

Forensic science shaping policing investigations

More than 1.5 million tonnes of ammonium nitrate are manufactured in Australia each year for mining, industrial, chemical and agricultural uses. The chemical can also be used as powerful explosive and the AFP is determined to address criminal use by applying forensic science as a law enforcement tool.

The National Manager of AFP Forensic and Technical, Dr James Robertson, says the Chemical Criminalistics team is one of many services within his portfolio which maintains a strong research and development focus that contributes to the success of AFP intelligence and operational efforts.

“One of the projects which Chemical Criminalistics team leader Sarah Benson and her team have been researching is the use of Isotope Ratio Mass Spectrometry (IRMS) to assist with crime detection and reduction,” Dr Robertson said.

The team has been using IRMS to explore its potential to identify a unique set of characteristics (characterisation) of particular samples of explosives such as ammonium nitrate. This raises the possibility of establishing that chemicals found at a staging point and chemicals found at a blast site have a common origin. The thinking behind the technique is that a particular batch of a chemical will develop an individual stable isotope composition depending on its origin, handling and storage history.

“As part of responding to a post-blast investigation where ammonium nitrate may have been used, the team tests a



Above: a post-blast investigation site. Far right: the Isotope Ratio Mass Spectrometry as used by the Chemical Criminalistics team

hypothesis: that the explosives recovered from a suspect’s house originated from the same source as the explosives used in the explosion under investigation,” Ms Benson said.

Representing the AFP, Dr Robertson and Ms Benson have collaborated with academic and industry partners in researching the characterisation of ammonium nitrate. The findings from this project have demonstrated that the IRMS technique is scientifically sound and fit-for-purpose in the forensic analysis of explosives.

Ms Benson is also undertaking a PhD at the University of Technology Sydney (UTS) on the topic of the analysis of explosives using IRMS and has collaborated with Australian explosive manufacturers to obtain sufficient samples for analysis.

“I have been analysing explosives in an attempt to individualise them and to be able to conclusively link two or more samples,” Ms Benson said. “This is evidence that is not currently achievable with regards to conventional explosive residue analysis.”

Ms Benson and co-authors Chris Lennard, Professor of Forensic Studies at the University of Canberra, Dr Philip Maynard, Lecturer at Centre for Forensic Science, UTS and Professor Claude Roux, Director at Centre for Forensic Science, UTS, recently received an award for Best Literature Review Paper for 2006 from the National Institute of Forensic Science.

“The paper, *Forensic applications of isotope ratio mass spectrometry – a review*, has remained in the top 25 downloads from Science Direct, which is a highly regarded web-based library resource for scientific, technical and



medical information,” Ms Benson said.

(An abstract from this paper at the end of this article highlights the applications of IRMS in the analysis of explosives, ignitable liquids and illicit drugs.)

As *Platypus* goes to press, Ms Benson will be presenting a paper at the third Forensic Isotope Ratio Mass Spectrometry network conference from 26 to 29 November in New Zealand.

The AFP is a key sponsor and the conference will bring together chemists, physicists, material scientists and life scientists who use the IRMS technique in their disciplines. Participants will have the opportunity to share knowledge and expertise on how this technique has the capability to assist with crime detection and reduction.

Traditionally, the IRMS technique has been applied in fields such as geology and environmental science. In the past few years, the international forensic community has discovered through significant research and development, the potential IRMS has to offer to criminal investigation. The AFP has also been at the forefront researching the use of stable isotopes and will report its findings to key forensic practitioners and academics attending the conference from around the globe.



Abstract, Forensic applications of isotope ratio mass spectrometry – A review, 2006

The key role of a forensic scientist is to assist determining whether a crime has been committed and if so, assist in the identification of the offender. Many people hold the belief that a particular item can be conclusively linked to a specific person, place or object. Unfortunately, this is often not achievable in forensic science. In performing their role, scientists develop and test hypotheses. The significance of those hypotheses that cannot be rejected upon completion of all available examinations/analyses is then evaluated.

Although one can generally identify the substances present using available techniques, it is generally not possible to distinguish one source of the same substance from another. In such circumstances, although a particular hypothesis can not be rejected, it can not be conclusively proven, i.e., the samples could have

originated from different sources.

This limitation of not being able to distinguish between sources currently extends to the analysis of other forensic samples including, but not limited to, ignitable liquids, paints, adhesives, textile fibres, plastics, and illicit drugs.

Stable IRMS is an additional technique that can be utilised to test a given hypothesis. This technique shows the potential to be able to individualise a range of materials of forensic interest.

This paper provides a brief description of the technique, followed by a review of the various applications of IRMS in different scientific fields. The focus of this summary is on forensic applications of IRMS in the analysis of explosives, ignitable liquids and illicit drugs.

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