AN APPROPRIATE MANAGEMENT BY USING INFECTIOUS WASTE INCINERATOR : A CASE STUDY OF HOSPITAL UNDER MINISTRY OF PUBLIC HEALTH IN NONTHABURI

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The purposes of this research were to study appropriate management of usage of infectious waste incinerators by medical personnel. Factors under considerations include: 1) policy, 2) appropriate management, 3) budgeting, 4) relationship between personal factors and knowledge, including behavior of general medical staff, 5) relationship between knowledge and behavior of general medical staff, 6) pursuit assessment, and, 7) problems and recommendations

The research was conducted as survey research by using in depth-interview for 2 hospital directors and 4 disposal staff dealing with infectious waste. The questionnaire was administered to 185 general medical staff chosen by the stratified random sampling method. The data was analyzed by description, percentage and Chi-square test. The findings were as follows:

The hospital directors need to formalize policy, determine appropriate management practices and budgets, especially with regard to using infectious waste incinerators. Most of the general medical staff had high level of knowledge, but had occasional lapses in practices and behavior. The relationship between the general medical staff and knowledge of appropriate management and infectious waste management training, behavior to appropriate management, work duration and infectious waste management training was apparent. Relationship of the general medical staffs were not found between knowledge on an appropriate management and work duration. The Relationship of the general medical staffs was not found between knowledge and behavior on an appropriate management, with the statistical significance at 0.05.

Therefore, this research recommends that there is a need to determine and formalize an appropriate management policy and orient and provide appropriate management training, especially to using infectious waste incinerators for all of medial personnel. These practices positively correlated with the thesis assumption

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ธาริณี นวานุช : กระบวนการในการจัดการมูลฝอยติดเชื้อ โดยใช้เตาเผามูลฝอยติดเชื้อของบุคลากรทางการแพทย์ : กรณีศึกษาโรงพยาบาลในสังกัดกระทรวงสาธารณสุขในเขตจังหวัดนนทบุรี (AN APPROPRIATE MANAGEMENT BY USING INFECTIOUS WASTE INCINERATOR: A CASE STUDY OF HOSPITAL UNDER MINISTRY OF PUBLIC HEALTH IN NONTHABURI) คณะกรรมการควบคุมวิทยานิพนธ์ : ศุภชัย ศุกรวรรณ, พบ.ม., ศิริชัย ชินะตังกูร, Ph.D., วศิน ปลื้มเจริญ, ศษ.ม., 121 หน้า. ISBN 974-04-1220-3

การวิจัยครั้งนี้ มีวัตถุประสงค์เพื่อศึกษาถึงกระบวนการในการจัดการมูลฝอยติดเชื้อโดยใช้เตาเผามูลฝอยติดเชื้อ ของบุคลากรทางการแพทย์ ในประเด็นต่าง ๆ คือ 1) นโยบาย 2) กระบวนการในการจัดการ 3) งบประมาณ 4) ความสัมพันธ์ระหว่างปัจจัยส่วนบุคคลกับความรู้และพฤติกรรมของกลุ่มบุคลากรทางการแพทย์ทั่วไป 5) ความสัมพันธ์ระหว่างความรู้และพฤติกรรมของกลุ่มบุคลากรทางการแพทย์ทั่วไป 6) การติดตาม ประเมินผล 7) ปัญหาและข้อเสนอแนะ

วิธีการดำเนินการวิจัย เป็นการวิจัยเชิงสำรวจ โดยการสัมภาษณ์เจาะลึกผู้บริหารโรงเรียน 2 คน และผู้กำจัดมูลฝอยติดเชื้อ 4 คน ส่วนบุคลากรทางการแพทย์ทั่วไปใช้แบบสอบถามรวบรวมข้อมูลและคัดเลือกกลุ่มตัวอย่างจำนวน 185 คน และนำมาวิเคราะห์โดยใช้การพรรณนา หาค่าสถิติร้อยละ และค่าไคสแควร์ (Chi-square) ผลจากการวิจัยสรุปได้ดังนี้

ผู้บริหารโรงพยาบาลยังไม่มีนโยบาย การกำหนดกระบวนการและงบประมาณในการจัดการเรื่องมูลฝอยติดเชื้อ โดยใช้เตาเผามูลฝอยติดเชื้อที่ชัดเจนเป็นลายลักษณ์อักษร ส่วนบุคลากรทางการแพทย์ทั่วไปมีความรู้อยู่ในระดับสูง และมีพฤติกรรมในการปฏิบัติไม่ค่อยสม่ำเสมอนัก ความรู้มีความสัมพันธ์กับการเข้ารับการอบรม แต่ความรู้ไม่มีความสัมพันธ์กับระยะเวลาในการปฏิบัติงาน ส่วนพฤติกรรมมีความสัมพันธ์กับระยะเวลาในการปฏิบัติงานและการเข้ารับการอบรม ความรู้และพฤติกรรมของกลุ่มบุคลากรทางการแพทย์ทั่วไปไม่มีความสัมพันธ์กัน ที่ระดับนัยสำคัญ 0.05 จากผลการวิจัย สามารถนำไปสู่ข้อเสนอแนะคือ ควรมีนโยบายเป็นลายลักษณ์อักษร และมีการส่งเสริมความรู้ให้แก่บุคลากรทั้งหมด เพื่อเป็นแนวทางในการปฏิบัติและให้บุคลากรได้ตระหนักถึงความสำคัญในการจัดการมูลฝอยติดเชื้อ โดยใช้เตาเผามูลฝอยติดเชื้อที่ถูกต้องและเหมาะสมต่อไป

CONTENTS

CONTENTS (cont.)

CONTENTS (cont.)

LIST OF TABLES

LIST OF FIGURES

CHAPTER I

INTRODUCTION

1.1 Background of the Research

Wastes refer to remain or by-products from human production and consumption processes. The disposal of domestic and industrial was to under environmentally sustainable conditions has become a matter of high priority for many places in Thailand, especially in Bangkok – the capital city with marked development and expansion. Most of the wastes come from Industrial factories households, markets, trading areas, and entertainment centers, following the rapid economic and population growth. On average, one person generates about 0.8 – 1.0 kilogram of waste daily (The Pollution Control Department, 1999: 219). Meanwhile, the responsible deportment cannot find lands to support waste disposal in the long run, as well as lack equipment for hygienic gathering and managing of mounting wastes. Operation and abandoned waste sites have increasingly developed into source of serious environmental pollution. Without proper waste management, the city will not only appear untidy but also face various environmental pollution problems, such as tainted wasted resources, hence an area that cultures and spreads bacteria, and pungent pollution, which will create health problems and damage pleasant landscape. Infectious waste is the main cause to pose a greater threat, as the medical-related wastes can cause infection. According to the research conducted by Mahidol University in blood taste of 136 waste collectors of On-nut waste disposal plant found 6 AIDS victims and 26 Hepatitis B Virus patients. The research also found that children and adults living in slums nearby suffered respiratory diseases. Infection prevention from the medical and public health services (1995: 11-14) found that accidents from sharp objects are the main courses of AIDS infection among medical staff. Diseases that can spread through blood are, for example, HIV, Hepatitis B Virus, Hepatitis C Virus, and Syphilis, etc. Though wounds from glass or needles may not lead to infection, but the wounds can enhance the risk of infection upon contact with patients' bloods or secretion

From the report on environmental conditions during 1995-1996 (1997: 314), infectious wastes collected in Bangkok in 1992 stood at 2,340 tons and then soared to 2,500 tons in 1994. Information from the Department of Public Cleansing in 1998 (1998: 123) disclosed that infectious wastes that the Bangkok Metropolitan Administration collected and disposed from hospitals in FY 1997 were averaged 3,128 tons a year. The survey of the Pollution Control Department, conducted in 1999, found that infectious wastes in the Bangkok Metropolitan Region 5,150 tons annually. That implied to a generation rate of infectious wastes at 0.26 – 0.65 kilogram/bed/day on average and the volume was likely to increase by 5.5 percent in the previous year.

To increase rapidly in infectious wastes comprise a rise in population, economic growth, and technological advancement, leading to greater consumption. The surge in production to upgrade economy and society has distorted balances in the ecosystem, increase of environmental pollutant. Hospitals have seen more patients. It

is evident that the spread of infectious diseases through blood and secretion has climbed, particularly AIDS still can not cure for mankind. Disposable medical equipment has been employed in order to prevent infection among service recipients and providers, hence a rise in infectious wastes.

Very important that infectious wastes have been managed properly, correct and special treatment. The consequent pollution problems would bacteria, causing dirty and bad smell.

Therefore, in order to solve problems and achieve well maintenance to reduce poles of infectious waste and general rubbish and also to reduce elimination and pollution from burning, the separation of infectious waste must be performed at its origin. (by Suwanna Teasuwan and colleagues, 1999 : 43)

Infectious waste is a hazardous waste since there was infection in it which could create epidemic to environment if there is no proper way of management. Presently, it become a stronger problem along with more nursing places. According to U.S. EPA advice the proper system of eliminating infectious waste is burning by using infectious waste incinerator for burning infectious waste. This is in conformity with the government policy to prepare budget for all types of hospitals.

The Ministry of Health also foresee the need of infectious waste incinerator and plan had been issued in Development Plan No.7 Starting from 2536 construction of infectious waste incinerator (IC system) in government hospitals would be 32.3% and in rural hospitals with infectious waste incinerator 38090% all in all up to 71.28%. For central and general hospitals, construction of infectious waste incinerator would be drived to complete within Plan No.7 also. (Summary of report on development plan for health No.7 1992-1996) However, by case study, The capacity of the infectious waste incinerator were low thus created air pollution thus in conformity with case study on elimination of infectious waste in government hospitals which specified the problem of usage of incinerator was the annoyance from smoke at 28.57% (Decha Ngamnikulchalin, 1994).

