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Development of a standardised protocol for sampling, analysis and risk assessment of Volatile Organic Compound (VOC) emissions from museum display cases

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ABSTRACT

Display cases are one of the major tools used for preventive conservation of objects housed in museums and cultural institutions. The materials used in the manufacture of cases are known to frequently off-gas after assembly, releasing Volatile Organic Chemicals (VOCs), especially formaldehyde and acetic acid. These VOCs accumulate within the case and can have negative effects on the artefacts they are supposed to protect. Museum employees carrying out exhibition changes or maintenance often note VOC presence as a chemical odour when cases are opened. Methods such as the Oddy Test have been developed in the past to identify VOCs present in showcases (Oddy 1973), but most are qualitative in nature and highly subject to differences in experimental procedure (Appelbaum 1991, Green and Thickett 1994, Thickett and Lee 2004). Sampling using air pumps and analysis using gas chromatographic mass spectroscopy (GCMS) have been used to provide more quantitative identification of VOCs in showcases, but the skills and equipment to provide these services are usually held by analytical contractors external to the museum. Cultural and contractual divisions between museum staff and analytical providers can result in tests being expensive, and not well targeted to effectively identify the materials and practices that result in off-gassing within the museum environment.

In 2015 the Australian War Memorial (AWM) initiated a collaboration with the University of Canberra to develop a more holistic approach to problem solving in this area. The project has two principal components: the development of a reproducible and accurate protocol for the sampling and analysis of compounds off-gassed from showcase materials, and evaluation of the results in the light of shared information about museum and scientific practices.

Work so far has identified two sample collection options – passive sampling using solid phase micro extraction (SPME) (reported in Ryhl-Svendsen & Glastrup, 2014, and Lattuati-Derieux et al, 2003), and

Capillary Micro-extraction of Volatiles (CMV) which can be coupled with a pump for airflow monitoring and larger sample collection (Guerra & Almirall, 2008, Tarifa & Almirall, 2015, Fan & Almirall, 2014). Samples will be analysed using Gas Chromatography Mass Spectroscopy (GCMS). This paper will describe the identification of reliable sample collection and analysis protocols that take into account the realities of museum exhibition and maintenance regimes, and evaluation of the results through an interdisciplinary, iterative discussion process.

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