Firefighting Hazards

Brian Whittaker
Commander, Metropolitan Fire Brigade Melbourne

Establishment of MFB HAZMAT Unit

2006 - Reviewed the MFBs' Hazmat Response capability and prepared a strategic report that placed great importance on the safety, health and wellbeing of MFB and other emergency services staff, the community, and the environment.

The report and its key strategies were accepted by senior management and established the 'Hazmat Unit' within the Emergency Management Department.

The report focused on the 'Hazmat Technician' programme that was implemented in 2008. That programme involved three key components; skills, resources and operational structure.

This initiative was necessary due to the increased use of dangerous goods within the community, and reinforced by the improved technologies that has provided firefighters with equipment to safely and effectively mitigate hazardous material incidents.

Fire-fighters Workplace

Initial response to a fire call exposes Fire-fighters to and uncontrolled environment that presents numerous hazards; explosion, fire, structural collapse, etc.

High risk of exposure to various toxic gases, vapours and particulate matter that exist in '**fire smoke**'

Products of combustion can be carcinogenic, cause irritation, incapacitation, systemic toxicity and asphyxiation

Fire-fighter safety is paramount, however 'safety controls' cannot eliminate all hazards encountered

Products of Combustion (Fire Smoke)

Common products of combustion, include;

- Polycyclic Aromatic Hydrocarbons (PAHs) – naphthalene, benzo[a]pyrene
- Irritant gases – formaldehyde, acrolein, oxides of nitrogen
- Asphyxiant gases – carbon monoxide, hydrogen cyanide

These present significant, compounding chemical health hazards to fire-fighters

This is based on materials used globally in manufacturing;

- Building materials
- Household furnishings
- Automotive and electrical components

Although each fire will have individual characteristics there are commonalities.

Products of Combustion (Fire Smoke)

	Complex Molecules		Irritant Gases					Asphyxiant gases	
	Polycyclic Aromatic Hydrocarbons (PAHs)	**Particulate Matter (PM)**	**Formaldehyde / Acrolein**	**Ammonia / Chlorine**	**Hydrogen Chloride**	**Sulphur Dioxide**	**Oxides of Nitrogen**	**Carbon Monoxide**	**Hydrogen Cyanide**
Polymeric Materials. (plastics, resins, fibres, foams)	H	VH	H	P	VH	P	H	VH	VH
Wood. (timber constructions, furnishings, vegetation)	P	VH	H	–	–	–	P	H	–
Rubber / Tyres	H	VH	H	P	P	VH	P	VH	P
Fossil Fuels (Petrol, Oil)	H	VH	H	–	–	P	–	H	–

Key

VH	Likely to be present in Very High concentrations
H	Likely to be present in High concentrations
P	Likely to be present
–	Unlikely to be present

Sourced from Health Protection Agency UK, Chemical Hazards Division, A Toxicological Review of the Products of Combustion 2010

Hazard Control – Protective Clothing/Equipment

Fire-fighters attempt to eliminate hazards to mitigate and control emergencies

Hierarchy of Safety Controls
- Engineering controls (equipment)
- Administrative controls (skills, procedures)
- Personal Protective Clothing/Equipment (PPC/E)

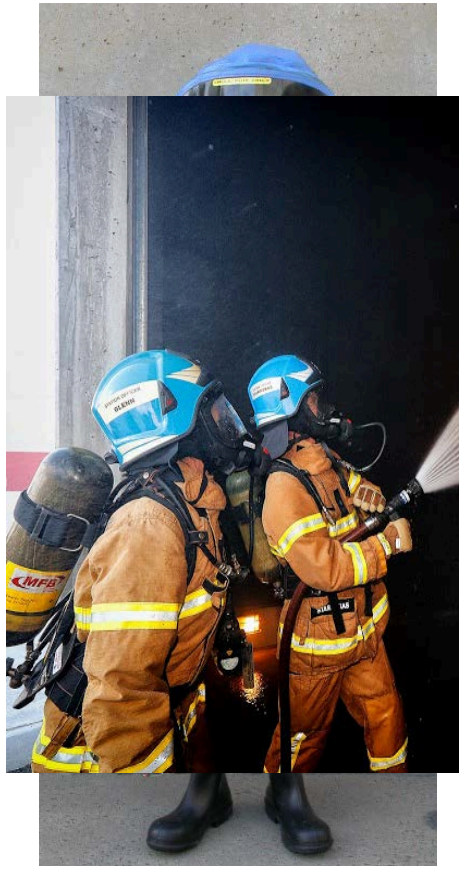
Today's personal protective clothing (PPC) and equipment (E) provides protection from most hazards encountered.

As per NFPA standards PPC/E is provided in several levels;

Level A	Fully encapsulating gas tight suit with breathing apparatus (BA)
Level B	Chemical splash suit (protection from liquids and solids) with BA
Level C	Chemical splash suit (protection from liquids and solids) with respirator
Level D	Structural firefighting ensemble with breathing apparatus

Exposure

The issue with PPC is selectivity, specifically regarding fit for purpose due to specific hazards encountered and task requirements.



Level A provides protection of fire-fighters from exposure from gases, vapours and particulate matters. However, Level A is inappropriate at a fire, therefore structural firefighting ensemble must be worn.

Structural fire-fighting ensemble has limited protection from gases, vapours and particulate matter due to the requirement and necessity to have a compromise between protection from radiated heat exposure and the release of metabolic heat build up. In short the breathability of the ensemble is in effect a hazard to fire-fighters that cannot be eliminated.

The products of combustion will penetrate/permeate structural firefighting uniforms (Level D), including the vapour barrier and expose the skin which will result in possible absorption into the body.

Exposure

It should be noted that exposure, and the extent of exposures may also come at different stages of fire fighting:

Primary exposure

Fire-fighters in direct contact with the products of combustion (smoke/firefighting water). Uniform exposed to gas, vapour and particulates cannot be eliminated due to the primary requirement of fire-fighters to perform rescue and fire fighting suppression activities as part of their core activities.

Secondary exposure

The contaminant is transferred when contact is made by fire-fighters when touching exposed materials (uniform or equipment), commonly known as ‘cross contamination’ and occurs during post fire operations. Procedures are in place to eliminate secondary exposure as much as practicable however; secondary exposure is a risk that cannot be totally eliminated.

Questions?