These problems came from high humidity and mixed composition of infectious waste and in practice, ordinary waste incinerator could not be controlled to burn the infectious waste therefore resulting to creation of smoke / gas out of chimney to the atmosphere. This hazardous mass was dangerous to health and in conformity to the pollution control limit by the Ministry of Science & Technology and others such as carbonmonoxide gas, hydrogen chloride gas, hydrogen fluoride gas, sulphurdioxide gas, nytrogenoxide gas and dust.

Normally, burnt in sanitary infectious waste incinerators should not produce non - hazardous gas but in fact that the infectious waste incinerators were not designed with eliminating system for gas thus burning created air pollution.

The method for burning in fireplace which is sanitary. Gas / smoke which let from the smokestack, it will not have pollution. But in the real, fire-stove is not designed for system get rid of smoke, gas and then it is the cause of the air - pollution.

One thing, which can operate to reduce the capacity of gas and reduce the capacity of ash which remain from burning is the control for the condition about working of efficient fire - stove and is followed the style which is fixed.

From the detail, can see that the most of problem is the operation which has not the effectiveness, since the process of collecting, transport and destruction about the rubbish which contact a disease. This process of separation about the rubbish have the mistake of personnel which is not understand or realize in the importance off

separation bout rubbish which contact a disease out from general rubbish and ignore in this thing. Then it should have the study about the practice for the first group and have to touch with the waste - thing which let from the body of the patient and have to operate about waste - thing. In the first process of operation is the collection and separation for the rubbish after to use in the activity for treatment about patient so that to protect the spread of disease and safe for the person who keep it. If the first process mistake, it can be the danger for yourself and another person.

Moreover, it has another problems to operate for rubbish which contact a disease of the hospital and have in Bangkok and circle:

1) Have not the separation for the rubbish which contact a disease out from another type.

The collection for rubbish which contact a disease, can see that the separation for rubbish is not good enough. It maybe have the officer who do not know that what the rubbish which contact a disease is. Then they do not understand that rubbish which come from the treatment it will be all rubbish which contact a disease and it is the cause of the capacity of rubbish which contact a disease in the red bag will increase. It has the effect for truck and the method for get rid of rubbish which is not enough. Pin and the sharp-thing which is sued in the hospital and is fixed for pasturlize and collect to keep. Can see that the method for keep rubbish is not right enough and cannot know that the pin which is thrown away, it will be pasturlize. If it has not pasturlize, it will be the danger for officer and the people who involve with. Moreover, it has the throw about pin and the sharpthing. Then cannot to know that the hospital will throw rubbish mix in the red bag as burn it because in some week has not keep the sharp - thing.

2) The control officer lacked of knowledge and experience thus affecting the burning of waste was not properly complete. The main problem was the smoke which inhabitants had protested.

3) The management personnel of the hospitals did not pay enough attention to the maintenance of infectious

4) The leftover and ash of burnt were left around the nearby area and were not properly eliminated thus rendering risk of epidemic if the burring was not fully operated.

5) The constructors lacked of knowledge and experiences so the construction of infectious waste incinerators did not meet the required standard, furthermore, the inspector also had limited knowledge thus resulting to poor quality of infectious waste incinerator (by Panit Manokarn, 1996).

And the researcher founded the problems from the basis survey of the hospitals under the Ministry of Public Health in Nonthaburi thus disturbing odors, smoke and may be cause of infectious waste diseases by various diseases spreading into the environment and community.

So, the researcher was interested in studying the aptitude on eliminating of infectious waste by using infectious waste incinerators in thews government hospitals in Nonthaburi. Points of interest cover the level of their knowledge and practices in infectious waste management; and factors influential to those practices. The study focuses on problems and impediments to such attempts so as to be a basis in the development and determine guidelines to enhance the accurate and appropriate infectious waste management in Pranangklao and Bamras-naradoon Hospital.

1.2 Objectives of the Research

1.2.1 To study policy process and budgeting on infectious waste management in. Pranangklao Hospital and Bamras-naradoon Hospital.

1.2.2 To study personal factors, knowledge, practices and correlation between personal factors and knowledge practices on infectious waste management by general medical staff.

1.2.3 To study personal factors, knowledge, practices and correlation between personal factors knowledge and practices on infectious waste management by infectious waste disposal staff.

1.2.4 To study problems, impediments and recommendations on infectious waste management in the hospitals

1.3 Research Questions

1.3.1 How are policy, appropriate management, pursuit, assessment, guidelines to improve, problems, impediments recommendations and budgeting on infectious waste management of hospital director of hospitals under Ministry of Public Health in Nonthaburi ?

1.3.2 How are precise, practice, knowledge in protect them selves from dangers on infectious waste management include problems and impediments recommendations of general medical staff depends on working duration and infectious waste management training ?

1.3.3 How are precise, practice, knowledge in protect themselves from accident on infectious waste management include problems and impediments recommendations on infectious waste disposal staff of hospitals under Ministry of Public Health in Nonthaburi ?

1.4 Research Hypothesis

1.4.1 Knowledge on infectious waste management of general medical staff depend on work duration

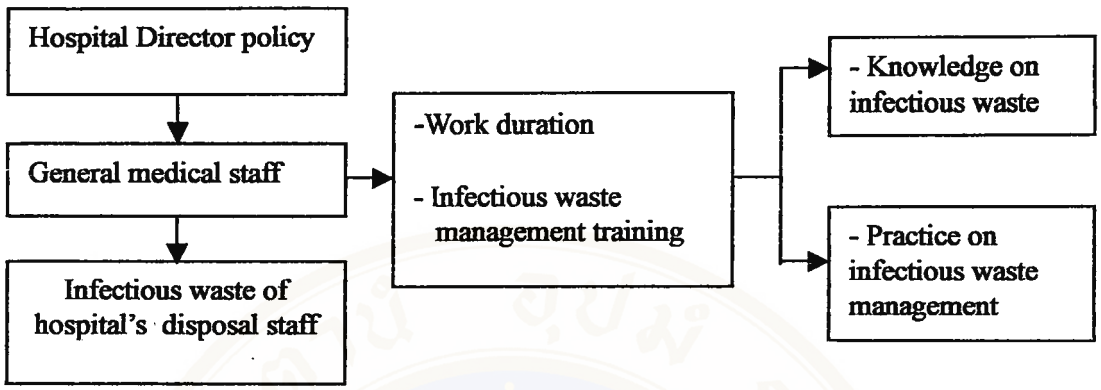
1.4.2 Knowledge on infectious waste management of general medical staff depend on infectious waste management training

1.4.3 Practice on infectious waste management of general medical staff depend on work duration.

1.4.4 Practice on infectious waste management of general medical staff depend on infectious waste management training

1.4.5 Practice on infectious waste management of general medical staff hinge on knowledge on infectious waste management

1.5 Framework of the Research



1.6 Scope of the Research

1.6.1 This case study was implemented to search the performance concerning the eliminating of infectious waste in the hospitals whereby selection the hospitals with 500 occupant beds up under the supervision of the Ministry of Health, are Pranangklao Hospital and Bamras-naradoon Hospital. However, this case study would not include the Srithanya Hospital which also had more than 500 beds because the information gained might not clear and incorrect. Since the occupants in this hospital were physically ill, they would not be moved for namely at Pranangklao Hospital and Bamras-naradoon Hospital. Therefore, it was not necessary to carry the case study at Srithanya Hospital.

1.6.2 Variables employed in the study are listed below ;

1.6.2.1 Independent variables

- Work duration
- Infectious waste management training

1.6.2.2 Dependent variables

- Knowledge on infectious waste management
- Practice on infectious waste management

1.7 Definitions of the Research

In order to understand the meaning of the specific words which used in this study. The following terms were stated as follow ;

1.7.1 "An appropriate management on infectious waste" means cooperation with management personnel and staff interns of infectious waste management in hospital or infectious waste committee to set policy and planning by manage organization to follow policy and fine staff plan to practice, pursuit and assessment for high efficiency and cooperate manage system and manage budgeting on infectious waste management in hospital.

1.7.2 "Knowledge" means the remember included understanding in actual, axiom and various information, as well as disposing and management on infectious waste in hospital

1.7.3 "Practice" means frequency of action and infectious waste disposal staff on infectious waste management.

1.7.4 "Hospital Director" means responded person in policy - setting or hospital vice - director who has assigned duty on infectious waste management.

1.7.5 "General medical staff" means chief of wards, chief of laboratories, nurses, assistant nurses, medical technologists, scientists, clerks of science.

1.7.6 "Infectious waste disposal staff" means workers who sort, collect, moving and disposal infectious waste in hospital

1.7.7 "Hospital under the Ministry of Public Health in Nonthaburi" means place where ill people stay and have treatment which should cure them capacity more than 500 beds under Ministry of Public Health in Nonthaburi : Pranangklao Hospital and Bamras-naradoon Hospital.

1.7.8 "Work duration" means the number of year that Hospital Director, Medical Personnel and Infectious waste disposal staff work in the hospital

1.7.9 "Infectious waste management training" means acknowledgement and application of policy and measure on sorting, collecting, moving as well as disposing and management on infectious waste in hospital.

