

**THE WASTEWATER TREATMENT PLANT MANAGEMENT OF
COMMUNITY HOSPITAL, MINISTRY OF PUBLIC HEALTH
IN CENTRAL REGION.**



**A THESIS SUBMITTED IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS FOR
THE DEGREE OF MASTER OF SCIENCE (PUBLIC HEALTH)
MAJOR IN HOSPITAL ADMINISTRATION
FACULTY OF GRADUATE STUDIES
MAHIDOL UNIVERSITY
2004**

**ISBN 974-04-5575-1
COPYRIGHT OF MAHIDOL UNIVERSITY**

Copyright by Mahidol University

Thesis
Entitled

**THE WASTEWATER TREATMENT PLANT MANAGEMENT OF
COMMUNITY HOSPITAL, MINISTRY OF PUBLIC HEALTH
IN CENTRAL REGION.**

Suradej Pradihatuka

Mr. Suradej Pradihatuka
Candidate

Somchart Torugsa

Assoc. Prof. Somchart Torugsa,
M.D., M.P.H.(Hosp. Adm.), Thai board
of Com. Mental Health
Major-Advisor

Dr. P.

Assoc. Prof. Prayoon Fongsatitkul
Ph.D. (Env. Eng.)
Co-Advisor

Thavatchai Vorapongsathorn

Assoc. Prof. Thavatchai Vorapongsathorn
Ph.D. (Res. Des. & Stat.in Ed.)
Co-Advisor

Rassmidara Hoonsawat

Assoc. Prof. Rassmidara Hoonsawat
Ph.D.
Dean
Faculty of Graduate Studies

Somchart Torugsa

Assoc. Prof. Somchart Torugsa,
M.D., M.P.H.(Hosp. Adm.), Thai board
of Com. Mental Health
Chair
Master of Science (Public Health)
Major in Hospital Administration
Faculty of Public Health

Thesis
Entitled

**THE WASTEWATER TREATMENT PLANT MANAGEMENT OF
COMMUNITY HOSPITAL, MINISTRY OF PUBLIC HEALTH
IN CENTRAL REGION.**

was submitted to the Faculty of Graduate Studies, Mahidol University
for the degree of Master of Science (Public Health)
Major in Hospital Administration

On
October 8 , 2004

Suradej Praditbatuka
.....
Mr. Suradej Praditbatuka
Candidate

Somchart Tongsa
.....
Assoc. Prof. Somchart Torugsa,
M.D., M.P.H.(Hosp. Adm.), Thai board
of Com. Mental Health
Chair

Pr. P.
.....
Assoc. Prof. Prayoon Fongsatitkul
Ph.D. (Env. Eng.)
Member

Sukont Cheasakul
.....
Mr.Sukont Cheasakul
M.Sc. (Env. Sc.)
Member

Thavatchai Vorapongsathorn
.....
Assoc. Prof. Thavatchai Vorapongsathorn
Ph.D. (Res.Des. & Stat.in Ed.)
Member

Rassmidara Hoonsawat
.....
Assoc.Prof. Rassmidara Hoonsawat,
Ph.D.
Dean
Faculty of Graduate Studies
Mahidol University

Chalermchai Chaikittiporn
.....
Assoc Prof. Chalermchai Chaikittiporn,
Dr.P.H.(Epidemiology)
Dean
Faculty of Public Health
Mahidol University

ACKNOWLEDGEMENT

This research had been successfully accomplished with the great kindness of the Associate Professor Dr. Somchart Torugsa, chairman of the thesis committee; Assoc. Prof. Dr. Prayoon Fongsatitkul, Assoc. Prof. Dr. Thavatchai Vorapongsathorn and Mr. Sukont Cheasakul, the research committee. The author would like to thank them for all of their valuable time and help in the development of the concepts, consultation, improvement, and advice on the thesis.

The author thanked all community hospitals, ministry of public health in central region. They provided the data and do contributed for this research. My gratitude goes to five academic experts who inspected the research tools as well as the suggestions to improve the tools in this research. I also would like to take this opportunity to express my gratitude to every personnel of all the community hospitals. Without them this study can not be completed.

The author would like to express heartfelt appreciated to my elder sister and brothers, and my wife Mrs. Chananun Praditbatuka for their kind support and encouragement, which had made me successfully finish this study.

Suradej Praditbatuka

THE WASTEWATER TREATMENT PLANT MANAGEMENT OF COMMUNITY HOSPITAL, MINISTRY OF PUBLIC HEALTH IN CENTRAL REGION.

SURADEJ PRADITBATUKA 4236813 PHPH/M

M.Sc.(PUBLIC HEALTH) MAJOR IN HOSPITAL ADMINISTRATION

THESIS ADVISORS: SOMCHART TORUGSA M.D., M.P.H. (Hosp. Adm.),
PRAYOON FONGSATITKUL Ph.D.(Env. Eng.), THAVATCHAI
VORAPONGSATHORN Ph.D. (Res. Des. & Stat. in Ed.)

ABSTRACT

This research studied the wastewater treatment system management in 30-60 bedded community hospitals under the Ministry of Public Health, in the Central Region of Thailand. Samples of 33 community hospitals from the provinces located along the Chao Phraya River Basin, except those of Bangkok and Samutprakarn, were selected as designated targets. Four different sets of questionnaires were tested for structure and content validity by experts. Data were collected during the period April-June 2004. The reliability value was more than 0.7. Hospital directors who were responsible for the wastewater treatment system, public health officers or community health officials who controlled the system, daily workers on the system, and people residing around the hospitals were requested to answer the questionnaires. Data of analytical quality were collected on effluent and hospital effluent samples were analyzed for water quality. The data were analyzed using descriptive statistics and multiple stepwise regression, This look at the association of the factors regarding administrators, controllers and daily workers of the wastewater treatment system with wastewater quantity, B.O.D. value, and satisfaction of administrators, operators, and people. SWOT matrix analysis of the problems and obstacles facing management of wastewater treatment system was conducted based on questionnaires and statistics. The results of this analysis were used to establish managerial guidelines for the improvement and development of the hospital wastewater treatment system.

The research found that wastewater treatment cost was about 24 Baht per cu.m.. People who were admitted to the hospital were willing to pay a wastewater treatment fee of about 10 Baht per day. The generated volume of wastewater was about 40 ± 33 cu.m. per day, and 97% of the total wastewater was treated. The average effluent B.O.D. value was about 20.78 ± 14.72 mg/l. Hospital directors, controllers, workers, and people were satisfied with the wastewater treatment performance with average values of satisfaction being 3.5, 3.7, 3.3, and 3.6 out of 5 respectively. It was also found that the method (techniques and practice) and sufficiency of equipment were related to the satisfaction of the daily worker ($p < 0.005$), with a $R^2 = 0.797$. In addition, guidelines in improvement and development of wastewater treatment system performance were recommended with an emphasis on providing seminars, supervision for the treatment plant operators, an increase in the financial income, an effective and appropriate usage of materials, and promotion of people's participation in community hospital wastewater treatment.

KEY WORDS : COMMUNITY HOSPITAL , WASTEWATER TREATMENT
MANAGEEMNT, EFFLUENT, B.O.D. VALUE, SATISFACTION

161 pp. ISBN 974-04-5575-1

การจัดการระบบบำบัดน้ำเสียของโรงพยาบาลชุมชน กระทรวงสาธารณสุข ในเขตภาคกลาง
(THE WASTEWATER TREATMENT PLANT MANAGEMENT OF COMMUNITY HOSPITAL,
MINISTRY OF PUBLIC HEALTH IN CENTRAL REGION.)

สุรเดช ประดิษฐ์บาท 4236813 PHPH/M

วท.ม. (สาธารณสุขศาสตร์) สาขาวิชาเอกการบริหารโรงพยาบาล

คณะกรรมการควบคุมวิทยานิพนธ์ : สมชาติ ไตรักษา พ.บ.,ส.ม., ประยูร ฟองสถิตย์กุล Ph.D., ธวัชชัย

วรพงษ์ Ph.D.

บทคัดย่อ

การวิจัยครั้งนี้เพื่อศึกษาการจัดการระบบบำบัดน้ำเสียของโรงพยาบาลชุมชนขนาด 30-60 เตียง สังกัด กระทรวงสาธารณสุข ในเขตภาคกลางที่ตั้งอยู่ตามลุ่มแม่น้ำเจ้าพระยา ยกเว้น กรุงเทพมหานคร และสมุทรปราการ จำนวน 33 โรงพยาบาล เก็บรวบรวมข้อมูลในช่วงเดือนเมษายน-มิถุนายน 2547 โดยใช้แบบสอบถาม 4 ชุด ที่ได้ทดสอบความตรงตามโครงสร้างและเนื้อหาจากผู้เชี่ยวชาญแล้ว และมีค่าความเที่ยงมากกว่า 0.7 นำไปสอบถามผู้อำนวยการโรงพยาบาลซึ่งรับผิดชอบระบบบำบัดน้ำเสีย นักวิชาการสาธารณสุข หรือเจ้าพนักงานสาธารณสุขชุมชนผู้ดูแลควบคุมระบบบำบัดน้ำเสีย คนงานผู้ปฏิบัติงานประจำวัน และประชาชนที่อาศัยอยู่รอบ ๆ โรงพยาบาล เก็บรวบรวมข้อมูลการวิเคราะห์คุณภาพน้ำทิ้ง และทำการวิเคราะห์คุณภาพตัวอย่างน้ำทิ้งของโรงพยาบาล วิเคราะห์ข้อมูลโดยใช้สถิติพรรณนา และวิเคราะห์หาความสัมพันธ์ของปัจจัยด้านผู้บริหาร ด้านผู้ดูแลควบคุม และด้านคนทำงานประจำในงานระบบบำบัดน้ำเสีย กับปริมาณน้ำเสียที่บำบัดได้ ค่าบีโอดี ความพึงพอใจของผู้บริหาร ความพึงพอใจของผู้ปฏิบัติ และความพึงพอใจของประชาชน โดยใช้สมการถดถอยเชิงเส้นแบบขั้นตอน นำข้อมูลที่ได้มาทำการวิเคราะห์สวทจากข้อมูลปัญหาและอุปสรรคของการดำเนินการ และผลที่ได้ของข้อมูลการวิจัย เพื่อเสนอแนวทางในการปรับปรุงและพัฒนาการจัดการระบบบำบัดน้ำเสียของโรงพยาบาล

ผลการวิจัย พบว่าการบำบัดน้ำเสียมีค่าใช้จ่ายเฉลี่ย 24 บาท ต่อลูกบาศก์เมตร ประชาชนยินดีเสียค่าธรรมเนียมการบำบัดน้ำเสียเมื่อเข้ารับการรักษาในโรงพยาบาล เฉลี่ยคนละ 10 บาทต่อวัน ปริมาณการเกิดน้ำเสีย 40 ± 33 ลูกบาศก์เมตรต่อวัน ปริมาณน้ำเสียที่บำบัดได้เป็นร้อยละ 97 ของปริมาณน้ำเสียของโรงพยาบาลทั้งหมด ค่าบีโอดีของน้ำทิ้งมีค่าเฉลี่ย 20.78 ± 14.72 มก./ลิตร ผู้บริหาร ผู้ดูแลควบคุม คนงาน และ ประชาชน มีค่าความพึงพอใจต่อผลการดำเนินงานการบำบัดน้ำเสียโรงพยาบาล เฉลี่ย 3.5, 3.7, 3.3 และ 3.6 คะแนน จากคะแนนเต็ม 5 ตามลำดับ และพบว่าวิธีการ (เทคนิคและการปฏิบัติ) และความพอเพียงของวัสดุอุปกรณ์มีความสัมพันธ์กับความพึงพอใจของคนทำงานประจำ ($p < 0.005$) โดยมีค่า $R^2 = 0.797$ ได้เสนอแนวทางในการปรับปรุงและพัฒนาการดำเนินงานระบบบำบัดน้ำเสียของโรงพยาบาลชุมชน โดยการจัดสมมนาและนิเทศงาน ให้ความรู้และเทคนิควิธีปฏิบัติแก่ผู้ปฏิบัติงาน หาเงินรายได้เพิ่ม ใช้วัสดุอุปกรณ์ให้คุ้มค่าอย่างเหมาะสม และส่งเสริมการมีส่วนร่วมของประชาชนในการบำบัดน้ำเสียของโรงพยาบาล

CONTENTS

	Page
ACKNOWLEDGEMENT	iii
ABSTRACT IN ENGLISH.....	iv
ABSTRACT IN THAI	v
LIST OF TABLES	ix
LIST OF CHART	xi
CHAPTER 1. INTRODUCTION	
- Background and Rationale	1
- Objectives	12
- Hypothesis.....	12
- Thesis variables.....	13
- Thesis Important terms.....	14
- Thesis variables definition	15
- Scope of the thesis.....	18
- Conceptual framework of the thesis.....	19
CHAPTER 2. LITERATURE REVIEW	
- Environmental management and administration.....	20
- Koontz’s management theory	23
- Concepts and theories related to domestic wastewater treatment.....	25
- Wastewater treatment in hospitals	33
- Concept involved laws and finances in wastewater treatment.....	39
- Community participation in controlling and solving of water pollution problem.....	45
- Related researches and variables to the research	48
- SWOT analysis.....	55
CHAPTER 3. RESEARCH METHODOLOGY	
- Research model	57
- Population and sample	57
- Research Tools.....	60

CONTENTS (Cont.)

	Page
CHAPTER 3. RESEARCH METHODOLOGY (Cont.)	
- Quality control of instrument	63
- Data collecting procedures	63
- Data analysis	64
CHAPTER 4. RESULTS	
- Personal characteristics of executives of wastewater treatment system of the community hospital	69
- Management of wastewater treatment system of the community hospital....	70
- Cost of management of wastewater treatment system of the community hospital in the past year.....	71
- Performances of wastewater treatment system of the community hospital....	72
- Quality of effluent.....	74
- Personal characteristics of controllers of wastewater treatment system of the community hospital.....	76
- Training, seminar, and supervision of controllers of wastewater treatment system of the community hospital.....	77
- Personal characteristics of daily workers of wastewater treatment system of the community hospital.....	78
- Training, seminar, and supervision of daily workers of wastewater treatment system of the community hospital.....	79
- Knowledge and understandings of controllers and workers on operations of wastewater treatment system of the community hospital.....	81
- Method (techniques and practices) of and controllers and workers on operations of wastewater treatment system of the community hospital	81
- Satisfaction on performances of wastewater treatment system of the community hospital.....	82
- Information of populations who reside nearby the community hospital.....	83

CONTENTS (Cont.)

	Page
CHAPTER 4. RESULTS (Cont.)	
- Analysis on relation of the community hospital in each province with willingness to pay wastewater treatment fee of people who reside nearby the community hospital	86
- Stepwise multiple linear regression analysis on results of the performances of wastewater treatment system of the community hospital.....	88
- Managerial guideline of wastewater treatment system of the community hospital using SWOT analysis.....	92
CHAPTER 5. DISCUSSION	106
CHAPTER 6. CONCLUSION AND RECOMMENDATION	119
BIBLIOGRAPHY	123
APPENDIX	127
BIOGRAPHY	161

LIST OF TABLES

Table	Page
1. Water Quality in the Chao Phraya River.....	5
2. Standard of Water Quality in Surface Water Source.....	6
3. Flow Rate of Wastewater from Various Buildings	9
4. Population Equivalence of Domestic Wastewater	10
5. Population Equivalence (PE) for Effluent from Various Buildings.....	28
6. Personal Characteristics of Community Hospital Administrator of wastewater Treatment System.....	70
7. Management of wastewater treatment system of the community hospital – classified by each part.	71
8. Cost of Wastewater Treatment Management in the past year.....	72
9. The Performance of Wastewater Treatment System of Community Hospital	72
10. The Quality of Effluent (B.O.D.)	74
11. Volume of wastewater, volume of treated wastewater, and BOD value of each community hospital.	74
12. Personal Characteristics of Community Hospital Controller of Wastewater Treatment System.....	77
13. Training, Seminar, and Supervision of Community Hospital Controller of Wastewater Treatment System.....	78
14. Personal Characteristics of Community Hospital Daily Worker of Wastewater Treatment System.....	79
15. Training, Seminar, and Supervision of Community Hospital Daily Worker of Wastewater Treatment System.....	80
16. Knowledge and Understanding of Community Hospital Controller and Worker in Operation of Wastewater Treatment System	81
17. Method (techniques and practices) of community hospital controllers and workers of wastewater treatment system on operations.....	81
18. Satisfaction on performances of wastewater treatment system of the community hospital – classified by group of population.	82

LIST OF TABLES (cont.)

Table	Page
19. Information of Population who reside nearly the community Hospital	84
20. Relation of the Community Hospital in Each Province and Willing to Pay Wastewater Treatment Fee of Population Who Reside Nearly the Community Hospital	86
21. Community Hospital in Each Province tat People Who reside nearly are Pleased to Pay Wastewater Treatment Fee.....	87
22. Stepwise Multiple Linear Regression Analysis of the results of Wastewater Treatment System Performance	91
23. Objectives and strategic activities follow 4 dimension by balance scorecard.	94
24. Strategy, Strategic Objective, and Indicator of Wastewater Treatment Management in Community Hospital	96
25. Managerial Guideline of Wastewater Treatment System of Community Hospital, Ministry of Public Health, in Central Region by SWOT Matrix Analysis	98

LIST OF CHART

Chart	Page
1. Positive Effect of Environmental Management	8
2. Research Conceptual Framework.....	19
3. Environmental Administration	20
4. Technique of Environmental System Management	23
5. The activated sludge system model.....	38
6. Map of Classified Water Source in the Chao Phraya River	59



CHAPTER 1

INTRODUCTION

Background and Rationale

Water is life. Water is an important environmental resource vital to human and all life on earth. Reckless human's consumption and economic expansion lead to depletion of resources. These clearly cause environmental problems.

Water resource is a natural resource essential to human's life. In Thailand, water consumption in agriculture and industry has been increased every year (Department of Community's Development: 1995). Furthermore, different cultures, geographies, communities, and seasons have different water consumption (Kanthee Sripongphan, 1997:18). Rapid population growth, industrial expansion, agricultural technology development and decreasing of water resources seriously damage the water supplies (Yothin Suriyapong, 1999 : 222-223) as high level of organic substances, inorganic substances and heavy metals are emitted into water.

The major source of water pollution is domestic wastewater which consists of wastewater from communities, *hospitals* and commercial establishments such as restaurants, hotels and markets where water is emitted of varying quality directly into urban water supplies. (Department of Environmental Quality Promotion 1998 : 6-7) As a result of excessive level of various types of pollutant such as organic compounds, inorganic compounds either solid or solution, and microorganisms like bacteria, viruses and protozoa enter waterway through untreated wastewater from homes, housing complexes and businesses, those water supplies can no longer support self purification process.

To control the quality of water supplies (Department of Health 1995: 90-95), at the 3rd – 4th stage of the public health development program (1972-1981), Division of Environmental Health had started the public health development program from controlling the quality of water by surveying the water supplies and collecting wastes water sample from various water supplies since 1966. In 1969, the quality of water from the source of the Chao Phraya river and eleven canals in Bangkok had been checked. In 1970, the Ministry of Public Health, the Ministry of Industry and the Ministry of Agriculture had been assigned by the council of Ministers for the wastewater controller. Wastewater control work and water resource development were finally proposed to the 4th stage environment health development program. In 1972, the Division of Sanitary Engineering had been renamed to the Division of the Environmental Health. They had laid the plan for the first wastewater treatment system and built it for the center hospital in Khonkaen province and had expanded the project to the center and community hospitals while started to design and built the incinerator for the large hospitals in 1973. The water supply work was assigned to the local water supply division in 1974. The Division of Environment Health has been assigned for waste disposal management for community and hospitals and includes the water quality control and air pollution control work. In 1987 (during health development program the 6th stage (1986-1990) they was assigned for Global Water Quality Monitoring project to set up two monitoring stations at the Chao Phraya River and Pasak River, one station at the Sirikit Dam for monitoring the water quality sponsored by the United National Environmental Program and WHO. During the health development program the 7th stage (1992-1996) there was a project set up to control the quality of water for main rivers. There was fifty three percents of water supplies that fall into the fourth and fifth type of quality level as they contain organic substances, bacteria and have to low dissolved oxygen. Those problems have heavily impacted the Chao Phraya river. Because of this, there was a solving plan for water pollution of the Chao Phraya river in 1993 to 1995. The aim of this plan is to have wastewater treatment system in every hospital that located in the Chao Phraya river area which is cover 9 provinces. In 1994, there were only 547 local hospitals that the wastewater treatment system has not been set up. There were 302 and 245 local

hospitals that had been set up under this system in 1996 and 1997 respectively. This project had been done in 1998. The drinking water quality surveillance was seriously monitored in Bangkok and the community area such as sanitation, municipality and the Pattaya city. Besides having a wastewater treatment system for all hospitals, there were 9 environment health centers in the region that have adequate laboratory facilities and capability to analyze and monitor the water quality.

In 2003, the Ministry of Natural Resources and Environment (Department of Toxicity Control, 2003: 8-9) had proposed the community wastewater management program which was compliant with the 9th Economic and Social development plan (2002-2007) strategy. This program's a guideline for wastewater management and clearly indicates the direction of all organizations to eliminate the overlapping responsibilities. This program has been proposed to the National Environmental Committee.

The objective of municipal wastewater management The objective was to find the strategy that allow significant progress toward achievement and assess The objective how the program activities by having the community involvement. The basic of the municipal waste water management program consists of

Target area There are 2 groups of municipal waste water area as following

Group 1: Present the area that water quality is extremely low. Revival, developing and enforcing regulation for controlling the water quality are need to be proceeded.

Group 2: Present the area that water quality is not in critical condition. The quality is fair to low. Water quality controlling and monitoring process are needed to be proceeded.

Municipal wastewater management Strategies for municipal wastewater management are detail in order of the most important to less.

Strategy 1 : Effectively wastewater management

Strategy 2 : Preparedness of wastewater management local organization

Strategy 3 : The public relation to build the environment, community wastewater pollution awareness and environment preservation participation

Strategy 4 : Public participatory role in addressing and solving the community wastewater management

Strategy 5 : Well- organized investigation and evaluation system of local organization

Strategy 6 : Laws and regulations to enforce and control municipal wastewater management

Strategy 7 : Budget to support the wastewater management of the local organization

In the central region of Thailand, the Chao Phraya river is regarded as the blood of the Thai people. It has its origin on Nakhon Sawan province and from there it runs through Ayutthaya province, Pratumthani province, Nonthaburi province and Bangkok downstream to the Gulf of Thailand at Samutprakarn province. The Chao Phraya river is 372 kilometers long. It is divided into three parts the upper, central and lower part. The upper part located between Amphur Pranakorn Sri Ayutthaya, Ayutthaya province and Amphur Muang, Nakhon Sawan province is 237 kilometers long. The central part covering Amphur Muang, Nonthaburi province and Ayutthaya province is 80 kilometers long. The lower part which covers Amphur Phrasamut Chedi, Samutprakarn to Amphur Muang, Nonthaburi province is 55 kilometers long.

The critical water pollution of the lower part of the Chao Phraya river which covers Bangkok and Samutprakarn province have occurred sequentially as the result of the growth of communities such as homes, condominiums, restaurants, shopping centers, *hospitals* and industries.

The outcome from the resolution of the Council of Ministry on December 3, 1991, the Department of Health, through the Ministry of Public Health had designed

wastewater solving program for the Chao Phraya river during the period of 1993-1995. A major focus for this program had been the construction of wastewater treatment system for all hospitals in the provinces of the Chao Phraya river area. In 1992, there were 26 wastewater quality control stations set up on the bank of the Chao Phraya river for controlling and monitoring the quality of water.

Table 1 shows the quality of water from the Chao Phraya river since 1990-1999 reported by the Office of Policy and Environment Program.

Table 1 Water Quality in the Chao Phraya River

Year	BOD (mg/l)			Dissolved Oxygen value (mg/l)			Bacteria-Coliform content * 1000(MPN/100 ml)		
	Northern	Central	Southern	Northern	Central	Southern	Northern	Central	Southern
1990	1.5	1.4	3.0	4.8	2.8	0.7	26.00	30.00	1002.00
1991	1.9	2.3	7.5	5.6	1.3	0.4	23.00	18.00	1650.00
1992	2.3	1.7	8.2	5.6	3.8	0.3	210.00	207.00	2020.00
1993	1.7	2.3	2.7	5.9	4.9	1.5	39.70	248.70	257.70
1994	0.8	1.4	2.4	6.3	5.0	2.2	228.00	144.00	770.00
1995	1.6	1.4	3.5	6.5	5.7	1.0	402.00	76.00	959.00
1996	1.1	1.0	6.2	5.8	4.6	0.7	20.00	12.00	85.00
1997	1.2	1.5	3.1	6.4	4.1	0.5	20.00	2.00	46.00
1998	0.9	0.8	2.8	5.7	4.5	1.0	1.30	2.70	14.50
1999	2.1	1.8	3.3	6.3	4.7	1.8	3.01	7.81	44.16

Reported by The Office of Policy and Environmental Program, 2001

Important term- * MPN – Most Probable Number

Refer to the announcement of the Ministry of Science Technology and Energy in 1986, the major water resources classified by their usage are as followed.

Table 2 shows the water quality standard from surface water based on the announcement of National Environment Administration No. 8 (1994) date January 20, 1994 , issued under the National Environmental Protection and Promotion Act (1992)

Table 2 Standard of Water Quality in Surface Water Source.

Item	Properties	Unit	The Standard Value for each class				
			1	2	3	4	5
1	Color, Odor, Taste	-	Natural	Do not change	Do not change	Do not change	-
2	Temperature	°C	Natural	Maximum 3 °C	Maximum 3 °C	Maximum 3 °C	-
3	pH value	-	Natural	5.0 – 9.0	5.0 – 9.0	5.0 – 9.0	-
4	Dissolved Oxygen	Mg/l	Natural	> 6.0	> 4.0	> 2.0	-
5	BOD	Mg/l	Natural	1.5	2.0	4.0	-
6	Coliform bacteria	MPN/100 ml	Natural	5,000	20,000	-	-

Considering of water quality standard from surface water based on table 1, the upper part of the Chao Phraya river has dissolved oxygen level 4.8-6.5 mg/l, BOD value 0.8-2.3 mg/l and the amount of total coliform bacteria 1,300-402,000 MPN/100 ml. If consider dissolved oxygen level and BOD value which is mainly higher than 4.0 mg/l and lower not exceed than 2.0 mg/l respectively, it fall into the third class of water quality resource standard. But if consider form total coliform bacteria, it fall into the fourth and fifth class.

The central part of the Chao Phraya river has dissolved oxygen level, BOD value and the amount of coliform bacteria at 1.3-5.7 mg/l, 0.8-2.3 mg/l and 2,000-248,700 MPN/100 ml respectively. It is in the third class if consider the dissolved oxygen level and BOD value which is mainly higher than 4.0 mg/l and lower not exceed 2.0 mg/l respectively, but fall into the fourth and fifth class if consider the coliform bacteria.

The lower part of the Chao Phraya river has dissolved oxygen level, BOD value and the amount of coliform bacteria at 0.3-2.2 mg/l, 2.4-8.2 mg/l and 14,500-2,020,000 MPN/100 ml respectively. It fall into the forth and fifth class as the dissolved oxygen level is mainly lower than 2.0 mg/l, BOD value and the amount of total coliform bacteria are higher than the standard. The rapid industrial expansion and population growth in Bangkok and Samutprakarn province without well organized of wastewater management system resulted in the critical water pollution. As the water pollution situation is not getting better, the wastewater treatment program has been made while the water quality monitoring activity will be continued.

If water becomes polluted, it loses its value to us economically and aesthetically and can become a threat to our health and to sociality, living style and businesses. The positive effect of environment management are detailed as chart 1

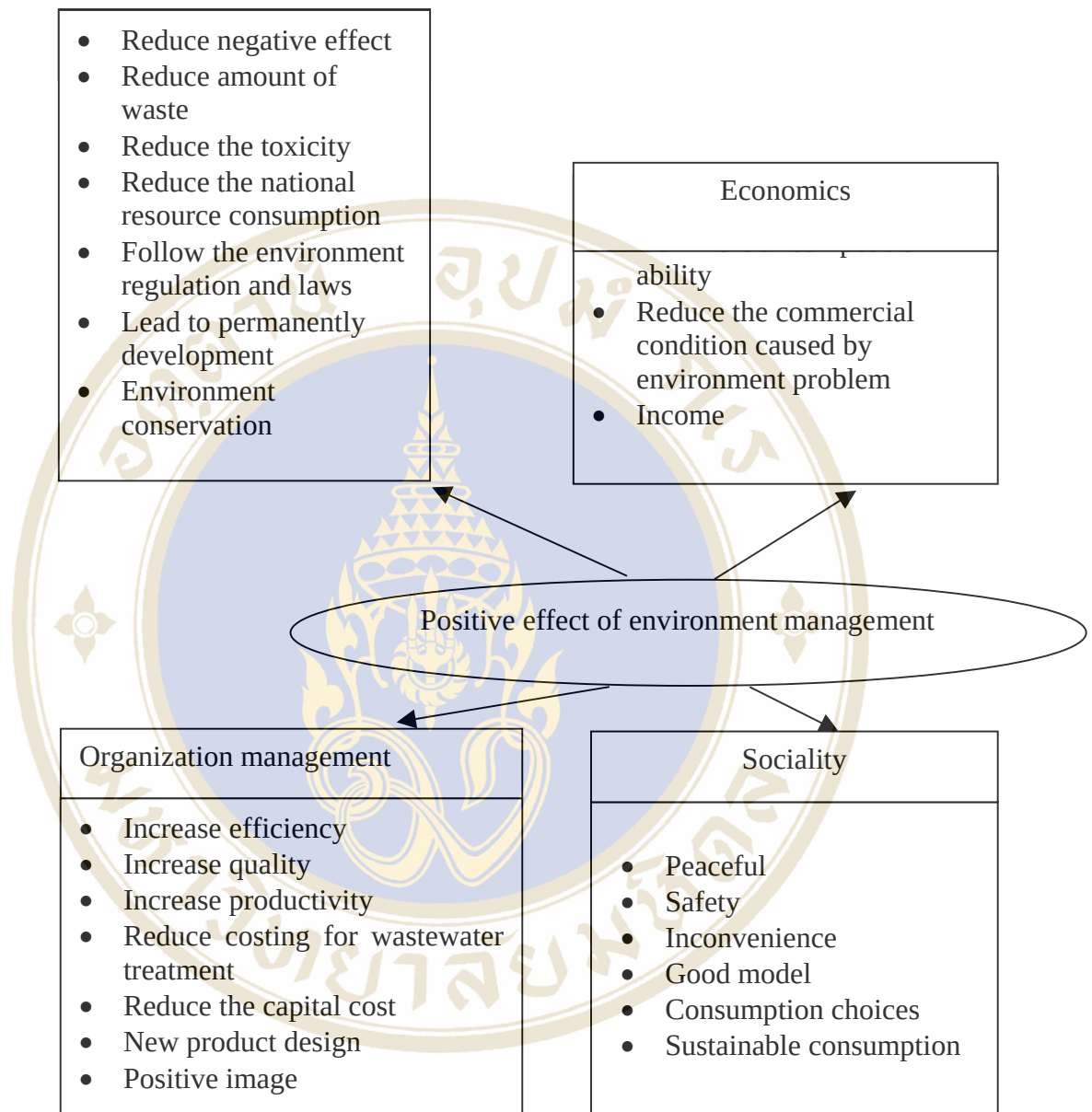


Chart 1 : Positive effect of environment management

Source : The Department of Industrial Works and Environmental Engineering

Association of Thailand 2002 : 8-8

The wastewater from hospitals is the source of many water-borne diseases like cholera, typhoid, dysentery and toxic substances which can cause many illnesses thus the regulation for hospitals which require them build wastewater treatment facilities had passed in Bangkok . this has helped to control water pollution.

Causes of problems.

There were many causes of water pollution, but municipal (The Department of Toxicity Control Journal, 2003: 3,8) and hospital wastewater (Pattana Moolpuek, 105,113) were majorities. The wastewater from hospitals was larger amount than wastewater from community such as hotels, schools, restaurants and houses (Thongchai Punsawat and group, 1997)

Table 3 and 4 show wastewater level and population equivalence value from various sources.

