DETERMINATION OF ACTIVITY CONCENTRATION OF RADON-222 BY USING ITS DAUGHTER PROGENY PLUMBUM-214 AND BISMUTH-214 AND POTASSIUM-40 FROM CAMERON HIGHLAND BY USING GAMMA SPECTROMETRY

CHE YASMIN BINTI AMIRUDIN

Final Year Project Report Submitted in Partial Fulfilment of the Requirements for the Degree of Bachelor of Science (Hons.) Applied Chemistry In the Faculty of Applied Sciences Universiti Teknologi MARA

MAY 2010
This Final Year Project Report entitled **“Determination Of Activity Concentration Of Radon-222 By Using Its Daughter Progeny Plumbum-214 And Bismuth-214 And Potassium-40 In Water from Cameron Highland By Using Gamma Spectrometry”** was submitted by Che Yasmin Binti Amirudin, in partial fulfillment of the requirements for the degree of Bachelor of Science(Hons.) Applied Chemistry, in the Faculty of Applied Sciences, and was approved by

Prof. Madyjadi B. Haji Hamzah  
Supervisor  
B.Sc. (Hons.) Applied Chemistry  
Faculty of Applied Sciences  
Universiti Teknologi MARA  
40450 Shah Alam  
Selangor

Mrs. Sabarina B. Md Yunus  
Co-supervisor  
B.Sc. (Hons.) Applied Chemistry  
Faculty of Applied Sciences  
Universiti Teknologi MARA  
40450 Shah Alam  
Selangor

Miss Sabrina Binti M. Yahaya  
Project Coordinator  
B.Sc. (Hons.) Applied Chemistry  
Faculty of Applied Sciences  
Universiti Teknologi MARA  
40450 Shah Alam  
Selangor

Dr. Siti Halimah B. Sarijo  
Head of Programme  
B.Sc. (Hons.) Applied Chemistry  
Faculty of Applied Sciences  
Universiti Teknologi MARA  
40450 Shah Alam  
Selangor

Date: 19/5/2010
ACKNOWLEDGEMENTS

First and foremost, all praise is to Allah, the Almighty, the Benevolent for His blessings and guidance for giving us the inspiration to embark on this thesis and installing in all of us the strength and patience to complete this thesis entitled “Determination of Activity Concentration of Radon-222 by using its Daughter Progeny Plumbum-214 and Bismuth-214 in Water from Cameron Highland by using gamma spectrometer” become successful. Many people have contributed to complete this thesis in order to fulfill the requirement for Bachelor of Science (Hons.) Applied Chemistry at Universiti Teknologi MARA (UiTM).

My First sincere gratitude’s goes to Assoc. Prof. Dr. Haji Zaini Bin Haji Hamzah as my supervisor for his guidance, encouragement, moral supports, ideas, helpful, critics, comments, suggestions and kindness to enable me to complete this thesis report. I also would like to express my appreciation to Assoc. Prof. Dr. Ahmad Bin Saat, Director Institute of Science for their guidance especially in the instrumentation parts and analysis, sharing the information, ideas and also supports. I also glad to dedicate a special thank and appreciation to my parents for their moral support, advice, and expenditures for this thesis. To the Tenaga Nasional Berhad staffs, thank you for your co-operation and help during taking this water samples, especially to Encik Firdaus and also Encik Asmadi.

Last but not least, I am also want to give a special thank to my theme work especially Seh Datul Redzuan for their help and give information regarding to this thesis and those who are involved and contributed directly and indirectly during collected samples at ‘Empangan Sultan Abu Bakar”, Ringlet, Cameron Highland, Malaysia.

Che Yasmin Binti Amirudin
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACKNOWLEDGEMENTS</td>
<td>iii</td>
</tr>
<tr>
<td>TABLE OF CONTENTS</td>
<td>iv</td>
</tr>
<tr>
<td>LIST OF TABLES</td>
<td>vi</td>
</tr>
<tr>
<td>LIST OF FIGURES</td>
<td>vii</td>
</tr>
<tr>
<td>LIST OF ABBREVIATIONS</td>
<td>ix</td>
</tr>
<tr>
<td>ABSTRACT</td>
<td>x</td>
</tr>
<tr>
<td>ABSTRAK</td>
<td>xi</td>
</tr>
</tbody>
</table>

## CHAPTER 1 INTRODUCTION

1.1 Water                                      | 1    |
1.2 Problem Statement                          | 3    |
1.3 Significant of Study                       | 3    |
1.4 Objectives of Study                        | 4    |
1.5 Scope of Work                              | 5    |

## CHAPTER 2 LITERATURE REVIEW

2.1 Radon                                      | 6    |
2.2 Sources                                    | 9    |
2.2.1 Natural Sources of Radiation             | 10   |
2.2.2 Man –Made Sources of Radionuclides       | 11   |
2.3 Radioactive Decay                          | 12   |
2.4 Effect of Radon                            | 13   |
2.5 Gamma Spectroscopy                         | 17   |
2.5.1 Instrumentation                          | 17   |
2.5.2 Type of Detector                         | 19   |
2.5.3 Sample Measurement                       | 20   |
2.6 Previous Study                             | 21   |

## CHAPTER 3 METHODOLOGY

3.1 Study Site                                 | 27   |
3.2 Material                                   | 30   |
3.3 Sampling Method                            | 30   |
ABSTRACT

DETERMINATION OF ACTIVITY CONCENTRATION OF RADON-222 BY USING ITS DAUGHTER PROGENY PLUMBUM-214 AND BISMUTH-214 DAN POTASSIUM-40 IN WATER FROM CAMERON HIGHLAND BY USING GAMMA SPECTROMETER.

This thesis presents the result of investigation of the water samples from “Empangan Sultan Abu Bakar”, Ringlet, Cameron Highland, Pahang. The instrument used for counting this samples was low background gamma ray spectrometer. It is applied to determine the activity concentration of radon-222 in the water samples. Through this method the water samples will be counted with only germanium (Ge) detector using the gamma- ray spectrometer from the radon-222 daughter nuclides plumbum-214 and bismuth-214. Water sample collected are separated into filtered and unfiltered then directly poured into Marinelli beaker and sealed and stored for at least 3 weeks to reach radon-222 equilibrium before counting. The radon-222 activity concentration derived from γ-ray lines associated with plumbum-214 and bismuth-214 decay. However, the radon-222 activity concentration has not be measured directly but calculated from the assumption that, radon-222 is in transient equilibrium with its daughter plumbum-214 and bismuth-214 or by other criteria. In this study, the activity concentration of radon-222 is higher at location downstream for unfiltered which is 7.00±1.31 Bq/L at wet season and location five which is 6.18±1.34 Bq/L for filtered water samples also in wet season. While the lowest activity concentration of radon-222 investigated at location one which is 2.82±1.42 Bq/L for filtered and 4.69±1.38 Bq/L unfiltered sample which are both in dry season.