Characterisation of Particle Emissions from the Combustion of Different Australian Vegetation

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It is well known that the bushfire fireground contains a range of hazards that makes firefighting an extremely risky activity. In particular, bushfires generate a range of air toxics that are potentially harmful to human health and safety. Of these air toxics, particulate matter (PM) is of particular interest. It is well known that Australian bushfires generate high levels of PM of various sizes, however it is not known what levels and which types of organics and heavy metals are being transmitted via these particulates. Studies have been conducted in Europe and the US that have evaluated the different toxics contained in smoke, and of the exposure of firefighters. However, as Australia has different fire fighting techniques, a different climate, and different vegetation, these studies cannot be applied to Australian firegrounds. Therefore, a specific study is required to evaluate the PM produced by Australian vegetation. The level of particle emissions, composition, and concentrations, all need to be evaluated for different Australian vegetation types under the different conditions likely to be found on the fireground.

This project aims to characterise the volatile organic components and heavy metals adsorbed to particulates generated in bushfires. This will include the evaluation of firefighter exposure, the determination of emission factors for typical vegetation, the investigation of noted "high emission" vegetation, and the investigation of the effect of fuel conditions, fuel load, and fuel size.

The first stage of this process has involved work monitoring firefighter exposure during Victorian bushfires in 2006/2007 and at prescribed burning activities conducted in Eastern Australia. Atmospheric sampling focused on two main areas: 1. personal monitoring, with samples collected in the breathing zone of active firefighters, and 2. local environment samples, collected with vehicle mounted instrumentation.

The second stage has involved small scale simulated burns, with sample collection using a specially designed high volume sampler. By establishing a carbon balance, emission factors for specific chemical species have been determined for different fuel types under different conditions.

This project is ongoing and will be further expanded to include: field sampling in different regions of Australia, a continuation of the simulated burn program to investigate different fuels, and further particle characterisation using specific techniques.