Table 3 Flow rate of wastewater from various buildings.

Sources	Wastewater flow rate				
	liters/ person/day	liter/m ² /day	liters/room /day	liters/bed /day	Liters/seat /day
1. Dormitories	244	16.4	928	-	-
2. Restaurants	-	58.09	-	-	74.01
3. Hospitals	-	-	-	1450	-
Size 60 beds					
5. Office buildings	106	3.41	-	-	-
6. Turkish bath			530	-	-
7. Department store	-	4.78	-	-	-

Table 3 Flow rate of wastewater from various buildings (continue).

Sources	Wastewater flow rate				
	liters/ person/day	liter/m ² /day	liters/room /day	liters/bed /day	Liters/seat /day
8. Movie theaters	-	-	-	-	3.76
9. Hotels	-	-	846.59	-	-
10. Condominiums	233	-	-	-	-

Source : Thongchai Punsawat et. al, 1997

Table 4 Population equivalence of domestic wastewater.

Sources	Wastewater quantity	BOD quantity
Condominiums and houses	520 liters/day-room, house	48 grams/day-room,house
Hotels	1061 liters/day-room	126 grams/day-room
Dormitories	78 liters/day-room	76 garms/day-room
Hospitals	800 lites/day-bed	94 grams/day-bed
Restaurants	25 liters/day-m ²	53 grams/day-m ²
Markets	69 liters/day-m ²	21 grams/day-m ²
Department stores	4.6 liters/day-m ²	0.27 grams/day-m ²
Offices	2.54 liters/day-m ²	0.09 grams/day-m ²

Source : Thongchai Punsawat et. al, 1997.

The used water of hospital is high level. It is mostly a result of large population. If it is not treated before being discharged into waterway, excessive level of diseases which can cause epidemic is the result.

As the wastewater pollution is getting worse, the government has planed to build the wastewater treatment system in a big city with a large number of residents such as

Chiang Mai, Khon Kaen, Pattaya, Phuket and Bangkok. Treatment of the wastewater is required before it can be safely released back into local water systems (Sitthiporn and Thirdsak, 1991:69). The government have to set up the budget for wastewater treatment program to cover the population growth. The expense for operation and maintenance is average 8-10 million Bath (Bangkok, 1990:3) Beside the wastewater treatment system, the system management ; and controlling least wastewater are also needed for effectively water pollution problem solving.

Conclusion

The effectively wastewater treatment system management is needed as community wastewater problem which cause water pollution is critical. The water pollution is also mainly a result of hospital waste water. The wastewater treatment system management is very important for the hospital due to the large number of residents. It is in line the policy of Province, National Health Development program under the authorization of the Ministry of Public Health and water pollution solving and the development of National environment improvement follow the fourth strategy, National resource environment management of the economically development and social program No.9 (2002-2006). As the author has seen that the hospital wastewater problem has remained and has become one of the most crucial, the thesis is initiated.

The data from this thesis will be useful information for future improvement of the management and the operator of wastewater treatment system of community hospitals.

Objectives

General objectives

To study the result of wastewater treatment management of community hospital under The ministry of Public Health in the central of Thailand and to provide the guideline for the improvement of the wastewater treatment system.

Specific objectives

1. To study the quality of the effluent wastewater treatment system of community hospitals.
2. To calculate the cost for the wastewater treatment system of community hospitals.
3. To study the satisfaction of the management and assigned personnel for wastewater treatment on the management of community hospitals wastewater treatment plant.
4. To study the satisfaction of the people, lived in the area of 500 meters away from the community hospitals on the management of hospital wastewater treatment plant.
5. To interpret the results of SWOT Analysis for determining the strategy for wastewater treatment system management and providing the guideline for improvement of the wastewater treatment system management for community hospitals.

Hypothesis

1. Factors of the hospital administrator management affect the wastewater treatment management process of community hospitals.
2. Factors of controlling of the controller affect the wastewater treatment management process of community hospitals.
3. Factors of daily working of the workers affect the wastewater treatment management process of community hospitals.

Thesis variables

Independent variables

1. Factor of the administrator for wastewater treatment system.

1.1 Personnel factor consist the variables of

- 1.1.1 Age
- 1.1.2 Sex
- 1.1.3 Management period

1.2 The wastewater treatment system management followed theory of Koontz and environmental management (Koontz and Cyril, 1980), which consist the variables of

- 1.2.1 Planning
- 1.2.2 Organization
- 1.2.3 Staffing
- 1.2.4 Directing
- 1.2.5 Controlling
- 1.2.6 Technique and Technology
- 1.2.7 Community participation
- 1.2.8 Laws and financial

2. Factor of the controller for the wastewater treatment system controlling consist the variables of

- 2.1 Age
- 2.2 Controlling period
- 2.3 Knowledge and understanding
- 2.4 Received training and supervision
- 2.5 Method (Technique and Practice)
- 2.6 Supporting budget
- 2.7 Category of the wastewater treatment system

3. Factor of daily worker for the wastewater treatment system consist the variable of

- 3.1 Age
- 3.2 Working operation period
- 3.3 Knowledge and understanding
- 3.4 Received training and supervision
- 3.5 Method (Technique and Practice)
- 3.6 Sufficient instrumentation

Dependent Variables

The result of wastewater treatment system of community hospital consists of variable as following

- 1. Proceeding results - the wastewater characteristics
 - 1.1 The quantity The wastewater quantity which is presented by the wastewater producing rate
 - 1.2 The quality. The wastewater quality which is presented by BOD value
- 2. Satisfaction the satisfaction of the management personnel, operation personnel and people living in the hospital area to the wastewater treatment system of the community hospitals.

Thesis Important Terms

1. Community hospitals wastewater treatment system presents the process for having the management personnel manage the community wastewater treatment system followed Koontz's management theory and followed the environment management which consists of planning, organizing , directing, controlling, technique and technology, public participation, laws and financial including the operation of assigned operator.

2. The result of the community wastewater treatment management presents the achievement of quantity and quality of hospital wastewater and the satisfaction of the management and operation personnel, and the residents live in the hospital area.

2.1 *The wastewater treatment result* is presented by

1. *Wastewater quantity*. It is presented by the amount of wastewater released from hospital.
2. *Wastewater quality*. It is presented by BOD value of wastewater.

2.2 *The satisfaction of the management personnel and operation personnel* to the wastewater management of community hospitals presents the positive attitude of management and operation personnel to community hospitals wastewater management they have assigned.

2.3 *The satisfaction of the people* living in the community hospitals area presents the positive attitude of people living in the area of 500 meters around hospitals to the result of wastewater management without making a complaint with hospital wastewater.

3. Effective factor of community hospitals wastewater treatment system management presents the factor of community hospital directors, of public health offices or community health officials, and of daily worker for wastewater treatment system management.

Thesis variables definition

1. Factor involve wastewater treatment system (WWTS) administrator is the characteristic of hospital director of community hospital wastewater treatment (CHWWT) management followed management theory of Koontz and environmental management that directly effect the wastewater management. It consists of

- Age, sex and wastewater managerial period of community hospital directors.

- Planning is that community hospital director assigns objective, process, coordination, evaluation and site up the wastewater treatment system plan for guideline to achieve performing goal.
- Organizing is that community hospital appoints the committee; assigns personal responsibility, role, and function ; and has clearly line of command and work-unit coordination.
- Staffing is that the hospital director manages personnel planing, recruiting, selecting, and transferring in Hospital wastewater treatment system.
- Directing is that hospital director elucidates role and function, assigns a works and operating calendar, supports and evaluates working, and develops skill-practice.
- Controlling is that community hospital director. verifies and evaluates performance appraisal for operation operational personnel comparing to the target dialogue.
- Technique and technology is the process for wastewater treatment follow the sanitation environment technique and technology under the management of community hospital director.
- Community participation means the community hospital have the participatory of the public in helping the hospital wastewater treatment performing.
- Laws and financials means the management by the hospital director is in line with the Enhancement and Conservation of National Environment Quality Act and The Public Health Act 1992, and the financial supporting from various sources.

All variables of environmental management are measured by ordinal scale by divided into 5 levels which are very high, high, medium, low, very low and graded into 5, 4, 3, 2, 1 respectively

2. Factor involves wastewater treatment system controller is the characteristic of wastewater treatment system controller. which consist of

- Age and operational period means age and wastewater treatment period of the controller
- Knowledge and understanding of wastewater treatment system means the controller knows the theory and principle of the system, and can be effectively used to get successful outcome.
- Training and supervision means that the controller obtained training and supervision from concerning units within the past 3 years.
- Method (Technique and Practice) means that the controller proceed for effectiveness wastewater treatment controlling.
- Supporting budget means that money that received in last year for running that wastewater treatment program.
- Category of wastewater treatment system means the existing wastewater treatment of community hospital.

3. Factor involves wastewater treatment system daily worker is the characteristic of wastewater treatment system daily worker which consist of

- Age and operational period means age and wastewater treatment working period of the daily worker.
- Knowledge and understanding of wastewater treatment system means the worker knows the procedure correctly, and can be effectively used to get successful outcome.
- Training and supervision means that daily worker obtained training and supervision from concerning units within the past 3 years
- Method (Technique and Practice) means that the worker do for effectiveness wastewater treatment working
- Sufficient means that the worker has enough necessary equipment for wastewater treatment system working.

The knowledge and understanding variable of the controller and the worker have the criteria of individual item in point.

Received training and supervision variable of the controller and worker is individual grade in nominal scale by receive or not receive and adequate or not adequate.

The method (technique and operation) variable of controller and worker is individual graded in ordinal scale by divided into 5 levels which are very high, high, medium, low, very low; and graded into 5, 4, 3, 2, 1 respectively.

The sufficient equipment variable of the worker is individual grade in ordinal scale by divided into 5 levels which are very high, high, medium, low, very low; and graded into 5, 4, 3, 2, 1 respectively.

4. The amount of wastewater treatment means the amount of effluent released from various sources of the hospital after treatment in the unit of percent of the total wastewater.

5. BOD (Biochemical Oxygen Demand) value means the amount of oxygen used up by the bacteria for organic material decomposition in 5 days at 20 degree Celsius in the unit of mg/l. This value can tell the effect of wastewater to the amount of oxygen in water.

Scope of the thesis

1. The place for the study of this thesis is the hospital 30 - 60 beds size under the authorization of the Ministry of Public Health in the Central part of Thailand of the provinces which are located in the Chao Phraya river basin except Bangkok and Samutprakarn.

2. The analytical data of the effluent in this thesis is only based on BOD value of effluent released from wastewater treatment system of hospital in 2001-2003.

Research conceptual framework

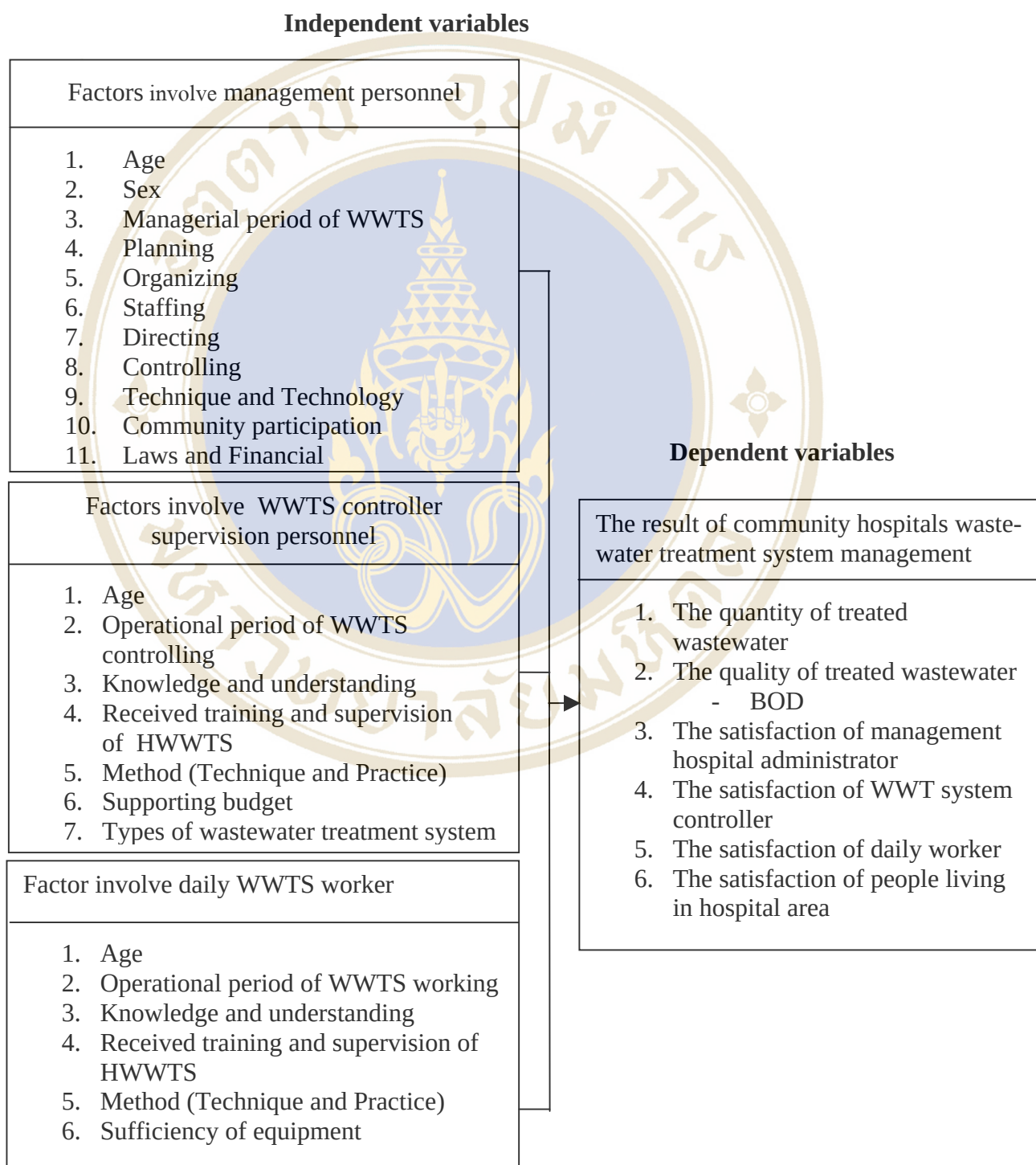


Chart 2 : Research conceptual framework

CHAPTER 2

LITERATURE REVIEW

In this chapter, reviews of important concepts and theories related to community wastewater treatments are described. In the beginning, the concept of environmental management and management theory of Koontz were discussed including their components, benefits and techniques then, the Koontz's management theory was introduced. This research primarily follows the Koontz's concept and focus specifically to wastewater treatments in hospitals and communities. Laws and financials involved in wastewater treatments, and participation of communities and private organizations are also presented; as well as SWOT analysis. Finally the related researches and important variables to the research are reviewed.

2.1 Environmental management and administration (Department of Industrial Works and Environmental Engineering Association of Thailand, 2002)

Environmental management and administrations apply business management principles to solve pollution problems affected to an environment. A systematic planning is employed for an effective solution. The components of the environmental management and administrations are shown in the Chart 3.

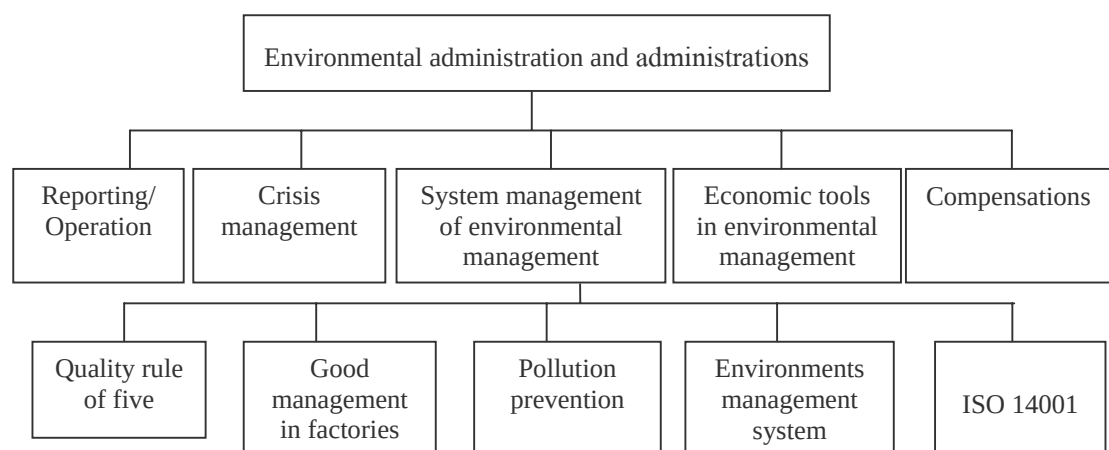


Chart 3 : Environmental administration

An environmental management and administration is required in all factories and plants for a sustainable economy, environment and society. A good environmental management and administration can solve the following problems:

- Pollution affected to an environment
- Violation of rules and regulations
- Waste products
- Resource depletion
- Dispute between communities
- Accidents in plants and factories
- High production cost
- Fines, compensations and environmental rehabilitation

Consequently, the proper environmental management and administration can yield:

- Good image
- Increase in productivity
- Safe from pollution
- Clean and safe in working environment
- Improvement in personnel efficiency
- Customer satisfaction
- Increase in market share
- Advantages in business competition

2.1.1 Benefits from a good environmental management system

The Department of Industrial Works has encouraged factories and plants to have a proper environmental management which will give benefits as follows:

1. Benefits to environments
 - a. Decrease in environmental damages

- b. Waste product reduction
- c. Reduce toxicity of chemical components and waste products in production
- d. Reduce resource consumption
- e. Follow the environmental laws?
- f. Lead to a sustainable development?
- g. Environmental conservation

2. Benefits to businesses

- a. Raise productivity
- b. Improvement in quality of products
- c. Increase in quantity of products
- d. Reduce the treatment cost
- e. Decrease in production cost
- f. Design for environment?
- g. Good image to company and product

3. Benefits to societies

- a. Reduce disputes in community
- b. Increase in health and safety of workers
- c. Lead to environmental awareness in community
- d. Set a good ethical example in community
- e. Provide a better choice to consumers (e.g., the green label products)
- f. Lead to a sustainable consumption

4. Benefits to economy

- a. Good image for the nation
- b. Increase competitiveness in business
- c. Less trade restrictions due to environment concerns
- d. Increase Exports due to customer acceptance

2.1.2 Environmental management techniques

An environmental management is a continuous process to improve environments with different techniques in each step. The Chart 4 shows various techniques in a continuous process.

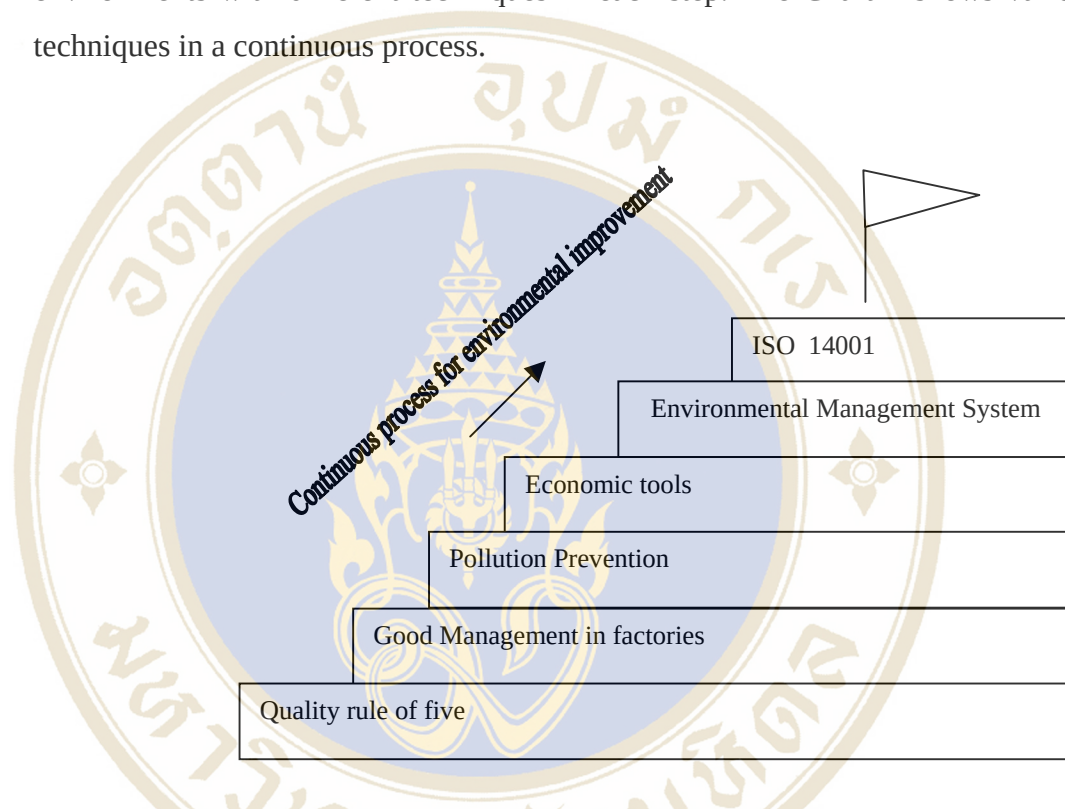


Chart 4 : Techniques of environmental system management.

Source : The Department of Industrial Works and Environmental Engineering
Association of Thailand 2002 : 8-10

A proper environmental management is required in the organization's management system. Cooperation from every side will have a continuous effect to environments. The same management techniques may be used in different organizations (for example, pollution prevention and the quality rule of five.) The better environmental management technique the more environments improved.

2.2 Koontz's management theory

There are many researchers developed their management theories, for example;

Peter f. Drucker (1999), John R. Schermerhorn, JR. (1999), David Schwartz (1980), Louis E. Boone and David L. Kurtz (1992), Heinz Weihrich and Harold D. Koontz (1994), Harold D. Koontz and Heing Wcihric (1975), Harold D. Koontz is one of those researchers. His theory is based on five principles:

- Planning
- Organizing
- Staffing
- Leading
- Controlling

This research is based on Koontz's concept. His theory of management can be applied to water treatment system especially in hospital. Each principle has an impact on the overall system. The Koontz's principles can be described as follows:

2.2.1 Planning

Planning is essential in every project to meet the organization's objective. There are many forms of planning such as objective, standard, budget, program, policy, procedure, and method. This includes agreement and decision. Planning should also consider methods, time, and staffs in each project.

2.2.2 Organizing

Managers need to understand all necessary activities to achieve the organization's goal. Cooperation is necessary; however, overlapping activities should be avoided. Responsibility of staffs must be clear. A good relationship between staffs and work place leads to an efficient organization.

2.2.3 Staffing

Staffing involves man power planning, recruiting, hiring, appointing, and transferring. This includes staff's development and benefits. Staffing needs to done properly and efficiently. Evaluation and staff's development are also important to the staff management.

2.2.4 Leading

Leaders have to lead, inspire, and support their staffs. Motivation from leaders has an effect on the individual performance and organization's objectives. Therefore, leading is to create a good and efficient organization.

2.2.5 Controlling

Managers have to pay attention to a progress of their projects and make sure their projects are on the schedule. Adjustment is required when delay occurs. Managers need to constantly monitor a progress of projects to be able to promptly make adjustments. Hence, controlling involves monitoring, evaluating and changing.

2.3 Concepts and theories related to domestic wastewater treatment

2.3.1 Wastewater

Wastewater inevitably created by a community. The bigger community the more wastewater produced. Toxic chemical makes the worst wastewater. Wastewater is hazardous to human's health and safety. Wastewater has an impact on every sides including economy.

Causes:

Water pollution is caused by (Yothin Suriyapong, 1999 : 222 – 223)

1. Population's growth

In Thailand, its population growth rate is slightly high, however; its migration to a big city is significantly high due to job demand. Consequently, water consumption and wastewater is rising at the same rate. Most human's activities involve water. Crowded communities usually are located near river bank or seashore. Bangkok and its perimeters, for example, has a population over seven million peoples that releases roughly 200,000 kilogram of organic wastewater a day to the Chao-Phaya River.

2. Industrial expansion

For the past 10 years, Thailand had been developed from an agricultural based country to an industrial based country. Its average industrial growth rate had increased to 13.7 percent a year. In addition, the seventh national economic and social development plan emphasized the rural development. Many industrial complexes had built to support such a plan, for example in Chiang-Mai, Phitsanulok, Nakornsawan, Khonkaen, Nakornrachasima, Saraburi, Rachaburi, Surachtani and Songkha. Most factories did not have a proper water treatment system. As a result, pollution is inevitable.

3. Depletion of water in nature

Deforestation and improper farming causes drought and flooding. Water cannot be retained without a natural dam. Low rate of river stream with the same rate of waste releases creates high concentration of wastewater.

4. Farming

Animal farming can cause high concentration of wastewater. In Nakornpathom, for example, over 2 millions of pigs created about 270 tons of BOD daily (one pig created 40 liters of wastewater a day, 136 grams of BOD daily.)

2.3.2 Sources and types of wastewater

There are various types of wastewater, which depends on their sources. The followings are three major types: (Saksith Tridej , 1987 : 259 – 276)

1. Domestic wastewater

Domestic wastewater is wastewater released from a community (e.g. residential areas, offices, stores, markets, hotels, hospitals and movie theaters etc.) Most human's activities produce wastes (Thongchai Punsawat, 1987 : 15); nevertheless most wastewater has an average pH value around 7. Wastewater is generally contaminated with micro-organism. The level of micro-organisms in wastewater can be measured from their oxygen demand called "Biochemical Oxygen

Demand” (BOD.) (Piamsak Manasavate, 1982 : 121) The amount of wastewater and its BOD from different activities are different from one another.

Wastewater in a community comes from different sources as follows:

1.1 Residential areas

There are two kinds of waste released from residential areas: solid waste and liquid waste. Wastewater is created from human’s activities in a household such as washing, cooking, and cleaning etc.

1.2 Hotels

Wastewater from hotels is similar to wastewater from a household; however, there are strict regulations for hotels. A proper water treatment is required before releasing wastewater to the public sewer. Nonetheless only large hotels on the riverside have a water treatment system.

1.3 Hospitals

According to (Uthok Therawatanasak’s study 1974); wastewater from hospitals is the most hazardous one. It contaminates with viruses and bacteria. Strict regulations are imposed on hospitals. A water treatment system in hospitals must meet the standard requirements specified by the department of health.

1.4 Schools

Wastewater from schools mostly comes from a canteen and restrooms.

1.5 Markets and restaurants

Fresh-food market is one of the main sources of wastewater. Waste products and garbage are carelessly dumped into a nearby river. According to the sewer bureau’s estimation, restaurants that have 100 customs daily produce

Wastewater from various places in a community of Bangkok

According to Maneesrikhum's study, Population Equivalence of wastewater from various activities in Bangkok are shown in the Table 5.

Table 5 : Population Equivalence (PE.) fore effluent from various building.

Place	Coefficient	Unit
Condominium	48	gram/unit/day
Hotel	123	gram/room/day
Dormitory	76	gram/room/day
Entertainment place	26	gram/room/day
Residential area	12.6	gram/room/day
Hospital	94	gram/bed/day
Movie theater	0.57	gram/seat/day
Restaurant	53	gram/m ² /day
Market	21	gram/m ² /day
Department store	0.27	gram/m ² /day
Office	0.09	gram/m ² /day

Source : Dongchit Maneesrikhume , 1987 : 2 – 8

1. Industrial wastewater is wastewater released from factories. Industrial processes such as raw-material cleaning, waste from production process, and machinery cleaning etc., are activities produced wastewater.

2. Agricultural wastewater is wastewater released from various agricultural activities including animal farming. This kind of wastewater consists of organic and inorganic substance. Fertilizer and chemical uses in agriculture can produce unsafe wastewater. High level of nitrogen, phosphate and potassium usually appears in agricultural wastewater. Animal farming can produced high level of organic in wastewater. Factories that need agriculture produces also created this kind of wastewater.

2.3.3 Property and characteristics of wastewater

Considering wastewater problems in severity or wastewater provision quantity and quality are important factors for scientific analysis of wastewater. In quantity, the amount of wastewater is considered. In quality, the amount of dirty is scrutiny. The combination of these two factors indicates the total waste loading. High dirty water in a small quantity may have the same total waste loading as low dirty water in a large quantity.

The conclusion of water quality index (Characteristics of wastewater) which should be measured for wastewater.

- (1) Temperature of wastewater
- (2) pH
- (3) Biochemical Oxygen Demand (BOD)
- (4) Chemical Oxygen Demand (COD)
- (5) Solid contents
- (6) Color and turbidity
- (7) Nutrient (e.g., nitrogen and phosphorus compounds)
- (8) Microorganisms (e.g., E.coli or faecal coliform)
- (9) Toxic substances
- (10) Metals and heavy metals

To control wastewater from communities, Ministry of Science, Technology, and Environment has set the legal standard of effluent control for different type and size of building. It is the guideline to do for the work unit involved and the owner or producer of toxic sources. Water released to the public sewer must meet the standard requirement.

2.3.4. Measures for solving water pollution (Ompun Jarurat, 1996 : 13)

1. Short-term guideline line solutions

- 1) Master plan for wastewater management

A master plan for wastewater management must be made for Bangkok and its perimeter area of 5 provinces

2) Constructing the first port of wastewater treatment system

A wastewater treatment system construction must be accelerated around the Rattanakosin's island according to the 8th national economic and social development plan. The efficient management and administration must also be implemented.

3) Monitoring a wastewater treatment system of industry factory

A wastewater treatment system in each factory must be constantly monitored to ensure that it meets the legal standard.

4) Assigning central wastewater treatment system in industry area

To study the of possibility private to invest sector in wastewater for industry factory.

A central wastewater treatment system may be a cheaper solution for factories within the same industrial area. All factories can share the same central wastewater treatment system with less cost.

5) Wastewater treatment system for government sectors

The government sectors must have their own wastewater treatment systems; for example, The Government Cold Storage Organization at Yannawa, The Fish Marketing Organization at Yannawa, Samutpakarn and Samutsakorn, The Thailand Tobacco Monopoly, Slaughterhouses of Public the Local Administration Organization, Hospitals under Ministry of Public Health, The Ministry of University Affairs, Army, Police Department, State Enterprises, Municipal's fresh-food markets, Penitentiaries, The Port Authority of Thailand, and The Bangkok's Port at Khongtey.

6) Accelerating action plan for garbage disposal

7) Wastewater controls from condominiums and shopping malls

8) Garbage handling along the waterway by boats

There must be a garbage handling plan along the waterway and on the riverside to reduce the amount of garbage in canals and rivers.

9) Campaign and public relation

Information about hazards and effects of water pollution including garbage and food residual discarding must be available to public.

2. Long-term guideline solutions

1) Land usage

Planning and usage patterns must be conformed with the development plan of land and waterway usage, capacity of water source.

2) Creation of industrial complexes.

Supports under state's rules and regulations must be provided to private sectors to create an industrial complex.

3) Supports for private sector's water and toxic waste treatment system.

4) Reduction plans for fertilizer and insecticide waste.

A proper wastewater treatment must be implemented to reduce the amount of fertilizer and insecticide in water before releasing it to rivers and canals.

5) Campaign and public relation plan.

All related government sectors must inform citizens regarding to the efficient uses of water resources. Cooperation is needed from all sides to keep river and canal clean.

2.3.5 Solving of domestic wastewater problem in various countries (Saksith Tridej, 1987 : 10)

Wastewater is a major problem in most nations. The followings are examples in various countries.

1. In Germany

Germany has a wastewater treatment policy that emphasizes a cooperation between the government sector and the private sector. Specific government's units will be responsible for wastewater treatment. German's government will not allow any private septic tank. Public wastewater treatment

systems are provided to communities and industrial complexes. Business owners and citizen must pay extra taxes for the public wastewater treatment system. The taxes for the public wastewater treatment system are proportional to the amount of wastewater released to the public sewer. The more wastewater released the higher the taxes. Progression rate will be applied for individuals and companies that released a large amount of wastewater every year. This measure is useful for the government in solving of community wastewater problem and can reduce wastewater indirectly. Factories will need to improve their production process in order to reduce their wastewater. Furthermore, taxes can support the operation and construction cost.