1.7.10 "Infectious waste" means materials or parts resulted from procedures in medical treatment, examination, vaccination, laboratory testing of human beings and animal, that is likely to or may cause diseases. Sharp equipment used with patients is also included in this category.

1.7.11 "Infectious waste incinerator" means Infectious waste incinerator in type of the office of Environmental Health or the other types have same efficiency or higher with a safety procedure and a system for the treatment of air pollution emissions, especially when burning waste containing sulfur and chlorine, are required

1.8 Expected Results of the Research

Research output will monitor as follows ;

1.8.1 An appropriate management, policy and budgeting on infectious waste in the hospital

1.8.2 Knowledge and practices of general medical staff and infectious waste disposal staff in the hospital

1.8.3 To serve as basis for formulation of an appropriate infectious waste management guidelines, in turn enhancing accurate and appropriate knowledge and practices of general medical staff and infectious waste disposal staff.

1.8.4 To improve the Practicability and give more knowledge of infectious waste incinerator to general medical staff and infectious waste disposal staff for high efficiency infectious waste incinerator can be.

CHAPTER II

LITERATURE REVIEW

This paper, the researcher has reviewed related documents, textbooks and research papers, as follow:

2.1 Meaning and Concepts of knowledge
2.2 Meaning and Concepts of practice
2.3 Meaning and Knowledge in infectious waste
2.4 Meaning and Knowledge in infectious waste management
2.5 Knowledge in infectious waste incinerator
2.6 Public Health Act, B.E. 1992
2.7 Research papers

2.1 Concepts of Knowledge

2.1.1 Definitions of Knowledge

According to the Dictionary of Education by Good (Good, 1973: 325) and the Lexion Webster Dictionary Encyclopedia Edition by Smith (Smith, 1997: 531), definition of knowledge can be summarized as things related with facts, truth, rules and structure, resulted from study or research. Knowledge of places, things or person can be attributable to observations, experiences, reports, or other information that human acquires or compiles from experiences. A genuine realization of those knowledge takes times.

Bloom and others (Bloom, et al 1971 : 271) defined knowledge as the recollection of immediate or general issues, methods, procedures, or situations, with focus on memory.

Praphapen Suwan (1977 : 10) defined that knowledge is an initial practice that learner memorizes, either through practicing, seeing, hearing, or memorizing. Knowledge in this respect covers knowledge on definitions, meanings, facts. theories, rules, structures, and solutions to problem, for example.

Thawatchai Chaijirachayakul (1984 : 45) defined knowledge as learning which centers on memorization and recollection of views, objects, and events. Memory begins with independent things that are easy to remember up to difficult, complex, and connected issues.

In this research, the researcher defines knowledge of medical personnel on infectious waste management as the realization of events, facts, regulations and other information that medical personnel acquire, regarding sorting, compiling, transferring, and disposing of infectious wastes in hospital, as well as knowledge about the problem and effects of infectious wastes on the environment.

2.1.2 Level of Knowledge

Bloom and others (Bloom and others as referred by Sunan Sonkodum 1982:24) has classified cognitive domain in 6 levels from simple to difficult, as

follows;

1. Knowledge is a brain capability to maintain or preserve stories that a person conceives in the brain.

2. Comprehension is an ability to communicate an intention to others and to notice desire of others.

3. Application is an ability to successfully apply knowledge, memories and understanding to solve new emerging problems.

4. Analysis is an ability to consider issue by separating it into its parts.

5. Synthesis is an ability to combine parts into a whole story as well as ability to examine issue in all angles and then and arrange a new structure so that the new outcome will be of greater efficiency.

6. Evaluation is an ability to assess values by using the set criteria and standard.

2.1.3 Measurement of Knowledge

A measurement of knowledge is to measure capability of brain, concerning recollection of memories on things that a person has experienced, perceived or memorized. This knowledge is the initial and minimum capability of human beings. As knowledge is expressions of brain capability in memorizing, the measurement of knowledge thus applies recollection methods, using a number of questions, as follows; (Naowarat Satienpagironkorn, 1998 : 13 – 15)

1. Knowledge of vocabularies and definitions. The questions ask about vocabularies or phrases us in certain subjects, the general or specific meanings, and characteristics of things, for example. Questions on definitions or meanings of signs, pictures, abbreviations, or symbols in each subject belong to this category.

2. Knowledge of rules and facts. The questions concern with formulas, regulations, truths, facts, stories, main themes or contents, proved or approved according to the subjects.

3. Operational knowledge. The questions about origins of stories, events, or written texts; regulations operational procedures; as well as procedures and methods employed in studying, examining or criticizing so as to reach a final decision of certain things. These questions aim to measure that a person can memorize procedures and operations of certain thing, not to actually practice such activity. Questions on operational knowledge can be broken into 5 parts, as follows;

3.1 Knowledge of regulations. The question focus on traditional practices, such as formats of letters or financing accounts; structures of poems; map and document; conversation regulation; and formats of various documents and reports.

3.2 Knowledge of procedures and priorities. The questions center on movements, trends, development or deterioration of events by times; lists of events; and steps that event has developed.

3.3 Knowledge of criteria. The questions ask how a person can memorized regulations in determining facts. That is the most appropriate criteria or

standard to judge or examine certain particular stories, such as what would be an appropriate criteria to examine facts, opinions, qualifications and practices?

3.4 Knowledge on methods or procedures. The questions ask about technique or practices in acquiring a particular outcome; and processes and steps to prove or seek the right procedures. Example is how to compile information or what actions should be taken to achieve certain things.

4. Core knowledge of the story. This memory is the primary goal of learning. The questions measure main concepts of particular subject that students can remember; as well as students' ability to compiles and summarizes a number of facts of the lesson into key point. The question come in 2 types, as discussed below;

4.1 Knowledge of main concepts and details of the subject. The questions aim to measure core concepts of certain subjects. Examples include questions asking a person to relate a phenomenon to theories, to describe the appropriate development of event, and to find correlation between component of the subject.

4.2 Knowledge of the theory and structure. The questions measure a person's ability to memorize or summarize issues in correlation with theories or principles. That is to measure ability to synthesize knowledge from all school or sources so as to explain natural phenomenon or daily surroundings.

2.1.4 Knowledge Measuring Tools

There are many knowledge measuring tools. Each tool suits to measure different kinds of knowledge. This paper will discuss the most popular tool, i.e. a test (Boontham Kijpredaborisuthi,1988: 21–25). A test or an exam is regarded as stimulant, i.e. arousing test takers to their responses through certain actions, such as speaking, writing, acting, so as to notice or come up with numbers that can represent level of qualifications of that person. there are 3 forms of test, namely;

1. Oral test, or the so-called interview, is to examine responses in words between the tester and test taker directly.

2. Written test comprises;

2.1 An essay test requires a person to explain, narrate, or criticize topics about particular knowledge.

2.2 A limited-answer test demands a test taker to consider and compare texts or details. This test has 4 formats: right-wrong answer, fill in the blank, pairing, and multiple-choice.

3. A practical test does not require a person to response in words or writing, but to actually perform.

In this research, the researcher opted for the limited-answer test to measure knowledge.

2.2 Concepts of Practice

Socrates liked to work with students. His approach essentially consisted of leading them through a series of questions in order to promote critical thinking. On one occasion, the philosopher purportedly lead a group of students to a difficult conclusion through his Socratic method. Socrates then pointed out that, since he had reported no facts, the students must have known the conclusion all along.

Socrates is not generally associated with constructivist philosophy. Nonetheless, this anecdote highlights the fact that discussions which link epistemology and learning have been taking place for thousands of years. From the perspective of psychology, epistemology considers the genesis and the nature of knowledge and includes learning (Ernest, 1995). Knowledge, its nature and how we come to know, are essential considerations for constructivists. Von Glasersfeld describes constructivism as a "theory of knowledge with roots in philosophy, psychology and cybernetics" (p.162). In the constructivist perspective, knowledge is constructed by the individual through his interactions with his environment.

How we perceive knowledge and the process of coming to know provides the basis for educational practice. If we believe that learners passively receive information then priority in instruction will be on knowledge transmission. If, on the other hand, we believe that learners actively construct knowledge in their attempts to make sense of their world, then learning will likely emphasize the development of meaning and understanding. Constructivists generally claim that knowledge is not discovered and that the ideas teachers teach do not correspond to an objective reality.

While the preceding paragraphs provide a seemingly simple explanation of constructivism and its relation to educational practice, the pages in this site will illustrate that the link between the philosophy, on one hand, and educational practice, on the other, is quite tenuous. Moving from theory to practice always presents challenges, be it in education or in any other domain. When there are multiple brands of the theory, the task becomes that much more demanding. Although there are those who will argue that constructivism does not provide a model for implementation, numerous researchers, educators and authors are actively engaged in using constructivist principles to design and implement new learning environments. Technology is increasingly being touted as an optimal medium for the application of constructivist principles to learning. Numerous online environments and technology-based projects are showing that theory can effectively guide educational practice.

The aim of this site is to highlight some of these attempts at integrating constructivist characteristics into the practice of teaching and learning. The site begins with a discussion of constructivist epistemology and learning theory. Following this discussion, a summary of characteristics of constructivist learning and teaching will be presented. The summary of characteristics will be used to compile a *constructivist checklist*. The checklist will then be applied to five educational projects and environments to observe the way in which constructivist epistemology and theory of learning can be accommodated in educational practice.

