
- → Thematic analysis
- → To investigate:
  - Understanding of risks of bushfire smoke
  - Attitudes and behaviours toward wearing and maintaining PPE

- → We found that:
  - Volunteer firefighters **lack an understanding** of the potential health risks of bushfire smoke
  - PPE wearing culture has **improved dramatically** over the last 20 years
  - Forestry firefighters lack **any access to P3 respiratory protection**
  - Forestry firefighters also **lack laundering and decontamination facilities** in their workplace- leading to concern about bringing harm to their families.

CSIRO PUBLISHING

RESEARCH PAPER
https://doi.org/10.1071/WF23147

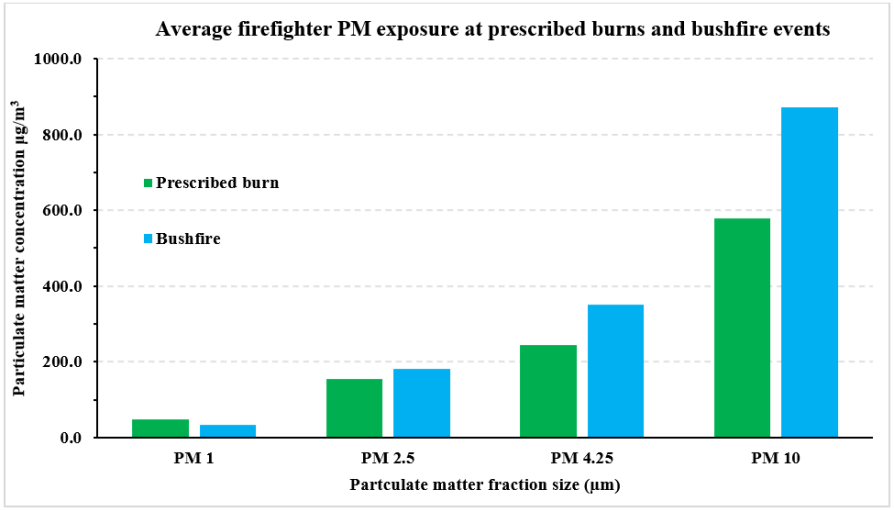
International Journal of WILDLAND FIRE
International Association of Wildland Fire

Fighting fire and fumes: risk awareness and protective practices among Western Australian firefighters

Kiam Padamsey[A,*], Ruth Wallace[A], Adelle Liebenberg[A], Martyn Cross[A] and Jacques Oosthuizen[A]

Workplace exposure monitoring

- → n=40 individual participants across 5 bushfire events and 4 prescribed burns
- → Wore particulate (PM) and gas monitors, urine analysis for internal PAH
- → Referenced to Workplace Exposure Standards



- → We found that:
  - Firefighters are exposed to high concentrations of PM, **in particular PM10**
  - Exposure to CO and VOC were elevated
  - No significant body PAH was observed
  - Exposures at bushfire events are quite similar to prescribed burns
  - Reinforced the **requirements for P3 breathing protection**

Off-gassing of firefighting tunics

- Hypothesised that firefighting tunic off-gasses chemicals following bushfires like has been shown at structural fires
- 10 tunics after fire events were taken for off-gassing analysis
- Measured for a minimum of 12 hours.

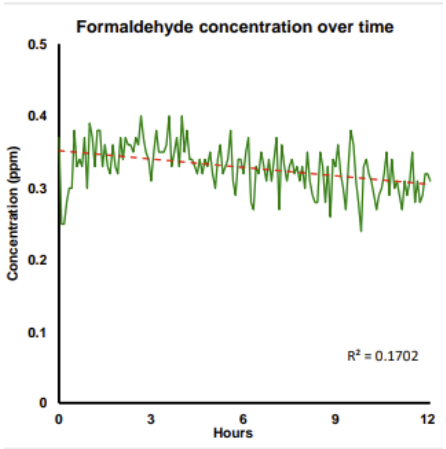


Figure 7: Formaldehyde off gassing over time from burn three.