2. In The United State of America

It is a government's duty to provide a environmental pollution control to its citizen. In 1948, the first federal law for water pollution control called "The Federal Water Pollution Control Act 1948" was written. It gave an authority to each state to impose its regulations for water pollution control including water quality standard. However, the state standard must at least meet the federal standard. The government also assisted research , and gave a technology, financial and technical support to each state.

Earlier, the U.S. government gave a financial support in a form of government's loans. In 1956, it wanted to emphasize in state solving wastewater problem. The government's funds was given instead of the loans. This federal policy let each state to take responsibility and operate on the control of domestic wastewater problem, if there were budget problems it asked for financial supports from the central government. With the federal subsidies and a flexibility from the government; communities, towns, and cities can operate efficiently and have sufficient wastewater treatment systems.

3. In Japan

The first Japan's environmental master law is the Basic Law for Environmental Pollution Control, which was drafted in 1967 by Japanese's environmental agency (EA.) The environmental agency also issued the Water

Pollution Control Law that set the standard quality of water released from factories and businesses involved including hotels. Water that does not meet the standard quality will not allow to release to public sewers. Water from public sewers will be further treated in the public treatment systems. The water quality bureau is the state agency that controls and manages the wastewater treatment system. The extra taxes is imposed on businesses and households depending on the amount of wastewater released.

Furthermore, the Japanese government has taken a special consideration to the damage from wastewater problem which people and all parts using water need to take responsibility. A special fund was set up to improve the water quality. Factories and businesses involved must give a financial support to this fund. This special fund will be managed by the government to improve the water quality in every location.

2.4 Wastewater treatment in hospitals

2.4.1 Wastewater in hospitals

Hospital wastewater is different from residential wastewater. Wastewater from hospitals usually contaminates with pathogens and chemicals used as germicides. The sources of wastewater from various activities in the hospital can be listed as follows: (Puakvimol et al., 1990 : 146)

- Wastewater from patient's toilets
- Wastewater from laundry rooms
- Wastewater from canteen, laboratories and treatment rooms

According to the concept of domestic wastewater treatment, wastewater from the populated area, such as a hospital, must be treated before releasing to the public sewer. A hospital consists of various structures, for instance, inpatient buildings, outpatient building, and residential buildings for doctors, nurses, and other

hospital staffs. Kasemsan and Pijak (1981 : 84) suggested that a population in the hospital is equivalent to a large residential area in a big city, such as Bangkok. A hospital requires 4 staffs per 1 patient (bed). The average population density in a hospital is approximately 144 persons per 10,000 square meters.

The wastewater treatment system in hospital is required to follow the Ministry of Public Health's standard design. There are two wastewater treatment systems suggested by the Ministry of Public Health: the stabilization pond (SP) system and the activated sludge (AS) system. Niroot Khunpol (1996 : 24-25) has described the stabilization pond system as the system that is not required any chemicals and used mechanical energy to implement; however, it needs a large area for water detention more than 10 days at a time.

The activated sludge system (Prayoon Fongsatitkul : 1998) is a wastewater treatment system that uses groups of multiple microorganisms suspended in wastewater to digest organic substances to a certain level within an adequate time. The aerobic system is needed for sustaining the microorganism's growth.

Niroot Khunpol (1996 : 26) suggested that the activated sludge system is the most popular system, since it requires a small area. Nonetheless, it needs high energy for aeration and experienced person for system control of complex treatment processes.

2.4.2 Control of a wastewater treatment system in community hospital

There are two components of the activated sludge system used in community hospital:

a.) Wastewater collection system

A good principle for this collection system is to prevent pipes from clogging up. It is necessary to check every sieve on a drain. Sieves can filter out some garbage and reduce a clogging problem especially from toilets. Announcement and cooperation of personnel in an organization will be the best prevention method. The

collection system consists of an odor trap, manhole / collecting pipes, and a garbage and grease trap in the cooking area. The clogging problem usually caused the following problems:

- (1) Flooding in the resting tank or odor absorbing tank
- (2) Water cannot flow through a pipe
- (3) Flushing problem in the toilet
- (4) Foul-smelling at the manhole due to fermented water.

b.) Wastewater treatment system control

The wastewater treatment system used in community hospitals is the aerobic treatment system which requires aeration to support bacterial growth. After organic wastes were decomposed by bacteria, sedimentation is needed to separate bacteria from water. While the sediment which have activated bacteria is returned to the aeration tank of pretreatment, the extra sediment will be properly discarded. This system uses a small area; however it needs high energy for the aeration. To have an efficient wastewater treatment system, the following procedures must be implemented:

(1) 60 minutes of sedimentation test is required to observe the characteristics of sedimentation in the aeration tank with the aerator stopped. Color, and flocculation characteristic, and the amount of bacteria sediment represent the characteristics of sedimentation. Furthermore, the supernatant is also observed.

(2) The level amount of sedimentation in the aeration tank needs to be measured. After long operation, the amount of sediment was significantly increased. So the level of sediment must be constantly monitored, because too much sediment affects the sedimentation efficiency and may causes drift of sediment in effluent. It is an inspection of the quality of dense sediment that it is a proper.

2.4.3 Efficiency measurement of wastewater treatment systems

The efficiency measurement is necessary for controlling the wastewater treatment system. It includes assessment, analysis, and calculation. Both field test and laboratory test are necessary procedures that need to go together. The efficiency or quality measurement procedures are the followings:

a.) Field test needs to observe:

- (1) Color, odor, turbidity and temperature
- (2) Dissolved Oxygen (DO)
- (3) pH
- (4) Residual Chlorine
- (5) 30 minutes of sedimentation test (V 30)

b.) Laboratory test needs to observe:

- (1) Biochemical Oxygen Demand (BOD)
- (2) Chemical Oxygen Demand (COD)
- (3) Suspended Solids (SS)
- (4) Volatile Suspended Solids (VSS)
- (5) Mixed Liquor Volatile Suspended Solids (MLSS or MLVSS)
- (6) Oil and Grease (O&G)
- (7) Sludge Density Index (SDI)
- (8) Sludge Volume Index (SVI)
- (9) Microscopic Examination

2.4.4 National management of wastewater treatment systems

In the past, there was less resource consumption and less environmental problems. The government solely manages all natural resources and environments. Since the first national economic and social development plan was used in 1962, the economy was expanded rapidly. However, it also caused severe environmental problems. Afterward, the government gave more attention to the environmental problems. The bureau of national environmental committees was established in 1975

along with the environmental development plan. The plan was later included in the nation economic and social development plan. To successfully solve the water pollution including domestic wastewater, cooperation is needed from citizen, private sector and government sector. The government needs to have the following roles:

- 1) Set policies and plans to prevent and solve water pollution. Furthermore the government needs to direct the state agencies involved with the definitive measures and practical plans.
- 2) Expedite the construction of sewer and public wastewater treatment system for an area that has severe water pollution.
- 3) Provide the annual budget to support researches related to water pollution prevention and treatments which is for policy planning.
- 4) Use economic tools to solve the water pollution problems, for example, the polluter pays principle (PPP) which force the polluter (both producers and consumers) to pay the environmental conservation cost. Or use measures of taxes/fees, and government subsidy etc.
- 5) Educate people on water pollution prevention and treatment. Public relation campaign and dissemination of information to promote public awareness about environmental protection and conservation of nature and natural resources can significantly reduce wastewater problems.

2.4.5 Wastewater treatment system in community hospitals

This research studies the Ministry of Public Health's standard designed systems: The Stabilization Pond (SP) system and The Activated Sludge (AS) system. There are several considerations for both systems.

(1) Considerations for the stabilization pond

Niroot Khunpol (1996 : 24-25) described this system as the natural wastewater treatment system. It does not require any chemical substances and use mechanical energy to function properly; however this system needs a large area for water detention more than 10 days. Photosynthesis can occur during the digestion cycle of wastewater. This process produces oxygen to microorganisms that digest the

wastewater. So the depth of pond should not over 1.5 meters for that light can pass through the bottom of the pond. Also the of sterilization is high efficient due to a long time of water detention. The longer the detention time, the more effective the sterilization. Therefore, the Ministry of Public Health has set the specification for the stabilization pond system as follows: (Ministry of Public Health, 1996 : 3)

Pond No.	Effective Depth (meters)	Detention Time (days)
1	2.0	At least 10
2	1.5	At least 8
3	1.0	At least 5

(2) Considerations for the activated sludge

According to Niroot Khunpol (1996 : 26), the activated sludge system is currently the most popular system in industrial and domestic wastewater treatment system. In this system, treatment begins in the aeration tank where wastewater is decomposed by bacteria for growth. Afterward bacteria is separated from sedimentation. As the sediment with activated bacteria is returned to the aeration tank for pretreatment, the extra sediment will be properly discarded. This activated sludge system uses a small area; however it needs high energy for the aeration. Moreover, this system requires high experienced personnel to implement and maintain the system. This system consists of multiple processes as shown in Chart 5.

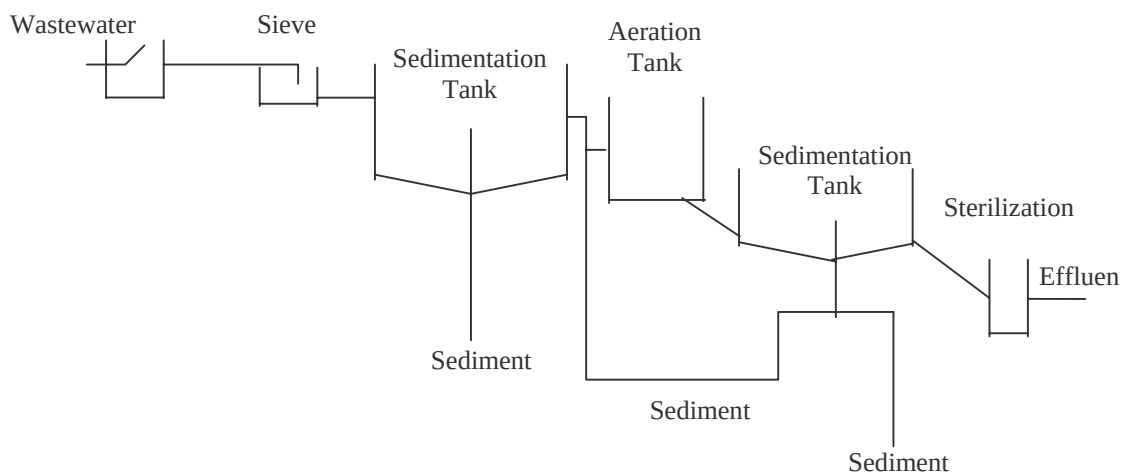


Chart 5 : The activated sludge system model., **Source:** Niroot Khunpol,1996.

The Ministry of Public Health has set the specification for construction of the activated sludge system as follows: (Ministry of Public Health, 1996 : 3)

(1) The components of the activated sludge system at least consist of

- Aeration Tank
- Sedimentation Tank
- Sludge Dewatering Unit

(2) Consideration for the activated sludge system, the extended aeration is the first priority. The extended Aeration can be specified as follows

Index	Assigned criteria
F/M Ratio (days)	0.2 or more
MLSS (mg/l)	6,000 or more
Sludge Age (days)	30 or more
HRT (hours.)	18 or more

2.5 Concept involved laws and finances in wastewater treatments

2.5.1 Regulations

1) Regulations involved in wastewater treatments

The Enhancement and Conservation of National Environmental Quality Act, 1992 section 70, 74 and 80 states that the owner or possessor of the point source of pollution shall have a monitoring control operator for the treatment facility and shall have the duty to collect statistic and data showing the daily functioning of the system facility or equipment and instrument, and make detailed notes thereof to be kept as recorded evidence at the site of that point source of pollution, and shall submit at least once a month report summarizing the functioning results of the facility, equipment or instrument to the local official of the locality where such point source is situate Niroot Khunpol (1996 : 33-34) suggested that any documents related to the wastewater treatment should be kept in a well-organized

manner. This will help retrieving data more efficient for using and reporting to pollution control officials

The details of the Enhancement and Conservation of National Environmental Quality Act, 1992 related to the wastewater treatment are the following:

Part 5 Water Pollution

Section 69 The Minister shall, with the advice of the National Environmental Committee, have the power to publish notification in the Government Gazette specifying the types of point sources of pollution that shall be controlled in regard to the discharge of wastewater or wastes, in conformity with the effluent standards set pursuant to section 55, section 56, and section 58.

Section 55 Prescribing emission or effluent standards for the control of wastewater discharge, polluted air emissions, or discharge of other wastes or pollutants from point sources into the environment.

Section 56 In case there have been standards prescribed by virtue of the other laws concerning wastewater discharges, polluted air emissions, or discharge of other wastes or pollutants from point sources of pollution into the environment and such standards are no less stringent than the emission or effluent standards, such standards shall continue to be effective by virtue of the laws related thereto. If however, such standards are less stringent than the emission or effluent standards, the National Environment Board shall resolve on such matter and the government agencies concerned shall act in accordance with such resolution.

Section 58 If it is deemed reasonable, the Provincial Governor shall have the power to publish notification in the Government Gazette prescribing a special set of emission or effluent standards applicable to the pollution control area.

Section 70 The owner or possessor of the point source of pollution has the duty to construct, install or bring into operation an on-site facility for wastewater treatment or waste disposal as determined by the pollution control official. For this

purpose, the pollution control official may also require that such owner or possessor commission a monitoring control operator to control the wastewater treatment or waste disposal facility that shall be constructed, installed or brought into operation accordingly.

Section 71 In any pollution control area or locality where the central wastewater treatment plant or a central waste disposal facility has been brought into operation by the administration concerned, the owner or possessor of the point source of pollution shall have the duty to pay the service fees at the rates fixed by virtue of this Act or the other related laws.

Section 72 In any pollution control area or locality where the central waste water treatment plant or central waste disposal facility has been brought into operation by the administration concerned, the owner or possessor of any point source of pollution shall have the duty to send wastewater or wastes from his source of pollution to the central waste water treatment plant or the central waste disposal facility in that pollution control area or locality for treatment or disposal facility which is capable to meet the standards prescribed under this Act.

Section 73 No person shall be employed as a monitoring control operator or as a service contractor, who renders for hire the services of wastewater treatment or waste disposal, without obtaining the license from the local official. In rendering the services of wastewater treatment or waste disposal by the service contractor, the service charges shall not exceed the rates fixed by the ministerial regulation.

Section 74 In any pollution control area or locality where the central wastewater treatment or central waste disposal facility of the public service is yet to be put into operation, but there is nonetheless a service contractor who is licensed to render such services within that area, the owner or possessor of the point source of pollution shall be required to send the wastewater or wastes from his point source for treatment or disposal by such service contractor in accordance with the rules, regulations, methods and conditions prescribed by the local official, with the advice of the pollution control official.

Section 75 In any pollution control area or locality where the central wastewater treatment or central waste disposal facility is yet to be put into service by the government and there is no licensed service contractor rendering services therein, the local official may, with the advice of the pollution control official, determine a temporary method necessary for the treatment of wastewater or disposal of wastes from point sources of pollution until the central wastewater treatment or central waste disposal facility will have been constructed, installed and put into operation within such pollution control area or locality.

Section 76 Wastewater treated by either the central wastewater treatment plant of the government or by the wastewater treatment facility of the Service Contractor must also have the properties which meet the requirements of the effluent standards prescribed by virtue of section 55, section 56, and section 58.

Part 7 Monitoring, Inspection and Control

Section 80 The owner or possessor of the point source of pollution, required by virtue of section 68 or section 70, to have his own facility for treatment of polluted air, equipment or instrument for control of the discharge of polluted air or other pollutants or the wastewater treatment or waste disposal facility, shall have the duty to collect statistics and data showing the daily functioning of the system facility or equipment and instrument, and make detailed notes thereof to be kept as recorded evidence at the site of that point source of pollution, and shall submit report summarizing the functioning results of the facility, equipment or instrument to the local official of the locality where such point source is situate at least once a month.

Section 81 The local official shall gather the reports received according to section 80 and send them to the pollution control official, who has jurisdiction over that locality, on a regular basis at least once a month. In doing so, the local official may make comments for consideration of the pollution control official.

Part 8 Service Fee and Penalty

Section 92 Any owner or possessor of the point source of pollution subject to the requirements of section 68 or section 70, who refrains from using his on-site facilities or equipment for the control of air pollution, noise pollution and vibrations, or refrains from operating his on-site facilities for the treatment of wastewater or disposal of wastes and illegally discharges such untreated wastewater or wastes into the environment outside the limits of the site of the point source of pollution, shall be liable to pay as a daily penalty four times as much the amount of daily expenses for the normal operation of his facilities, equipment or process for wastewater treatment or waste disposal throughout the duration of such illegal discharge.

2) Various institutes that enforce the water pollution regulations from the industrial sector

In addition to two regulations related to water pollution from the industrial sector: the Enhancement and Conservation of National Environmental Quality Act, B.E. 1992 of the Ministry of Science, Technology, and Environment, (with 3 departments related to environment: the Office of Environmental Policy and Planning, the Pollution Control Department, and the Department of Environmental Quality Promotion) which the main national regulations for environmental control, and the Factory Acts (1992) of the Ministry of Industry (by the Department of Industrial Works) which the regulations for factories, there are other regulations involved water pollution of government offices such as the Department of Transportation (by the Harbor Department), the Ministry of Agriculture and Cooperatives (by the Royal Irrigation Department and the Department of Fisheries) and the Ministry of Public Health (by the Department of Health) etc. These regulations play an important role in supervision, prevention and remedy of water pollution. However the Department of Industrial Works under the Ministry of Industry is the main institute oversees industrial pollution with the Factory Acts (1992). Factories all over country must have a pollution treatment system that meets the standard specified in the Factory Acts. The pollution control officials have duties to inspect and punish factories that violate the regulations.

Moreover, local institutes, such as Bangkok Municipal, Tambol's Administration Agency, Provincial Administration Agency, have the power and duty to control and assess local businesses including factories for local environmental conservation. With the supports from the Ministry of Public Health, the Ministry of Science, Technology and Environment and the Ministry of Industry are the institutes that directly in charge of water pollution.

Ministry of Public Health

The Public Health Acts (1992)

The Public Health Acts (1992) is proclaimed on March 29, 1992. This acts are improved and reformed from the previous 5 public health acts and the 3 fertilizer control acts. It is deem to modernize the previous acts and keep the same pace of social advancement. The improvements involve the official roles, civil liabilities, supervision, inspection, and specifications.

The minister of public health is appointed by the Public Health Acts (1992) to be a deputy as stated in the acts. The public health board consists of the permanent secretary of the ministry of public health as the chairman of the board, the department director-generals of institutes that related to environmental conservation as committees, for example, the director-general of medical communicable department, the director-general of medical science department, the director-general of disease control department, the secretary general of the food and drug administration, the director-general of local administration department, commander of national police office, the director-general of labor protection and welfare department, the director-general of industrial works, the director-general of department of agriculture, the secretary general of national environmental council, the deputy governor of Bangkok Metropolitan and at most 5 advisors appointed by the minister. In addition, the director-general of health department is also the committee and secretary.

2.5.2 Monetary concept involved in wastewater treatment

The most important issues for budget planning involved in wastewater treatment system are the construction cost, the operation cost, and the maintenance

cost. Most of the cost is covered by the government's budget such as from the ministry of industry, the ministry of natural resources and environment, the ministry of public health and other ministries involved. As for the wastewater treatment in hospital, the budget for the construction and operation cost comes from the department of health under the ministry of public health. In present, there are new institutes and restructuring, regional and provincial offices of environment have been established under the ministry of natural resources and environment. It has been helped and supported for wastewater treatment system in hospitals. However, no charges of hospital wastewater treatment collected from citizen or patients, and the operation cost of the wastewater treatment is very high. Therefore, with limited annual budget, the hospital needs other financial supports such as from the hospital incomes.

The funds for wastewater treatment system in hospital can come from the following sources:

1. The annual budget or subsidy from government funds
2. The hospital incomes
3. The funds from international organization, for example, the Japan International Cooperation Agency (JICA) etc.
4. Loans from many sources such as the financial institutes
5. The funds from the private sector or cooperation of people.

2.6 Community participation in controlling and solving of water pollution problem

The Constitution of the Kingdom of Thailand 1997 has prescribed that the local communities and people should participate in natural resource conservation. It states "Persons so assembling as to be a traditional community shall have the right to conserve or restore their customs, local knowledge, arts or good culture of their community and of the nation and participate in the management, maintenance, preservation and exploitation of natural resources and the environment in a equivalence and sustainable as provided by law," in the section 46, and "The right of

a person to give to the State and communities participation in the preservation and exploitation of natural resources and biological diversity and in the protection, promotion and preservation of the quality of the environment for usual and consistent survival in the environment which is not hazardous to his or her health and sanitary condition, welfare or quality of life, shall be protected, as provided by law,” in the section 56, and “The State shall promote and encourage public participation in the preservation, maintenance and balanced exploitation of natural resources and biological diversity and in the promotion, maintenance and protection of the quality of the environment in accordance with the sustainable development principle as well as the control and elimination of pollution affecting person health, and hygiene, welfare and quality of life,” in the section 79. This shows that people have the right to conserve and restore their natural resources as provided by law, and must be promoted and supported by government institutes.

A good solution for water pollution problems is to prevent a new problem and control the existent problem at the acceptable level; however, cooperation from all sides in a community is necessary. Public relation campaign and dissemination of information to promote public awareness about environmental protection and conservation of nature and natural resources can significantly reduce wastewater problems. Prevention and solutions for water pollution problems can be described as follows:

2.6.1 Prevention and solutions for water pollution problems in community

Water resource is a natural resource and public property that must be protected and conserved by people in a community. The roles of various parties can be summarized as follows:

1.1 Participation of residences in communities

Participation of residents in communities for prevention and solutions of water pollution problems can be described in two ways: direct and indirect participation. The direct participation requires residents to use water properly. Unlawful activities in area where classified quality of water resource area are prohibited. Garbage, plant and animal remains including water weeds should not be

discarded in waterways or public water resources. Houses on the riverside should use an anaerobic tank for wastes from all household activities. Treatment to meet the standard requirements must be applied to wastewater before releasing to the waterway. Participation to the activities and events arranged by the government sector is needed, for example, volunteering to take care of rivers and canals, suggesting and warning anyone who will violate the law. Wastewater can be observed from its color, odor and clarity. The local residents should notify the business owners to check and repair their treatment facility in case of leakage occurred. The officials, such as the provincial industrial office, should be notified if there is any business released wastewater to the waterway. Residents can participate indirectly by using the products that are guarantee for environmental conversation, reducing the toxic chemicals or using the fast degradable chemicals, reducing the amount of garbage. Proper treatments must be applied for the hazardous waste. Self study on environmental protection and conservation will create an environmental awareness. Cooperation for paying the public treatment fee is also needed.

1.2 Participation of businesses

Businesses can participate by cleaning their factories or offices. A proper location for garbage disposal must be provided. The contaminated water and wastes must be treated with the standard methods. Responsibility and awareness of businesses to society is the most important issue. The wastewater problems has a widespread effects; therefore a good management is needed.

1.3 Participation of government officials

The government officials must campaign and disseminate information about knowledge, understanding and cooperation to businesses and people in management of water quality, and controlling at wastewater source, tax producing for non-pollutant producer or tax abstinence for businesses which supplying tools for the treatment system, and funding for researches to promote and develop technology in wastewater control and management are necessary.

2.6.2 Cooperation for water pollution prevention and solutions in community

Cooperation for all sides is needed to efficiently prevent and solve the water pollution. Therefore, everyone must take care of waterway together. The three party committee consisted of community, private sector, and government sector need to participate in controlling and solving the water pollution. Volunteering, investigating, preventing, solving, public relation campaign, and disseminating of information, creating environmental awareness, helping community and people affected from the pollution, and advising the community are activities that can effectively solve the water pollution problems.

2.7 Related researches and variables to the research

2.7.1 Related researches

Somchai Sakulitsariyaporn (1997) studied on development of the wastewater treatment management model used in the hospitals under the administration of the Minister of Public Health. He found that there were 72.80 percent of the wastewater treatment systems whose efficiency met the standards and 22.70 percent of them did not meet the standard. The most important factor that affected the efficiency of the system was the system controlling.

Environmental Health Division, the Department of Health (1997) studied the characteristics of wastewater discharged from the hospitals locating along the Chao Phraya River and found that the average BOD, Suspended Solids (SS), and Total Kjeldahl Nitrogen (TKN) were higher than those of the hospitals locating in the upper Northeast region. However, from the results, the hospital size might be the factor because differences in the hospital size lead to differences in water usage and dirtiness of water.

Pol.Lt.Col. Manorot Sittanon (1997) studied on an acceptance level of industrial plant owners to use wastewater treatment system: Case Study: Ampur

Sampran, Nakornpratom. The study revealed that industrial plant owners accepted the use of wastewater treatment system in moderate level. The acceptance to use the wastewater treatment system depended on age, monthly income, cost of the system, capital investment, debts, modernization, and access to the information on wastewater treatment system of the industrial plant owners. In addition, the owners who attained more information had higher level of acceptance than those who attained information at moderate and low level.

For the problems and obstacles, the industrial plant owners faced the problem of high price of wastewater treating chemicals. They requested that the Government lower the import duty of these chemicals. In addition, the Government should build the centralized wastewater treatment system for them because the wastewater treatment system required high setup cost, operating cost and maintenance cost.

Hadirat Lorpensri (1997) studied on possibility to charge for the wastewater treatment. According to the Sripraya's project, the factor that influenced knowledge on wastewater problem, domestic wastewater, and wastewater treatment system was gender. Factors that influenced the attitude to the wastewater problem and the domestic wastewater treatment system depended on education, handling of drained wastewater and the access to information regarding water pollution problems, domestic wastewater, and the wastewater treatment system. The access to the information of households did not differ from that of businesses. The access level to the information about water pollution reached almost 89.1 percent and the access to the information about the domestic wastewater treatment system was only 60.3 percent. For the knowledge and attitude toward the domestic wastewater treatment system, both households and businesses had good knowledge about the system in moderate level, but households had better attitudes toward the system than businesses. The attitude levels of households and businesses were 47.53 percent and 46.64 percent, respectively.

Banjop Chanchareon (1999) studies on the readiness of administrator in managing the wastewater treatment system of the community hospitals. The study found that 41.7 percent of the management of the hospitals are sanitary officers, 68.6 percent received training and attended seminars, and 67.3 percent obtained supervision. The readiness in managing the system was at moderate level. Age, marital status, education background, and duration in holding a position had no relation to the readiness in managing the wastewater treatment system. Variables that affected the readiness in managing the system were current position, opportunities to receive training and obtained supervision, knowledge about wastewater treatment system, and work incentives. Moreover, the study revealed problems and obstacles that were related to the wastewater treatment system such as no cost assesses, lack of cooperation among hospital staffs, insufficient training, and lack of support from high level management.

Uraiwan Inmoung et al (2001: 80) studied on Influent and Effluent Characteristics of Hospital Wastewater Treatment in the upper Northeast region. The results showed that the mean values of pre- and post wastewater parameters were significantly different ($p < 0.05$). The effluent treated by all community hospitals' did not meet the Community Effluent Standards. When compared with parameters of quality water standard, the effectiveness of in reducing dirty two treatment systems -- oxidation ditch and stabilization pond--were found. The oxidation ditch could effectively reduce such parameters as BOD, SS, settleable solids, sulfide, TKN, total and fecal coliform bacteria, with 69.05 , 65.4 , 58.39 , 45.49 , 61.98 , 82.69 and 83.62 percent respectively. The stabilization pond could minimize these parameters as 55.58 , 36.94 , 48.95 , 36.61 , 54.82 , 92.45 and 87.32 percent respectively. The stabilization pond system was capable of reducing total and faecal coliform bacteria more effective than the oxidation ditch system but the oxidation ditch are more effective than the stabilization pond system for other parameter. The two system were significantly difference in reducing SS ($p = 0.001$). However, they were not significantly different in removing BOD, settleable solids, sulfide, TKN, total and faecal coliform bacteria ($p < 0.05$). The study also suggested that there were needs in training programs in order

to develop potentials of the operators. Since most of the hospitals did not have the maintenance budget for the wastewater treatment system, therefore maintenance expenses should be included to yearly budget.

2.7.2 variables related to the research

1.) Age : It is one of the factors that differentiate one person from another. A person at different ages has different perspectives. Thus, persons at different ages have different knowledge, roles, and attitudes. According to the Anuchit Issariyamatt (1993 : 118), the study was on factors that affected awareness of the Tambol's council for solving the Chaophraya river problems. The case study of the Pathomthani district showed that persons at different ages had different concern for solving the Chaophraya river problems. Persons at age 35 or lower had more concern than persons at age more than 36. This is consistent with the Malkis and Crasmick's study (Malkis and Crasmick , 1977 : 20-27), which showed that the older persons had better environmental concern than the younger persons, since they received more information. Somporn Ittidejpong's study (1987 : Abstract; cite in Wanna Youngcharoen 1999 : 77) showed that the age of community hospital's director had a positive relationship to his or her achievement. Moreover, manorot Sitthanont's study (1997 : 95) showed that the age of the business owner had different awareness in wastewater treatment.

2.) Gender: The Orawan Yenjai's study (1992 : 186) showed that women had better environmental knowledge in a household than men, since women usually takes care of her house. On the other hand, the Thaweerat Sansanao's study (1998) showed that the gender of staffs in hospitals did not affect their environmental knowledge and in quote waste management. In addition the Somchai Ompuntong's study (1989 : Abstract ; cite in Varurat sansanoa , 1998 : 146) showed the gender of secondary school's administrators did not affect their environmental knowledge and waste management.

3.) Duration time of working : The Bunjop Juncharoen's study (1999 : 70) showed that the duration time working did not affect the readiness of wastewater treatment administration and management in community hospitals. The Vareerateerat Sansanao's study (1998 also showed that the staff's work experience in the Rachaburi

hospital did not affect their environmental waste management, since the hospital staffs had the same chance to receive experiences.

4.) Knowledge and Understanding : From; The Wannee Wuttiwongsumpun's study (1998 : Abstract ; cite in Wanna Youngcharoen, 1999 : 84) showed that knowledge and behaviors of people about tap water under responsibility of the Metropolitan Waterworks Authority had a positive relationship consistent to Somchai Dontri's study (1998 : 89) which showed knowledge and conservation awareness of Chaophraya river had a positive relationship.

5.) Planning: Planning means the organization's objectives and strategies including future assessment, development, and coordination to achieve the organization goals.

6.) Organizing : The organizing means the design of the organization structure. It includes classifying, functioning, appointing and objective setting of organization. Assigning job to the right person is the most difficult task. The organization's objectives depend on this arrangement.

7.) Staffing: Staffing means a personnel. It involves recruiting, interviewing, training, and rewarding. This includes position appointing in the organization's structure.

8.) Directing : Directing involves overseeing people and activities to meet the organization's objectives. Good relationship and understanding between supervisors and staffs are essential to the organization. Resolving conflict is a challenging job for every supervisors.

9.) Controlling : Controlling involves following up the organization's activities, solving problems and making sure all personnel going to the right direction. Adjustment must be made when it seems to be off the course.

10.) Type of wastewater treatment system: There are various types of wastewater treatment system.

1. Activated sludge system
2. Rotating biological contractor system
3. Trickling filter system
4. Oxidation pond system

5. Aerated lagoon system

6. Anaerobic filter system

11.) Participation in a community : Participation of residents in a community can be characterized into 2 categories : Direct participation and Indirect participation. The direct participation requires residents to use water properly. Unlawful activities in the quality classified area are prohibited. Residents can participate indirectly by using the products that guarantee to help environmental conservation, reducing the toxic chemicals or using the fast degradable chemicals, reducing the amount of garbage. Proper treatments must be applied for the hazardous waste. Self study on environmental protection and conservation will create an environmental awareness. Cooperation for any campaign related to wastewater treatment is also desirable.