Socrates is now online. That is to say that there are various World Wide Web sites that feature his discussions and lectures as reported by Plato. Ironically, his approach led to his downfall since the self-doubt that individuals experienced after conversing with him finally led the Athenian assembly to vote to put him to death. Today, Socrates is not only widely quoted and well known, but his questioning approach is often hailed as an effective teaching technique. Were he present today, he would likely show an interest in constructivism, no doubt recognizing in it some similarities with his own philosophy.

The study of practice on an appropriate on infectious waste management consists of levels of practice . From the measurement methods, the researcher decided to employ the practice study with questionnaire and indepth-interview

2.3 Knowledge an Infectious Waste

According to the Ministry of Public Health's order No. 184/1995 defined infectious wastes as wastes resulted from procedures of medical treatments, examinations, vaccinations, laboratory testing on human beings and animals, that are likely to or may cause diseases.

1. Materials, remains or parts of human beings and animal from operations, autopsies, laboratory testing on infectious diseases conducted on animals; as well as contacted materials resulted from such acts.
2. Materials used in medical services, services, such as gauze, clothes, and rubber tubes, etc. that contact or may contact with blood or blood compositions, e.g. blood cells; blood products; or liquid from the body, such as urine, saliva, lymph, and pus, etc.
3. Sharp objects used in activities, such as blazes, needle syringes, glass tubes, glass containers, and slides, which are used in medical services, and aboratories.
4. Bacteria and gelatin culture; lab and examination equipment with direct or indirect contacts with Micro-organism, such as bio materials, gelatin culture, used culture plate, as well as equipment for bacteria transfers or mixes.
5. Vaccines made from living germs and containers, such as Tuberculosis, German measles, Mumps, and Typhoid vaccines.
6. Wastes from severe infectious room, such as a separate room for severe infectious patients that require particular care, and the hazardous infectious disease labs.

2.3.1 Origins of Wastes from Hospital

There are 3 main origins, are

1. Hospital buildings for medical services and treatments of patients, such as pediatric, medicine, obstetrics and gynecology, surgery, and male-female in-patient buildings, etc.
2. Kitchen and canteen
3. Staff wards

Conditions causing wastes in the hospital can be classified, as follows;

1. Normal wastes are wastes from offices, residences, and wards of hospital staff' residences, which are generated in daily lives similar to wastes from other communities or wards. Those are plastic bags, papers, clothes, foods, woods, tree branches, etc.

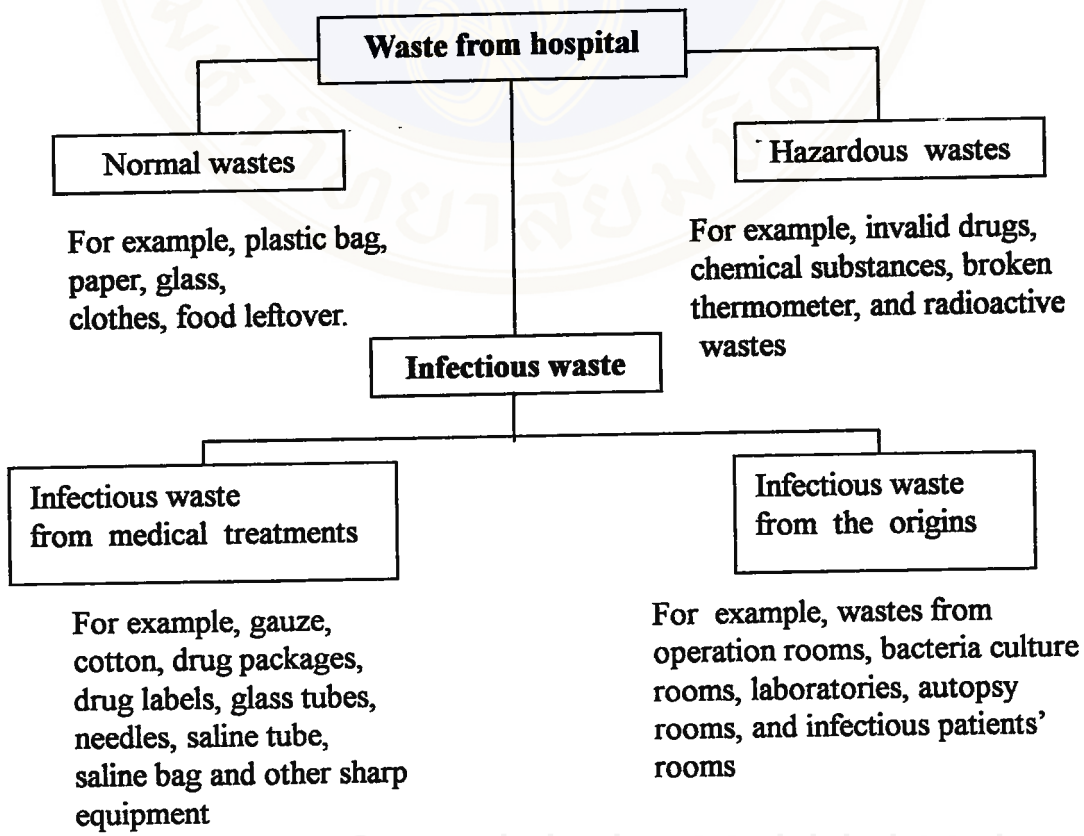
2. Infectious wastes from hospital buildings. They are normally materials from medical treatments or laboratory testing on disease identification. There are 2 types of infectious wastes, namely;

2.1 Wastes that originated in hospital are medical equipment for treatment of patient suffered from non-communicable disease, such as from first aid room; or patients from accidents. Examples are roll gauze, cottons, drug packages, glass tubes, needles, saline tube, saline bag.

2.2 Wastes from treatments of infectious patients, as well as part of the boy or internal organs resulted from operation. Included in this category is wastes from autopsy room and bacteria culture room. Liquid waste requires special disposal method.

3. Hazardous wastes are wastes that require similar disposal methods as industrial wastes. Examples are invalid drugs, drug containers, other chemicals, mercury from broken thermometer, radioactive wastes from x-ray and wastes from patients received ray treatment.

Figure 1 Types and characteristics of wastes from hospital



2.4 Knowledge in Infectious Waste Management

Infectious waste control by chief and prevent any dangers spread from infectious wastes. It is regarded as responsibility of the origins, i.e. hospitals and clinics, to pay attention to and be careful with infectious wastes, as well as to abide by relevant regulations. Operations can be broaden into the following steps;

- Collection
- Transportation
- Disposal

Collection

1. Infectious wastes according to the above definition should be sorted from other wastes.

The collection should be conducted at the origin. Collection and sorting should not be done afterward as germs can easily spread out.

2. Appropriate characteristics of infectious waste containers are described below:

2.1 Infectious waste bag

2.1.1 The bag should be of appropriateness and exceptional quality, e.g. plastic bags that can sustain heavy weight and resist chemical substances. The bags should be tough and water-resistance, without any leakage.

2.1.2 A color of the bag should be obvious, usually red. It is imperative to have a special warning sign, such as "Dangerous infectious wastes" print and a symbol like crossing bones under a skull.

2.1.3 The bag should vary in sizes with enough capacity to contain infectious wastes of no more than one day.

2.1.4 Infectious wastes should take up three-fourths of the bag. The bag should be fastened with strong robes that can sustain a pierce by hard plastic, paper, metal, etc.

2.2 Boxes or containers to hold sharp infectious wastes, such as needles, knifes, and glasses should made from materials strong enough to resist a pierce by hard plastic, paper, metal, etc.

2.2.1 The materials made should be durable and strong.

2.2.2 A lid of the box or container should be sealed and can prevent liquid from leaking. The box or container should be easily carried with no contact with infectious wastes therein.

2.2.3 The color of the container should be obvious, usually red or black. It is crucial to have a special warning sing, such as print indicating "Dangerous infectious waste", "do not reuse", or "Do not open", and a symbol like crossing bones under a skull.

2.3 Liquid infectious wastes, such as sputum and blood, should be stored in a bottle or container with coil lid.

Transportation. Large hospital comprises many origins of infectious wastes.

The transfers of infectious wastes to storage building for transportation to disposal sites should be systematic. The collection times and transfer routes, for example, should be widely known.

Factors related to infectious waste transportation and compilation are, namely;

1. Cart for transferring infectious wastes
2. Infectious waste carrier
3. Infectious waste storage building
4. Transfer methods

1. Cart for Transferring Infectious Wastes should be used to transfer infectious wastes only. Characteristics of the cart are, as follows;

1.1 The cart should made from smooth, strong, rust-free, water-resistant materials with no leakage at seam.

1.2 The cart should be cleaned easily, without any unreachable corner.

1.3 The cart should have a floor drain, which can be closed when in use and open only for cleaning purpose.

1.4 The wall of the cart should be thick. The cart should have a lid to avoid leakage and prevent animals or insects entering.

2. Infectious Waste Carrier is a staff responsible for carrying infectious wastes from various units to a waste storage building. They should be trained to follow the procedures summarized below.

2.1 Examine that a waste bag has no leakage and strongly fastened.

2.2 Hold and put down waste bags with care.

2.3 Hold the bag at the top, not to embrace it.

2.4 Handle fallen wastes correctly.

2.5 Dress properly with thick gloves, aprons, and rubber boots when on duty.

2.6 Clean the infectious waste cart correctly.

2.7 After duty, they should take off the gloves, aprons and boots. Put them on antiseptic solution (0.5% Sodiumhypochlorite solution for 30 minutes) before washed as normal. Take a bath immediately after daily work.

