

# Forensic Science Standards: Minimizing contamination in products used to collect and analyse biological material for forensic purposes

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## Introduction

The Australia New Zealand Policing Advisory Agency National Institute of Forensic Science (ANZPAA NIFS) have been part of a Standards Australia Forensic Analysis Committee established in 2009 to develop a range of forensic standards for use in Australia. The forensic Standards are based on internationally recognised and accepted practices and procedures and will ensure that the use of forensics is robust, repeatable and consistent across all jurisdictions in Australia.

The framework for the forensic standards development consists of four core standards (described in detail in two accompanying papers) that provide a comprehensive matrix and are applicable to the majority of forensic science disciplines. These can then be supported by the development of discipline specific forensic science standards, referencing the core standards for the more universal aspects of forensic science practice such as collection of forensic material, examination techniques, interpretation of analytical results and reporting findings (see Figure 1).

The effectiveness of DNA profiling as an investigative and evidentiary tool is weakened by sample contamination. Contamination occurs when extraneous DNA is mixed with the DNA relevant to the case. This can occur at many points in the forensic process from the crime scene to the laboratory, and including the manufacture of consumables and products used by crime scene examiners or within the laboratory. A discipline specific Standard was identified for development early to address this issue.

## Manufacturer-Based Contamination Incidents

In the 'Phantom of Heilbronn' case, German police spent eight years, an estimated two million euros and over 16,000 hours of overtime searching for a 'female serial killer' linked to over 40 crimes across Germany, Austria and France.

The DNA was linked to the murder of a female church warden in 1993, the murder of a 22 year old policewoman in 2007 and the execution-style killings of three Georgian car dealers. The number and diversity of the crimes had raised the suspicion of contamination, however, this was also mitigated by evidence appearing to support matches in several cases. For example, the profile was reproduced, in two of the murder cases, by sampling similar traces.

The investigation was also complicated by several factors. These factors included: the geographical disparity of the crime scenes; the lack of pattern in her list of accomplices (including Slovaks, Serbs, Romanians, Albanians and Iraqis); that persons convicted for some of the crimes denied her existence; she had not been captured on any security camera; and that certain witnesses described her as looking like a man (see Figure 2).

Investigators suspected that batches of cotton swabs had been contaminated with DNA from an employee at a firm in Bavaria who boxed the cotton swabs. The contamination was later confirmed by a German forensic laboratory. The swabs were used by police forces in several European countries.

DNA contamination by staff associated with the manufacturing of consumables used in the DNA analysis process, such as eppendorf tubes and other plastic wear, has been found to have occurred in numerous countries including Europe, the United States and New Zealand. Recently a link between three US laboratories was found on plasticware contaminated with a female DNA profile.

In Australia, up to 37 incidents have been reported in recent years, including a match to the UK Forensic Science Service manufacturer elimination database. A male DNA profile has been found in PCR kit reagents in four State/Territory government laboratories. Additionally, a female profile has been located on swabs used in two States. Clearly manufacturer contamination continues to be a major issue.



Figure 1. The forensic science development framework in Australia.



Figure 2. The witness description of the 'Phantom of Heilbronn'.

## Minimising the risk of contamination in products used to collect and analyse biological material for forensic DNA purposes

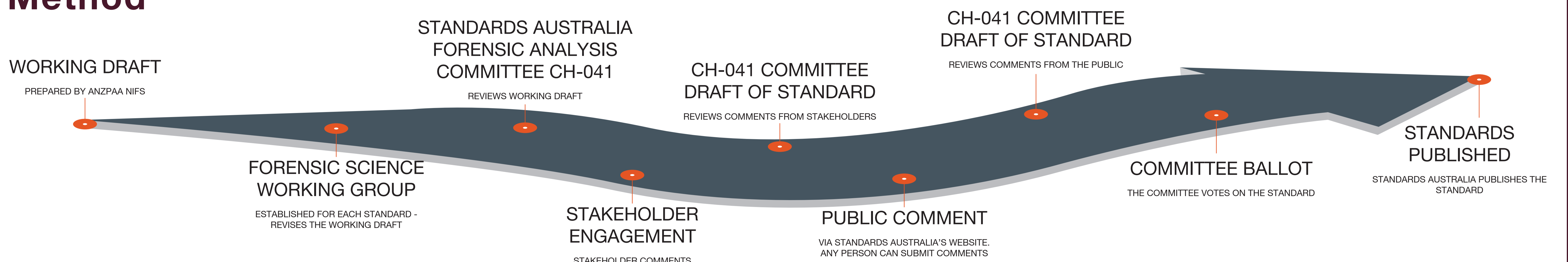
The Australian Standard, 'Minimizing the risk of contamination in products used to collect and analyse biological material for forensic DNA purposes' has been published as an Australian Standard. Standard AS 5483-2012 sets the criteria around which consumables used in forensic DNA collection and analysis should be manufactured to ensure the consumables are free of amplifiable and detectable human DNA.

- The Standard covers the following types of products:
- products that come into direct contact with biological stains or material potentially containing human DNA
  - chemicals, reagents and solvents and some disposables involved in the analysis of human DNA products used in areas where human DNA is collected or analysed products used in the collection of human DNA.

- It details a quality system including:
- documentation and environmental provisions, setting criteria for the following environments: Manufacturing environments, Sensitive environments and Critical Environments
  - requirements for quality assurance and monitoring of the sensitive and critical environments, including testing requirements and pass/fail criteria
  - requirements for post production treatment of products, which could be one of the following: radiation techniques such as ultraviolet (UV), gamma irradiation (GR) and electron beam processing (EB) and chemical techniques such as ethylene oxide (EO)
  - requirements for quality assurance and monitoring of contamination elimination and prevention measures, including guidance on sampling, test methods, results and reporting
  - requirements for product packaging and labelling.

The Standard also includes some informative information on compliance testing, which targets methods of detecting human DNA fragments that are of sufficient size and/or quantity to interfere with current forensic DNA analysis methods. The Standard has been used as a draft for a proposal to ISO for development of a similar international standard.

## Method



## Affiliations

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