12.) Laws and Financials: In pollution management, the Polluter Pays Principle (PPP) is one of many approaches that can be used to control and reduce pollution. Regulations need to be enforced with the punishments for any violations. The government can control the pollution by setting the standard quality in the environmental regulations. Laws involves wastewater treatment are The Enhancement and Conservation of National Environmental Quality Act, 1992 The Public Health Acts (1992) of the Ministry of Public Health. Moreover, there are laws of other institutes such as The Enhancement and Enforce Law of National Environmental Act, 1992 of the Ministry of Science, Technology and Environment etc.

In the past, most pollution management of the government solves the problem at the end result by issuing the laws and regulations. Few economic tools are used. For example, the tax exemption for all machines and tools used in the environmental conservation, a special privilege with investment supports and the income tax exemption for factory in the area assigned by the government. The wastewater treatment fee is used to cover the construction cost of the wastewater treatment system. The other cost, such as the operation cost and the maintenance cost, is supported by government budget.

13.) Supporting budget: The budget for the wastewater treatment is received from the annual government budget. However in using money there is not specially separate for this treatment. In present, hospitals receive the annual budget according to population in coverage responsibility area.

14.) Sufficiency of equipment : Most tools used in the wastewater treatment system are expensive and difficult to find the supplier. The essential tools for the wastewater treatment are the water pump, equalizing tank, sedimentation filter, and sludge denaturing equipment, etc.

15.) The quantity of wastewater: Wastewater means effluent or water that comes from various activities such as wastewater from cleaning and washing in households and businesses, wastewater after production processes in factories, wastewater from agricultural activities and other activities that contaminate water in the form of solution and suspended solid. These water can not be used as required.

The quantity wastewater and wastewater characteristic are two main factors important to the design and operation of the wastewater treatment system. In general, the amount (flow rate) and the attribute (concentration) of waste are considered in the form of “loading.” Loading is the amount (weight) of dirty or unclean substance released in unit of time.

$$\text{Loading} = \frac{\text{Waste concentration (attribute)} \times \text{Flow rate of wastewater}}{\text{(amount)}}$$

16.) Quality of effluent : The quality of effluent from various sources can be determined by the waste concentration, population equivalence, and loading (Department of Industrial Works and Environmental Engineering Association, 2002 :

12.) The concentration indicates the amount of mass in water. The proper parameters need to be chosen to indicate the level of pollutant in water. For example, the mount of organic substance in wastewater from household can be indicated by the BOD value. Analysis of BOD in water in concentration form used to find efficiency of wastewater treatment system, and to inspect water quality from various sources. The concentration unit normally are mg/l, g/m³ and p.p.m. etc. The factors that affects the BOD value are

the followings : type and quantity of toxic substance, pH, type and quantity (concentration) of substance, temperature, light, oxygen dissolution, water attributes that affects oxygen dissolution, organic substance, soil characteristic, type and amount of microorganism.

Wastewater problems have effects to human's health, society, scenery of water resource, transportation and economy etc.

17.) Satisfaction : Work satisfaction is the state of good feeling or emotion resulted from work experience. The state of good emotion depends on the level of physical and psychological rewards (Thepnom Muangman and Swing Suwan , 1986 : 98). Frederick Herzberg mentioned that work satisfaction is the feeling or attitude of person to his or her work, which results from sufficient motivation factors and hygiene factors. This Herzberg's two-factor theory can be classified into 2 categories consist of 16 factors (Somchart Toruksa 1999 : 145 – 146.)

6 factors that are internal factors affect the work satisfaction. They are the followings : Achievement, Recognition, Creative and challenging work, responsibility, Advancement, and Growth in job.

On the other hand, 8 factors that are external factor affect the work dissatisfaction. They are the followings: Policy and administration, Supervision, Interpersonal relationships to superior, Working condition, Salary, Personal life, Job status.

The other 2 factors are the Relationship to colleagues which incline hygiene factor, and the Relationship to subordinates which incline motivation factor.

2.8 SWOT analysis

SWOT analysis consists the analysis of strength and weakness within the organization, and the analysis of opportunity and threat. out of organization. It is a simple and rapid use tool to build situational strategy of the organization. Strategic

assignment must base on well accordance between competence in origination and situation out of organization.

2.8.1 Strength and Weakness Strength is a character characteristic that make organization strong and competence. It is something which organization can do excellent; may be skillful, expertise, resources, or successful. Weakness is a characteristic that organization can not do excellent that make organization weak.

When strength and weakness in organization are specified. They must be evaluate carefully. It may considers by Mckinsey 7-S framework which are structure, strategy, system, style, staff, skills and shard-value. Some Strength are more important than the others and are high affect or impact with the performance and success of the organization. Some weakness may make organization weak which depend on its importance.

2.8.2 Opportunity and Threat Opportunity is a characteristic of environmental situation out of organization that can help to attain strategic goal of the organization, It is an advantage events in environment. But threat is characteristic of environmental situation out of organization that may obstruct organization to attain strategic. It is an disadvantage in environmental. Opportunity and threat analysis need to analyze the environmental situation of the organization which may be considered and analyzed by considered and analyzed by PEST Model. The model consists of the environmental situation factors of policy, economic, social, and technology.

CHAPTER 3

RESEARCH METHODOLOGY

Research Model

This research was conducted using Survey Research. The objectives of the research are to study efficiency of managing, maintenance, and daily operations of the wastewater treatment systems in community hospitals, under the administration of the Ministry of Public Health, in the Central region.

Population and Sample

Population consists of

Community hospital represents a community hospital which under administration of the Ministry of Public Health in the Central region.

Management represents the director of the hospital or a representative who was appointed by the director to manage the wastewater treatment system.

Operator is categorized in two groups.

1. A public health officers or public health officials who controls the wastewater treatment system.
2. A worker who daily does the wastewater treatment system.

Resident represents people who live within the perimeter of five hundred meters from the hospital. For each hospital, four to five people were selected as the residents for the research.

Sample consists of one management, one operator, and one hundred and thirty-nine residents who were selectively chosen from surrounding areas of the hospital. Size of the community hospitals in the Central region that participated in this research is thirty to sixty-bed hospital. The sample was selectively chosen from community hospitals that are located along the Chao Phraya River, starting from Uthaitani province to Nonthaburi province. In total, there are thirty-three community hospitals were selected. These community hospitals can be listed by province as follows:

1. Uthaitani has four hospitals, which are Baan Rai Hospital, Sawang Arom Hospital, Nhong Kha Yang Hospital and Huy Kod Hospital.
2. Chainart has five hospitals, which are Han Ka Hospital, Wat Singh Hospital, Sankaburi Hospital, Sappraya Hospital, and Manorom Hospital.
3. Singhburi has three hospitals, which are Bang Rajan Hospital, Ta Chang Hospital, and Khai Bang Rajan Hospital.
4. Ang Thong has four hospitals, which are Pal Mok Hospital, Sawengha Hospital, Poh Thong Hospital, and Chai Yo Hospital
5. Ayutthaya has eight hospitals, which are Bang Pa-In Hospital, Tah Rer Hospital, Pak Hai Hospital, Lad Bua Luang Hospital, Bang Sai Hospital, Pa Chi Hospital, Bang Pa Han Hospital, and Bang Bal Hospital
6. Pathumthani has four hospitals, which are Nhong Sear Hospital, Lum Lukka Hospital, Lad Lumkaew Hospital, and Klong Luang Hospital
7. Nonthaburi has five hospitals, which are Pak Kret Hospital, Bang Yai Hospital, Bang Bua Thong Hospital, Bang Krui Hospital, and Sai Noi Hospital.

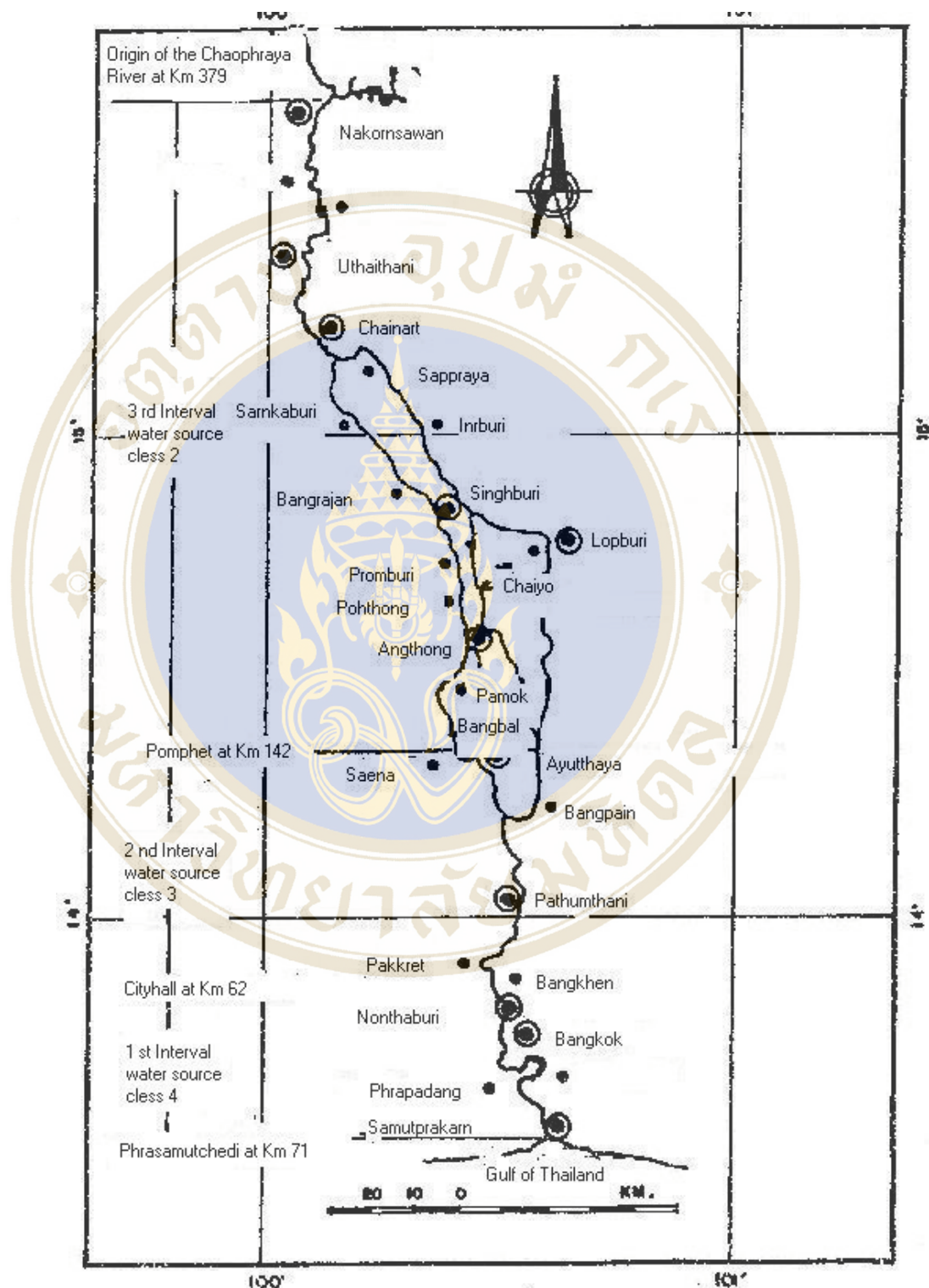


Chart 6 : Map of classified water sources in the Chao Phraya River

Sources : Textbook of water pollution treatment system, 2002 (3-16)

Research Tools

Tools that were used in gathering information process of this research are a questionnaire. The questionnaire was constructed from the studies of other related researches.

The questionnaires were designed into four types as follows:

Type 1: Questionnaire for Executive (for the Director of the hospital or the representative of the Director). It contains 4 main parts.

Part 1 This part consists of questions about personal information. The questions are open-ended. There are 4 questions regarding age, gender, job position, and job assignment.

Part 2 This part consists of questions about water treatment management according to Koontz's Management Principles and the Environmental Management. There are thirty-eight questions in this part including:

Planning of wastewater treatment system in hospital	7 questions
Management of wastewater treatment system in hospital	5 questions
Staffs allocation to the wastewater treatment system in hospital	5 questions
Administration of wastewater treatment system in hospital	7 questions
Controlling of wastewater treatment system in hospital	5 questions
Techniques and knowledge	3 questions
Participation of community	3 questions
Laws and Budgets	4 questions

Part 3 This part consists of questions about satisfaction of Management to the effectiveness of the wastewater treatment system used in hospital over the past year. There are eight questions in total

Part 4 This part consists of questions about expenses of the wastewater treatment system used in the hospital over the past year. There are six open-ended questions in this part.

Part 5: This part of questions about obstacles and problems that occurred during the implantation of the wastewater treatment system in the hospital. The obstacles or problems are separated into eight items including budgets, human resources, wastewater treatment system, equipment, techniques and knowledge, community involvement, laws, and others.

Type 2: Questionnaire for Controller. It contains four main parts.

Part 1 This part consists of questions about personal information. There are three open-ended questions.

Part 2 The part is separated into four sections as follows:

Section 1 This section consists of questions about knowledge of how to maintain the wastewater treatment system in hospital. There are eight close-ended questions.

Section 2 This section consists of questions about training, seminars, and exhibitions. There are four questions and they are both open-ended and close-ended.

Section 3 This section consists of questions about how to operate the wastewater treatment system in hospital (techniques and implementation). There are seven open-ended questions.

Section 4 This section consists of questions about budgets and types of wastewater treatment system that is used in hospital. There are seven close-ended questions.

Part 3 This part consists of questions about satisfaction of the results of the operation. There are eight close-ended questions

Part 4 This part consists of questions about problems and obstacles that occurred during the implementation of the wastewater treatment system in hospital.

The questions are open-ended and cover many areas including budgets, human resources, knowledge, training, exhibition, techniques, equipment, etc.

Type 3: Questionnaire for Worker. It contains four main parts.

Part 1 This part consists of questions about personal information. There are three open-ended questions.

Part 2 The part is separated into 4 sections as follows:

Section 1 This section consists of questions about knowledge of how to maintain the wastewater treatment system in hospital. There are eight close-ended questions.

Section 2 This section consists of questions about training, seminars, and exhibitions. There are four questions and they are both open-ended and close-ended.

Section 3 This section consists of questions about how to operate the wastewater treatment system in hospital (techniques and implementation). There are eighteen open-ended questions.

Section 4 This section consists of questions about budgets and types of wastewater treatment system that is used in hospital. There are seven close-ended questions.

Type 4: Questionnaire for People. It contains three main parts.

Part 1 This part consists of question about background information. There are three open-ended questions.

Part 2 This part consists of general questions. The questions are open-ended and closed ended. There are seven questions.

Part 3 This part consists of questions about satisfaction level of the wastewater treatment system management. There are six questions in this part.

Quality Control of Instrument

Content Validity

In order to control the quality of questionnaires, the questionnaires were evaluated by five experts to check content validity. The questions adequately probe the required area. Comments and recommendations from the experts were adopted and the questionnaires were corrected accordingly.

Reliability

After the questionnaires have been evaluated and corrected for validity, they must be tested for reliability to ensure that all the questions will be responded consistently throughout the questionnaire. The questionnaires were assessed by five community hospitals and then analyzed for reliability using Cronbach's Alpha Coefficient. The results were illustrated as follows:

Cronbach's alpha coefficient of the questionnaire for Director was 0.78

Cronbach's alpha coefficient of the questionnaire for Supervisor was 0.76

Cronbach's alpha coefficient of the questionnaire for Operator was 0.72

Cronbach's alpha coefficient of the questionnaire for Resident was 0.81

Data Collecting Procedures

1. Submitting questionnaires to Ethic Committee to consider and give the permission to do the research.
2. Submitting the request letter to the Director of all thirty-three community hospitals for data and the wastewater testing results.
3. Distributing three sets of questionnaires, which included the questionnaire for management, the questionnaire for controller, and the questionnaire for worker, to the management, controller, and worker, respectively for assessment. The questionnaires were collected by the researcher himself.

4. Distributing the questionnaire to residents. The researcher interviewed and collected data.

5. Final checking the questionnaires after they are completed and returned. If there is a mistake or unclear data in the questionnaire, the researcher called back for further information. If the respondents do not receive the questionnaire, the researcher distributes the questionnaire to the respondent again.

6. Collecting monthly wastewater analysis results of the community hospitals over the past three years. In case of data missing or obsolete, the researcher collected the wastewater sample and sent to laboratory of the Department of Sanitary Engineering, Faculty of Public Health, and Mahidol University for the analysis. In total, seventeen wastewater samples were sent to the Lab.

7. The questionnaire were examined for completeness and prepared for further analysis.

Data Analysis

After the data was completely collected, it was coded and statistically analyzed using SPSS for Windows.

1. Scoring and grouping

1.1 To measure the performance level of Director, Supervisor, and Operator of the wastewater treatment system. There are 5 levels of performance, scoring by the following criteria.

Best performer, doing tasks between 80-100 percent	5 points
Good performer, doing tasks between 60-80 percent	4 points
Moderate performer, doing tasks between 40-60 percent	3 points
Somewhat bad performer, doing tasks between 20-40 percent	2 points
Bad performer, doing tasks between 0-20 percent	1 point

The performance can be grouped into 3 levels based on X value.

1. If $X > \bar{x} + S.D.$, then it means the performance is high.
2. If $\bar{x} - S.D. \leq X \leq \bar{x} + S.D.$, then it means the performance is moderate.

3. If $X < \bar{x} - S.D.$, then it means the performance is low.

1.2 To measure the satisfactory level of Director, Supervisor, and Operator to the wastewater treatment system. There are 5 levels of satisfaction, scoring by the following criteria.

Extremely satisfactory, satisfying between 80-100 percent	5 points
Very satisfactory, satisfying between 60-80 percent	4 points
Satisfactory, satisfying between 40-60 percent	3 points
Somewhat satisfactory, satisfying between 20-40 percent	2 points
Unsatisfactory, satisfying between 0-20 percent	1 point

Satisfaction can be grouped into 3 levels based on X value as follows.

1. If $X > \bar{x} + S.D.$, then it means satisfaction is high.
2. If $\bar{x} - S.D. \leq X \leq \bar{x} + S.D.$, then it means satisfaction is moderate.
3. If $X < \bar{x} - S.D.$, then it means satisfaction is low.

1.3 To measure the understanding and knowledge of Supervisor and Operator of the wastewater treatment system, the score will be calculated based on the following equation.

$$\frac{\text{Maximum Score} - \text{Minimum Score}}{\text{Number of Level}}$$

$$= \frac{8-0}{3} = 2.66$$

The score can be categorized in 3 levels.

If the value ranges between 0 – 2.66, it means low score.

If the value ranges between 2.67 – 5.23, it means moderate score.

If the value ranges between 5.24 – 8.00, it means high score .

1.4 Wastewater volumes and Biochemical Oxygen Demand (BOD) are categorized into 3 levels based on the X value as follows.

If $X > \bar{x} + S.D.$, then the value is high

If $\bar{x} - S.D. \leq X \leq \bar{x} + S.D.$, then the value is moderate.

If $X < \bar{x} - S.D.$, then the value is low.

2. Statistical Data used in the Analysis

2.1 Data collected from the Management in regard to the administration of the wastewater system and level of satisfaction to the wastewater system used in the hospital was analyzed by Descriptive Statistics such as Frequency, Percentile, Mean, and Standard Deviation.

2.2 Data collected from of the Supervisor in regard to the knowledge and understanding of the wastewater treatment system, techniques, maintenance, and satisfaction level to the treatment processes used in the hospital were analyzed by Descriptive Statistics such as Frequency, Percentile, Mean, and Standard Deviation.

2.3 Data collected from of the Operator in regard to the knowledge and understanding of the wastewater treatment system, techniques and operations, availability of equipment, and satisfaction level to the treatment processes used in the hospital were analyzed by Descriptive Statistics such as Frequency, Percentile, Mean, Standard Deviation.

2.4 Data collected from of the Residents in regard to the knowledge and understanding of the wastewater treatment system and the satisfaction level to the treatment processes used in the hospital were analyzed by Descriptive Statistics such as Frequency, Percentile, Mean, and Standard Deviation.

2.5 Relationship analysis between community hospitals and willingness of residents who live nearby the hospitals to pay for the wastewater treatment was calculated using Chi Square (χ^2).

2.6 Stepwise Multiple Linear Regression was used to find the relationship of management factor, supervisor factor, operator factor in relation to treated wastewater volumes, disposal water, and satisfaction level.

3. SWOT Analysis

SWOT analysis was used to identify problems and obstacles that occurred in the wastewater treatment system in the community hospitals, which are currently under the administration of the Ministry of Public Health in the Central region. It also was used to find the solutions for those problems.



CHAPTER 4

RESULTS

The objectives of this research are to study performance of management and operations of wastewater treatment system using in a community hospital in central of Thailand under Ministry of Public Health; and to include troubleshooting guidelines from executives and operators. This research classifies information and data from the study in 10 aspects for analysis. The results of this research are reported in 16 sections as detailed below.

- Section 1 Personal characteristics of executives of wastewater treatment system of the community hospital.
- Section 2 Management of wastewater treatment system of the community hospital.
- Section 3 Cost of management of wastewater treatment system of the community hospital in the past year.
- Section 4 Performances of wastewater treatment system of the community hospital.
- Section 5 Quality of effluent.
- Section 6 Personal characteristics of controllers of wastewater treatment system of the community hospital.
- Section 7 Training, seminar, and supervision of controllers of wastewater treatment system of the community hospital.
- Section 8 Personal characteristics of daily workers of wastewater treatment system of the community hospital.
- Section 9 Training, seminar, and supervision of daily workers of wastewater treatment system of the community hospital.
- Section 10 Knowledge and understandings of controllers and workers on operations of wastewater treatment system of the community hospital.

Section 11 Method (techniques and practices) of and controllers and workers on operations of wastewater treatment system of the community hospital.

Section 12 Satisfaction on performances of wastewater treatment system of the community hospital.

Section 13 Information of populations who reside nearby the community hospital.

Section 14 Analysis on relation of the community hospital in each province with willingness to pay wastewater treatment fee of people who reside nearby the community hospital.

Section 15 Stepwise multiple linear regression analysis on results of the performances of wastewater treatment system of the community hospital.

Section 16 Managerial guideline of wastewater treatment system of the community hospital using SWOT analysis.

Section 1 Personal characteristics of executives of wastewater treatment system of the community hospital.

Most executives or 35.5% of executives who manages wastewater treatment system of the community hospital are 35-39 and 40-44 years of age. Average age is 38 years old. 96.8% of executives are male. Most of them or 35.5% has been entitled in that position for 5-9 years. Average years in position as an executive are 9 years (see details in Table 6).

Table 6 Personal characteristics of community hospital administrator of wastewater treatment system .

Personal characteristics	Number of person	Percentage
Number of person	31	100.0
Age (years)		
< 30	3	9.7
30 – 34	2	6.5
35 – 39	11	35.5
40 – 44	11	35.5
≥ 45	4	12.9
Average age ± Standard deviation = 38.71 ± 5.08 years old		
Minimum age – Maximum age = 28 – 47 years old		
Gender		
Male	30	96.8
Female	1	3.2
Number of years in position as an executive		
< 5	9	29.0
5 – 9	11	35.5
10 – 14	7	22.6
≥ 15	4	12.9
Average years in position ± Standard deviation = 8.87 ± 5.59 years		
Minimum years in position – Maximum years in position = 1 – 22 years		

Section 2 Management of wastewater treatment system of the community hospital.

Overall management of wastewater treatment system of the community hospital is mostly in medium level, i.e. 61.3%. Main management activities are in community participation, law, and finance, which account for 19.4%. However, activities related

to techniques and technologies in wastewater treatment are in the low level of 22.6% (as shown in table 7).

Table 7 Management of wastewater treatment system of the community hospital – classified by each part.

Management of wastewater treatment system in community hospital	Level of activities in percentage			$\bar{X} \pm S.D.$
	High	Medium	Low	
Overall management	16.1	61.3	22.6	3.12 $\pm$ 0.52
Management by activities				
Planning	12.9	77.4	9.7	3.51 $\pm$ 0.69
Organization	9.7	77.4	12.9	3.54 $\pm$ 0.75
Staffing	9.7	77.4	12.9	3.26 $\pm$ 0.52
Directing	6.5	71.0	22.6	3.60 $\pm$ 0.50
Controlling	6.5	77.4	16.1	3.44 $\pm$ 0.59
Techniques and technologies	9.7	61.4	29.0	2.18 $\pm$ 0.91
Community participation	19.4	67.7	12.9	2.18 $\pm$ 0.91
Law and finance	19.4	67.7	12.9	3.22 $\pm$ 0.51

Section 3 Cost of management of wastewater treatment system of the community hospital in the past year.

Cost of management of wastewater treatment system of the community hospital in the year 2003 was 60,269.44 Baht. It consisted of 32,557.14 Baht of raw material and equipment costs, 30,383.33 Baht of cost of maintenance and examination of raw materials and equipment, and 24.29 Baht/m³ of wastewater treatment cost (as shown in Table 8).

Table 8 Cost of wastewater Treatment Management in the Past Year

Cost of management of wastewater treatment system	$\bar{X}$ (Baht)	S.D.
- Budget paid for management of wastewater treatment system.	60,269.44	66,922.53
- Raw material and equipment costs	32,557.14	31,884.19
- Cost of maintenance and examination of raw materials and equipment	30,383.33	31,330.65
- Cost of wastewater treatment per cubic meter	24.29	42.96

Section 4 Performances of wastewater treatment system of the community hospital.

Wastewater treatment system mostly used by the community hospital is Oxidation Pond. It is being used by 17 community hospitals or 51.2% of hospitals surveyed in this research. The average volume of treated wastewater is 40.00 m³/day in average, which accounts for 94.05% of total wastewater from the hospitals. Number of days per annum that wastewater treatment system can be operated normally accounts for 94.39%. (as shown in Table 9).

Table 9 The performances of wastewater treatment system of the community hospital.

Performance of wastewater treatment system of the community hospital	Quantity	Percentage	$\bar{X} \pm S.D.$
1. Type of wastewater treatment system			
1.1 Activated Sludge Process	5	15.2	-
1.2 Aerated Lagoon	5	15.2	-
1.3 Oxidation Pond	17	51.2	-
1.4 Activated Sludge Process and Aerated Lagoon	1	3.0	-

Table 9 The performances of wastewater treatment system of the community hospital (continue).

Performance of wastewater treatment system of the community hospital	Quantity	Percentage	$\bar{X} \pm S.D.$
1.5 Oxidation Pond and Aerated Lagoon	1	3.0	-
1.6 Oxidation Ditch	4	12.1	-
2. Capacity to treat wastewater (m ³ /day)	-	-	64.44 $\pm$ 52.96
3. Volume of wastewater from the community hospital (m ³ /day) Maximum = 150 m ³ /day	-	-	40.00 $\pm$ 33.28
4. percent volume of treated wastewater versus total volume of wastewater from the hospitals	-	94.05	-
5. percent number of days per annum that wastewater treatment system is operated normally.	-	94.39	-
6. Budget allocated for operations of wastewater treatment system:			
- Sufficient	16	48.5	-
- Insufficient	17	51.5	-
7. Additional monetary support beyond budget:			
- Obtained	4	12.1	-
- Not obtained	29	87.9	-

When studying the volume of wastewater occurred by each community hospital, the maximum volume is 150 m³/day. Details are reported in Table 13 in Section 5.

Section 5 Quality of effluent.

Qualitative analysis on effluent shows that BOD of wastewater from most community hospitals is in the range of medium level up to 81.8% (as shown in Table 10).

Table 10 The quality of effluent. (BOD)

	Volume of wastewater					
	High		Medium		Low	
	No.	%	No.	%	No.	%
BOD of treated effluent	4	12.1	27	81.8	2	6.1
Average BOD = 20.78 ± 14.72 mg/l						

With reference to the qualitative data of effluent from each community hospital, average BOD value is 20.78 ± 14.72 mg/l. Maximum and minimum BOD value are 58.5 mg/l and 5.0 mg/l. Please see details in Table 11.

Table 11 Volume of wastewater, volume of treated wastewater, and BOD value of each community hospital.

Hospital	Volume of wastewater (m ³ /day)	Volume of treated wastewater (percent of total volume of wastewater)	BOD value (mg/l)
1 st Province			
1.1	40-60	100	16.0
1.2	30	100	11.0
1.3	10	80	25.0
1.4	7	-	8.0

Table 11 Volume of wastewater, volume of treated wastewater, and BOD value of each community hospital (continue).

Hospital	Volume of wastewater (m ³ /day)	Volume of treated wastewater (percent of total volume of wastewater)	BOD value (mg/l)
2 nd Province			
2.1	28	100	9.0
2.2	10	75	14.5
2.3	30	100	18.0
2.4	18	-	51.9
2.5	150	-	21
3 rd Province			
3.1	15	100	58.5
3.2	10	90	26.9
3.3	10-20	90	7.0
4 th Province			
4.1	-	80-90	28.0
4.2	-	90	20.5
4.3	20	100	6.5
4.4	7	80-90	5.0
5 th Province			
5.1	80	100	11.0
5.2	-	100	12.5
5.3	20	-	55.0
5.4	60	100	20.0
5.5	30	100	15.0
5.6	60	-	27.0
5.7	40.6	85	19.0

Table 11 Volume of wastewater, volume of treated wastewater, and BOD value of each community hospital (continue).

Hospital	Volume of wastewater (m ³ /day)	Volume of treated wastewater (percent of total volume of wastewater)	BOD value (mg/l)
5.8	25	100	10.0
6 th Province			
6.1	25	100	21.0
6.2	30	-	5.1
6.3	-	100	15.0
6.4	30	100	17.0
7 th Province			
7.1	30	100	8.2
7.2	19	100	9.0
7.3	40	100	50.0
7.4	-	100	16.8
7.5	20-30	80	32

Section 6 Personal characteristics of controllers of wastewater treatment system of the community hospital.

Most controller or 36.4% of controller who operate wastewater treatment system of the community hospital are 40-44 years of age. Average age is 38.55 years old; standard deviation is 6.48. Most of them or 60.6% hold a title as public health officers and are in that position for 5 up to 9 years. Average years in position are 6.76 years; standard deviation is 4.28 years (as shown in Table 12).

Table 12 Personal characteristics of community hospital controllers of wastewater treatment system .

Personal characteristics	Number of person	Percentage
Total number of person	33	100.0
Age:		
< 30 years	4	12.1
30 – 34 years	6	18.2
35 – 39 years	4	12.1
40 – 44 years	12	36.4
≥ 45 years	7	21.2
Average age ± Standard deviation = 38.55 ± 6.48 years old		
Minimum age - Maximum age = 22 – 48 years old		
Current position:		
Public health expert officers	20	60.6
Community health officials	13	39.4
Number of years in position:		
< 5 years	8	24.2
5 – 9 years	20	60.6
10 – 14 years	2	6.1
≥ 15 years	3	9.1
Average years in position ± Standard deviation = 6.76 ± 4.28 years		
Minimum years in position – Maximum years in position = 1 – 21 years		

Section 7 Training, seminar, and supervision of controllers of wastewater treatment system of the community hospital.

51.5% of controllers have been trained and attained seminar in the past 3 years, however, 27.3% of controllers who attended the training thought that it was not sufficient for their job. 72.7% of controllers have been visited and supervised related to wastewater treatment system (see details in Table 13).

Table 13 Training, seminar ,and supervision of the community hospital. controllers of wastewater treatment system .

Training, seminar, and supervision	Number of person	Percentage
Attending training, meeting, seminar, and study tour related to wastewater treatment system in the past 3 years		
- Yes	17	51.5
- No	16	48.5
Usefulness of training or supervision for job.		
- Sufficient	8	47.1
- Insufficient	9	52.9
Being visited or supervision regarding wastewater treatment system in the past year		
- Yes	24	72.7
- No	9	27.3
Organization that paid a visit in the past year		
- The Bureau of Environmental Health	2	6.1
- Regional Health Promotion Center	5	15.2
- Provincial Public Health Office	5	15.2
- Others	9	27.3
- Being visited by more than 2 organizations	6	18.2

Section 8 Personal characteristics of daily workers of wastewater treatment system of the community hospital.