3. Waste Storage Building of a hospital should have the following characteristics;

3.1 The storage building should be located further away from other buildings and close to a chamber, if any.

3.2 The size should be big enough to store infectious wastes for at least 2 days. The wall should be smooth and water-resistant. The floor should be lifted to allow water to drain and prevent still water.

3.3 Windows and ventilation channels under roof should have mosquito net.

3.4 The entrance and exit doors should be separated. The door should be wide enough for a waste cart to enter. It should be a swing door and must by locked at all time, except when the cart enters and exit.

3.5 The space for cleaning a waste cart should be close to the exit door.

4. Transfer Methods of infectious wastes in hospital, waste carriers should wear thick gloves, aprons, and rubber boots when on duty.

4.1 Collection should be conducted twice daily in accordance with the set schedule.

4.2 Transfer route of infectious wastes should be clearly determined and widely acknowledged in a hospital.

4.3 Infectious waste bag should be carried at the top with care. No throwing or dragging the bag.

4.4 When the cart is full with infectious waste bags or the collection is completed, the cart should be pushed to a storage house immediately without any stops.

4.5 When reaching a storage building, the carrier should unlock the door key, push a cart into
a storage building, and carefully carry and place infectious waste bags.

4.6 After pushing a cart from a storage building, the carrier should lock both doors.

4.7 The cart, storage building and nearby areas should be cleaned with cleaning solutions daily.

4.8 After daily duties, the waste carries should take off the gloves, apron, and boots, keeping in a 0.5-percent Sodiumhypochlorite solution for 30 minutes before normal washes.

4.9 The waste carries should take a bath immediately after daily tasks.

Nowaday, Infectious waste disposal is one step to dispose bacteria without dangers. The disposal should be a responsibility of the business of entrepreneurs so that infectious wastes originated from their activities have been treated and disposed of properly. Management guidelines can be summarized, as follows;

1. Infectious waste disposal. Have been disposed under and method certified by the Ministry of Public Health, those infectious wastes are regarded as an longer infectious wastes and can be treated as general wastes. International methods of normal waste disposal comprises;

1.1 Burn can completely destroy bacteria. Remaining ashes should be disposed of at the waste disposal area.

1.2 Steam is another method to kill bacteria. The left-over wastes will be of equal or higher volume due to stream moisture.

1.3 Chemical treatment.

1.4 Electric wave treatment (microwave) is a modern method that yields good results.

1.5 Others.

2. In the disposal, bacteria in the infectious wastes must be destroyed, before the wastes were disposed of as normal wastes. Some disposal methods can destroy the bacteria as well as dispose the wastes immediately, such as burn. Such disposal is responsible by the local government agencies to set up a system to dispose of bacteria, destroy remains and provide services in that area. Otherwise, the local

state agencies can assign other party. The business may be allowed to conduct the disposal.

However technique employed, it should suit the area and be in accordance with the right treatment methods.

2.1 Practices of Infectious Wastes

Practices when accidents cause the infectious waste bag broken or unfastened are, as follows;

1. Pick up the fallen infectious wastes with metal gripping tool or by hands in thick rubber gloves and put the wastes in other infectious waste bags.
2. Liquid waste, wipe it with paper and put that paper in the infectious waste bag.
3. Pour the area with 2 % Lysol for 30 minutes before cleaning as normal.

2.2 Volume and Generation Rate of Infectious Wastes

The volume of infectious wastes in hospitals varies upon hospital size, type and number of patients. The Generation Rate refers to a volume of infectious wastes in a hospital for one bed per day, with kilogram/bad/day as unit.

There is no actual statistic on infectious wastes in medical institutions that indicate a total volume of the wastes in question. There is no agency responsible for compiling this statistic. However, there are various agencies studying situations, guidelines in infectious waste management, as well as report on infectious waste statistics, as follows;

In 1994, Thailand was home to 25,000 medical institutes, i.e. hospitals, public health service centers, health stations, and clinics, both public and private. Volume of infectious wastes of public and private medical institutions with in-patient beds stood at 48 tons a day. Of which, 14 tons were generated in the Greater Bangkok Region (GBR). The generation rate of infectious waste was 0.26-0.65 kilogram/bed/day on average. (Pollution Control Department 1999:8)

Environmental quality condition during 1995-1996 pointed out that a volume of infectious wastes collected in Bangkok in 1994 stood at 2,550 tons and then climbed up to 3,960 in the following year.

Dr. Chakkrit Poomswasdi, Director of the Institute of public Health Science Research, the Department of Medical Sciences, The Ministry of Public Health, disclosed that infectious wastes of public and private hospitals topped 25 tons daily. Those came from over 20,000 medical institutions, with almost 130,000 beds. On average, each bed produced almost 1 kilogram of infectious wastes (Sukran Rojanapaiwong, editor, 1999:319).

The Toxic Smoke Prevention and Environmental Protection Foundation suggested a higher volume of infectious wastes about 130 tons a day or 47,450 tons/year. According to the foundation's research study, there were over 20,000 medical institutions nationwide, with 130,000 patients staying in bed for medical treatment. The generation rate would hover between 0.31-0.67 kilogram/bed/day (Sukran Rkojanapaiwong, editor, 1999: 319).

2.3 Effects of Infectious Wastes from Hospitals

Wastes from hospitals are of high varieties, normal wastes and wastes related to medical treatments tainted with various diseases. Management of hospital wastes thus has to be accurate and appropriate in a bid to prevent diseases spreading into the environment and community. Such as air and water pollution, foster and carry diseases, generate dirt and disturbing odors. And incorrect waste management will waste the hospital's budget and have effects to the community (Aker Unhalega, 1998: 223).

2.5 Knowledge in Infectious waste Incinerator

2.5.1 Infectious waste incinerator usage in Pranangklao Hospital.

ZDL series of incinerators are suitable for of hospitals (body tissue, animal remains), factories (processing Plants, fish, meat, poultry), hotels, restaurants, markets, stations (ports, docks, airports) and etc. The total combustion process conducts no smoke or odor and keeps environment clean.

The furnace construction is made by mounding process with fire-proved materials enabling ZDE incinerators to withstand very high furnace temperature and assuring an excellent durability.

The compact construction makes use of neat appearance and floor area saving employment of high quality heat insulation material and negative air pressure to protect heat radiation passing through the incinerator exterior housing. The incinerators automatically control lighting up, oil feed measurement and temperature. Then it is easily operated with safety, reliability and stability.

The design of the incinerator is based on the following concepts: the system must be simple in construction, easy to operate and low cost, and where most of the maintenance work can be done by local workers using locally available material. The design criteria can be summarized as follow:

Characteristic of waste

The detail of the characteristics of the hospital waste can now be summarizes for the design as follow:

- The design waste includes type 0, 1, and 4 as defined by Incinerator Institute of America, the percentage composition being 40, 40 and 20 respectively.
- the average waste density is 280 kilograms per cubic meter.
- moisture content is 32%
- volatile solid content is 62%
- unburned combustible or ash is 7%
- heating value of waste is 27,187 kJ/kg of waste

Incinerator

1. The worker principle of the incinerator is of an intermittent controlled-air type.
2. The incinerator is to designed to work with a waste-charging device.
3. The incinerator has a de-ashing door allowing convenient ash removal from the chamber.

4. The incinerator is designed with negative pressure in the chamber to prevent leakage and the chamber is tightly sealed.

5. The burner installed at the primary combustion chamber is for igniting the waste and maintaining the chamber temperature at 700-800 C.

6. The burner installed at the secondary chamber is for reburning the gas coming from the primary chamber and maintaining the temperature at 900 – 1,000 C.

7. The combustion air is supplied by a blower installed at the back of incinerator, and flows through the runner pipe to each chamber, the flow rate of which can be adjusted by a butterfly valve to match the controlled-air principle.

8. The primary chamber has a size big enough to be filled a waste charging rate (batch) of 10 to 15 kilograms every 15 to 20 minutes.

9. The secondary chamber is designed to have a resident time of at least 1 seconds for the fuel.

10. The primary burner will stop to operate immediately when the charging door or the de-ashing door opens.

11. The operator cannot charge any waste into the primary chamber if the setting time is not yet attained. This is to prevent over-charging of incinerator which may result in incomplete combustion

The automatic feeding system

1. The waste can be fed from the waste bin into incinerator mechanically without exposing the operator to direct contact with the hospital waste.

2. The hydraulic drive unit is used to operate the charging door and the pushing ram. The system is designed to work with a minimum number of hydraulic cylinders.

Emission control system

1. The emission control (fuel treatment) system consists of a counter current packed-bed wet scrubber.

2. The system is capable of treating the pollutants to a level below the air emission standard.

3. A system to treat the wastewater resulting from fuel treatment will be provided. The condition of the treatment system of the hospital.

