

**THE EFFECTS OF BIOLOGICAL  
DECONTAMINATION ON THE  
RECOVERY OF CRITICAL  
FORENSIC EVIDENCE**

by

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A thesis

submitted as requirement for the  
degree of Doctor of Philosophy (Science)

University of Technology, Sydney

Faculty of Science

## Certificate of Authorship and Originality

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## **Abstract**

The principle objectives of this research were: (i) to investigate gamma irradiation and formaldehyde gas as successful decontamination options for the destruction of bacterial spores; (ii) determine their impact, within the context of a biological crime, on the recovery of selected evidence types; and (iii) develop triage systems for contaminated evidence.

Substrates including paper, plastic, glass, electronic devices and firearms were contaminated with viable bacterial spores, and subjected to the decontamination methods developed. The effects of these methods were tested by comparing evidence recovered both pre and post decontamination. Evidence types recovered included; latent fingerprints, DNA, electronic data and firearm related toolmarks.

An exposure range of between 40-90 minutes for formaldehyde gas was determined effective compared to the standard 12-hour, laboratory based procedure. Experiments determined a detrimental interaction between formaldehyde gas and amino acids, with a reduction in recovery rates for latent fingerprints and DNA from porous items. Formaldehyde did not however affect the recovery of electronic data or firearm markings. Based on the collective results formaldehyde gas decontamination is recommended for use on non-porous items such as glass, plastic and metal, with emphasis on electronics and weaponry, yet would not be recommended for use as a primary decontaminant for porous items or items where DNA evidence is required.

Test items were also subjected to a range of gamma doses to determine the effective kill curves based on log reductions. Successful decontamination was achieved between 5-10 kGy, depending on the sample type. Gamma irradiation did not affect the recovery of latent fingerprints, firearm comparisons or DNA from paper. Significant damage to electronic devices was observed at the levels required for bacterial spore death; therefore, gamma irradiation is not recommended where data is the primary evidentiary concern.

This research has explored the notion that no one biological decontamination option is suitable for all substrates or all evidence types. It has demonstrated, through the development and validation of specific decontamination methods, that both formaldehyde gas and gamma irradiation can be applied successfully to certain substrates prior to recovering forensic evidence.

The ability to recover vital evidence from the scene of a biologically contaminated crime scene, be it through an act of terrorism or inadvertent release, is a valuable tool to the forensic analyst and an emerging concept in the field of forensic microbiology.