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The chemical composition of particulate matter in Cork city centre

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Numerous studies worldwide have highlighted the detrimental effects of airborne particulate matter (PM) on human health. The toxicity of airborne PM is dependant on two factors; size and chemical composition. Generally the smaller the particle the greater the toxicity, leading to the classification of PM_{10} (particulate matter with a diameter less than 10 μm) and $PM_{2.5}$(less than 2.5 μm). PM_{10} passes the initial clearance mechanisms in the nose and throat and enters the lungs, so is termed the 'inhalable' fraction. $PM_{2.5}$ reaches the sensitive gaseous exchange regions of the alveoli, so is termed the 'respirable' fraction. The exact mechanism by which airborne PM exerts its toxic effect remains unclear. However, increasing the concentration of metals has been found to increase lung injury and acidity may play a role in increasing the bioavailability of these toxic components.

Seasonal sampling of $PM_{10-2.5}$ and $PM_{2.5-0.1}$ was undertaken using a high volume cascade impactor (HVCI) in Cork city centre, a background urban site and a background rural site. Microwave digestion coupled with inductively coupled plasma atomic emission spectroscopy (ICP-AES) was used to analyse 15 crustal and anthropogenic trace metals (Ca, Fe, Ni, Zn, Mg, Pb, Mn, Cr, V, Cd, Cu, Si, As, Ti, Al) and an aqueous extract was also analysed to quantify the solubility (bioavailability) of the different metal components. Ultrasonic water extraction followed by ion chromatography (IC) was utilised to quantify seven anions (fluoride, chloride, bromide, nitrite, nitrate, sulphate and phosphate) and six cations (lithium, sodium, ammonium, potassium, magnesium and calcium) and the relative acidity was measured using the sulphate to ammonium ratio. This information on chemical composition will be vital in an upcoming source and distribution modelling study due to commence mid 2006.