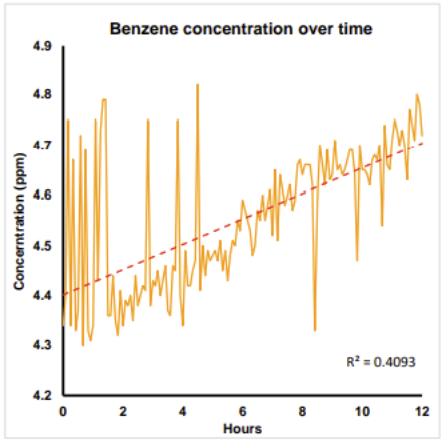
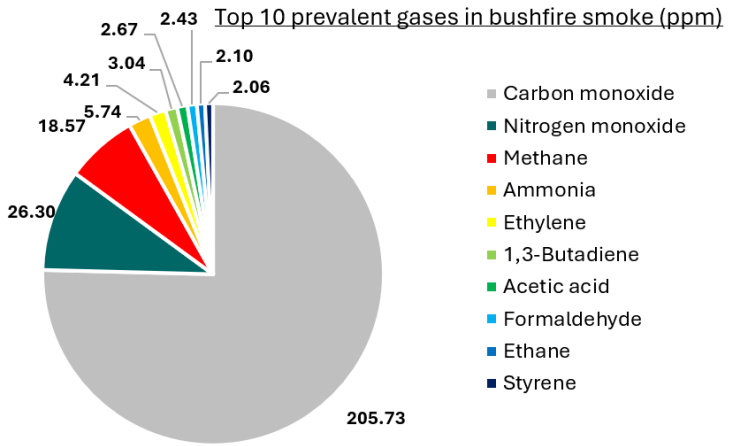


Figure 6: Benzene off gassing over time from burn three.

- We found that:
  - The tunic indeed off-gasses chemicals following exposure at bushfire events
  - The tunic **should be considered contaminated**, isolated from personnel, and washed appropriately.
  - Due to the potential of carcinogenic off-gassing, the home washing machine is **not appropriate for this.**
  - Highlights the inequalities of firefighters in the wildland versus structural space.

Toxicology of bushfire smoke

- 5 separate prescribed burns targeted across diverse ecoregions of WA
- FTIR analysis at the fire-front, where firefighters were working
- Aiming to compare phases of fire, ecoregions and types of fires.



- We found that:
  - General makeup of smoke similar to those reported through other methods
  - Peat (acid sulphate) fires are significantly different to all other fires sampled
  - No specific trend of chemicals observed over different bush types (ecoregions)
  - The smouldering phase **may be more harmful** to firefighters compared to the flaming phase
  - The **clear air may also be a danger**.

So what..?

Real-world impacts

We have communicated findings early to fire management agencies.

For the first time ever, forestry firefighters (600) will be entering the 2024/25 season with P3 breathing protection.

We have engaged with DFES to investigate the potential of contamination ‘breakthrough’ of PPE and we are investigating the effectiveness of laundering procedures.

What's next?

Natural Hazards Research Australia

CDC Centers for Disease Control and Prevention
CDC 24/7: Saving Lives, Protecting People™

The National Institute for Occupational Safety and Health (NIOSH)

Over 10,000 Firefighters Registered and Counting!

It's been one year since NIOSH launched the National Firefighter Registry (NFR) for Cancer. The NFR for Cancer is a voluntary registry of U.S. firefighters. With support from fire service leaders, NIOSH created the NFR to better understand and reduce cancer among firefighters. Research has shown that firefighting can increase the risk of certain types of cancer, but many knowledge gaps remain. For example, studies have not included enough diverse groups of firefighters to understand their cancer risk. These include women and nonwhite firefighters, as well as volunteer, wildland, or other types of fire service.

NFR™

NATIONAL FIREFIGHTER REGISTRY *for Cancer*
Understanding & Reducing Cancer

Natural Hazards Research Australia

Thanks!