

UNIVERSITI TEKNOLOGI MARA

**ENVIRONMENTAL EXPOSURE ON
LEGIONELLA SPP. IN COOLING SYSTEMS AT
SELECTED HOSPITALS IN KLANG VALLEY**

MUHAMMAD RUSHDI BIN IBRAHIM

**Dissertation submitted in partial fulfilment for the
requirements
for the degree of
Environmental Health and Safety**

Faculty of Health Sciences

MAY 2010

DECLARATION

I hereby declare that this dissertation is my original work, which is not previously and concurrently submitted by any other person at UiTM or other institutions.

MAY 2010

A handwritten signature in black ink, consisting of a large, stylized initial 'R' followed by a horizontal line and a short vertical stroke.

MUHAMMAD RUSHDI IBRAHIM

870126-02-5799

2006841107

ACKNOWLEDGEMENT

Bismillahirrahmanirrahim.

First of all, I would like to thank God for his Mercifulness, I am still able to produce this report as a sign that I am one step forward in ending my study in the University and advance into the adulthood and the working life. I would like to thank Mr. Hashim Ahmad for his endless guide and advice as well as motivation to keep me going. He is now my mentor, and I would be proud to see and call myself as his apprentice. May the sky be your limit in all your future endeavours and may Jannatul-Firdaus be your abode in the hereafter. I also would like to express my highest gratitude to the lab technician, Mr. Shahfie Md. Latep and Mr. Muhamad Azwat Abdullah who has helped me in various aspects tirelessly. Not to forget the lecturers and friends.

On top of that, I would like to thank the management of Kuala Lumpur Hospital, Sungai Buloh Hospital and Serdang Hospital as well as its facility service management (Radicare Sdn. Bhd.) for their willingness and cooperation for me to conduct the study there. Now I know a lot about cooling systems, particularly cooling tower. Lastly, I would like to thank the staffs of Universiti Teknologi Mara (UiTM), academic and non-academic wise for the chance given to me to change the future of myself and my family. These four years have been brutally enriching and exciting.

Finally, my acknowledgment will be incomplete if I left out my parents and family. Thank you for your endless love, support and patience. I dedicate this dissertation to both of you. God bless you.

Muhammad Rushdi Ibrahim

TABLE OF CONTENTS

TITLE PAGE	
DECLARATION	iv
ACKNOWLEDGEMENTS	vi
TABLE OF CONTENTS	vii
LIST OF TABLES	x
LIST OF CHARTS	xi
LIST OF FIGURES	xii
LIST OF PLATES	xiii
LIST OF EQUATIONS	xiv
LIST OF ABBREVIATIONS	xv
ABSTRACT	xvi
CHAPTER ONE: INTRODUCTION	
1.0 Introduction	1
1.1 Background	1
1.2 Problem statement	2
1.3 Justification	3
1.4 Objectives	4
1.5 Hypotheses	4
1.6 Conceptual framework	5
1.7 Conceptual & operational definitions	7
1.8 Keywords	8
CHAPTER TWO: LITERATURE REVIEW	
2.0 Literature review	9

Environmental exposure of *Legionella spp.* in cooling systems at selected hospitals in Klang Valley

Muhammad Rushdi Ibrahim

Abstract

This paper describes the environmental exposure of *Legionella spp.* at three ($n=3$) selected hospitals in the Klang Valley. The study involves the isolation of *Legionella spp.* using positive pressure membrane filtration method, and then the calculation of exposure dose. The exposure dose is then plotted onto the satellite map at the sampling location, indicating the environmental exposure to the residential population. The results showed that 20% of the cooling towers in Kuala Lumpur were contaminated; 11% for Sungai Buloh; and 66.67% of cooling towers in Serdang Hospital was contaminated. The exposure dose ranges from 0.90 cfum³/mL/kg/day to 50 cfum³/mL/kg/day. There is a significant difference between the bacterial growth for morning and evening sample, due to the evening sample taken on microbiocide treatment day ($p= 0.005$). Chlorine was used as disinfection method for the cooling water, but there is a significance difference between the concentrations of free chlorine on the sample with the standard concentration based on standard by Ministry of the Environment Singapore ($p= 0.00$). Statistical analysis also revealed that treatment using microbiocide is significantly associated with the bacterial growth ($p= 0.009$). Nevertheless, in order to determine the overall environmental exposure, the cooling towers in other buildings and also environmental factors such as weather, wind direction and velocity has to be considered. The low number of Legionnaires' disease is also linked with the formation of anti-*Legionella* antibodies, but further research is needed to confirm this. As a conclusion, *Legionella spp.* was isolated in the cooling towers ($n=31$) of selected hospitals in Klang Valley, with the exposure dose up to 50 cfum³/mL/kg/day. Chlorine was used to disinfect the cooling water, but the dose is not up to the referral standard from Singapore.