Most workers or 35.5% of operators of wastewater treatment system of the community hospital are 35-39 years of age. There is no workers that is younger than 30 years old. Average age of workers is 40.10 years old; standard deviation is 6.38. Most worker or 96.8% hold a title as worker of wastewater treatment system. 51.6

percent of operators are in the position less than 5 years. Average years in position as workers of wastewater treatment system are 4.71 years; standard deviation is 2.78 years. Maximum years in positions are 10 years (see details in Table 14).

Table 14 Personal characteristics of community hospital daily workers of wastewater treatment system.

Personal characteristics	Number of person	Percentage
Total number of person	31	100.0
Age:		
30 – 34 years	5	16.1
35 – 39 years	11	35.5
40 – 44 years	7	22.6
≥ 45 years	8	25.8
Average age $\pm$ Standard deviation = 40.10 $\pm$ 6.38 years old		
Minimum age - Maximum age = 32 – 59 years old		
Current position:		
Worker of wastewater treatment system	30	96.8
Mechanic	1	3.2
Number of years in position:		
< 5 years	16	51.6
5 – 9 years	12	38.7
10 – 14 years	3	9.7
Average years in position $\pm$ Standard deviation = 4.71 $\pm$ 2.78 years		
Minimum years in position – Maximum years in position = 1 – 10 years		

Section 9 Training, seminar, and supervision of daily workers of wastewater treatment system of the community hospital.

Most workers or 74.2% of workers have never attended training, meeting, seminar, and study tour regarding wastewater treatment system in the past 3 years. In contrary, most of them or 90.3% were visited and supervised (see details in Table 15).

Table 15 Training, seminar, and supervision of community hospital daily workers of wastewater treatment system .

Training, seminar, and supervision	Number of person	Percentage
Attending training, meeting, seminar, and study tour related to wastewater treatment system in the past 3 years		
- Yes	8	25.8
- No	23	74.2
Usefulness of training or supervision for job.		
- Sufficient	5	62.5
- Insufficient	3	37.5
- No reply	23	74.2
Being visited or supervision regarding wastewater treatment system in the past year		
- Yes	28	90.3
- No	3	9.7
Organization that paid a visit in the past year		
- The Bureau of Environmental Health	1	3.1
- Regional Health Promotion Center	3	9.7
- Provincial Public Health Office	5	16.1
- Others	17	54.8
- Being visited by more than 2 organizations	5	16.2

Section 10 Knowledge and understanding of controllers and workers on operations of wastewater treatment system of the community hospital.

Most controllers and workers have medium level of knowledge and understandings on operations of wastewater treatment system of the community

hospital, i.e. 75.8% and 61.3%, respectively. However, the workers can answer correctly to questions that required higher degree of knowledge and understandings more than the controllers do, i.e. 32.3% and 24.2%, respectively (see details in Table 16).

Table 16 Knowledge and understanding of community hospital controllers and workers on operations of wastewater treatment system .

Level of knowledge and understandings	Controllers		Daily workers	
	Number of person	Percentage	Number of person	Percentage
Low	0	0	2	6.5
Medium	25	75.8	19	61.3
High	8	24.2	10	32.3
Total	33	100.0	31	100.0

Section 11 Method (techniques and practices) of controllers and workers on operations of wastewater treatment system of the community hospital.

Most controllers and workers have medium skills on method and (techniques and practices), i.e. 72.7% and 77.4%, respectively (see details in Table 17).

Table 17 Method (techniques and practices) of community hospital controllers and workers of wastewater treatment system on operations

Level of skills on operations	Controllers		Daily worker	
	Number of person	Percentage	Number of person	Percentage
Low	3	9.1	4	12.9
Medium	24	72.7	24	77.4
High	6	18.2	3	9.7
Total	33	100.0	31	100.0

Section 12 Satisfaction on performances of wastewater treatment system of the community hospital.

With regard to the results of performances of wastewater treatment system of the community hospital, it found that only 12.9% of directors, 21.2% of controllers, and 9.7% of workers highly satisfied the results (see details in Table 18).

Table 18 Satisfaction on performances of wastewater treatment system of the community hospital – classified by group of population.

Satisfaction on performances of wastewater treatment system of the community hospital		percent satisfaction in each level			$\bar{x}$ score
		High	Medium	Low	
1	Satisfaction of hospital directors	12.9	77.4	9.7	3.5
2	Satisfaction of controllers	21.2	57.6	21.2	3.7
3	Satisfaction of workers	9.7	77.4	12.9	3.3
4	Satisfaction of people who live nearby the community hospital	18.7	65.5	15.8	3.6

Section 13 Information of populations who reside nearby the community hospital.

Populations who live nearby the community hospital are mostly higher than 45 years old. This accounts for 30.9 % of the residents. Most of population or 27.3 percent are employees. 53.2% of population are aware of wastewater treatment system in the community hospital. 75.5% of residents do not receive information or news from the hospital.

Most of residents or 64.0% perceive that environment will be badly affected if the wastewater is drained wrongly into the environment, e.g. unpleasant smell, dirty water, being a carrier of disease, and unpleasant scenery. 81.1% of populations agree

to share cost of wastewater treatment if they admit to the hospital. An average rate that they can share is 10.36 Baht/day.

Table 19 Information of populations who reside nearby the community hospital.

Information of populations who reside nearby the community hospital	Number of person	Percentage
Total number of person	139	100.0
Age:		
< 30 years	35	25.2
30 – 34 years	16	11.5
35 – 39 years	23	16.5
40 – 44 years	22	15.8
≥ 45 years	43	30.9
Average age ± Standard deviation = 39.13 ± 13.91 years old		
Minimum age– Maximum age = 15 – 85 years old		
Occupation:		
State officers	14	10.1
Retailer	30	21.6
Farmer	20	14.4
State enterprise officers	0	0
Employees	38	27.3
Others	37	26.6
Awareness on existence of wastewater treatment system in the community hospital nearby the residence		
Yes	74	53.2
No	65	46.7

Table 19 Information of populations who reside nearby the community hospital (continue).

Information of populations who reside nearby the community hospital	Number of person	Percentage
Water environment of community nearby the community hospital will be damaged if the hospital does not treat the wastewater before draining.		
Agree	125	89.9
Disagree	14	10.1
Awareness on information and news regarding wastewater treatment of the community hospital nearby the residences.		
Yes	32	23.0
No	105	75.5
No reply	2	1.4
Awareness on affects to the community environment if the community hospital drains wastewater without treatment.		
Unpleasant smell and dirty water	5	3.6
Carrier of disease	6	4.3
Unpleasant scenery	4	2.9
No affect	6	4.3
Unpleasant smell and dirty water + carrier of disease	23	16.5
Unpleasant smell and dirty water + unpleasant scenery	3	2.2
Carrier of disease + unpleasant view	3	2.2
Unpleasant smell and dirty water + carrier of disease + unpleasant scenery	89	64.0

Table 19 Information of populations who reside nearby the community hospital (continue).

Information of populations who reside nearby the community hospital	Number of person	Percentage
If the community hospital has well management of wastewater treatment system at present, benefits to the community will be:		
1. Reduction of spread-out of disease	10	7.2
2. Improving environmental surrounding	6	4.3
3. Improving quality of people life	2	1.4
4. Rnchanged environmental surrounding	3	2.2
5. Reduction of spread-out of disease + improving environmental surrounding	7	5.0
6. Reduction of spread-out of disease + improving quality of people life	3	2.2
7. Improving environmental surrounding + improving quality of people life	3	2.2
8. Reduction of disease spread-out + improving environmental surrounding + improving quality of life	104	74.8
Existence of private sector or foundation that support activities on water environment		
Yes	23	16.5
No	116	83.5
Awareness on the protection by law of water environment in the community surrounding		
Yes	55	39.6
No	84	60.4

Table 19 Information of populations who reside nearby the community hospital (continue).

Information of populations who reside nearby the community hospital	Number of person	Percentage
Acceptance to pay wastewater treatment fee if yourself or your relatives admit to the community hospital		
Yes	113	81.3
Average acceptable rate is 10.36 Baht/day.		
No	26	18.7

Section 14 Analysis on relation of the community hospital in each province with willingness to pay wastewater treatment fee of people who reside nearby the community hospital.

There is no relation between acceptability to pay wastewater treatment fee of people who reside nearby the community hospital and the community hospital in each province, whereas $\chi^2 = 10.413$, p-value = 2.108 at d.f. = 6 (see details in Table 20).

Table 20 Relation of the community hospital in each province and willingness to pay wastewater treatment fee of population who reside nearby the community hospital.

Community hospital	Accepted to pay	Unaccepted to pay	χ^2 Value
Uthaithani province	7	6	
Chainat province	21	5	
Singburi province	10	4	
Angthong province	13	6	10.413
Ayutthaya province	33	1	
Pathumthani province	13	2	

Table 20 Relation of the community hospital in each province and willingness to pay wastewater treatment fee of population who reside nearby the community hospital (continue).

Community hospital	Accepted to pay	Unaccepted to pay	χ^2 Value
Nonthaburi province	16	2	
Total	113	26	

$\chi^2 = 10.413$, p-value = 2.108 at d.f. = 6 , not significant

In addition, people who live nearby the community hospital of Nonthaburi province are pleased to pay the wastewater treatment fee at the highest average rate of 14.0 Baht/day. (see details in Table 21).

Table 21 Community hospital in each province that people who reside nearby are pleased to pay wastewater treatment fee.

Community hospital	Number of community hospital in the province	Average acceptable fee (Baht/day)
Uthaithani province	4	6.54
Chainat province	5	6.42
Singburi province	3	5.77
Angthong province	4	12.50
Ayutthaya province	8	13.00
Pathumthani province	4	9.33
Nonthaburi province	5	14.44

Section 15 Stepwise multiple linear regression analysis on results of the performances of wastewater treatment system of the community hospital.

Relationships between the director's management, the supervisor's control, the operator's handling of the wastewater treatment system and the operation results of the wastewater treatment system performance.

Information and data collected from the directors, controllers, and workers of the hospital regarding amount of wastewater, quality of treated effluent, and satisfaction level of the hospital directors and workers were analyzed using Stepwise Multiple Linear Regression. The analytical results are as follows.

1. Analysis of the relation of factors involved the hospital director's management which consist of 11 variables

1. Age
2. Gender
3. Managerial period
4. Planning
5. Organizing
6. Staffing
7. Directing
8. Controlling
9. Techniques and technology
10. Community Participation
11. Laws and Financial

With quantity of treated wastewater (percentage of total wastewater produced in the hospital), quality of effluent (BOD valve), and director's satisfaction level of the treatment performance. The results of the analysis were as follows:

1.1 Stepwise multiple linear regression analysis of factor involve wastewater treatment management of hospital director with treated wastewater as percentage of total wastewater. There was no relation between the director's techniques and technology variables and the percentage of treated wastewater to the total wastewater.

1.2 Stepwise multiple linear regression analysis of factor involve wastewater treatment management of hospital director with BOD value. There was a relation statistically significant at $p = 0.024$, $R^2 = 0.163$ between the director's technique and technology variables and BOD.

1.3 Stepwise multiple linear regression analysis of factor involve wastewater treatment management of hospital director with hospital director's satisfaction. There was a relation statistically significant at $p < 0.005$, $R^2 = 0.355$ between the laws and budgets variable and the satisfaction level of the director.

However, according to Pearson's correlation analysis among the director's variables, the results revealed that the organizing management variable and the staffing management variable were highly correlated ($r = 0.80$).

2. Analysis of the relation of factors involved the treatment system controller which consist of 7 variables.

1. Age
2. Operation period
3. Knowledge and understanding
4. Training and supervision
5. Method (techniques and practice)
6. Supporting budget
7. Types of the wastewater treatment system

With quantity of treated wastewater (percentage of total wastewater), quality of effluent (BOD value), and controller's satisfaction level of treatment performance. The results were as follows:

2.1 Stepwise multiple regression analysis of factor involve wastewater treatment controller with treated wastewater as percentage of total wastewater. There was no relation between the controller's variable and the percentage of treated wastewater to the total wastewater.

2.2 Stepwise multiple regression analysis of factor involve wastewater treatment controller with BOD value. There was no relation between the controller's variables and BOD value.

2.3 Stepwise multiple regression analysis of factor involve wastewater treatment controller with controller's satisfaction. There was a relation statistically significant at $p < 0.005$, $R^2 = 0.419$ between the controller's method (techniques and practice) and the satisfaction level of the controller.

According to Pearson's correlation analysis among the controller variables, the results showed that the age variable was highly correlated to the controlling time variable ($r = 0.505$).

Analysis of the relation of factors involved the workers which consist of 6 variables.

1. Age
2. Operation period
3. Knowledge and understanding
4. Training and supervision
5. Method (Techniques and Practice)
6. Sufficiency of equipment

3. With quantity of treated wastewater (percentage of total wastewater), with quality of effluent (BOD value), and worker's satisfaction level of treatment performance. The results were as follows :

3.1 Stepwise multiple regression analysis of factor involve wastewater treatment worker with treated wastewater as percent of total wastewater. There was no relation between the worker's variable and the percentage of treated wastewater to the total wastewater.

3.2 Stepwise multiple regression analysis of factor involve wastewater treatment worker with BOD value. There was no relation between the worker's variables and BOD value.

3.3 Stepwise multiple regression analysis of factor involve wastewater treatment worker with worker satisfaction. There was a relation statistically significant at $p = 0.002$, $R^2 = 0.797$ between the worker's method (techniques and practice) variable and the sufficiency of equipment. (see table 22)

Table 22 Stepwise multiple linear regression analysis of the results of wastewater treatment system performance.

Procedure	Variable	R^2	R^2 change	Coefficient Beta	F	P-value	N
1	Procedures (Techniques and practice)	0.708	0.708	0.673	70.353	< 0.0001	31
2	Sufficiency of equipment	0.797	0.088	0.342	54.83	< 0.0001	31

Regression analysis calculated the satisfaction of workers to the results of the performance of the hospital's wastewater treatment system by using the method variable and the sufficiency of equipment variable as the equation below.

$$\text{Satisfaction of wastewater treatment worker} = 0.761 + 0.565 (\text{method}) + 0.302 (\text{sufficiency of equipment})$$

However, according to Pearson's correlation analysis among the worker's variables, the results showed that the method variable were highly correlated to the sufficiency of equipment variable ($r=0.427$).

In conclusion from data analysis of this research it was found that according to hypothesis the variables which affected result of the managerial wastewater treatment system performance result of the managerial wastewater treatment system performance are the following.

- Factors concerning with wastewater treatment system of the hospital director with officiated the performance were technique and technology variable and lows and financed variable.
- Factor concerning the controller which affected the performance was withal (techniques and practice) variable.
- Factors the worker which affected the performance were method (xechnigues and practice) variable and sufficiency of equipment s there variable affected the recently mere then the other variable.

Section 16 Managerial guideline of wastewater treatment system of the community hospital using SWOT analysis.

A managerial equipment of wastewater treatment system for community hospitals

After all the problems and obstacles during the data gathering and analytical processes have been taken into account, these data were then summarized and set priority in SWOT analysis.

1. Strengths

- The hospital has plans and policies for supporting, preventing, and solving environmental problems
- Other departments of the hospital well-supported the performance
- The hospital provided large space for the wastewater treatment system

2. Weaknesses

- Lack of funds, staffs, equipment, and tools
- Staffs did not receive, training, seminar, and supervision
- Lack of good cooperation from other staffs in wastewater treatment system. For example, some staffs trashed garbage and leftover food in the sewer.
- Equipment and tools are expensive and hard to find

- Lack of method (techniques and practices)
- Staffs worked too many tasks or did not work in their fields of study.
- Frequent changes in both executives and staffs

3. Opportunities

- People are willing to support the wastewater treatment performance.
- People are willing to pay for the wastewater treatment system
- People have good knowledge in laws and regulations regarding water environment such as water resource protection
- Many organizations such as Environmental Health Center Region, City Municipal and Tambol Administration Agency are willing to support the wastewater treatment system.

4. Threat

- Increases in the number of patients and relatives in the hospital
- Increases in wastewater treatment system's expenses due to economy situation
- Lack of participation from people
- People received insufficient information and public relations regarding the wastewater treatment system
- Obsolete technology used in the system, treatment depended on nature, and environmental factors in the hospital were not suitable to the system such as flooding, no sunlight, etc.
- Thief problems

The Balanced Scorecard method is used to specify strategic activities for a management of wastewater treatment system in hospitals. The Balanced Scorecard method can be described in 4 perspectives: Financial Perspective, Customer Perspective, Internal Process Perspective, Learning and Growth Perspective as shown in Table 23. Strategies, strategic objectives and indicators of wastewater treatment management in community hospital are shown in Table 24.

Table 23 Objectives and strategic activities follow 4 dimension by balance scorecard

Perspective	Strategic objectives	Activities						
		Control, follow, evaluation	Increase incomes, reduce costs	Coordination with other work units involved	Set wastewater treatment committee	Setup training seminar, and supervision	Give opportunity for people's participation	Campaign for public relation
Financial	- have more budget for performance - have more satisfaction		/					
Customer	- have and appropriate plan/project of wastewater treatment			/	/		/	/
Internal Process	- have and correct ding task - have sufficient of equipment and material - take advantage form area usage of hospital	/	/	/	/			

Table 23 Objectives and strategic activities follow 4 dimension by balance scorecard (continue).

Perspective	Strategic objectives	Activities					
		Control, follow, evaluation	Increase incomes, reduce costs	Coordination with other work units involved	Set wastewater treatment committee	Setup training seminar, and supervision /	Give opportunity for people's participation
Learning and Growth	- Staffs have good knowledge in waking						
	- Staffs concern to reduce wastewater treatment problems.			/			
							Campaign for public relation

Table 24 Strategies, strategic objectives and indicators of wastewater treatment management in community hospital.

Perspective	Strategy	Strategic objective	Indicator
1. Financial	- collect wastewater treatment fees	- increase an operation cost	- income form treatment fees announcement.
2. Customer	- support and promote public participation in hospital wastewater treatment	- increase satisfaction	- the proportion of persons participated in hospital wastewater treatment
3. Internal Process	- set plan / project to get supports from government, people and institutions involved	- have a proper project / plan of wastewater treatment system, and high efficiency	- plan / project for hospital wastewater treatment
	- campaign for efficient uses of equipment	- sufficient number of equipment for the operation	- the rate of equipment usage
	- use suitable area of hospital	- efficient area usage in hospital	- a proper wastewater treatment system in a hospital area

Table 24 Strategies, strategic objective and indicator of wastewater treatment management in community hospital (Continue).

Perspective	Strategy	Strategic objective	Indicator
4. Learning and Growth	- develop knowledge and ability of staff, and concerns of the personnel	- sufficient knowledge of operator	- the rate of people attended in training session, seminar, and number of supervision
	- campaign for wastewater reduction and elimination of clogging in a public sewer	- awareness in reduction of wastewater problems and wastewater producing	- the rate of correct working - the amount of wastewater and the rate of wastewater treatment problems

From the SWOT Analysis, the researcher proposed the approaches to manage the hospital's wastewater treatment system as shown in Table 25.

Table 25 Guidelines for wastewater treatment system management of community hospital, Ministry of Public Health in central region by SWOT matrix analysis.

SWOT	Strength – S	Weakness – W
SW	1. The hospital has plans and policies for supporting, preventing, and solving environmental problems	1. Lack of funds, staffs, equipment, and tools 2. Staffs did not receive, training, seminar, and supervision 3. Lack of good cooperation from other staffs in wastewater treatment system. For example, some staffs trashed garbage and leftover food in the sewer.
OT	2. Other departments of the hospital well-supported the performance 3. The hospital provided large space for the wastewater treatment system	

Table 25 Guidelines for wastewater treatment system management of community hospital, Ministry of Public Health in central region by SWOT matrix analysis. (Continue)

Opportunity – O	Strategy SO	Strategy WO
1. People are willing to support the wastewater treatment performance. 2. People are willing to pay for the wastewater treatment system 3. People have good knowledge in laws and regulations regarding water environment such as water resource protection	1. Set plan /project to get supports from government, people and institutions involved (S1O1,2). 2. Set hospital wastewater treatment fees announcement (S012,2). 3. Set a board to manage the hospital wastewater treatment at district level with local people's participation and with coordination of work units involved (S2O,3).	1. Give an opportunity for local people's participation in wastewater treatment and campaign for wastewater reduction of hospital's officers (W3O1). 2. Control, follow up, assess the performance, and also give an opportunity for local people's participation in wastewater treatment problems (W1,3O1).

Table 25 Guidelines for wastewater treatment system management of community hospital, Ministry of Public Health in central region by SWOT matrix analysis. (Continue)

Opportunity – O	Strategy SO	Strategy WO
1. Increases in the number of patients and relatives in the hospital, and increases in wastewater treatment system's expenses due to economy situation. 2. Lack of participation from people and people received insufficient information and public relations regarding the wastewater treatment system. 3. Obsolete technology used in the system, treatment depended on nature, and environmental factors in the hospital were not suitable to the system such as flooding, no sunlight, etc and thief problems.		

Table 25 Guidelines for wastewater treatment system management of community hospital, Ministry of Public Health in central region by SWOT matrix analysis. (Continue)

Threat – T	Strategy ST	Strategy WT
	1. Campaign for efficient uses of equipment and use suitable area of hospital. (S3T1) 2. Coordinate with other work units involves to give information and public relations to people, and campaign for community participation regarding problems. (S2T2)	1. Set up training, seminar, and supervision, also transfer modern knowledge, techniques and practices, and appropriate technology to hospital staffs (W2T3). 2. Set up training, seminar, and supervision in proper and accurate operations for the most efficient wastewater treatment (W2T1).

Summary of important findings

1. Information as regard to the hospital's directors

The hospital's directors are mostly male. In average, they have been working as the director for less than 10 years. The performance in managing the wastewater treatment system is moderate. Most of their activities were related to laws and encouragement of people's participation to the system. Methods (techniques and technologies) are the task that they involved the least.

2. Information as regard to the hospital's wastewater treatment controllers

The controllers are mainly public health officers. They have been working as the system's operators in average less than 10 years. Most of them received training, attended seminars and supervisions. However, those training did not provide sufficient knowledge to their operations.

3. Information as regard to the hospital's wastewater treatment workers

Most of the workers have an average age of 40. They have been working as the operators less than 5 years. They have never received any training or seminar about the wastewater treatment system, but on the other hand, they have supervision and been visited by others.

4. Information as regard to the people

Most of the people have not been informed about the hospital's wastewater treatment system, but they have knowledge and been aware of the effects to the community's environment nearby the hospital areas.

5. Information as regard to the satisfaction level to the results of the hospital's wastewater treatment performance.

The director, the controllers, the workers of the system, and the people were moderately satisfied with the results of the wastewater treatment..

6. Information as regard to laws and finances.

According to the study, it revealed that the hospital's director did in part of community participation and part of law and finances at high level. From the budgeting perspective, the budgets for the wastewater treatment system are approximately 60, 269.00 Baht per year, with an average cost of 24.29 Baht per cubic meter. Furthermore, the study founded that most of the hospital's patients were willing to pay for the system.

7. Information as regard to the hospital's wastewater treatment operation

In average, the hospital produced 40 cubic meter of wastewater per day and the capability of the hospital's wastewater system is 64.44 cubic meter per day. The system daily operated at higher than 90 percent of the total capability. The treated wastewater accounted for 94.05 percent of the total wastewater, and the average BOD value met the standard value.

8. The director's management factors that influenced the results of the wastewater treatment system performance.

Factor of the hospital director which effect the treatment results in quality of effect is techniques and technologies variable. But laws and finances variable have an effect on the director's satisfaction to the performance.

9. The controller's factors that influenced the operational results of the wastewater treatment system.

With consideration of all the controller's operational factors, the study found that methods (techniques and practice) variable have an effect on the satisfaction level of the controller.

10. The worker's factors that influenced the operational results of the wastewater treatment system.

Methods (techniques and practice) variable and sufficiency of equipment have an effect on the satisfaction level of the worker.

11. Managerial guideline of wastewater treatment system in community hospitals

From SWOT Analysis the *strength* are the supporting policy and plan of hospitals, allocated large area in hospital for wastewater treatment. On the other hand, the *weakness* are lacking of budget and staffs; inadequacy of equipment ; not obtained training, seminar, and supervision. The *opportunities* are the followings: Cooperation and supports from people, such as paying the treatment fee, understanding of water environmental laws and regulations. But *threaten* are increasing in the number of patients and relatives in the hospital, increasing in wastewater treatment system's expenses due to economy situation, lack of participation from people, insufficient information and public relations regarding the wastewater treatment system, obsolete technology used in the system and environment in the hospital were not suitable to the systems. The management guideline of wastewater treatment system in hospitals are as follows:

1. Set plan /project to get supports from government, people and institutions involved (S1O1,2).
2. Set hospital wastewater treatment fees announcement (S2O1,2).
3. Set a board to manage the hospital wastewater treatment at district level with local people's participation and with coordination of work units involved (S2O3).
4. Give an opportunity for local people's participation in wastewater treatment and campaign for wastewater reduction of hospital's officers (W2O1).
5. Control, follow up, assess the performance, and also give an opportunity for local people's participation in wastewater treatment problems (W1O1).
6. Set up training, seminar, and supervision, also transfer modern knowledge, techniques and practices, and appropriate technology to hospital staffs (W2T3).
7. Set up training, seminar, and supervision in proper and accurate operations for the most efficient wastewater treatment (W2T1).

8. Campaign for efficient uses of equipment and use suitable area of hospital. (S3T1).
9. Coordinate with other work units involves to give information and public relations to people, and campaign for community participation regarding problems. (S2T2)



CHAPTER 5

DISCUSSION

The objectives of this research is to study the result of wastewater treatment management of 30-60 beds community hospital under the administration of the ministry of Public Health in the Central region of Thailand by analyzing data related to the variables of the management of the wastewater treatment system which consist of :

1. Age
2. Gender
3. Duration time of wastewater treatment system management
4. Planning
5. Organizing
6. Staffing
7. Directing
8. Controlling
9. Techniques and Technologies
10. Participation of the community
11. Laws and Finances

Data related to factor of system controller consist variables of :

1. Age
2. Duration time of wastewater treatment system controlling
3. Knowledge and understanding
4. Obtained training and supervision
5. Methods (techniques and practice)
6. Budget supporting
7. Types of the wastewater treatment system

Data that are related to the system worker factors were analyzed consist of 6 variables as follows :

1. Age
2. Duration time of wastewater
3. Knowledge and understanding
4. Obtained training and supervision
5. Methods (techniques and practice)
6. Sufficiency of equipment

Other data related to the performance results from the hospital's wastewater treatment system such as the amount of treated wastewater, the quality of treated wastewater, the satisfaction of the executives and the operators to the performance, and the satisfaction of the people who lives nearby the hospital to the wastewater treatment system were also taken into account.

There are some interesting issues from Chapter 4 need to bring into the discussion. The details are as follows:

1. Information of the community hospital's directors.

From the questionnaire's results, 96.2 percent of the hospital's directors are male with an average age of 38 years old. They have been working as the directors for 8.87 years in average. According to the data, it indicated that the directors have good qualification and enough experience to improve the quality of services in the hospitals in relation to the environment and the management of the wastewater treatment system in the hospitals. From the Somporn Ittidejpong's study of factors that affected performances of the community hospitals' director (1987: Abstract; cited in Wanna Youngcharocn 1999 : 77), it revealed that age of the director is positively correlated to the performance. In addition, the research found that 61.3 percent of the hospital's director has moderate performance in managing the wastewater treatment system in the hospital.

With comparison to all management activities, the hospital's directors involved in community participation, and laws and finance the most, with account for 19.4 percent. The result is in line with Strategy 4 of the National Health Development Plan under the 9th National Economic and Social Development Plan (2002-2006) in associated with the strength of civil society in health development as it was stated that "To support community's role, to strengthen family and all levels of society, and to promote the participation in setting regulations in health resources selection, health resources management, and social movement in community healthcare promotion, and to examine the governmental work" In general, the plan is to focus on community participation and conform with the main mission of the Ministry of Public Health, which is to promote all levels participation, to comply to the regulations and laws, and to effectively utilize budgets.

For other management activities, 29.0 percent of the hospital's directors involved the activities related to techniques and technologies in wastewater treatment at low level. This is due to the directors performed too many activities including patient examination and other management tasks. They have less time to involve in the activities related to techniques and technologies of the hospital's wastewater treatment, which is associated with the Wareerat Sansanoa's study (1998:152) of knowledge and doing of personnel in Rachburi Hospital. The study revealed that the management did not pay enough attention to the environment. They more concentrated in patient treatment because they thought that the environment is not a part of their job. It should be in the care of the technical person, not the management. So, it is necessary that the management pay more attention to the techniques and technologies of the wastewater treatment system.

2. Information of the community hospital's controller.

The controllers of the wastewater treatment system have an average age of 39.6 years, 36.4 percent of them are public health officers and 60.6 percent are community health officials. They have been working as the system's operator for 6.8

years in average. According to the information, the controllers are considered as well-qualified and experienced sanitary personal. Approximately half of the controllers received training over the past three years and 73 percent of them being visited or supervised concerning wastewater treatment system. The results are consistent with the Banjop Chanchareon's study (1999:62) on the readiness of administration in managing the wastewater treatment system in the community hospitals. The study showed that most of the hospital's management is sanitary officers with less than 10 years experience in the wastewater treatment system. 67.3 percent of them being visited or supervised and 67.3 percent of them claimed that they did not received sufficient knowledge for their operations.

So it is important that the wastewater treatment operation require knowledge and experience in the system. As Niroot Khunpol (1996:33-34) mentioned that although the suitable wastewater treatment system is used, good control and maintenance are always needed. The research also found that there were not enough training and seminars for doing task. The decisions whether to receive training and seminars were made from Provincial Health Office, Regional Health Promotion Center, Bureau of Environmental Health, and other related organizations.

3. Information of the hospital's wastewater treatment worker.

Most of the workers have an average age of 40 years old. About half of them have been working as the workers for 4.7 years. Seventy-four percent of the workers have never received any training, seminar, or study tour about the wastewater treatment system over the past three years and 90 percent of them being visited or supervised. According to the study of Uraiwan Inmoung (2001: 87), more than 50 percent of the workers are temporary workers and finished only Pratom 6. Only 50 percent of the them received the training about control and maintenance of the wastewater treatment system. This research demonstrated that the wastewater treatment's worker did not get sufficient training for their daily work.

In part of knowledge with under handing and the method, Both the controllers (76percent) and the workers (61percent) were moderately knowledgeable in the system. Somkid Wongchaisuwan (2001: 282) stated that personnel who are in charge of the wastewater treatment operation, especially the operators, should have knowledge and expertise in the operation. Moreover, it is important that a coordinator be assigned to communicate and work with other parties. Overall, the operators have just enough knowledge and understanding to continue their works. However in term of the methods (techniques and practices), the controller and the workers were also able to follow at the moderate level, with account for 72.7 and 77.4 percent, respectively. In conclusion the daily workers did the correct method of this task fair enough.

4. Information on the people.

According to the questionnaire results, 31 percent of people are older than 45 years old and 27 percent of them are employees. About half of them (53percent) have known that the hospital has the wastewater treatment system, but 75.5 percent have not been informed about the information regarding the system. However, 64 percent of the people are aware that the improper treatment could affect the environment nearby the hospital areas. This indicated that the Ministry of Public Health has publicized information and environmental management policies to the people. The present environmental management policy of Ministry of Public Health has supported a public relation campaign, and given information to all people. Although most people in this survey are employees, they knew that good environmental management can have a positive impact to their community. For example, the wastewater problem from hospitals, an inefficient management of wastewater treatment has an effect to the community's environment. This is consistent to Hadrat Lorpensri's study (1997 : 97) on the feasibility of collecting wastewater treatment fee: the Siphraya's Project. The study revealed 60.3 percent of the households and the businesses used to inform of the wastewater treatment system as high as 80.5 percent of them were informed by the media about the wastewater problems. But this study found that most of the community hospitals did not inform the people on the current wastewater treatment

projects, the progress, the results of the problems and the effects to the community, and the requests for support from people or other parties. The results of the study showed that 75.5 percent of people did not receive information from their community hospital.

