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***MICROBIOLOGICAL AEROSOLS IN
DRAINAGE SYSTEMS***

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A thesis submitted in fulfillment of the requirements for the degree of Doctor of
Philosophy (PhD) - Architecture

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ABSTRACT

Drainage codes exist to provide appropriate and safe means of disposal of effluent from buildings. If it is seen that those codes may not be written in a way which leads to an assured appropriate outcome, then they need to be questioned. Accordingly, this thesis follows up on the author's concerns regarding the approach taken to the layout of drainage under today's building regulatory regime. Under the New Zealand Building Code any standards may be used or any approach may be taken to methods of building, drainage and plumbing, providing the approach used can be justified as complying with the non-prescriptive objectives and performance requirements of the Building Code.

Under this approach drains are now being installed more often under buildings with their maintenance access points within the building. This situation, and the consequent likely emission of microbiological aerosols, are cause for concern: that is the airborne release of microscopic particles. The "*Report of the Departmental Committee - Intercepting Traps in House Drains*" of 1912 from the UK, parts of which are quoted in Section 7.0, reinforced these concerns of the author.

But these concerns were not shared by many others who have a major influence on the form and shape of our buildings, and it was assumed that current code requirements may not have been based on any significant research. Based on a relatively widespread lack of knowledge, there was a scenario of doubt and denial as to whether or not there were shortcomings in current code requirements in New Zealand. This provided incentive for the research project within this thesis, on the basis that there may be encouragement for future code requirements to be based on even more research in order to confirm their validity.

This thesis demonstrates that the ambiguity in existing approved methods of compliance with current building codes fails to adequately protect the populace from adverse potential health effects.

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TABLE OF ABBREVIATIONS

ACGIH	The American Council of Governmental Industrial Hygienists
AS 2	Acceptable Solution 2 of the New Zealand Building Code
AS 3500	Australian Standard 3500 - The National Plumbing and Drainage Code
ASTM	American Society of Testing and Materials
BIA	Building Industry Authority - the controlling authority for all building and drainage matters in New Zealand.
BS	British Standard
cfu	colony-forming units
<i>E coli</i>	<i>Escherichia coli</i> (faecal bacteria)
EHO	Environmental Health Officer
G3	Approved Document <i>Food Preparation and Prevention of Contamination</i> of NZ Building Code.
G4	Approved Document <i>Ventilation</i> of NZ Building Code.
G13	Approved Document <i>Foul Water</i> of NZ Building Code.
HSE	Health and Safety in Employment Act 1992
HVAC	Heating, ventilating and air conditioning (system)
mycotoxins	toxins produced by fungi
µm	micrometre (micron) = 10 ⁻⁶ metre
NZBC	New Zealand Building Code.
NZS	New Zealand Standard
RH	relative humidity
SBS	Sick Building Syndrome
TA	Territorial Authority (eg City or District Council).
VM	Verification Method of NZ Building Code.
WC	water closet (toilet)