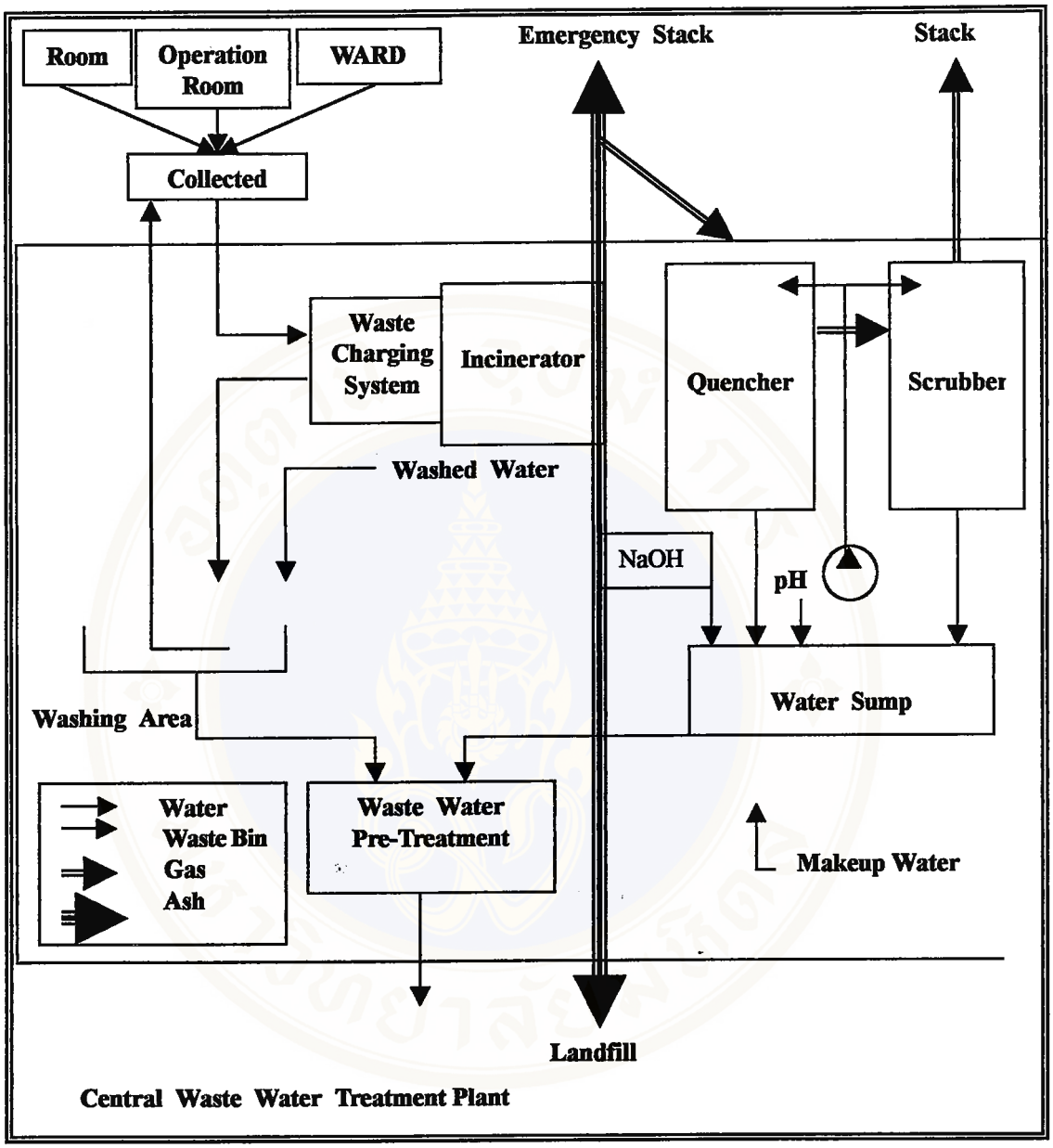


Figure 2. The schematic of the hospital waste incineration system.
Source : Calvin R. Bruner 1991 : 62

2.5.2 The design of hospital waste incinerator

Principle of the controlled – air incinerator.

The combustion control for a controlled-air incinerator is usually based on the temperature of the primary and secondary chambers. Thermocouples within each chamber are used to monitor temperatures continuously. The combustion air rate to each chamber is adjusted to maintain the desired temperatures. Systems operating under temperatures. Systems operating under controlled-air principle have varied degrees of combustion air control. In many systems, the primary and secondary combustion air systems are automatically and continuously regulates or "modulates' to maintain the desired combustion chamber temperature despite varying waste

composition and characteristics. In other systems (particularly batch or intermittent-duty systems), the combustion air level control is simplified and consist of switching the combustion air rate from a "high" to "low" level setting

Mass & Heat Balance

The mass & Heat balance at design conditions of the incinerator. The data used in the calculation is quoted from Calvin R. Brunner, "Handbook of Incinerator System", McGraw-Hill, 1991.

Primary Combustion Chamber

The function of the primary combustion chamber is to receive the waste which is fed through the charging door. To initiate combustion with the aid of a burner, and to maintain the temperature. For a treating capacity of 50 kg/hr, the waste is divided in 10 to 15 kilogram per batch and feeding is initiated every 15 to 20 minutes. The average density of waste is about 280 kilogram per cubic meter, so the 50 kilograms of waste have a volume of about 0.18 cubic meters. The volume of the chamber should then be at least four times that of the waste fed in. (0.72 cubic meters) this is to ensure that there is enough volume to sustain the gaseous combustion products.

With a heating value of 27,187 kJ/kg and 32% of moisture content, the 50-kg/hr of waste feed rate would have a heat release rate of about 924,358 kJ/hr. Based on Reynolds' recommendation that a heat release rate of proximately 1,117,979 kJ/m^3 is needed for sustaining the combustion, the volume of the primary combustion chamber should be at least 0.8 cubic meters.

Reynolds also comments that the ratio of length to diameter of the incinerator should not exceed 3 : 1 for better movement of the waste material from the charging door to the de-ashing door. Consequently, the incinerator is designed to have a diameter of 0.77 meters and a length of 1.62 meter, so that the length to diameter ratio is about 2.14.

Feeding Door

The feeding door is placed at the front of the incinerator for ease of feeding, and for convenient connection to an automatic charging device. The door is of a square shape and of 0.6 x 0.6 m^2.

De-ashing Door

The fact that the incinerator is of intermittent-duty type, it places a constraint on ash from the chamber. Therefore it is designed to remove the ash once a day after burn down and cool-down periods are attained(usually in the morning before start-up). Ash removal is done by raking the ash through the de-ashing door.

The de-ashing door is located on the back of the incinerator for ease of operation. The door can turn freely and has a dimension of about 0.32 x 0.25 m^2.

Secondary Combustion Chamber

The function of secondary combustion chamber is to reburn the gas coming from the primary combustion chamber with excess-air to ensure complete combustion before allowing the combustion gas product to exit through the slack. From mass and heat balances, the mass flow rate of fuel will be 578.85 kg/hr at 1,000 C or equivalent to a volumetric gas flow rate of about 0.58 cubic meter per second. The secondary combustion chamber is designed to have a volume of about 0.64 m^3 , so the resident time of fuel will equal to 0.64 m^3/ 0.58 m^3 /s or 1.2 seconds, which is enough to burn the hospital fuel

Incinerator Wall

The outer shell of the incinerator is made of mild steel of 4.5-mm. Thickness. It is lined with a layer of low thermal-conductivity insulating of 25-mm. Thickness. The wall is a refractory. The total thickness of the incinerator wall is thus 140 mm.

Air Distribution

The combustion air is fed into the incinerator according to the controlled-air principle. The air is supplied by a blower which draws atmospheric air into a conditioning room before being distributed to each chamber. The desired air flow rate may be regulated by a butterfly valve which is installed in each runner is injected as under-fire air into the hearth of the incinerator from both sides, with 5 inlet-ports on each side.

The combustion air for the secondary chamber is injected into the center of the chamber from both sides, each with 3 inlet-ports. The purpose of this air injection is to aid the combustion of the hot fuel stream, having receive heat from the secondary burner, so as to maintain the chamber temperature to higher than 1,000° C. Figure 3 shows the configuration of the air distribution system.

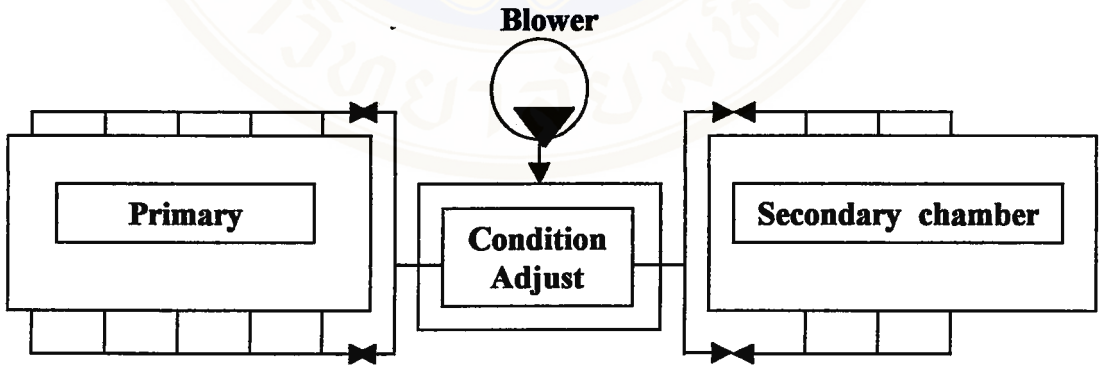


Figure 3. The configuration of the air distribution system.
Source : Calvin R. Bruner 1991 : 122

Burner

The function of the primary burner, fired on auxiliary fuel, is to ignite the waste and to maintain a constant combustion temperature. It is installed in the center position on the sidewall of the incinerator and inclined toward the lower hearth. This configuration allows the pilot flame to touch the waste.

The secondary burner is used to burn the gas coming from the primary combustion chamber and maintain the temperature to a constant level. It is placed at the entrance of the secondary combustion chamber; and the secondary air is fed

around the end of the chamber to ensure complete combustion and maintain a constant overall chamber-temperature.