The study of Pol.Lt.Col. Manorot Sittanon (2540:99) on an acceptance level of industrial plant owners to use wastewater treatment system: Case Study: Ampur Sampran revealed that a group of people who obtained more information had higher level of acceptance than those who obtained information at moderate and low level. Therefore, it is very necessary that the community hospitals and other types of hospitals have public relation campaigns to encourage people to take care of the environment in their community. Moreover, the Water Quality Management Bureau under the Pollution Control Department has arranged the events and activities to give opportunities to people to be able to participate in the environmental management process from start to finish. It is based on the principle that emphasizes local management. Local people need to be involved in every steps of environmental conservation. This public participation process requires a genuine cooperation from people. (Water quality newsletter TC :1)

5. Data related to satisfaction of the results of wastewater treatment performance in hospitals.

The results show that there is 13percent high satisfaction of hospital directors, 21percent high satisfaction of public health officers and community health officials, and only 10percent high satisfaction of workers for wastewater treatment system in hospitals. On the other hand there is 19percent high satisfaction of people living around hospitals. However, there is 50percent moderate satisfaction of all 3 groups of treatment staffs in hospitals and 66percent of moderate satisfaction of people living around hospitals.

According to the study of Banjop Chanchareon (1999 : 77), the wastewater treatment administrators with high level of satisfaction were readiness in wastewater treatment system management better than the administrators with moderate and low level of satisfaction. Supatra Joongsa-ngasom's study showed that the satisfaction in doing task correlated with the operations role of responsibility of the chief of public health administration section of district municipal.

From the results and studies, they can be concluded that all people involved have a fair satisfaction in hospital wastewater treatment. This is due to the fact that the Ministry of Public Health had constructed the wastewater treatment system for all community hospitals around the country since 1999. Furthermore the government had a policy to promote and support the environmental conservation under the 9th national economic and social development plan 2002 – 2006 (the 4th Strategic plan). It emphasizes the efficient management and administration of pollution problems. The Ministry of Public Health has also adopted the health development principle that integrates all factors, e.g. economic, social, politic and environmental factors, for total health system development.

6. Laws and financial data

The laws and financial data in this research showed that 19percent of hospital administrators use the law as a tool in their wastewater management at high level and 40percent of people are aware of the water conservation law. Hadirat Lorpensri (1997 : 81) had studied the feasibility of collecting treatment fees. In Siphraya wastewater project, for example, the study showed that only 24.1percent of people received information related to the wastewater management law. Thus this research suggested that there should be more public relation campaign concerning to the environmental law. The study is consistent to the study of the Water Quality Management Bureau under the Pollution Control Department (newsletter of water quality, PC :10). It showed that wastewater treatment systems of many hospitals are lack of system personnel and enforcement of law.

As for the financial data, it showed that there was an averaged cost of wastewater treatment system at 60,269.44 baht annually. This is a fairly high number. The treatment cost per wastewater volume was 24.29 baht per cubic meter. Normally hospitals have to spend a large amount of budget for patient. With the high cost of wastewater treatment and government health insurance (Universal Coverage : UC), hospitals need to have a prudent plan to be able to survive in the present situation. Walaiporn Patcharanalumol (2002 : 334 , 341) had mentioned about financial system in that there is low level of budget for hospitals. This created financial uncertainty. Hospital administrators have to pay more attention to the patient treatment. So in wastewater treatment cost, executives may see over its importance. But in fact wastewater treatment cost is an important issue that needs a systematic performance.

However, the survey showed that 81.3percent of patients were agreed to pay an additional fee for wastewater treatment. The averaged allowable fee is 10.36 baht daily with the maximum at 100 baht a day. The results from this research were varied in each province. The willing to pay or not pay wastewater treatment fee of people around the hospital were not related to community hospital in each province. The maximum allowable fee was 14.44 baht a day for community hospitals in Nonthaburi province. The minimum allowable fee was 5.77 baht a day for community hospitals in Singhburi province. This is an opportunity that hospitals need to have a continuous public relation campaign with information related to cost in wastewater treatment in order to reduce the treatment cost. As in the Hadirat Lorpensri's study (1997 : 97) on the feasibility of collecting wastewater treatment fee: the Siphaya's Wastewater Project, the study revealed that people who received information willing to pay higher fee than people who did not received information. Furthermore the usage charge can be an economic tool for water pollution management in Thailand (Department of Industrial Work, Ministry of Industry and Environmental Engineering Association of Thailand 2002 : 22). Therefore, to have people involve in management of wastewater treatment system and aware of the high treatment cost, hospitals need to have a continuous public relation campaign with information related to cost in wastewater

treatment. However the relation campaign must conform to the government's policy of water pollution management.

7. Statistical data related to the system and performance of wastewater treatment in hospitals.

In this research 51percent of wastewater treatment system in community hospitals is the oxidation pond system. The rests of them are the activated sludge system, oxidation ditch system, aerated lagoon system, the combination of activated sludge and aerated lagoon system, and the combination of oxidation pond and aerated lagoon system. The study of Somchai Sakulitsariyaporn (1997) showed that most wastewater treatment system of all government hospitals under the Ministry of Public Health around the country is the oxidation ditch system. This research also showed that community hospitals have average wastewater at 40 cubic meters a day, the treated wastewater at 94.05percent of all hospital wastewater, the average BOD at 20.78 mg/l, the average capacity of the system at 64.44 – 52.96 cubic meters a day and the number of days in a year that the system is functional at 94.39percent. Thongchai Pansawat et.al. (1987) mentioned that hospitals have 800 liter/day/bed with BOD value at 94 gram/day/bed. The conclusion of this research showed that the wastewater treatment is quite complete by the percent of treated wastewater at 94.05percent. The BOD is in the normal level. There is sufficient capability of the treatment systems. In circumstance with the normal number of patients, the water pollution problem will not occur. However, in the future, hospitals need to have a plan to increase its capacity for wastewater treatment due to growing number of patients. According to the 1st meeting reports of Bangkok wastewater treatment project (1990) showed that the government needs to allocate more budgets for constructing large treatment facilities that can support an increasing population.

8. Factors related to the management of the community hospital directors which affect the wastewater treatment performance.

The study of factors that affect the management of the hospital director showed that techniques and technologies had an impact on the BOD value with statistical significance ($p < 0.05$). This can be described that the hospital directors need to have technical skills and technologies to efficiently manage the wastewater treatment system. The water quality of the treated wastewater must be in the standard range. This is consistent to the study of Somchai Sakulitsariyaporn (1997). The study involved the development of wastewater management method for the Ministry of Public Health. It showed that an important factor to the efficiency of wastewater treatment system is a proper monitoring and maintaining of technical principle and technology. His work is also consistent to Uraiwang Inmuong's study (2544 : 89) in the characteristic of wastewater before and after treatment for hospitals in the upper north eastern part of Thailand. Her study showed that most hospitals have an inefficient wastewater treatment system. The major factor to the efficiency of wastewater treatment system is the proper monitoring and maintaining technique and technology.

The other factors affect the management of the hospital director are the law and financial variable related to the satisfaction of the hospital director, which have a statistical significance ($p < 0.05$). In the present time the wastewater management system must consider the effect to the performance. Satisfaction to the treatment the important variable involve is laws and financials variable. This is consistent to the study of Banchop Chanchareon (1999 : 87). It showed that satisfaction and motivation of administrators had a positive relationship with readiness in the management of wastewater treatment system by all aspects. The study of Uraiwang Inmuong (2001 : 90) showed the same consistent. She founded that the difficulties of wastewater management in hospital were that the budget for wastewater treatment system was not provided. As for the management plan for domestic wastewater (Newsletter of water Quality, PC : 8) of the Pollution Control Department under the Ministry of Natural Resources and Environment which proposed in 2004 to the committee of national environment, it involved the difficulties of wastewater treatment readiness and improper management, enforcement of law and budget. There

are 7 strategies for wastewater management. The 6th strategy is the law factor, and the 7th strategy is the financial or budget factor. All strategies can increase the efficiency of the treatment.

In order to increase the efficiency of operations in community wastewater management, knowledge and techniques are factors related to the management of the hospital director, which affect to the operations of wastewater treatment. The water quality after treatment (BOD value), law and financial factors also affect to the satisfaction.

Furthermore the correlation between variables of the management of hospital directors has the organizing variable and staffing variable with $r = 0.80$. This showed that the organizing and staffing is significantly related to the management of the hospital director.

9. Factors related to controllers of wastewater treatment system in community hospitals, which affect to the wastewater treatment performance.

According to the study of the factors of controller that affect to the wastewater treatment operation in community hospital, it showed that the method variable (techniques and practice) can affect to the satisfaction of controllers with a statistical significance ($p < 0.05$). This variable has the most impact on the satisfaction of controllers in wastewater treatment system for community hospitals. To have an efficient wastewater treatment system, controllers must constantly control the system. This study also founded that most controllers had higher level of satisfaction than the hospital directors and worker staffs. The study is consistent to the Somkit Wongchaisuwong's concept (2001 : 282). He mentioned that personnel providing must have both appropriate quantity and quality. All personnel must have knowledge and understanding in the system including the system control theory. He also suggested that operators must have proper techniques and practices sufficient to the wastewater treatment operations.

In addition, the correlation between variables of the operations of controllers has $r = 0.505$ of the age and work duration variables. This showed that the age and work duration of controllers significantly correlated to the operations of the system.

10. Factors related to daily workers of wastewater treatment system in community hospitals, which affect to the wastewater treatment performance.

According to the study of factors of workers in daily operation, it shows that the relationship between two variables: the method (technique and practice) and the sufficiency of equipment has a statistical significance ($p < 0.05$) with $R^2 = 0.797$. These variables have an important effect to the worker's satisfaction, which the According to the study of factors of workers in daily operation, it shows that the relationship between two variables: the method (techniques and practice) and the sufficiency of equipment has a statistical significance ($p < 0.05$) with $R^2 = 0.797$. regression equation can accurately estimate up to 80percent. The result of the study may be that the method (techniques and practice) directly affects the efficiency of wastewater treatment system. Then the workers need to closely follow the standard procedures. Moreover, the equipment must be sufficient to the staffs' operations especially in case of failure occurred. The satisfaction of staffs depends on this factor. Somkit Wongchaisuwang had described that the control and maintenance of wastewater treatment system (2001 : 280) needs a well- plan construction of the wastewater treatment system, tools and equipment. The availability of tools and equipment is crucial to staffs' satisfaction and the efficiency of wastewater treatment system.

According to the study of Uraiwan Inmoang (2001 : 87), the difficulties of wastewater treatment operations were experience, knowledge and techniques of workers who most are temporary employee. Multiple tasks and under-training lead to inefficient treatment operations. Only 50percent of workers had sufficient training. Tools, equipment, and budget were also inadequate. The study suggested that all operators need to attend the control and maintenance courses of wastewater treatment

system. Moreover, a frequent technical consultation from the Environmental Health Center Region or Provincial Public Health Office is required. Uraivan recommended that a hospital must have a permanent staff or workers for its wastewater treatment facility.

In addition the correlation between the variables of daily operations of workers can be shown that the method (techniques and practice) and the sufficiency of equipment have $r = 0.427$. This showed that a method and sufficiency of equipment very much affect to daily operations of workers.

11. Managerial guideline of the wastewater treatment system in hospitals

From Tables of the SWOT analysis of the wastewater treatment system and the improvement / development guidelines, it shows that problems and difficulties of water pollution from domestic wastewater which hospitals are an important part to produce wastewater can be solved completely with cooperation from all parties involved within and out of hospitals, government's institutions, and people in community. Not only does wastewater from daily activities need to be released as least as possible, but also participation of people in resource consumption. A limited budget needs to be managed with maximum profit for hospital needs. Patients can share the treatment cost by paying the wastewater treatment fee. An efficient wastewater treatment system needs to have modern technology, proper knowledge and method (techniques and practice) by provide training, seminar and supervision for staffs. In addition, management methods of hospital's director or executives including government standards and regulations can efficiently solve the problems and difficulties of wastewater treatment system.

CHAPTER 6

CONCLUSION AND RECOMMENDATION

This survey research is to study the wastewater treatment system management of community hospital and to propose guideline problems solving and improving for the quality and efficiency of the wastewater treatment system. Results of the study are the following.

The administrator or hospital director 35.5 percent of the hospital directors are age 35-44 years old, male 96.8 percent. Duration time of working as the director 5 – 9 years is also 35.5 percent.

In wastewater treatment system management , 61.3 percent hospital directors administered at medium level. It separated to variable which 19.4 percent of hospital director did in community participation, laws and financial variables wars than others variables. But they did in technique and technology variable the least.

In part of the expense of wastewater treatment system management of community hospital, the average budget of the wastewater treatment system management was 60,269.44 baht. It divided to average equipment and material cost 32,557.14 baht per year, and average maintenance cost 30,383.33 baht per year. The average cost of wastewater treatment 24.29 baht per cubic meter. Others financial support in addition to annual budget, 87.9 percent of community hospital did not have supporting.

5.1.2 percent of wastewater treatment management system of the community hospital are oxidation pond. The average capacity of equalizing tank for wastewater was 64.44 cu.m., and average wastewater occurring was 40 cu.m. per day. The amount of treated wastewater was 94.05 percent of the total wastewater. In performing treatment system it was 94.39 percent of the working days of the system which operated normally in one years.

For quality of the effluent, average B.O.D. values was 20.78 ± 14.2 mg/l, maximum values 58.8 mg/l and minimum values 5 mg/l which in standard criteria. So, there were water pollution problems of wastewater from the hospital.

The controller of wastewater treatment system of community hospital 36.4 percent of the controllers are 40-44 years old with an average age of 38.55 years old. They were public health officers 60.6 percent and the other were community health officials. 60.6 percent of them had duration time of controlling between 5-9 years. 51.5 percent of the controller received training, seminar, conference, and study tour in the past 3 years, and 72.7 percent had been supervised. It also found that most of them, 75.8 percent had knowledge to control the system at the moderate level, and 72.7 percent had method (techniques and practice) at the moderate level.

The daily worker of wastewater treatment system 35.5 percent of the workers are 35-39 years old with average age 40.10 years. 51.6 percent of them worked in wastewater treatment system less than 5 years. Average duration time of working was 4.71 years. The majority of the controller, 74.2 percent did not received training, seminar, conference, and study tour; but 90.3 percent had not site visiting, and were supervised. It also found that 61.3 percent of them had knowledge and understanding at the moderate level, and 72.7 percent had method (techniques and practice) at the moderate level.

People who reside around the community hospitals The age of 30.9 percent people are more than 45 years, and 27.3 percent are employee. 53.2 percent people living around the hospitals knew that the hospitals had wastewater treatment system but 75.5 percent had not been informed about wastewater treatment of the hospitals. However 64.0 percent of them concern that the adverse effect or impact about problems of stink and black color, resulting in bad scenery of the hospital surrounding and in diseases carrier if there is inappropriate effluent from the hospitals.

Most of the surrounding hospitals community up to 83.5 percent were net supported from private organization or foundation. 81.3 percent people admitted in the hospitals willing to pay for wastewater treatment fee at the average rate 10 Baht per day. It also found that there was no association between people were willing and not willing to pay wastewater treatment fee of hospital in each province. People in nonthaburi province can pay average maximum 14 Baht per day.

For satisfaction of wastewater treatment system of community hospitals, the hospital directors, the controllers, the daily workers, and the people reside around the hospital satisfy to wastewater treatment performance at moderate level which percent of these groups are 77.4, 57.6 77.4, and 65.5 percent respectively. However satisfaction at the high level, the controllers (public health officers and community health officials) was more satisfaction than the other groups which was 21.2 percent of them.

When considering factors effected the performance of wastewater treatment system management of wastewater quantity it found that factors regarding management of hospital disectors, controlling of the public health officers and community health officials, and daily working of the workers did not have variables of these factors associated with wastewater quantity. For in part of the performance of wastewater treatment system management which was effluent quality (B.O.D. value), it found that techniques and technology variable in hospital director's management factor effected to B.O.D. value with statistical significance ($p < 0.05$)

For in part of the performance of wastewater treatment system management which was satisfaction of all sample groups, it found that laws and financial variable in the hospital director's management factor effected to satisfaction with statistical significance ($P < 0.05$), method (techniques and practice) variable in the system controlling of controller factor effected to satisfaction with statistical significance ($p < 0.05$), and also method (techniques and practice) variable in daily working of worker factor effected to satisfaction with statistical significance ($p < 0.05$).

Then SWOT Matrix analysis of the problems and obstacles facing management of wastewater treatment system was conducted based on questionnaires and statistic. The results of this analysis were used to establish managerial guidelines for the improvement and development of the hospital wastewater treatment system. In conclusion the overall performance of community hospital wastewater treatment was fair enough. There were only few water pollution problems of wastewater from the hospital. However there were still managerial and operational problems and obstacles in hospital wastewater treatment which need to be improved and developed for effective and efficient of the treatment system.

Recommendation for the next research

1. To study in detail that the people resided around the hospital were willing to pay wastewater treatment fee when admitted in the hospital of the ability to pay, fee cost per day, and the reasons to pay.
2. To study results of the wastewater treatment in performance in general hospital, center hospital, and hospital of the university.
3. To compare wastewater treatment performance between government hospital with private hospital that the different in management and other variable can affect the wastewater treatment management.
4. To study in detail in-depth of budget and unit cost of wastewater treatment management in order to develop of effective and efficient system.
5. To study guidelines for community participation in wastewater treatment system management, and to coordinate between hospitals, work units in involved, or people reside around the hospital.
6. To study performance of wastewater treatment management in other institutes such as school, crowded area where the amount of wastewater is generated.

BIBLIOGRAPHY

- กรมควบคุมมลพิษ. ข่าวสารคุณภาพน้ำ คพ. ปีที่ 3 ฉบับที่ 2 เมษายน - มิถุนายน 2546 8-9.
- กรมพัฒนาชุมชน, กระทรวงมหาดไทย. โครงการพัฒนาแหล่งน้ำขนาดเล็ก. กรุงเทพฯ : 2538.
- กรมโรงงานอุตสาหกรรม และ สมาคมวิศวกรรมสิ่งแวดล้อมแห่งประเทศไทย. ตำราระบบบำบัดมลพิษน้ำ. กรุงเทพฯ :สมาคมวิศวกรรมสิ่งแวดล้อมแห่งประเทศไทย, 2545.
- กรมส่งเสริมคุณภาพสิ่งแวดล้อม. การอนุรักษ์สิ่งแวดล้อม. กรุงเทพมหานคร : โรงพิมพ์ดอกเบญจ 2541 : 6-7.
- กองอนามัยสิ่งแวดล้อม, กรมอนามัย. วารสาร 43 ปี. กรมอนามัย 2538 : 90 – 95.
- กรุงเทพมหานคร. รายงานการประชุมโครงการบำบัดน้ำเสียของกรุงเทพมหานคร ครั้งที่ 1. (17 กันยายน 2533) (อัดสำเนา).
- บริษัท อาคดไทย จำกัด, เอกสารประกอบการฝึกอบรม โครงการออกแบบ แก้ไข ปรับปรุงระบบระบบรวบรวมน้ำเสียและระบบบำบัดน้ำเสียโรงพยาบาลพระจอมเกล้า จังหวัดเพชรบุรี. 2545. (อัดสำเนา)
- สำนักงานนโยบายและแผนสิ่งแวดล้อม. รายงานสถานการณ์คุณภาพสิ่งแวดล้อม. พ.ศ. 2543-2544.
- สมาคมอนามัยแห่งประเทศไทย. ปฏิทินสาธารณสุข 2546. กรุงเทพมหานคร : สหประชาพาณิชย์; 2545.
- กันทรีย์ ศรีพงศ์พันธุ์. มลพิษทางน้ำ. นครปฐม : โรงพิมพ์มหาวิทยาลัยศิลปากร, 2540.
- ณรงค์ศักดิ์ ธนวิบูลย์ชัย. เศรษฐศาสตร์ทรัพยากรธรรมชาติ หน่วยที่ 14. นนทบุรี : โรงพิมพ์มหาวิทยาลัยสุโขทัยธรรมราช, 2544.
- ดวงจิตต์ มณีศรีจำ. แหล่งกำเนิดน้ำเสียในกรุงเทพมหานคร ใน เอกสารสัมมนาแนวทางการบริหารจัดการน้ำเสียชุมชน. กรุงเทพมหานคร: สำนักคณะกรรมการสิ่งแวดล้อมแห่งชาติ 2530.
- ธงชัย พรรณสวัสดิ์ และคณะ. น้ำเสียชุมชนและปัญหามลภาวะทางน้ำในเขตกรุงเทพมหานคร และปริมณฑล. รายงานการศึกษาเสนอต่อคณะกรรมการสิ่งแวดล้อมแห่งชาติ กระทรวงวิทยาศาสตร์และเทคโนโลยีและการพลังงาน 2530.
- นิรุติ คุณผล. ความรู้ทั่วไปเกี่ยวกับการบำบัดน้ำเสีย. ฝ่ายวิศวกรรมสิ่งแวดล้อม กองอนามัยสิ่งแวดล้อม กรมอนามัย(เอกสารเย็บเล่ม) 2539.

- บรรจบจันทร์เจริญ. ความพร้อมในการบริหารจัดการของผู้บริหารระบบบำบัดน้ำเสียในโรงพยาบาลชุมชน. วิทยานิพนธ์ปริญญาสาทรณศาสตรร์ สาขาวิชากฎหมายการแพทยและสาทรณสุข บัณฑิตวิทยาลัย มหาวิทยาลัยมหิดล 2542.
- ประยูร ฟองสติยกุล . เอกสารประกอบคำบรรยาย โครงการก่อสร้างระบบบำบัดน้ำเสียกรุงรัตนโกสินทร์ บทที่ 4 ระบบบำบัดน้ำเสียแบบตะกอนเร่ง. หลักสูตรฝึกอบรมเจ้าหน้าที่กรุงเทพมหานคร 2541.
- พัฒนา มูลพฤกษ์ . อนามัยสิ่งแวดล้อม (ฉบับปรับปรุง). กรุงเทพมหานคร: พิมพ์ที่ ชิกมา ดีไซน์กราฟฟิค 2546.
- มนโรธ สิทธานนท์ , พันตำรวจโท. การยอมรับการใช้ระบบบำบัดน้ำเสียของผู้ประกอบการโรงงานอุตสาหกรรม : กรณีศึกษา อ.สามพราน จ.นครปฐม. วิทยานิพนธ์ปริญญาตั้งคมศาสตรมหาบัณฑิต สาขาสังแวดล้อม บัณฑิตวิทยาลัย มหาวิทยาลัยมหิดล 2540.
- มาชัย ไพศาลธนสมบัติ. การจัดการมูลฝอยติดเชื้อจากสถานพยาบาลในเขตเทศบาลเมืองปทุมธานี. วิทยานิพนธ์ปริญญาศิลปศาสตรมหาบัณฑิต สาขานโยบายและการจัดการทรัพยากรและสิ่งแวดล้อม บัณฑิตวิทยาลัย มหาวิทยาลัยเกริก 2542.
- โยธิน สุริยพงศ์ . พื้นฐานทางวิทยาศาสตร์สิ่งแวดล้อม. คณะวิทยาศาสตร์และเทคโนโลยี สถาบันราชภัฏนครราชสีมา, 2542 : 222 - 223
- รัชณี ไพสิทธิ์ และอารีย์ แก้วเขียว (วันที่ 7 ตุลาคม 2546) . คุณภาพแม่น้ำเจ้าพระยา. www.documenthttp://www.anamai.moph.go.th
- วรรณา ยังเจริญ. บทบาทของสมาชิก อบต. ในการจัดการมูลฝอยและน้ำเสีย : กรณีศึกษา อ.เมือง จ.นครปฐม. วิทยานิพนธ์ปริญญาวิทยาศาสตรมหาบัณฑิต สาขาเทคโนโลยีการบริหารสิ่งแวดล้อม บัณฑิตวิทยาลัย มหาวิทยาลัยมหิดล 2542.
- วาริรัตน์แสนเสนาะ . ความรู้และการปฏิบัติของบุคลากรในโรงพยาบาลราชบุรีเกี่ยวกับการจัดการมูลฝอย. วิทยานิพนธ์ปริญญาวิทยาศาสตรมหาบัณฑิต สาขาสังแวดล้อม บัณฑิตวิทยาลัย มหาวิทยาลัยมหิดล 2541.
- วลัยพร พชรณมด . หลักเศรษฐศาสตร์และเศรษฐศาสตร์สาธารณสุข หน่วยที่ 15. นนทบุรี : โรงพิมพ์มหาวิทยาลัยสุโขทัยธรรมาราช , 2545.
- ศิริพร วัฒนาจิตติกุล. การจัดการคุณภาพน้ำในโรงงานอุตสาหกรรม หน่วยที่ 15. นนทบุรี : โรงพิมพ์ มหาวิทยาลัยสุโขทัยธรรมาราช , 2544.

ศักดิ์สิทธิ์ ตรีเดช. องค์การบริหารและส่งเสริมเอกชนในการดูแลรักษาน้ำเสีย เอกสารสัมมนาแนวทางการบริหารจัดการน้ำเสียชุมชน. กรุงเทพมหานคร: สำนักคณะกรรมการสิ่งแวดล้อมแห่งชาติ, 2530.

สิทธิพร ขจรเนติยุทธ และเทิดศักดิ์ ขงทวี. การเก็บค่าธรรมเนียมบำบัดน้ำเสีย. สิ่งแวดล้อม ปีที่ 2 ฉบับที่ 20 พฤศจิกายน 2534.

สิทธิศักดิ์ พุกขยัณติกุล, นพ. การบริหารกลยุทธ์และผลสัมฤทธิ์ขององค์กรด้วยวิธี Balaenced Scorecard. พิมพ์ครั้งที่ 2 ; กรุงเทพมหานคร :สำนักพิมพ์ ศ.ส.ท. (สามคมส่งเสริมเทคโนโลยี (ไทย - ญี่ปุ่น) 2546.

สุธีรวัฒน์ สุวรรณรัตน์. ประสิทธิภาพระบบบำบัดน้ำเสียของโรงพยาบาลในเขตกรุงเทพ และปริมณฑล. วิทยานิพนธ์ปริญญาวิศวกรรมศาสตรมหาบัณฑิต (วิศวกรรมโยธา) บัณฑิตวิทยาลัย มหาวิทยาลัยเกษตรศาสตร์ 2536.

สุนทนา หลบภัย. จิตสำนึกในการอนุรักษ์ตลาดน้ำดำเนินสะดวก. วิทยานิพนธ์ปริญญาศึกษาศาสตร มหาบัณฑิต สาขาสิ่งแวดล้อม บัณฑิตวิทยาลัย มหาวิทยาลัยมหิดล 2543.

สุนนา ยวดยง. พฤติกรรมประชาชนในการป้องกันและแก้ไขปัญหามลพิษทางน้ำในแม่น้ำเจ้าพระยา ต.เกาะเกร็ด อ.ปากเกร็ด จ.นนทบุรี. วิทยานิพนธ์ปริญญาศึกษาศาสตร มหาบัณฑิต สาขาสิ่งแวดล้อม บัณฑิตวิทยาลัย มหาวิทยาลัยมหิดล 2544.

สุนทร จรัสมาธูสร. การศึกษาแนวทางการวางแผนการจัดการทรัพยากรน้ำที่เหมาะสม การจัดการทรัพยากรน้ำ. วิทยานิพนธ์ปริญญาวิทยาศาสตรมหาบัณฑิต สาขาเทคโนโลยีการวางแผนสิ่งแวดล้อมเพื่อพัฒนาชนบท บัณฑิตวิทยาลัย มหาวิทยาลัยมหิดล 2542.

สมคิด วงศ์ไชยสุวรรณ. การจัดการคุณภาพน้ำในโรงงานอุตสาหกรรม.หน่วยที่ 10.นนทบุรี: โรงพิมพ์มหาวิทยาลัยสุโขทัยธรรมาราช, 2544.

สมชาติ ไตรรักษา. หลักการบริหารโรงพยาบาล. พิมพ์ครั้งที่ 2 ; กรุงเทพมหานคร: หจก.พี เอ็นการพิมพ์ ,2542 .

สมชาย สกุดอสิริยาภรณ์. การพัฒนารูปแบบการจัดการน้ำเสียโรงพยาบาลของกระทรวงสาธารณสุข .วารสารการส่งเสริมสุขภาพและอนามัยสิ่งแวดล้อมปีที่ 20 ฉบับ 3 กรกฎาคม – กันยายน 2540 : 65 – 74

หฤทัย โพธิ์พงษ์ . สภาพปัญหาสิ่งแวดล้อมในจังหวัดนครปฐม . วิทยานิพนธ์ปริญญาศึกษาศาสตรมหาบัณฑิต.สาขาสิ่งแวดล้อม บัณฑิตวิทยาลัย มหาวิทยาลัยมหิดล 2542.

หิรัญณ์ หล่อเพ็ญศรี. ความเป็นไปได้ในการเก็บค่าบำบัดน้ำเสีย : โครงการสีพระยา. วิทยานิพนธ์
ปริญญาวิทยาศาสตรมหาบัณฑิต สาขาเทคโนโลยีการบริหารสิ่งแวดล้อม บัณฑิตวิทยาลัย
มหาวิทยาลัยมหิดล 2540.

อุไรวรรณ อินทร์ม่วง และคณะ. การศึกษาคุณลักษณะของน้ำทิ้งก่อนและหลังการบำบัดด้วยระบบ
บำบัดน้ำเสียของโรงพยาบาลในภาคตะวันออกเฉียงเหนือตอนบน. วารสารส่งเสริมสุขภาพ
และอนามัยสิ่งแวดล้อม เดือน มกราคม – มีนาคม 2544 : 80 – 91

ภาษาอังกฤษ

Environmental Quality Standards. Division Office of the National Environment Board Thailand.

Law and Standards on Pollution Control in Thailand. . Second edition, Thailand : July
1989.

David Schwartz. Introduction to management Principles , Practices, and Processes. New York
: Harcourt Brace Jovano Vich, Inc , 1980.

Herold Koontz and Cyril O' Donnell. Essentials of Management. 2 nd. Edition, New Delhi :
McGraw – Hill Publishing (Inc), 1980.

Heinz Weihrich, Harold Koontz. Management. A Global Perspective. Tenth edition. Printed in
Singapore :McGraw – Hill International editions, 1993.

John R.Schermerhorn, Jr. Management. Sixth edition, New York : John Wiley & Sons, Inc. 1999.

Louis E.Boone and David L. Kurtz. Management. Fourth edition, New York : McGraw-Hill ,
1992.

Peter F. Drucker. Management. Tasks, Responsibilities, Practices. Oxford; : Butterworth
Heinemann , 1999.

Steinmetz and Todd. Supervision. First – Line Management. Fifth edition.

Richard D. Irwin , Inc. Boston , 1992.

Stephen P. Robbins. Managing Today. Second edition.

Prentice Hall, New Jersey , 2000.

Stephen P. Robbins and Mary Coulter. Management. Fifth edition, New Jersey : Prentice Hall,
International ,Inc, 1996.



The List of Instruments Experts

1. Assoc. Prof.Dr.Jukkris Sivadechathep Lecturer
School of Health Science,
Sukhothai Thamathirat University.
2. Assoc. Prof.Udom Kompayak Lecturer
Faculty of Public Health, Mahidol
University.
3. Assoc. Prof.Rungjarat Hutacharoen Lecturer
Faculty of Environment and Resources
Mahidol University.
4. Mr.Komate Nakwannakit Health Insurance Institute, Ministry of
Public Health.
5. Mrs.Boontuien Poonsiri Deputy Director of Hospital
Administration, Makarak Hospital,
Thamaka District, Kanchanaburi
Province.

