Characterisation of Particle Emissions from the Combustion of Different Australian Vegetation

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Introduction

It is well known that bushfires generate high levels of particulates of various sizes, and may present a significant hazard to firefighter health. While there have been studies on the relationship between the particulate load from bushfires and the incidence of asthma [Johnston, *et al.*,2002], there appears to have been **no** studies conducted on the organics and heavy metals being transmitted via the particulates from Australian vegetation combustion.

Project aim

Characterisation of the volatile organic components and heavy metals adsorbed to particulates generated in bushfires

• Evaluation of Firefighter exposure
• Determination of emission factors (EF's) for typical vegetation
• To investigate noted "high emission" vegetation
• To investigate effects of fuel conditions/fuel load/fuel size

Fire ground monitoring

To monitor particles on the fire ground, a specially designed sampling box was constructed to be mounted on active fire vehicles. Including:

• Micro pump fitted with 32 mm quartz filter and PUF plug

• Microvol pump with a 47mm teflon filter and PM2.5 impactor

• Dustrak/Q-trak and GPS

Methodology

Following two directions: 1. Collection of particles during fire fighting activities, and 2. Collection of particles in controlled experiments. Followed by chemical analysis.

Particle collection using 'The Woozle'

The Woozle is a high volume sampler (0.9 to 1 m^3 min^{-1}) originally intended to sample dioxins emitted from bushfires. Including:

• An 8 x 10" quartz filter

• A PM 2.5 Dustrak upstream of the filter.

• A CO_2 gascard, a Q-trak and a Hydrocarbon analyzer drawn from the main sample line downstream of the filter.

• $[CO_2]$, $[CO]$, $[CH_4]$, $[NMHC]$, $[PM]$, enable carbon mass balance EF's

Characterisation

Medium/instrument	Characterisation
Quartz filter (10x8" and 32mm)	Particle mass, PAH's, TC, OC, EC.
PUF (polyurethane Foam) plug	Semi volatile PAH's
47mm Teflon filter	Mass, Water soluble Ion (WSI)s, Levoglucosan (LG)
Hydrocarbon analyser	CH4/NMHC
Q-trak	CO2/CO
Dustrak	PM2.5
Gas card	CO2

So far…Carbon analysis

Samples from 06-07 Bushfires and Victorian prescribed burns have been analysed for TC, OC, and EC.

• The results show high OC/EC ratios for both eucalypt and pine samples
• The high OC/EC ratio may indicate the formation of secondary organic species
• The high OC/EC ratio may also indicate the presence of harmful organic species

Organic Carbon/Elemental Carbon for Two Vegetation Types
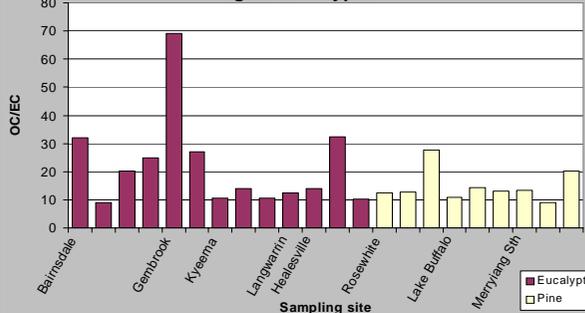
Next

• Further field sampling

  • QLD / WA / NSW

• Continued 'Woozle' sampling

  • Fuel moisture / fuel size / fuel type

• Analysis for PAH's, WSI, and LG

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