ABSTRACT

In the midst of Australia's 'Black Summer' of bushfires in 2019-20, South Australia experienced numerous days of extreme heat, drying out vegetation and steadily increasing tinderbox conditions. On 20 December 2019, a day of catastrophic fire danger, a pine tree in the Adelaide Hills fell and hit a powerline, sparking a blaze which by the end of the day had torn through forest, orchards, vineyards, pasture and homes. By the end of the day the Cudlee Creek bushfire had torn through over 23,000 ha in the upper reaches of the River Torrens, Onkaparinga River and Bremer River catchments.

The impact on watercourses of contaminants generated and remobilised through bushfire remains an under-investigated area of environmental research, which is of concern in the Australian context, where climate change may mean that 'Black Summers' occur more frequently. In forest catchments like in the Cudlee Creek bushfire area, vegetation acts as a stabilising force for soils, and acts to filter excessive or undesirable nutrients before they enter sensitive watercourse environment. However, bushfires in these areas turn the benefits of forest catchments around; vegetation becomes fuel, creating carcinogenic polycyclic aromatic hydrocarbons (PAHs) from incomplete combustion which can adsorb to ash and be distributed widely, while contaminants held in situ vegetation are remobilised. Runoff of sediments containing these contaminants poses a threat to the health of the watercourses and to the people who rely on them.

This research investigated the water courses in the Cudlee Creek bushfire to determine if concentrations of trace metals and PAHs were affected by the bushfire event. As an extension to that aim, this research also investigated whether the Cudlee Creek bushfire affected water safety in the Adelaide Hills region. The use of Graphical Information Systems (GIS) software was used to investigate the characteristics of the catchments and assess the severity of the burning, from which a sampling plan of watercourses was devised. Over the course of six monitoring events, samples of surface water were collected to test for metal and PAH concentrations in areas of the River Torrens and Onkaparinga River catchments. A photo set of all the sampling locations was also used to create a visual log of the area and support the quantitative research by assessing the health of the riparian vegetation along the watercourses.

Testing of the samples collected in this area found no strong evidence of increased concentrations of metals attributable to the Cudlee Creek bushfire. No PAHs were detected in the area, but limits in PAH testing, and the evidence of low metal mobilisation coupled with the strong recovery of riparian vegetation in the Cudlee Creek bushfire area suggested that there were no ongoing contaminant effects by PAHs.

This research acts as a solid basis of knowledge that will act to further develop the understanding of the relationship between metals and PAHs, and the impact of bushfire events on their concentrations in the watercourse. This research represents a base from which further research into the sensitivities of waterbodies in post-fire forest catchments can be developed and adapted.

Key Words: trace metals, polycyclic aromatic hydrocarbons (PAH), bushfire, watercourse contamination, contaminant mobilisation, forest catchment