In order to control the emission level and maximize the use of locally manufactured equipment, the burner is chosen to be fuel burner (using propane as fuel). The heating capacity of each burner is to be

Control System

The automatic control system of the incinerator is divided in two parts : temperature control and timing control.

The temperature of each chamber of the incinerator is to be controlled to near preset values. This is done by feeding thermocouple signals from each chamber to the controller where they are compared with the set values. The signal differential is used to actuate the on-off control of the burners and the modulating control of butterfly valves.

Timing control of the incinerator is done by a timer. The operation sequence of the incinerator is as follow :

1. Preheat the secondary chamber with the secondary burner: 15 minutes
2. Preheat the primary chamber with the primary burner: 15 minutes
3. Charge the waste into the primary chamber in batches of 10 – 15 kilograms every 15 minutes. It will not be possible for the operator to charge the waste before the set time is over. However, in some case, the setting time can be set off.
4. Following the final charge, the primary burner will continue to operate for 2 hours (burndown period).
5. Following the completion of the burn-down period, the secondary burner will continue to operate for 30 minutes.

2.5.3 The design of automatic feeding system

General Description

Mechanical feeding systems have several advantages:

- They provide added safety to the operating personnel by preventing heat, flames, and combustion products from escaping the incinerator during charging.
- They limit ambient air infiltration into the incinerator. This assist in controlling the combustion rate by strictly controlling the amount of available combustion air.
- The facilitate charging the incinerator with smaller batches of waste at regulated time intervals.

Function and operation

The function of the mechanical charging system is to sustain the waste charge coming from the sources or from the storage room. When the operator of the incinerator pushes the waste bin to the feeder, a mechanism would tip the waste inside the bin into the hopper. Then, the fire door opens automatically through the action of a hydraulic cylinder. The feed ram then pushes the waste in the hopper forward into the primary chamber. After that, the feed ram retracts to the original position and the fire door lowers to the closed position.

Other considerations

The system is to be designed to handle hospital wastes in municipal hospitals. Therefore the following design concepts will be adopted.

1. Hydraulic drive is to be chosen because of its suitability for handling heavy loads, which includes the fire door and feed ram. Thus, two sets of hydraulic cylinders will be needed.

2. Waste tipping is done manually with the aid of a tipping mechanism because the waste feed and the bin are of low weight, offering a cost saving opportunity.

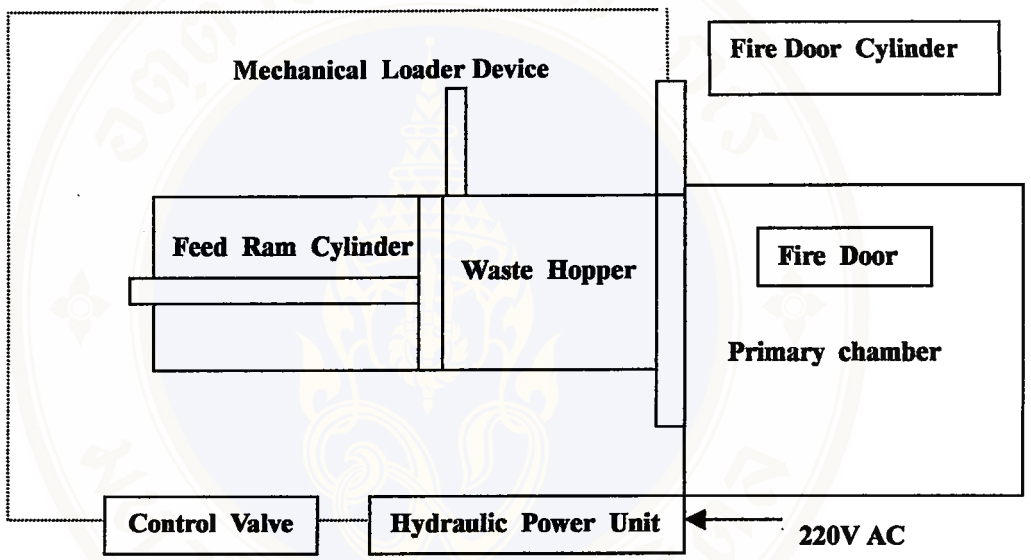


Figure 4 Schematic of the operation of automatic feeder
Source : Chapman & Hall, 1992 : 135

Volume of waste hopper

The volume of the waste hopper depends on the volume of the waste to be contained in the primary combustion chamber. Normally, this would be limited to about one fourth of the combustion volume, i.e., 0.2 cubic meters. And in order to allow enough length for the movement of the feed ram, the design capacity of the hopper should then be 0.2 cubic meter, with a cross section of 0.5 x 0.5 square meter and 0.8-meter in length.

2.5.4 The design of emission control system

The technology

An add-on air pollution control system for hospital waste incinerator is packed-bed wet scrubber. The wet scrubber is used for collecting particulate matter as well as for HC1 and SO_2, whereas the fabric filter is used for collecting particulate matter and the dry scrubber for controlling the level of HCl and SO_2.

Mass & Heat Balance

The mass & heat balance of the designed emission control system. The calculation data based on that of Calvin R. Burner, "Handbook of Incinerator Systems" , McGraw-Hill, 1991.

Installation to the incinerator

This system is connected to the incinerator by Y-connection at the slack. Flow direction is controlled by the adjustable damper, which normally would direct the fuel flow to the scrubber. However in case of emergency, fuel would bypass the system and flow directly to the slack by damper control.

Conclusion

The 50 kg/hr hospital waste incineration system has been designed for the destruction of hospital waste generated by hospitals in Thailand. The systems included controlled-air incinerator, automatic feeding system, packed-bed wet scrubber emission control equipment and the control system.

2.5.5 Infectious waste incinerator usage in Bamras - naradoon Hospital

- Types and operation principles of the incinerator
- Incinerator usage in Bamras - naradoon Hospital
- Incineration effectiveness and emission quality
- Personnel and operating cost
- Prevailing problems

Types and operating principle of the incinerators

The hospital waste incinerators of the BMA have been used to dispose hospital waste collected from healthcare institutions in Bangkok since 1995. The BMA has two incinerators built with Australian technology, each with a disposal capacity of 10-ton/day and fueled by LPG.

The incinerators are of the two-chamber type whose operating principles are as follow:

The waste from the charging system is delivered into the primary chamber and incinerates at 850 Degree Celsius under excess air condition. Ash is removed from the bottom of the incinerator, where the base plate can be opened by a hydraulically-driven mechanism, allowing the ash to be collected in ash bins. The ash from the incinerator is then transported by trucks to a landfill site.

The secondary chamber is used to re-burn the fuel gas exhausting from the primary chamber at a temperature of 1,100 Degree Celsius. The toxic and carcinogenic substances are burned completely in this chamber.

The flue gas from the secondary chamber then passes through a scrubber system, which captures carbon particles and absorbs acid gases, e.g. HCl. The water reduces the temperature, toxicity and smoke of the flue gases. After that the water is treated by NaOH and re-circulated back the system

Incinerators usage

At the incineration plant, waste are received in 240-liter bins and placed in the area in front of the incinerators before treatment. If there are too many

bins, they will be stored in a room controlled to a temperature below 0 C. at this temperature, the growth of the diseases and the chemical reactions are inhibited, reducing the problem of odor. When ready, the waste bins are transferred to the automatic charger equipped with a hydraulic lift to tip the waste into the top of the primary chamber. The emptied bins are then washed using germicide and dried in the sun before the next use. The incinerators operate 24 hours everyday.

Incineration effectiveness and emission quality

The incineration effectiveness and emission quality of the two incinerators are reported as follow:

- Complete destruction of toxic substances and diseases
- Volume and weight reduction of 5-15% of the original waste and the residue appears as ash
- The fine grain of the ash show the complete ness of the combustion.
- Smoke and toxic gases measurement results are shown in Table 1. The measurements were performed by the Department of Industrial Works on April 21, 1995

Table 1 Emission level of BMA hospital waste incinerators

Emission	Infectious waste Incinerator In Bamras – naradoon Hospital	PCD Standards
1. Particulate(mg/m³)	388	400
2. Carbon monoxide (ppm)	33	None
3. Nitric Oxide (ppm)	73	250
4. Nitrogen dioxide (ppm)	0	250
5. Oxide of Nitrogen (ppm)	73	250
6. Sulfur dioxide (ppm)	7	30
7. Hydrogen chloride (mg/m³)	155	136

Note : Pollution Emission Standard issued by the Pollution Control Department(PCD), Ministry of Science Technology & Environment are for Municipal Waste Incinerators, reported at standard conditions (25 C and 760 mm Hg). There are no emission standard for the Hospital Waste Incinerator.

Source : Department of Pollution Control, 1998: 6

Table 2 Comparison of the different types and of the hospital waste incinerators

Manufacturer	Thailand (Infectious waste incinerator type in Bamras – naradoon Hospital)	USA (Infectious waste incinerator type in Pranangklao Hospital)
Burning technology	Excess-air	Controlled-air
Emission control system	Non	Yes
Automatic feeding system	Non	Yes
Construction cost (Bht)	11,250	500,000
No. of operator	1	4
Operating cost (US&/kg-waste)	0.1	0.25
Emission	Do not meet the standards	Pass the standards
Visual inspection at the slack	Thick black smoke during the operating	Mist of white smoke occasionally
Evaluated by the operator	Fair to re-improvement needed	Good

Source : Mechanical Engineering Network of Thailand Conference 12th, 1998
: John Wiley & Sons, 1996: 153

It is shown that the different between the effects of excess-air and controlled-air on the pollution emission agrees well with the theoretical background. The controlled air seems to be suited with the small volume capacity incinerators, the most needed to be concerned.

