

The rise, fall and remobilisation of industrial lead contamination in Australia

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Abstract

Gasoline lead additives resulted in more than 240,000 tonnes of lead being emitted to the Australian environment between 1932 and 2002. Industrial lead emissions and subsequent depositions caused widespread contamination of urban and peri-urban aerosols, soils, plants, animals, and humans. This paper details these emissions using environmental archives and proxies and examines the extent of recovery from the 20th century insult from lead contamination. Remobilisation of industrial lead is examined via analysis of lead sources in aerosols and ash emitted during wildfires between 1994 and 2012. Proxy atmospheric measurements of historical wine, lichen and fungi samples from the last 150 years show that lead concentrations and its isotopic composition values shifted in the middle to late 20th century to reflect gasoline emissions. Recovery from the environmental insult occurred rapidly at the end of the century as lead gasoline additives were phased out. Lead isotopic composition of aerosol filters from Adelaide and Sydney show that air lead composition shifted from values that approximate Broken Hill type ores, the predominant lead source used in gasoline ($^{206}\text{Pb}/^{207}\text{Pb} = 1.04$; $^{208}\text{Pb}/^{207}\text{Pb} = 2.32$), towards ratios that more closely match local uncontaminated soil and bedrock values in Adelaide ($^{206}\text{Pb}/^{207}\text{Pb} = 1.21$; $^{208}\text{Pb}/^{207}\text{Pb} = 2.52$) and Sydney ($^{206}\text{Pb}/^{207}\text{Pb} = 1.14$; $^{208}\text{Pb}/^{207}\text{Pb} = 2.44$). However, recovery from historic industrial lead contamination is incomplete. Measurements of contemporary surface soils, ash produced from wildfires and aerosols demonstrate legacy industrial lead depositions are declining but are still subject to remobilisation.