The B.O.D. value of community hospitals and analytical method

Community hospitals	B.O.D. value (mg./l.)	Analytical method
1. Uthaithani		
Hospital no. 1	16.0	Azide Modification
Hospital no. 2	11.0	Azide Modification
Hospital no. 3	25.0	Azide Modification
Hospital no. 4	8.0	Azide Modification
2. Chainart		
Hospital no. 5	9.0	5-day BOD Test
Hospital no. 6	14.5	Azide Modification
Hospital no. 7	18.0	Azide Modification
Hospital no. 8	51.9	5-day BOD Test
Hospital no. 9	21	5-day BOD Test
3. Singhburi		
Hospital no. 10	58.5	Azide Modification
Hospital no. 11	26.9	5-day BOD Test
Hospital no. 12	7.0	Azide Modification
4. Angthong		
Hospital no. 13	28.6	5-day BOD Test
Hospital no. 14	20.5	5-day BOD Test
Hospital no. 15	6.5	Azide Modification
Hospital no. 16	5.0	5-day BOD Test
5. Ayutthaya		
Hospital no. 17	11.0	5-day BOD Test
Hospital no. 18	12.5	Azide Modification
Hospital no. 19	55.0	Azide Modification
Hospital no. 20	20.0	Azide Modification
Hospital no. 21	15.0	5-day BOD Test

แบบสอบถาม (ผู้อำนวยการโรงพยาบาล)

เรื่อง

การจัดการระบบบำบัดน้ำเสียของโรงพยาบาลชุมชน กระทรวงสาธารณสุข ในเขตภาคกลาง

เลขที่แบบสอบถาม

--	--

แบบสอบถามต่อไปนี้ เป็นเรื่องของการจัดการระบบบำบัดน้ำเสียของโรงพยาบาลชุมชน กระทรวงสาธารณสุข ประกอบด้วย 5 ส่วน ขอให้ท่านกรุณาตอบด้วยตัวท่านเอง เนื่องจากเป็นเรื่องการบริหารจัดการ

ส่วนที่ 1 ลักษณะส่วนบุคคล

คำชี้แจง โปรดเติมคำลงในช่องว่าง หรือทำเครื่องหมาย / ลงในช่อง [] ตามความเป็นจริง

1. ท่านอายุ.....ปี
2. เพศ [] ชาย [] หญิง
3. ท่านปฏิบัติงานตำแหน่งผู้อำนวยการโรงพยาบาลมา.....ปี
4. ท่านได้มอบหมายให้ใครเป็นผู้ดูแลควบคุมระบบบำบัดน้ำเสียของโรงพยาบาล
 - 4.1 ตำแหน่ง
 - 4.2 ตำแหน่ง
 - 4.3 ตำแหน่ง

ส่วนที่ 2 การบริหารจัดการเกี่ยวกับระบบบำบัดน้ำเสียโรงพยาบาล

คำชี้แจง คำถามต่อไปนี้เกี่ยวกับการบริหารจัดการระบบบำบัดน้ำเสีย ตามแนวทางทฤษฎีการบริหารของคุนทซ์ (Koontz) และตามแนวทางการบริหารจัดการสิ่งแวดล้อม ขอให้ท่านประเมินกิจกรรมการบริหารจัดการทางซ้ายมือว่า ท่านปฏิบัติกิจกรรมนั้นในรอบปีที่ผ่านมา น้อยเพียงใด แล้วกรุณาทำเครื่องหมาย / ลงในช่องทางขวามือ ให้ตรงมากที่สุด กับสิ่งที่ท่านปฏิบัติจริงโดยมีเกณฑ์ในการพิจารณาดังนี้

ระดับของการปฏิบัติ

- | | | | | | |
|-----------|---------|-----------------------|-----------|------------------------|-----------|
| มากที่สุด | หมายถึง | ได้ปฏิบัติกิจกรรมนั้น | มากที่สุด | หรือปฏิบัติกิจกรรมนั้น | 80 – 100% |
| มาก | หมายถึง | ได้ปฏิบัติกิจกรรมนั้น | มาก | หรือปฏิบัติกิจกรรมนั้น | 60 – 80% |
| ปานกลาง | หมายถึง | ได้ปฏิบัติกิจกรรมนั้น | ปานกลาง | หรือปฏิบัติกิจกรรมนั้น | 40 – 60% |
| น้อย | หมายถึง | ได้ปฏิบัติกิจกรรมนั้น | น้อย | หรือปฏิบัติกิจกรรมนั้น | 20 - 40% |
| น้อยมาก | หมายถึง | ได้ปฏิบัติกิจกรรมนั้น | น้อยมาก | หรือปฏิบัติกิจกรรมนั้น | 0 - 20% |

กิจกรรมการบริหารจัดการระบบบำบัดน้ำเสีย ของโรงพยาบาล	ระดับของการปฏิบัติ				
	มากที่สุด	มาก	ปานกลาง	น้อย	น้อยมาก
การวางแผนระบบบำบัดน้ำเสียของโรงพยาบาล 1. มีการนำข้อมูล ปัญหา และความต้องการของผู้ควบคุมระบบบำบัดน้ำเสียของโรงพยาบาลมาใช้ในการวางแผน 2. ได้มีการกำหนดวัตถุประสงค์ของแผนให้สอดคล้องกับวัตถุประสงค์ /นโยบายของกระทรวงสาธารณสุข 3. ในการวางแผน ได้มีการกำหนดวิธีการขั้นตอน และ ผู้รับผิดชอบ ในการปฏิบัติงานไว้อย่างชัดเจน (มีแผนปฏิบัติงาน) 4. มีการประสานแผนในการทำงานร่วมกับหน่วยงานอื่น ๆ ในโรงพยาบาล 5. มีการกำหนดระยะเวลาในการติดตามและประเมินผลงานอย่างชัดเจน 6. มีการกำหนดวิธีการประเมินผลไว้ในแผนอย่างชัดเจน 7. ได้มีการดำเนินการจัดทำแผนให้สอดคล้องกับแผนการขยายโรงพยาบาล การจัดองค์กรระบบบำบัดน้ำเสียของโรงพยาบาล 1. มีการจัดตั้งคณะกรรมการ / คณะทำงานในการจัดการระบบบำบัดน้ำเสียของโรงพยาบาลไว้อย่างชัดเจน 2. มีการกำหนดผู้รับผิดชอบในแต่ละกิจกรรมของงานบำบัดน้ำเสียของโรงพยาบาลอย่างชัดเจน 3. มีการกำหนดบทบาทหน้าที่ของผู้รับผิดชอบงานบำบัดน้ำเสียของโรงพยาบาลอย่างชัดเจน					

กิจกรรมการบริหารจัดการระบบบำบัดน้ำเสีย ของโรงพยาบาล	ระดับของการปฏิบัติ				
	มากที่สุด	มาก	ปานกลาง	น้อย	น้อยมาก
4. มีการวางแผนสายการบังคับบัญชาไว้ในหน่วยงานเกี่ยวกับการจัดการระบบบำบัดน้ำเสียของโรงพยาบาลอย่างชัดเจน 5. มีการวางแผนการประสานงานในการดำเนินงานบำบัดน้ำเสียของโรงพยาบาลอย่างชัดเจน การจัดคนเข้าทำงานในระบบบำบัดน้ำเสียของโรงพยาบาล 1. มีการจัดบุคลากรในการดูแลระบบบำบัดน้ำเสียให้พอ เพียงในการดำเนินงานทุกวัน 2. มีการกำหนดเกณฑ์ คุณสมบัติ และคุณวุฒิ เพื่อคัดเลือกผู้ดูแลระบบบำบัดน้ำเสีย 3. ท่านสนับสนุนให้ผู้ดูแลระบบได้ศึกษาความรู้ หรือ อบรมเพิ่มเติม 4. ท่านได้แจ้งผลการประเมินพร้อมคำแนะนำให้ผู้ปฏิบัติงานทราบทุกครั้ง การอำนวยการในระบบบำบัดน้ำเสียของโรงพยาบาล 1. มีการชี้แจงบทบาทหน้าที่และมอบหมายงานให้แก่ ผู้ดูแลระบบบำบัดน้ำเสียตามหน้าที่ที่กำหนด 2. จัดให้มีปฏิทินการปฏิบัติงานในรอบปีเพื่อความคุมระบบบำบัดน้ำเสีย 3. ท่านติดตามผลการปฏิบัติงานของผู้ดูแลระบบฯ อย่างสม่ำเสมอ 4. มีการค้นหาปัญหาและปรับปรุงแก้ไขเมื่อพบว่ามีผู้ดูแลระบบฯ ปฏิบัติงานผิดพลาด					

กิจกรรมการบริหารจัดการระบบบำบัดน้ำเสีย ของโรงพยาบาล	ระดับของการปฏิบัติ				
	มากที่สุด	มาก	ปานกลาง	น้อย	น้อยมาก
5. ท่านช่วยแก้ปัญหาเมื่อได้รับรายงานว่าการดำเนินงานระบบบำบัดน้ำเสียประสบปัญหาต่างๆ 6. จัดให้มีการรายงานปัญหาการดำเนินงานระบบบำบัดน้ำเสียโดยเปิดโอกาสให้ผู้ดูแลระบบ ฯ แสดงความคิดเห็นด้วย 7. ท่านเปิดโอกาสให้ผู้ดูแลระบบ ฯ มีส่วนร่วมการบริหารจัดการในการดำเนินกิจกรรมการจัดการบำบัดน้ำเสีย การควบคุมงานระบบบำบัดน้ำเสียของโรงพยาบาล 1. ท่านติดตามผลการปฏิบัติงานของผู้ดูแลระบบบำบัดน้ำเสียอย่างสม่ำเสมอ 2. ท่านตรวจสอบผลการดำเนินงานของระบบบำบัดน้ำเสียตามแนวทางที่กำหนดไว้ในแผน 3. ท่านประเมินผลการดำเนินงานของระบบ ฯ โดยพิจารณาจาก คุณภาพน้ำที่ผ่านการบำบัดแล้ว ตามเกณฑ์ที่กฎหมายกำหนด 4. มีการกำหนดให้ผู้รับผิดชอบหรือผู้ปฏิบัติจัดทำสรุปรายงานผลการดำเนินงานให้ท่านทราบเพื่อการตรวจสอบ 5. มีการนิเทศติดตามประเมินผลให้กับบุคลากรในการปฏิบัติงานเป็นระยะ ๆ เทคนิคและวิชาการ 1. ท่านนำหลักวิชาการทางด้านสุขาภิบาลสิ่งแวดล้อมมาใช้ในการจัดการระบบบำบัดน้ำเสียของท่านเป็นประจำ					

กิจกรรมการบริหารจัดการระบบบำบัดน้ำเสีย ของโรงพยาบาล	ระดับของการปฏิบัติ				
	มากที่สุด	มาก	ปานกลาง	น้อย	น้อยมาก
1. รูปแบบของระบบบำบัดน้ำเสียของโรงพยาบาลที่ใช้ยู่มีความเหมาะสมและสามารถดำเนินการแก้ไขปัญหาน้ำเสียได้อย่างทันทั่วทั้งที่ทุกครั้ง 2. การดำเนินงานบำบัดน้ำเสียได้ดำเนินการตามขั้นตอนที่กำหนดของระบบบำบัดน้ำเสียของกระทรวงสาธารณสุข การมีส่วนร่วมของชุมชน 1. โรงพยาบาลได้ให้ประชาชนแสดงความคิดเห็นและมีส่วนร่วมในเรื่องระบบบำบัดน้ำเสียของโรงพยาบาล 2. หน่วยงานภาคเอกชน หรือมูลนิธิอื่นได้เข้ามาให้ความร่วมมือและช่วยเหลืองานบำบัดน้ำเสียของโรงพยาบาล 3. หน่วยงานท้องถิ่น เทศบาล สุขาภิบาล อบต. ได้ให้การสนับสนุน และช่วยเหลืองานบำบัดน้ำเสียของโรงพยาบาล กฎหมายและการเงิน 1. โรงพยาบาลได้ดำเนินการตาม พ.ร.บ. ส่งเสริมและรักษาคุณภาพสิ่งแวดล้อมแห่งชาติ พ.ศ. 2535 ในการบำบัดน้ำเสียของโรงพยาบาล 2. พ.ร.บ. การสาธารณสุข พ.ศ. 2535 ของกรมอนามัย กระทรวงสาธารณสุข ช่วยในการวางแผนและดำเนินการด้านระบบบำบัดน้ำเสียของโรงพยาบาลได้เป็นผลดี					

กิจกรรมการบริหารจัดการระบบบำบัดน้ำเสีย ของโรงพยาบาล	ระดับของการปฏิบัติ				
	มากที่สุด	มาก	ปานกลาง	น้อย	น้อยมาก
3. ท่านได้รับความช่วยเหลือสนับสนุนด้านการเงินจากแหล่งเงินทุนอื่น นอกจากเงินงบประมาณ ในการบริหารจัดการระบบบำบัดน้ำเสีย					
4. ท่านพร้อมที่จะให้มีการประเมินค่าใช้จ่ายในการดำเนินงานทุกขั้นตอน					

ส่วนที่ 3 ความพึงพอใจของท่านต่อผลการดำเนินงานระบบบำบัดน้ำเสียโรงพยาบาลในรอบ 1 ปีที่ผ่านมา

คำชี้แจง คำถามต่อไปนี้เป็นการวัดความพึงพอใจต่อผลการดำเนินงานการบำบัดน้ำเสียโรงพยาบาล ขอให้ท่านประเมินความพึงพอใจต่อผลการดำเนินงานระบบบำบัดน้ำเสียโรงพยาบาลทางซ้ายมือว่า มีความพึงพอใจในระดับใด แล้วกรุณาทำเครื่องหมาย / ลงในช่องทางขวามือให้ตรงมากที่สุดกับระดับที่ท่านพึงพอใจจริง โดยมีเกณฑ์ในการพิจารณาดังนี้

ระดับของความพอใจ

มากที่สุด	หมายถึง มีความพอใจมากที่สุด	หรือพึงพอใจ 80 - 100%
มาก	หมายถึง มีความพอใจมาก	หรือพึงพอใจ 60 - 80%
ปานกลาง	หมายถึง มีความพอใจปานกลาง	หรือพึงพอใจ 40 - 60%
น้อย	หมายถึง มีความพอใจน้อย	หรือพึงพอใจ 20 - 40%
น้อยมาก	หมายถึง มีความพอใจน้อยมาก	หรือพึงพอใจ 0 - 20%

กิจกรรมการบริหารจัดการระบบบำบัดน้ำเสีย ของโรงพยาบาล	ระดับของการปฏิบัติ				
	มากที่สุด	มาก	ปานกลาง	น้อย	น้อยมาก
1. ท่านพอใจกับระบบบำบัดน้ำเสียของโรงพยาบาล					
2. ผลสำเร็จที่เกิดขึ้นในส่วนระบบบำบัดน้ำเสียของโรงพยาบาล นับตั้งแต่ท่านเป็นผู้รับผิดชอบมีผลงานเป็นที่น่าพอใจ					
3. ท่านพอใจที่ต้องรับผิดชอบในส่วนการจัดการระบบบำบัดน้ำเสียโรงพยาบาล					
4. ท่านพอใจกับอำนาจหน้าที่และความรับผิดชอบที่มีอยู่ต่อการจัดการระบบบำบัดน้ำเสียโรงพยาบาล					
5. ท่านพอใจต่อผู้รับผิดชอบและความรับผิดชอบของผู้ปฏิบัติงานระบบบำบัดน้ำเสียโรงพยาบาลเพียงใด					
6. ผู้ปฏิบัติงานระบบบำบัดน้ำเสียโรงพยาบาลปฏิบัติงานได้เป็นที่น่าพอใจ					
7. ท่านพอใจด้านคุณวุฒิของผู้ที่ปฏิบัติงานระบบบำบัด น้ำเสียโรงพยาบาล					
8. ท่านพอใจกับเงินงบประมาณที่ได้รับเพื่อการจัดการระบบบำบัดน้ำเสียของโรงพยาบาล					

ส่วนที่ 4 ค่าใช้จ่ายของการจัดการระบบบำบัดน้ำเสียโรงพยาบาลในรอบปีที่ผ่านมา

1. ในปีงบประมาณ 2546 ค่าใช้จ่ายในส่วนของวัสดุและอุปกรณ์ในการดูแลและควบคุมระบบบำบัดน้ำเสีย

โรงพยาบาลมีค่าใช้จ่าย ประมาณ บาท

2. ในปีงบประมาณ 2546 ค่าใช้จ่ายในการบำรุงรักษา และการตรวจสภาพวัสดุ และอุปกรณ์ของการดูแลควบคุมระบบบำบัดน้ำเสียของโรงพยาบาลมีค่าใช้จ่ายประมาณ บาท
3. เงินงบประมาณที่ใช้จ่ายในการจัดการระบบบำบัดน้ำเสียของโรงพยาบาลปีงบประมาณ 2546 เป็นเงิน บาท
4. โรงพยาบาลต้องเสียค่าใช้จ่ายในการบำบัดน้ำเสียประมาณลูกบาศก์เมตรละ บาท
5. ร้อยละของจำนวนวันที่ระบบบำบัดน้ำเสียของโรงพยาบาลทำงานได้ตามปกติ% (365 วัน = 100%)
6. ปริมาณน้ำเสียที่บำบัดได้ ประมาณร้อยละ ของปริมาณน้ำเสียของโรงพยาบาลทั้งหมด

ส่วนที่ 5 ปัญหา อุปสรรคในการดำเนินงานบริหารจัดการระบบบำบัดน้ำเสียโรงพยาบาล

ท่านคิดว่าปัญหา อุปสรรคของการบริหารจัดการระบบบำบัดน้ำเสียโรงพยาบาลมีอะไรบ้าง ในด้านต่อไปนี้

1. ด้านงบประมาณ คือ

.....

.....

2. ด้านบุคลากร คือ

.....

.....

3. ด้านตัวระบบบำบัดน้ำเสีย คือ

.....

.....

4. ด้านวัสดุ อุปกรณ์ คือ

.....

.....

5. ด้านเทคนิคและวิธีการ คือ

.....

.....

6. ด้านการมีส่วนร่วมของชุมชน คือ

.....
.....

7. ด้านกฎหมาย คือ

.....
.....

8. ด้านอื่น ๆ (โปรดระบุ) คือ

.....
.....



ขอขอบคุณที่กรุณาตอบแบบสอบถาม

แบบสอบถาม (ผู้ดูแลควบคุมระบบบำบัดน้ำเสีย)

เรื่อง

การจัดการระบบบำบัดน้ำเสียของโรงพยาบาลชุมชน กระทรวงสาธารณสุข ในเขตภาคกลาง

เลขที่แบบสอบถาม

--	--

แบบสอบถามต่อไปนี้ เป็นเรื่องของการจัดการระบบบำบัดน้ำเสียของโรงพยาบาลชุมชน กระทรวงสาธารณสุข แบบสอบถามทั้งหมด ประกอบด้วย 4 ส่วน ขอให้ท่านกรุณาตอบตามความเป็นจริงทุกข้อ อย่างถูกต้องครบถ้วนดังต่อไปนี้

ส่วนที่ 1 ลักษณะส่วนบุคคล

คำชี้แจง โปรดเติมคำลงในช่องว่าง หรือทำเครื่องหมาย / ลงในช่อง [] ตามความเป็นจริง

1. ท่านอายุ.....ปี
2. ตำแหน่งปัจจุบัน
☐ นักวิชาการสาธารณสุข ☐ เจ้าพนักงานสาธารณสุขชุมชน
3. ท่านปฏิบัติงานดูแลควบคุมระบบบำบัดน้ำเสียมา ปี

ส่วนที่ 2

ตอนที่ 1 ความรู้ความเข้าใจในการดูแลระบบบำบัดน้ำเสียโรงพยาบาล

คำชี้แจง โปรดเติมคำลงในช่องว่าง หรือทำเครื่องหมาย / ลงในช่อง [] ตามความเห็นที่แท้จริงของท่าน เพียงข้อเดียว

1. น้ำเสียโรงพยาบาลก่อให้เกิดปัญหาสำคัญอะไรที่แตกต่างจากน้ำเสียแหล่งอื่น ๆ
☐ การแพร่กระจายของเชื้อโรค ☐ ทำให้เกิดความรำคาญ
☐ ทำให้แม่น้ำ ลำคลองเน่าเสีย ☐ ทำให้สิ่งแวดล้อมเป็นมลพิษ

2. แหล่งกำเนิดน้ำเสียในโรงพยาบาลที่มีความสำคัญมากที่สุดคือบริเวณใด

☐ สถานที่รับคนไข้ใน	☐ สถานที่ตรวจคนไข้นอก
☐ ที่พักรักษา	☐ โรงครัวและโรงอาหาร
 3. หลักการดูแลระบบรวบรวมน้ำเสียที่ดีคืออะไร

☐ ป้องกันมิให้มีการอุดตันในเส้นท่อรวบรวมน้ำเสีย	
☐ ตรวจสอบสภาพตะกอนจากช่องระบายน้ำในที่ต่าง ๆ เพื่อไม่ให้เกิดการปนเปื้อนเศษขยะ	
☐ ประชาสัมพันธ์และขอความร่วมมือจากเจ้าหน้าที่และผู้รับบริการในการทิ้งขยะเข้าระบบ	
☐ ถูกทุกข้อ	
 4. เนื่องจากน้ำเสียจากโรงพยาบาลมีเชื้อโรคปะปนอยู่มาก ดังนั้นในกระบวนการบำบัดน้ำเสียจึงจำเป็นต้องผ่านกระบวนการฆ่าเชื้อ ซึ่งอยู่ในขั้นตอนใดของระบบบำบัดน้ำเสียในโรงพยาบาล

☐ ขั้นตอนการเติมอากาศ	☐ ขั้นตอนการตกตะกอน
☐ ขั้นตอนก่อนปล่อยน้ำทิ้งจากระบบ	☐ ขั้นตอนก่อนและหลังการตกตะกอน
 5. ในการประเมินประสิทธิภาพของระบบบำบัดน้ำเสียทางกายภาพ หากท่านพบว่า มีฟองสีขาวที่ผิวน้ำในถังเติมอากาศ จะบ่งบอกอะไร

☐ แสดงว่ามีค่าความเข้มข้นของจุลินทรีย์ในถังเติมอากาศมากเกินไป	
☐ แสดงว่ามีค่าความเข้มข้นของจุลินทรีย์ในถังเติมอากาศน้อยเกินไป	
☐ แสดงว่าตะกอนจุลินทรีย์มีอายุมากเกินไป ต้องนำตะกอนส่วนเกินไปทิ้งให้มากขึ้น	
☐ แสดงว่าตะกอนจุลินทรีย์มีอายุน้อยเกินไป ต้องนำตะกอนส่วนเกินไปทิ้งให้น้อยลง	
 6. ตามประกาศกระทรวงวิทยาศาสตร์ เทคโนโลยี และสิ่งแวดล้อม เรื่องมาตรฐานน้ำทิ้งที่ผ่านการบำบัดแล้ว

กำหนดให้น้ำทิ้งที่ผ่านการบำบัดแล้วมีค่า BOD เท่าไร ในกรณีโรงพยาบาล 30 เตียง

☐ ไม่เกิน 25 มิลลิกรัมต่อลิตร	☐ ไม่เกิน 20 มิลลิกรัมต่อลิตร
☐ ไม่เกิน 18 มิลลิกรัมต่อลิตร	☐ ไม่เกิน 15 มิลลิกรัมต่อลิตร
 7. ค่าบีโอดี มีความสำคัญต่อระบบบำบัดน้ำเสียอย่างไร

☐ ใช้ตรวจคุณภาพของระบบบำบัดน้ำเสีย	☐ ใช้ตรวจคุณภาพน้ำทิ้ง
☐ ใช้ในการออกแบบระบบบำบัดน้ำเสีย	☐ ถูกทุกข้อ

8. ท่านมีความคิดเห็นอย่างไรเกี่ยวกับน้ำเสียโรงพยาบาล

☐ เป็นปัญหาที่ต้องรีบแก้ไข

☐ เป็นปัญหาที่ต้องแก้ไข

☐ ไม่มีปัญหา

☐ อื่น ๆ (ระบุ)

9. ท่านคิดว่าการจัดการระบบบำบัดน้ำเสียในโรงพยาบาลที่ดี จะได้ประโยชน์อย่างไร

☐ ลดค่าใช้จ่ายในการจัดการสิ่งแวดล้อม

☐ ลดอัตราการแพร่เชื้อโรคที่มีน้ำเสียเป็นพาหะ

☐ สภาพแวดล้อมจะดีขึ้น

☐ ประชาชนมีคุณภาพชีวิตดีขึ้น

10. ท่านคิดว่าระบบบำบัดน้ำเสียระบบใดเหมาะสมที่สุดสำหรับการจัดการระบบบำบัดน้ำเสียโรงพยาบาล 30 เตียง ของประเทศไทย

☐ ระบบคลองวนเวียน

☐ ระบบบ่อฝังน้ำ

☐ ระบบถังกรองอากาศ

☐ ระบบบ่อเติมอากาศ

11. เหตุผลที่บอกว่าระบบที่ท่านเลือกเหมาะสมที่สุด คือ

12. หน่วยงานที่สนับสนุนการจัดการระบบบำบัดน้ำเสียโรงพยาบาลในปัจจุบันคือ

ตอนที่ 2 การฝึกอบรม สัมมนา และการนิเทศงาน

1. ในรอบ 3 ปีที่ผ่านมา ท่านเคยได้รับการอบรม ประชุม/สัมมนา ศึกษาดูงาน เกี่ยวกับระบบบำบัดน้ำเสียหรือไม่

☐ เคย จำนวน ครั้ง

ขอให้ยกตัวอย่างที่ท่านเห็นว่าได้ประโยชน์มากที่สุด มาอย่างละ 1 ครั้ง ดังนี้

1.1 อบรม/ประชุมเรื่อง.....

จัดโดย.....ระยะเวลา.....วัน

1.2 ศึกษาดูงานเรื่อง

สถานที่.....

☐ ไม่เคย (ข้ามไปตอบข้อ 3)

2. ท่านคิดว่าการอบรม หรือการนิเทศงานที่ได้รับมีประโยชน์เพียงพอต่อการปฏิบัติงานของท่านหรือไม่

☐ เพียงพอ

☐ ไม่เพียงพอ

3. ในรอบปีที่ผ่านมา ท่านเคยได้รับการตรวจเยี่ยมหรือนิเทศงานเกี่ยวกับระบบบำบัดน้ำเสีย บ้างหรือไม่

[] เคย (ตอบข้อต่อไป)

[] ไม่เคย

4. ในรอบปีที่ผ่านมา ท่านได้รับการตรวจเยี่ยมหรือนิเทศงานจากหน่วยงานใด จำนวนกี่ครั้ง (ตอบได้ทุกข้อ)

[] สำนักอนามัยสิ่งแวดล้อม จำนวน.....ครั้ง

[] ศูนย์อนามัยเขต จำนวน.....ครั้ง

[] สำนักงานสาธารณสุขจังหวัด จำนวน.....ครั้ง

[] อื่น ๆ ระบุ..... จำนวน.....ครั้ง

ตอนที่ 3 วิธีการ (เทคนิคและการปฏิบัติ) การดูแลระบบบำบัดน้ำเสียโรงพยาบาล

คำชี้แจง คำถามต่อไปนี้เกี่ยวกับวิธีการ (เทคนิคและการปฏิบัติ) การดูแลควบคุมระบบบำบัดน้ำเสีย โรงพยาบาลขอให้ท่านประเมินกิจกรรมเกี่ยวกับวิธีการ (เทคนิคและการปฏิบัติ) การดูแล ควบคุมระบบบำบัดน้ำเสียโรงพยาบาลทางซ้ายมือว่า ท่านปฏิบัติกิจกรรมนั้นในระดับใด แล้วกรุณาทำเครื่องหมาย / ลงในช่องทางขวามือ ให้ตรงกับสิ่งที่ท่านปฏิบัติจริงมากที่สุด โดยมีเกณฑ์ในพิจารณา ดังนี้

ระดับของการปฏิบัติ

มากที่สุด หมายถึง ได้ปฏิบัติกิจกรรมนั้น มากที่สุด หรือปฏิบัติกิจกรรมนั้น 80-100%

มาก หมายถึง ได้ปฏิบัติกิจกรรมนั้น มาก หรือปฏิบัติกิจกรรมนั้น 60-80%

ปานกลาง หมายถึง ได้ปฏิบัติกิจกรรมนั้น ปานกลาง หรือปฏิบัติกิจกรรมนั้น 40-60%

น้อย หมายถึง ได้ปฏิบัติกิจกรรมนั้น น้อย หรือปฏิบัติกิจกรรมนั้น 20-40%

น้อยมาก หมายถึง ได้ปฏิบัติกิจกรรมนั้น น้อยมาก หรือปฏิบัติกิจกรรมนั้น 0-20%

กิจกรรมวิธีการการดูแลควบคุมระบบบำบัดน้ำเสีย โรงพยาบาล	ระดับของการปฏิบัติ				
	มากที่สุด	มาก	ปานกลาง	น้อย	น้อยมาก
1. ท่านปฏิบัติงานดูแลควบคุมระบบ รวบรวมน้ำเสีย ได้ถูกต้องตามเทคนิคหรือวิธีการที่กำหนดไว้ในขั้นตอน					
2. ท่านปฏิบัติงานดูแลควบคุมระบบ บำบัดน้ำเสียและฆ่าเชื้อโรค ได้ถูกต้องตามเทคนิคหรือวิธีการที่กำหนดไว้ในขั้นตอน					
3. ท่านปฏิบัติงานดูแลควบคุมระบบ กำจัดน้ำทิ้ง ได้ถูกต้องตามเทคนิคหรือวิธีการที่กำหนดไว้ในขั้นตอน					
4. ท่านได้ปฏิบัติงานในการดูแลและควบคุมระบบบำบัดน้ำเสียโรงพยาบาลครบทุกขั้นตอนตามที่กระทรวงสาธารณสุขกำหนดไว้					
5. ท่านได้ใช้ความรู้และความเข้าใจปฏิบัติงานระบบบำบัดน้ำเสียโรงพยาบาล					
6. ท่านปฏิบัติงานดูแลควบคุมระบบบำบัดน้ำเสียได้สำเร็จตามระยะเวลาที่กำหนดทุกครั้ง					
7. ได้มีการตรวจสอบบำรุงรักษาวัสดุและอุปกรณ์ในการปฏิบัติงานดูแลควบคุมระบบบำบัดน้ำเสียก่อนการใช้งานทุกครั้ง					

ตอนที่ 4

ก. งบประมาณในการดำเนินงานระบบบำบัดน้ำเสีย

คำชี้แจง โปรดเติมค่าลงในช่องว่าง หรือทำเครื่องหมาย / ลงในช่อง [] ตามความเป็น

จริง

1. ในการปฏิบัติงานท่านได้รับเงินงบประมาณในส่วนการดำเนินงานระบบบำบัดน้ำเสีย ในปี 2546

เป็นเงิน บาท

2. งบประมาณที่ได้รับพอเพียงต่อการดูแลควบคุมระบบในแต่ละส่วนหรือไม่

[] พอเพียง [] ไม่พอเพียง

3. ในการปฏิบัติงานท่านได้รับเงินสนับสนุนเพิ่มเติมนอกจากเงินงบประมาณหรือไม่

[] ได้รับ งบประมาณ บาท [] ไม่ได้

4. ค่าใช้จ่ายในการปฏิบัติงานดูแลควบคุมระบบบำบัดน้ำเสียของโรงพยาบาลในปี งบประมาณ 2546 ประมาณ บาท

ข. ประเภทของระบบบำบัดน้ำเสีย

1. ระบบบำบัดน้ำเสียของโรงพยาบาลเป็นแบบระบบ.....

