BUSITEMA UNIVERSITY
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FACULTY OF ENGINEERING

DEPARTMENT OF MINING AND WATER RESOURCES ENGINEERING

WATER RESOURCES ENGINEERING

FINAL YEAR PROJECT REPORT

Design and Simulation of a residual chlorine concentration monitoring system for a piped water distribution network

(Case study: NWSC-Tororo)

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A final year project report submitted to the Department of Mining and Water Resources Engineering as a partial fulfillment of the requirements for the award of a Bachelor of Science in Water Resources Engineering

May 2016

ABSTRACT

Water quality monitoring is an important responsibility of all water supply agencies which ensures the water received by their customers is of required quality and is free of all disease causing organisms. Disinfectant residual is normally used as the major water quality indicator and in NWSC, chlorine is used as the disinfectant. The recommended chlorine concentrations as per WHO are between 0.2mg/L and 0.5mg/L. The existing water quality monitoring techniques are manual, laborious and less effective in maintaining the residual chlorine concentrations within the recommended ranges, at the end of the water distribution network.

This project analyzes and reviews the water distribution network, the existing water quality monitoring techniques, and the likely causes of chlorine decay in the distribution system for example leakages/contaminant pathways, too old pipes, initial quality of the water distributed. The research data collection methods included literature study, consultations, and field visits and observations. The information obtained helped come up with the relevant requirements for the design and simulation of an appropriate residual chlorine concentration monitoring system.

The sampling points, where the systems are to be installed were established not randomly but based on a certain criteria. This was followed by the design of the system components like the sensor, microcontroller, GSM, LCD that are compatible with the existing water distribution network and networking to the phone. The monitoring system was simulated in proteus simulating environment with a code written in MikroC programming environment and gave the required results. The water quality personnel is notified via phone by the system in case of low concentrations (<0.2mg/L) and high chlorine concentrations (> 0.5mg/L).

From the previous field tests on residual chlorine in NWSC-T distribution network, it showed 7%, 21% and 72% occurrences of high, low and normal chlorine concentrations respectively. This means water quality deteriorations remain a serious problem with the many risks involved with consumption of contaminated and highly chlorinated water thus the urgent need for implementation of this automatic residual chlorine concentration monitoring system.

DECLARATION

I **IMOOT WINNIE, BU/UP/2012/631** hereby declare that, this report is a true work of my hands and has never been presented by any person or institution for an academic award.

Signature: .....

Date: 25th. 05. 2016.

APPROVAL

This piece of work has been approved by;

Main Supervisor

MR. WANGI MARIO

Signature.....

Date.....

Co-supervisor

MR. OKETCHO YORONIMO

Signature.....

Date.....

DEDICATION

This piece of work is dedicated to all those who have supported, guided and financed me throughout this level of education especially my parents, the staff of FAWE and NWSC-Tororo.

ACKNOWLEDGEMENT

I am very grateful to the Almighty God for the protection, guidance and good health He has provided to me.

In a special way, I would like also to thank my supervisors Mr. Wangi Mario and Mr. Oketcho Yoronimo for the advice, guidance and encouragement offered throughout the study.

I would like to thank the staff in the department of Mining and Water Resources Engineering and other lecturers for their guidance and assistance during the design project.

Sincere appreciation to the Staff of NWSC-Tororo, who granted me with the opportunity to carry out my design research from there. Great thanks to Mr. Ogire John and Mr. Etednal Fred for the guidance knowledge they accorded to me. May God bless you all!

I appreciate my parents for their guidance and financial support they rendered to me. May the Almighty God bless the works of their hands!

Finally I appreciate my friends who helped me to accomplish this project work especially Mwanja Samuel, Bukenya Francis, Maseruka Bendicto, Javan, Muhoozi Denis, Ajok Paska, Eberu Daniel, kwesiga Edith and Muhindo Loida. May the Good Lord bless and reward them with success in their endeavors.

LIST OF ABBREVIATIONS

NWSC	National Water and Sewerage Corporation.
WHO	World Health Organization
LCD	liquid-crystal display
DPD	diethyl-p-phenylene diamine
GSM	Geographical Systems Module
NWSC-T	National Water and Sewerage Corporation- Tororo
WDSD	Water Distribution System Deficiencies
mg/L	milligrams per liter
pH	Power of Hydrogen ion.
USEPA	Environmental Protection Agency
m^3	cubic meters
km	kilometers
GI	Galvanized Iron
HDPE	High Density Polyethylene
PVC	Polyvinyl chloride
T/R	Tororo Reservoir
M/T	Malaba Tank
S/W	Steel Works

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CHAPTER ONE

1.0 INTRODUCTION

This chapter entails relevant information about the project, problem statement, and justification, objectives of the study, purpose of the study and the scope of the study.

1.1 BACK GROUND

The major elements of a comprehensive potable water system multi-barrier approach include source water protection, treatment to remove harmful contaminants, disinfection to kill or inactivate disease-causing organisms, proper operation and maintenance of the distribution system, and water quality monitoring "to detect, preclude or solve water quality problems before they adversely affect public health" (Berman 17 et al., 1999; Ormeci and Linden, 2002).

Many municipalities have a comprehensive water quality monitoring program in place for their source water and treatment processes. Since water quality can change after leaving the treatment facility, monitoring water quality throughout the distribution system and responding to any changes is required. Residual disinfectant major water safety indicator and most surface water systems use chlorine as a disinfectant (USEPA, 2002a).

Contaminated water supplies are a source of epidemic diseases especially water borne diseases (WHO, 2009).

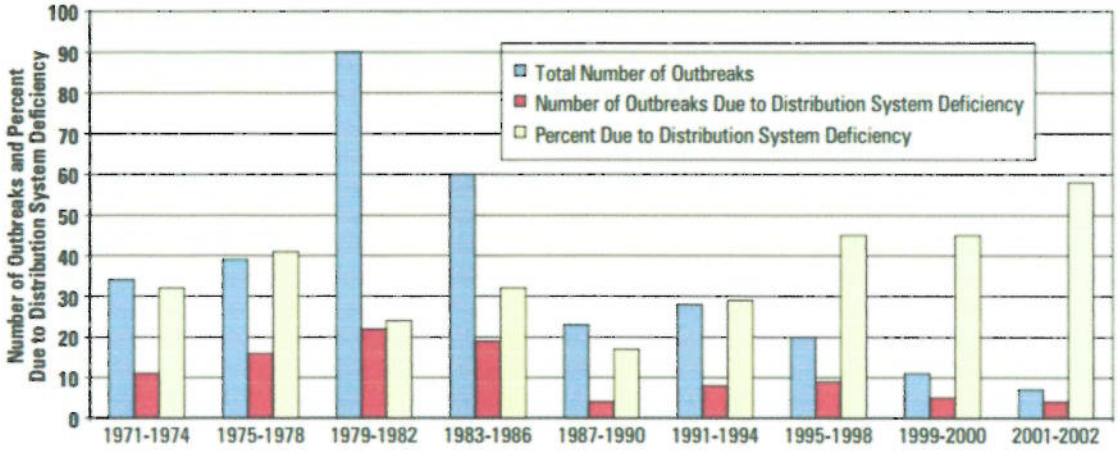

Figure1.1: The Proportion of Waterborne Diseases Associated with WDSD in U.S

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