2. ความสามารถในการรองรับน้ำเสียได้ ลูกบาศก์เมตร / ต่อวัน

3. ปริมาณการเกิดน้ำเสียของโรงพยาบาล ลูกบาศก์เมตร / ต่อวัน

ส่วนที่ 3 ความพึงพอใจต่อผลการดำเนินงานการบำบัดน้ำเสียโรงพยาบาล

คำชี้แจง คำถามต่อไปนี้เป็นการวัดความพึงพอใจต่อสภาพผลการดำเนินงานการบำบัดน้ำเสียโรงพยาบาล

ขอให้ท่านประเมินความพึงพอใจต่อผลการดำเนินงานระบบบำบัดน้ำเสียโรงพยาบาล

ทางซ้ายมือว่า ท่านมีความพึงพอใจในระดับใด แล้วกรุณาทำเครื่องหมาย / ลงในช่องทาง

ขวามือให้ตรงมากที่สุดกับระดับที่ท่านพึงพอใจจริง โดยมีเกณฑ์ในการพิจารณาดังนี้

ระดับของความพอใจ

มากที่สุด	หมายถึง มีความพอใจมากที่สุด	หรือพึงพอใจ 80-100%
มาก	หมายถึง มีความพอใจมาก	หรือพึงพอใจ 60-80%
ปานกลาง	หมายถึง มีความพอใจปานกลาง	หรือพึงพอใจ 40-60%
น้อย	หมายถึง มีความพอใจน้อย	หรือพึงพอใจ 20-40%
น้อยมาก	หมายถึง มีความพอใจน้อยมาก	หรือพึงพอใจ 0-20%

ผลการดำเนินงานการบำบัดน้ำเสียของโรงพยาบาล	ระดับของการปฏิบัติ				
	มากที่สุด	มาก	ปานกลาง	น้อย	น้อยมาก
1. ผลสำเร็จที่เกิดขึ้นในส่วนระบบ รวบรวม น้ำเสียของโรงพยาบาล นับตั้งแต่ท่านเป็นผู้ปฏิบัติดูแลควบคุมระบบฯ มีผลงานเป็นที่น่าพอใจ					
2. ผลสำเร็จที่เกิดขึ้นในส่วนระบบ บำบัดและฆ่าเชื้อโรค ของโรงพยาบาล นับตั้งแต่ท่านเป็นผู้ดูแลควบคุมระบบฯ มีผลงานเป็นที่น่าพอใจ					
3. ผลสำเร็จที่เกิดขึ้นในส่วนระบบ กำจัดน้ำทิ้ง ของโรงพยาบาล นับตั้งแต่ท่านเป็นผู้ดูแลควบคุมระบบฯ มีผลงานเป็นที่น่าพอใจ					
4. ท่านพอใจที่ต้องปฏิบัติงานหลายหน้าที่ซึ่งรวมทั้งการปฏิบัติงานดูแลควบคุมระบบบำบัดน้ำเสียด้วย					
5. ท่านพอใจกับอำนาจหน้าที่และความรับผิดชอบที่ได้รับต่อการปฏิบัติงานดูแลระบบบำบัดน้ำเสียของโรงพยาบาล					
6. ท่านพอใจในการทำงานร่วมกับผู้ดูแลควบคุมระบบฯ และเจ้าหน้าที่อื่น ๆ ในโรงพยาบาล					
7. ท่านพอใจกับเงินงบประมาณที่ได้มาภายในส่วนของการปฏิบัติงานดูแลระบบบำบัดน้ำเสียโรงพยาบาล					
8. ท่านพอใจกับอิสระในการคิด กระบวนการปฏิบัติ และรับผิดชอบงานของท่าน					

ส่วนที่ 4 ปัญหา อุปสรรคในการปฏิบัติงานดูแลควบคุมระบบบำบัดน้ำเสียโรงพยาบาล

ท่านคิดว่าปัญหา อุปสรรคของการปฏิบัติงานดูแลควบคุมระบบบำบัดน้ำเสียโรงพยาบาลมีอะไรบ้าง ในด้านต่อไปนี้

1. ด้านงบประมาณ คือ

.....

.....

2. ด้านบุคลากร คือ

.....

.....

3. ด้านความรู้ การอบรมและนิเทศงาน คือ

.....

.....

4. ด้านเทคนิคและการปฏิบัติ คือ

.....

.....

5. ด้านวัสดุอุปกรณ์ คือ

.....

.....

6. ด้านอื่น ๆ (โปรดระบุ) คือ

.....

.....

ขอขอบคุณที่กรุณาตอบแบบสอบถาม

แบบสอบถาม (ผู้ทำงานประจำของระบบบำบัดน้ำเสีย)

เรื่อง

การจัดการระบบบำบัดน้ำเสียของโรงพยาบาลชุมชน กระทรวงสาธารณสุข ในเขตภาคกลาง

เลขที่แบบสอบถาม

--	--

แบบสอบถามต่อไปนี้ เป็นเรื่องของการจัดการระบบบำบัดน้ำเสียของโรงพยาบาลชุมชน กระทรวงสาธารณสุข แบบสอบถามทั้งหมด ประกอบด้วย 4 ส่วน ขอให้ท่านกรุณาตอบตามความเป็นจริง อย่างถูกต้องดังต่อไปนี้

ส่วนที่ 1 ลักษณะส่วนบุคคล

คำชี้แจง โปรดเติมคำลงในช่องว่าง หรือทำเครื่องหมาย / ลงในช่อง [] ตามความเป็นจริง

1. ท่านอายุ ปี
2. ตำแหน่งปัจจุบัน
[] นายช่าง [] คนทำงานบำบัดน้ำเสียโรงพยาบาล
3. ท่านปฏิบัติงานในการทำงานบำบัดน้ำเสียมา ปี

ส่วนที่ 2

ตอนที่ 1 ความรู้ความเข้าใจในการทำงานบำบัดน้ำเสียโรงพยาบาล

คำชี้แจง โปรดเติมคำลงในช่องว่าง หรือทำเครื่องหมาย / ลงในช่อง [] ตามความเห็นที่แท้จริงของท่านเพียงข้อเดียว

1. น้ำเสียโรงพยาบาลก่อให้เกิดปัญหาสำคัญอะไรที่แตกต่างจากน้ำเสียแหล่งอื่น ๆ
[] การแพร่กระจายของเชื้อโรค [] ทำให้เกิดความรำคาญ
[] ทำให้แม่น้ำ ลำคลองเน่าเสีย [] ทำให้สิ่งแวดล้อมเป็นมลพิษ

2. แหล่งกำเนิดน้ำเสียในโรงพยาบาลที่มีความสำคัญมากที่สุดคือบริเวณใด

☐ สถานที่รับคนไข้ใน	☐ สถานที่ตรวจคนไข้นอก
☐ ที่พักรักษา	☐ โรงครัวและโรงอาหาร
 3. หลักการดูแลระบบรวบรวมน้ำเสียที่ดีคืออะไร

☐ ป้องกันมิให้มีการอุดตันในเส้นท่อรวบรวมน้ำเสีย
☐ ตรวจสอบสภาพตะกอนจากช่องระบายน้ำในที่ต่าง ๆ เพื่อไม่ให้เกิดการปนเปื้อนเศษขยะ
☐ ประชาสัมพันธ์และขอความร่วมมือจากเจ้าหน้าที่และผู้รับบริการในการทิ้งขยะเข้าระบบ
☐ ถูกทุกข้อ
 4. เนื่องจากน้ำเสียจากโรงพยาบาลมีเชื้อโรคปะปนอยู่มาก ดังนั้นในกระบวนการบำบัดน้ำเสียจึงจำเป็นต้องผ่านกระบวนการฆ่าเชื้อ ซึ่งอยู่ในขั้นตอนใดของระบบบำบัดน้ำเสียในโรงพยาบาล

☐ ขั้นตอนการเติมอากาศ	☐ ขั้นตอนการตกตะกอน
☐ ขั้นตอนก่อนปล่อยน้ำทิ้งจากระบบ	☐ ขั้นตอนก่อนและหลังการตกตะกอน
 5. ในการประเมินประสิทธิภาพของระบบบำบัดน้ำเสียทางกายภาพ หากท่านพบว่ามีฟองสีขาวที่ผิวน้ำในถังเติมอากาศจะบ่งบอกอะไร

☐ แสดงว่ามีค่าความเข้มข้นของจุลินทรีย์ในถังเติมอากาศมากเกินไป
☐ แสดงว่ามีค่าความเข้มข้นของจุลินทรีย์ในถังเติมอากาศน้อยเกินไป
☐ แสดงว่าตะกอนจุลินทรีย์มีอายุมากเกินไป ต้องนำตะกอนส่วนเกินไปทิ้งให้มากขึ้น
☐ แสดงว่าตะกอนจุลินทรีย์มีอายุน้อยเกินไป ต้องนำตะกอนส่วนเกินไปทิ้งให้น้อยลง
 6. ตามประกาศกระทรวงวิทยาศาสตร์ เทคโนโลยี และสิ่งแวดล้อม เรื่องมาตรฐานน้ำทิ้งที่ผ่านการบำบัดแล้ว กำหนดให้น้ำทิ้งที่ผ่านการบำบัดแล้วมีค่า BOD เท่าไร ในกรณีโรงพยาบาล 30 เตียง

☐ ไม่เกิน 25 มิลลิกรัมต่อลิตร	☐ ไม่เกิน 20 มิลลิกรัมต่อลิตร
☐ ไม่เกิน 18 มิลลิกรัมต่อลิตร	☐ ไม่เกิน 15 มิลลิกรัมต่อลิตร
 7. ค่าบีโอดี มีความสำคัญต่อระบบบำบัดน้ำเสียอย่างไร

☐ ใช้ตรวจสอบคุณภาพของระบบบำบัดน้ำเสีย	☐ ใช้ตรวจสอบคุณภาพน้ำทิ้ง
☐ ใช้ในการออกแบบระบบบำบัดน้ำเสีย	☐ ถูกทุกข้อ
 8. ท่านมีความคิดเห็นอย่างไรเกี่ยวกับน้ำเสียโรงพยาบาล

☐ เป็นปัญหาที่ต้องรีบแก้ไข	☐ เป็นปัญหาที่ต้องแก้ไข
☐ ไม่มีปัญหา	☐ อื่น ๆ (ระบุ)

9. ท่านคิดว่าการจัดการระบบบำบัดน้ำเสียในโรงพยาบาลที่ดี จะได้ประโยชน์อย่างไร
- [] ลดค่าใช้จ่ายในการจัดการสิ่งแวดล้อม [] ลดอัตราการแพร่เชื้อโรคที่มีน้ำเสีย
- [] สภาพแวดล้อมจะดีขึ้น เป็นพาหะ
- [] ประชาชนมีคุณภาพชีวิตดีขึ้น
10. ท่านคิดว่าระบบบำบัดน้ำเสียระบบใดเหมาะสมที่สุดสำหรับการจัดการระบบบำบัดน้ำเสีย
โรงพยาบาล 30 เตียง ของประเทศไทย
- [] ระบบคลองวนเวียน [] ระบบบ่อกึ่งน้ำ
- [] ระบบถังกรองอากาศ [] ระบบบ่อบำบัดอากาศ
11. เหตุผลที่บอกว่าระบบที่ท่านเลือกเหมาะสมที่สุด คือ
12. หน่วยงานที่สนับสนุนการจัดการระบบบำบัดน้ำเสียโรงพยาบาลในปัจจุบันคือ
-

ตอนที่ 2 การฝึกอบรม สัมมนา และการนิเทศงาน

1. ในรอบ 3 ปีที่ผ่านมา ท่านเคยได้รับการอบรม ประชุม/สัมมนา ศึกษาดูงาน เกี่ยวกับระบบบำบัด
น้ำเสียหรือไม่
- [] เคย จำนวน ครั้ง
- ขอให้ท่านยกตัวอย่างที่ท่านเห็นว่าท่านได้ประโยชน์มากที่สุดมาอย่าละ 1 ครั้ง ดังนี้
- 1.1 อบรม/ประชุมเรื่อง.....
- จัดโดย.....ระยะเวลา.....วัน
- 1.2 ศึกษาดูงานเรื่อง
- สถานที่.....
- [] ไม่เคย (ข้ามไปตอบข้อ 3)
2. ท่านคิดว่าการอบรม หรือการนิเทศงานที่ได้รับมีประโยชน์เพียงพอต่อการปฏิบัติงานของท่าน
หรือไม่
- [] เพียงพอ [] ไม่เพียงพอ
3. ในรอบปีที่ผ่านมา ท่านเคยได้รับการตรวจเยี่ยมหรือนิเทศงานเกี่ยวกับระบบบำบัดน้ำเสีย
บ้างหรือไม่
- [] เคย (ตอบข้อต่อไป) [] ไม่เคย

4. ในรอบปีที่ผ่านมา ท่านได้รับการตรวจเยี่ยมหรือนิเทศงานจากหน่วยงานต่อไปนี้ จำนวนกี่ครั้ง
(ตอบได้ทุกข้อ)

- [] สำนักงานมัยสิ่งแวดล้อม จำนวน.....ครั้ง
 [] ศูนย์อนามัยเขต จำนวน.....ครั้ง
 [] สำนักงานสาธารณสุขจังหวัด จำนวน.....ครั้ง
 [] อื่น ๆ ระบุ..... จำนวน.....ครั้ง

ตอนที่ 3 วิธีการ (เทคนิค และการปฏิบัติ) การทำงานบำบัดน้ำเสียโรงพยาบาล

คำชี้แจง คำถามต่อไปนี้เกี่ยวกับวิธีการ (เทคนิคและการปฏิบัติ) การทำงานบำบัดน้ำเสียโรงพยาบาล ขอให้ท่านประเมินกิจกรรมเกี่ยวกับวิธีการ (เทคนิคและการปฏิบัติ) การทำงานบำบัดน้ำเสียโรงพยาบาลทางซ้ายมือว่า ท่านปฏิบัติกิจกรรมนั้นในระดับใด แล้วกรณำเครื่องหมาย / ลงในช่องทางขวามือ ให้ตรงกับสิ่งที่ท่านปฏิบัติจริงมากที่สุด โดยมีเกณฑ์ในการพิจารณาดังนี้

ระดับของการปฏิบัติ

- มากที่สุด หมายถึง ได้ปฏิบัติกิจกรรมนั้น มากที่สุด หรือปฏิบัติกิจกรรมนั้น 80-100%
 มาก หมายถึง ได้ปฏิบัติกิจกรรมนั้น มาก หรือปฏิบัติกิจกรรมนั้น 60-80%
 ปานกลาง หมายถึง ได้ปฏิบัติกิจกรรมนั้น ปานกลาง หรือปฏิบัติกิจกรรมนั้น 40-60%
 น้อย หมายถึง ได้ปฏิบัติกิจกรรมนั้น น้อย หรือปฏิบัติกิจกรรมนั้น 20-40%
 น้อยมาก หมายถึง ได้ปฏิบัติกิจกรรมนั้น น้อยมาก หรือปฏิบัติกิจกรรมนั้น 0-20%

ผลการดำเนินงานการบำบัดน้ำเสียของโรงพยาบาล	ระดับของการปฏิบัติ				
	มากที่สุด	มาก	ปานกลาง	น้อย	น้อยมาก
1. ได้มีการตรวจสอบบ่อดักขยะ – บ่อดักกลั่นและบ่อดักขยะโรงครัวตามระยะเวลาที่กำหนดทุกครั้ง					
2. ได้มีการดักไขมันที่โรงครัวทิ้งโดยใส่ถังนำไปทิ้งที่ทำลายขยะเทศบาล ตามระยะเวลาที่กำหนดทุกครั้ง					
3. ได้มีการตรวจสอบตะกร้าดักขยะในบ่อสูบลมตามระยะเวลาที่กำหนดทุกครั้ง					
4. ได้มีการตั้งเครื่องสูบน้ำเพื่อตรวจสอบว่ามีขยะติดอยู่ในเครื่องสูบน้ำตามระยะเวลาที่กำหนดทุกครั้ง					
5. ได้มีการตรวจหาคลอรีนในบ่อน้ำฆ่าเชื้อโรคตามวิธีตรวจหาคลอรีนตามระยะเวลาที่กำหนดทุกครั้ง					
6. ได้มีการตรวจหาค่าออกซิเจนละลาย (DO) ตามวิธีการวัดหาค่า DO ตามระยะเวลาที่กำหนดทุกครั้ง					
7. ได้มีการดูแลบริเวณสนามและสิ่งแวดล้อมรอบบ่อบำบัดตามระยะเวลาที่กำหนดทุกครั้ง					
8. ได้มีการทาสีกันสนิมอุปกรณ์ส่วนที่เป็นเหล็กตามระยะเวลาที่กำหนดทุกครั้ง					
9. ได้มีการตรวจน้ำมันหล่อลื่นเครื่องสูบน้ำในบ่อสูบลมตามระยะเวลาที่กำหนดทุกครั้ง					

ผลการดำเนินงานการบำบัดน้ำเสียของโรงพยาบาล	ระดับของการปฏิบัติ				
	มากที่สุด	มาก	ปานกลาง	น้อย	น้อยมาก
10. ได้มีการถ่ายน้ำมันหล่อลื่นเครื่องสูบน้ำในบ่อสูบลตามระยะเวลาที่กำหนดทุกครั้ง					
11. ได้มีการล้างแนวท่อบำบัดทั้งระบบฯ ภายในโรงพยาบาลตามระยะเวลาที่กำหนด					
ข้อ 12 – 17 <u>ตอบเฉพาะสำหรับระบบบำบัดน้ำเสียโรงพยาบาลที่เป็นระบบแบบคลองวนเวียนหรือระบบบ่อเติมอากาศ</u>					
12. ได้มีการอัดจารบีที่รองรับเพลลาไบพัดเติมอากาศตามระยะเวลาที่กำหนดทุกครั้ง					
13. ได้มีการตรวจสอบสายพานมอเตอร์ไฟฟ้าไบพัดเติมอากาศตามระยะเวลาที่กำหนดทุกครั้ง					
14. ได้มีการจดบันทึกจำนวนหน่วยไฟฟ้าในแต่ละเดือนใช้ไฟฟ้าเป็นจำนวนหน่วยตามระยะเวลาที่กำหนดทุกครั้ง					
15. ได้มีการตรวจสอบแบร็งที่รองรับเพลลาไบพัดเติมอากาศ และตรวจสอบหรือใส่จารบีให้เพียงพอตามระยะเวลาที่กำหนดทุกครั้ง					
16. ได้มีการทำความสะอาดตู้คอนโทรลไฟฟ้าทั้งหมดตามระยะเวลาที่กำหนดทุกครั้ง					
17. ได้มีการฉีดน้ำยาล้างหน้าคอนแทคไฟฟ้าตามระยะเวลาที่กำหนดทุกครั้ง					
ข้อ 18 <u>ตอบเฉพาะสำหรับระบบบำบัดน้ำเสียโรงพยาบาลที่เป็นระบบแบบคลองวนเวียน</u>					
18. ได้มีการวิเคราะห์ตะกอนในคลองวนเวียนโดยการตรวจด้วยกรวยอิมฮอฟ (Imhoff) ตามระยะเวลาที่กำหนดทุกครั้ง					

ตอนที่ 4 ความพอเพียงของวัสดุอุปกรณ์

คำชี้แจง คำถามต่อไปนี้เป็นความคิดเห็นต่อความพอเพียงของวัสดุอุปกรณ์ในการทำงาน
 บำบัดน้ำเสียโรงพยาบาล ขอให้ท่านประเมินความคิดเห็นต่อความพอเพียงของ
 วัสดุอุปกรณ์ในการทำงานบำบัดน้ำเสียทางซ้ายมือว่า ท่านมีความคิดเห็นในระดับ
 ใด แล้วกรุณาทำเครื่องหมาย / ลงในช่องทางขวามือ ให้ตรงมากที่สุดกับระดับ
 ความคิดเห็นของท่าน โดยมีเกณฑ์ในการพิจารณาดังนี้

ระดับของความคิดเห็น

มากที่สุด หมายถึง มีความคิดเห็นพอเพียง มากที่สุด หรือ 80-100%
 มาก หมายถึง มีความคิดเห็นพอเพียง มาก หรือ 60-80%
 ปานกลาง หมายถึง มีความคิดเห็นพอเพียง ปานกลาง หรือ 40-60%
 น้อย หมายถึง มีความคิดเห็นพอเพียง น้อย หรือ 20-40%
 น้อยที่สุด หมายถึง มีความคิดเห็นพอเพียง น้อยที่สุด หรือ 0-20%

ผลการดำเนินงานการบำบัดน้ำเสียของโรงพยาบาล	ระดับของการปฏิบัติ				
	มากที่สุด	มาก	ปานกลาง	น้อย	น้อยมาก
1. ในการปฏิบัติงานท่านมีวัสดุที่เกี่ยวกับการบำบัดน้ำเสียในการทำงาน					
2. ในการปฏิบัติงานท่านมีเครื่องมือเครื่องใช้ในการทำงานระบบบำบัดน้ำเสีย					
3. ในการปฏิบัติงานท่านมีสิ่งอำนวยความสะดวกในการทำงานระบบบำบัดน้ำเสีย					

ส่วนที่ 3 ความพึงพอใจต่อผลการดำเนินงานการบำบัดน้ำเสียโรงพยาบาล

คำชี้แจง คำถามต่อไปนี้เป็นการวัดความพึงพอใจต่อผลการดำเนินงานการบำบัดน้ำเสียโรงพยาบาล

ขอให้ท่านประเมินความพึงพอใจต่อผลการดำเนินงานระบบบำบัดน้ำเสียโรงพยาบาล

ทางซ้ายมือว่า ท่านมีความพึงพอใจในระดับใด แล้วกรุณาทำเครื่องหมาย / ลงในช่องทาง

ขวามือ ให้ตรงมากที่สุดกับระดับที่ท่านพึงพอใจจริง โดยมีเกณฑ์ในการพิจารณาดังนี้

ระดับของความพอใจ

มากที่สุด	หมายถึง มีความพอใจมากที่สุด	หรือพึงพอใจ 80-100%
มาก	หมายถึง มีความพอใจมาก	หรือพึงพอใจ 60-80%
ปานกลาง	หมายถึง มีความพอใจปานกลาง	หรือพึงพอใจ 40-60%
น้อย	หมายถึง มีความพอใจน้อย	หรือพึงพอใจ 20-40%
น้อยมาก	หมายถึง มีความพอใจน้อยมาก	หรือพึงพอใจ 0-20%

ผลการดำเนินงานการบำบัดน้ำเสียของโรงพยาบาล	ระดับของการปฏิบัติ				
	มากที่สุด	มาก	ปานกลาง	น้อย	น้อยมาก
1. ผลสำเร็จที่เกิดขึ้นในส่วนระบบรวบรวมน้ำเสียของโรงพยาบาล นับตั้งแต่ท่านเป็นผู้ปฏิบัติดูแลควบคุมระบบฯ มีผลงานเป็นที่น่าพอใจ					
2. ผลสำเร็จที่เกิดขึ้นในส่วนระบบบำบัดน้ำเสียและฆ่าเชื้อโรคของโรงพยาบาล นับตั้งแต่ท่านเป็นผู้ดูแลควบคุมระบบฯ มีผลงานเป็นที่น่าพอใจ					
3. ผลสำเร็จที่เกิดขึ้นในส่วนระบบกำจัดน้ำทิ้งของโรงพยาบาล นับตั้งแต่ท่านเป็นผู้ดูแลควบคุมระบบฯ มีผลงานเป็นที่น่าพอใจ					
4. ท่านพอใจที่ต้องปฏิบัติงานหลายหน้าที่ซึ่งรวมทั้งการปฏิบัติงานดูแลควบคุมระบบบำบัดน้ำเสียด้วย					

ผลการดำเนินงานการบำบัดน้ำเสียของโรงพยาบาล	ระดับของการปฏิบัติ				
	มากที่สุด	มาก	ปานกลาง	น้อย	น้อยมาก
5. ท่านพอใจกับอำนาจหน้าที่และความรับผิดชอบที่ได้รับต่อการปฏิบัติงานดูแลระบบบำบัดน้ำเสียของโรงพยาบาล					
6. ท่านพอใจในการทำงานร่วมกับผู้ปฏิบัติงานเกี่ยวกับระบบบำบัดฯ และเจ้าหน้าที่อื่น ๆ ในโรงพยาบาลที่เกี่ยวข้องกับระบบบำบัดฯ					
7. ท่านพอใจกับเงินงบประมาณที่ได้มาภายในส่วนของการปฏิบัติงานดูแลระบบบำบัดน้ำเสียโรงพยาบาล					
8. ท่านพอใจกับอิสระในการคิด กระบวนการปฏิบัติ และรับผิดชอบงานของท่าน					

ส่วนที่ 4 ปัญหา อุปสรรคในการปฏิบัติงานการทำงานบำบัดน้ำเสียโรงพยาบาล

ท่านคิดว่าปัญหา อุปสรรคของการปฏิบัติงานการทำงานบำบัดน้ำเสียโรงพยาบาลมีอะไรบ้างในด้านต่อไปนี้

1. ด้านบุคลากร คือ

.....

2. ด้านความรู้ การอบรม และนิเทศงาน คือ

.....

3. ด้านเทคนิคและการปฏิบัติ คือ

.....

4. ด้านวัสดุอุปกรณ์ คือ
-
5. ด้านอื่น ๆ (โปรดระบุ)
-



ขอขอบคุณที่กรุณาตอบแบบสอบถาม

แบบสอบถาม (ประชาชน)

เรื่อง

การจัดการระบบบำบัดน้ำเสียของโรงพยาบาลชุมชน กระทรวงสาธารณสุข ในเขตภาคกลาง

เลขที่แบบสอบถาม

--	--	--

แบบสอบถามต่อไปนี้เป็นเรื่องของการจัดการบำบัดน้ำเสียของโรงพยาบาลชุมชน กระทรวงสาธารณสุข แบบสอบถามทั้งหมดประกอบด้วย 2 ส่วน ขอให้ท่านกรุณาตอบตามความเป็นจริง อย่างถูกต้องดังต่อไปนี้

ส่วนที่ 1 ข้อมูลพื้นฐาน

คำชี้แจง โปรดเติมคำลงในช่องว่างหรือทำเครื่องหมาย / ลงใน [] ตามความเป็นจริง

1. ท่านอายุ ปี
2. อาชีพ

☐ ราชการ	☐ รัฐวิสาหกิจ
☐ ค้าขาย	☐ ลูกจ้าง
☐ เกษตรกรรม	☐ อื่นๆ ระบุ
3. ท่านทราบหรือไม่ว่าโรงพยาบาลใกล้บ้านของท่านมีระบบบำบัดน้ำเสีย

☐ ทราบ	☐ ไม่ทราบ
-------------------------------	----------------------------------

ส่วนที่ 2 เรื่องทั่วไป

คำชี้แจง โปรดเติมคำลงในช่องว่างหรือทำเครื่องหมาย / ลงใน [] ตามความเป็นจริง

1. ถ้าโรงพยาบาลไม่มีการจัดการบำบัดน้ำเสียโรงพยาบาลก่อนปล่อยน้ำทิ้งจะส่งผลให้สภาพแวดล้อมทางน้ำของชุมชนรอบโรงพยาบาลเสียหาย

☐ เห็นด้วย	☐ ไม่เห็นด้วย
-----------------------------------	--------------------------------------
2. ท่านได้รับทราบข้อมูลข่าวสารเกี่ยวกับเรื่องการบำบัดน้ำเสียของโรงพยาบาลใกล้บ้านท่านหรือไม่

☐ ทราบ จาก	☐ ไม่ทราบ
---	----------------------------------

3. มีผลกระทบอย่างไรบ้างถ้ามีการระบายน้ำเสียจากโรงพยาบาลมายังบริเวณชุมชนของท่าน
(ตอบได้มากกว่า 1 ข้อ)
- ☐ เกิดกลิ่นเหม็นและสีดำคล้ำสกปรก ☐ เกิดทัศนียภาพไม่สวยงาม
☐ เป็นพาหะของโรค ☐ ไม่มีผลใดๆ
4. ท่านคิดว่าถ้าโรงพยาบาลจัดการระบบบำบัดน้ำเสียของโรงพยาบาลเป็นอย่างดีได้ในปัจจุบัน
จะเกิดประโยชน์อย่างไรบ้างต่อชุมชน (ตอบได้มากกว่า 1 ข้อ)
- ☐ ลดการแพร่กระจายของเชื้อโรค ☐ ประชาชนมีคุณภาพชีวิตที่ดีขึ้น
☐ สภาพแวดล้อมดีขึ้น ☐ สภาพแวดล้อมเหมือนเดิม
5. ในชุมชนของท่านมีหน่วยงานภาคเอกชนหรือมูลนิธิให้ความช่วยเหลือหรือสนับสนุนในการดูแล
สภาพแวดล้อมทางน้ำบ้างหรือไม่
- ☐ มี ☐ ไม่มี
6. ท่านทราบหรือไม่ว่าชุมชนของท่านได้รับความคุ้มครองตามกฎหมายเกี่ยวกับสภาพแวดล้อมทาง
น้ำรอบๆ ที่อยู่อาศัยของท่าน
- ☐ ทราบ ☐ ไม่ทราบ
7. ถ้าท่านหรือญาติพี่น้องต้องเข้ารักษาตัวในโรงพยาบาล ท่านยินดีที่จะจ่ายค่าธรรมเนียมการบำบัด
น้ำเสียของโรงพยาบาลหรือไม่
- ☐ ยินดีจ่าย ในอัตราวันละ บาท ☐ ไม่ยินดีจ่าย

ส่วนที่ 3 ความพึงพอใจต่อการบริหารจัดการการบำบัดน้ำเสียของโรงพยาบาล

คำชี้แจง คำถามต่อไปนี้ เป็นความพึงพอใจต่อการบริหารจัดการการบำบัดน้ำเสียของโรงพยาบาล
ขอให้ท่านประเมินความพึงพอใจของท่านต่อการบริหารจัดการการบำบัดน้ำเสียของ
โรงพยาบาลทางซ้ายมือว่าท่านมีความพึงพอใจในระดับใด แล้วกรณการทำเครื่องหมาย /
ลงในช่องทางขวามือ ให้ตรงมากที่สุด กับระดับที่ท่านพึงพอใจจริง โดยมีเกณฑ์ในการ
พิจารณาดังนี้

ระดับของความพอใจ

มากที่สุด	หมายถึง มีความพอใจมากที่สุด หรือพึงพอใจ 80-100%
มาก	หมายถึง มีความพอใจมาก หรือพึงพอใจ 60-80%
ปานกลาง	หมายถึง มีความพอใจปานกลาง หรือพึงพอใจ 40-60%
น้อย	หมายถึง มีความพอใจน้อย หรือพึงพอใจ 20-40%
น้อยมาก	หมายถึง มีความพอใจน้อยมาก หรือพึงพอใจ 0-20%

ผลการดำเนินงานการบำบัดน้ำเสียของโรงพยาบาล	ระดับของความพอใจ				
	มากที่สุด	มาก	ปานกลาง	น้อย	น้อยมาก
1. เมื่อได้กลิ่นเหม็นของน้ำทิ้งบริเวณ โรงพยาบาล หรือรอบๆข้าง ทำให้ท่านมีความรู้สึกอย่างไร					
2. เมื่อเห็นน้ำทิ้งของ โรงพยาบาลมีสภาพสีดำคล้ำ สกปรกทำให้ท่านมีความรู้สึกอย่างไร					
3. ท่านพอใจที่จะร้องเรียนปัญหาเกี่ยวกับการระบายน้ำทิ้งของ โรงพยาบาลสู่ทางน้ำและ สาธารณะเพียงใด					
4. ท่านพอใจกับการดำเนินการบำบัดน้ำเสียก่อนปล่อยน้ำทิ้งสู่ท่อระบายน้ำและลำธารของ โรงพยาบาลเพียงใด					
5. ท่านพอใจกับการปฏิบัติและให้ความร่วมมือในการจัดการบำบัดน้ำเสีย โรงพยาบาลกับทางราชการมากน้อยเพียงใด					
6. ท่านพอใจกับสภาพแวดล้อมทางน้ำบริเวณรอบๆ โรงพยาบาลและชุมชนที่อยู่อาศัยของท่านเพียงใด					

ขอขอบคุณที่กรุณาตอบแบบสอบถาม

BIOGRAPHY

NAME	Mr.Suradej Praditbatuka
NATIONALITY	Thai
DATE OF BIRTH	1 st December 1953
PLACE OF BIRTH	Bangkok, Thailand
INSTITUTIONS ATTENDED	Chulalongkorn University 1972-1976 Bachelor of Science (Medical Technology) Mahidol University 1978-1982 Master of Science (Biostatistics) Mahidol University 1999-2004 Master of Science (Public Health) Major in Hospital Administration
POSITION & OFFICE	Present, School of Health Science Sukhothai Thammathirat University Nonthaburi Province, Thailand <i>Position</i> : Assistant Professor.
RESEARCH - GRANT	Supported in part by the Thesis Grant, Faculty of Graduate Studies, Mahidol University.