- An appropriate construction cost
- Small number of operators and less complicate task
- Operating cost should not be high

In addition, it is found imported waste incinerators with automatic feeding systems as a standard items. The systems protects the operators to be in direct contact with the wastes. The imported incinerators are also with an air pollution control system. Therefore in this project we have also included both systems into our incineration system.

2.6 Public Health Act, B.E. 1992

In each country in the world , the government has assigned for the regulation of potentially infectious waste. In the same way, The Ministry of Public Health in Thailand has guidelines for disposal of sewage and solid waste management and sanitary building as follows;

SECTION 18. Disposal of sewage and solid waste in the area of any local government shall be in the power and duty of such local government.

With reasonable cause, the local government may entrust any person with the task pursuant to paragraph on its behalf under the control and supervision of the local government or may permit any person to operate the disposal of sewage or solid waste Section 19.

SECTION 19. Any person is forbidden to operate the business of collecting, transporting, or disposing of sewage or solid waste as a business or for payment of service charges, unless he has obtained a license from the local official.

SECTION 20. For the purpose of maintenance of cleanliness and establishment of orderliness in collecting, transporting, and disposing of sewage or solid waste the local government shall have powers to issue local provision as follow:

(1) Forbidding the discharging, emptying, leaving, or causing to exist in a public place or way of sewage or solid waste , except in the place provided by the local government for such purpose;

(2) Prescribing that there be receptacles for sewage or solid waste available along public places or ways and private places;

(3) Prescribing means of collecting, transporting disposing of sewage or solid waste or that owner or occupant of any building or place be require to practice correctly according to the hygiene and to condition and nature of use of such building or place;

(4) Prescribing rate of fees for services provide by the local government on collection and transportation of sewage of solid waste not exceeding that prescribed in the ministerial regulation;

(5) Prescribing rule, procedure, and conditions on collecting, transporting, and disposing of sewage or solid waste, for observance by person obtaining a license pursuant to section 19, and prescribing a rate of maximum charge collectable by the persons obtaining pursuant to Section according to the nature of services provided.

(6) Prescribing any order requirement necessary for hygienic practice

SECTION 21. When it appears to the local official that any building or part thereof or any addition thereto is dilapidated or left in a mess to and extent that may endanger health of the inhibitors, or does not conform to sanitary conditions rendering it fit for human habitation, the local official shall have powers issue a written order to the owner or occupant there of requiring him to repair, alter , or demolish the building or the addition thereto in whole or in part, or to take other action necessary to prevent it from endangering health or to conditions within a reasonable period of time as prescribed.

SECTION 22. When it appears to the local official that any building is excessively stored with merchandise, furniture, or supplies or those articles are so excessively piled up as to provide holes for vermin or likely to endanger health of habitation, the local official shall have powers to issue a written order to the owner or occupant of the building requiring him to remove the merchandise, furniture or supplies out of such Building, or to rearrange them so that they may not endanger health or to be in conform it with sanitary conditions, or to eliminate the animals that are carries of disease, a reasonable period of this time as prescribed.

SECTION 23. In the event the local official hand issued and order to the owner or occupant of a building under Section 21 and Section 22 and such person failed to comply with the order within the prescribed period, the local official may enter to carry out the task at the expense of the owner or occupant.

SECTION 24. For the purpose of controlling any building from being so over-inhabited as to likely to endanger the health of the occupants thereof, the Minister shall, by and with advice of the committee , have the power to make

announcement in the Royal Government gazette prescribing a number of area of a building to be deemed over crowded, however, taking into consideration the development level, population, and commodities of each locality.

Upon announce by the Minister under paragraph one, the owner or occupant of the building thereunder is forbidden to permit or have his building inhabited by a number of persons exceeding that prescribed by the Minister.

2.7 Research papers

The researcher has complied several research papers on infectious waste, knowledge, practice on infectious waste management, as follow;

Jintana U-nipan (1984: 31) pointed out that knowledge, conception and experiences are basic factors enhancing an individual to think about and solve problems as well as initiate new things at workplace. In other words provision of knowledge would develop practices, both directly and indirectly. Indirect way has attitude as a medium.

Primprao Sakornchaipitak (1993: 89-90) has studied knowledge, acknowledgement, and attitude of works on AIDS relevant to infectious waste management in Chulalongkorn Hospital. The researcher found that over half of the workers had relatively high knowledge about AIDS and negative attitudes toward AIDS patients. Their knowledge about risk of aids infection and infectious waste management were relatively similar. Marital status has a correlation with knowledge about infectious waste. Same is true between sexes and infectious waste management. Working experienced, for instance working in a ward with AIDS patients and/or infectious patients, were correlates with knowledge of AIDS and risk acknowledge with infectious waste management.

Julara Kongpetch (1996: 202) in Khon Kaen, the management of infected waste in every nursing place was improper, the rubbish was also disposed into infected waste tanks thus added up the quantity. Nursing places with occupant beds used 60% of red plastic bags and 40% of black plastic bags to collect the infected waste and all container tanks were lidded. The collection in non-occupant nursing places were not suitable, using improper or easy-torn containers, therefore rendering the epidemic. All occupant-nursing places had no antiseptic and only 6.67% of non-occupant nursing places had antiseptic. This encourage the epidemic to environment and concerned personnel.

Every Nursing place with more than 30 occupant beds burned the infected waste in the oven percent to rules of ministry of Health. But every non-occupant place transported them to municipal.

Panit Manogarn (1996 : 91 - 93) studied factors influencing practices of medical personnel on infectious waste management in hospital. Case study is 500-bed hospitals of the Ministry of Public Health in Nonthaburi Province. The information was compiled from 308 medical personnel from three 500-bed hospitals of the Ministry of public Health in Nonthaburi province. The research revealed that factors

influencing practice on infectious waste management of medical personnel with significant statistical difference of 0.05 comprised personal factors, ages and attitudes Ages have a reverse correlation. That is the young group has more correct practice in infectious waste management than the older. A positive correlation was observed in the case of attitudes. In other words, a group with positive attitudes to infectious waste management in hospital had the more correct practices in infectious waste management

Pornchita Suwanrat (1996: abstract) studied knowledge of and practices on vegetable and fruit consumption of housewives in the BMR. The research found that knowledge of vegetable and fruit consumption of housewives in the BMR had a correlation with practice on fruit and vegetable consumption with statistical significance of 0.05 In other words, practice on fruit and vegetable consumption varied upon different knowledge of fruit and vegetable consumption.

Veerachai Chokevinyo (1996: 89) The summary of surveys on the procedure of collection of infectious waste in the hospital over central part showed that 90% of generate hospitals using separate colors of wastage bags and dropped in specific containers. However, only 26% of rural hospital practiced the same. For primitive treatment, antiseptic chemical were added before carrying to keeping place. Normally, the job was done once a day by hand-carrying or using trolleys which were the same that used to carry other things such as electrolyte bottles, clothes for patients or even wheel chairs. It was found that only one hospital that had building place to remain these infectious waste, the rest kept them lying on concrete area or dropped in 200 ltrs oil tanks awaiting for town municipal to collect them. It could be concluded that the hospitals had no formality to manage the infectious waste to protect epidemic. Not in all hospital that the stained containers used by laboratories were dipped in antiseptic before disposal. Even within the same hospital but different sections the needle-like were/were not dipped in antiseptic before disposal. Some section disposed needle-likes and sharp materials into thin plastic electrolyte bottles which sometimes leaked out and endangered to collectors.

Therefore, there was no formality to manage the infectious waste and the management personnel had less attention on the object thus could endanger to general medical staff and infectious waste disposal staff

Patcharee Pakcharoen (1997: 150) studied knowledge, attitudes and practices on infectious waste management of nurses in hospital. Case study is hospitals under the ministry of Public Health in Chantaburi Province. Information has been gathered from 257 nurses. The research found that knowledge depended on age, education, and working experiences with statistical significant of 0.05 As far as attitudes are concerned, most nurse agrees with infectious waste management. Attitude hinged on education and types of hospital with statistical significant of 0.05. Most practices were regular practice and depended on type of hospital and training in infectious waste management with statistical significance of 0.05

Naowarat Satienpakiranakorn (1998: 76-81) studied knowledge and practices on infectious waste management of nurses in the Bangkok Metropolitan Region(BMR). The study was conducted on nurse in hospital, with over 200 beds, in the Health and 200 nurses in private hospitals. The research found that samples had similar knowledge on infection on infectious waste management through different channels or media, i.e. televisions, radios, newspaper, magazine, journals, other persons, training, exhibitions, and brochure at statistical significance of 0.05. Knowledge of infectious waste management varies upon types of hospital with statistical significance of 0.05. practice on infectious waste management was at a satisfactory level. Practice on infectious waste management of the samples did not differ with ages, working experience via various channels or media, with statistical significance of 0.05. Practice on infectious waste management differed upon knowledge on infectious waste management and acknowledgement of infectious waste management from training, with statistical significance of 0.05.

Phada Limpasaichon (1998: 105) studied factors influential to knowledge, beliefs, and practice on tuberculosis prevention of family members with tuberculosis patients in Chantaburi Province. Phada found that practices on tuberculosis prevention of family members with tuberculosis patient varied, on the back of experiences of sickness, knowledge, and belief on tuberculosis prevention.

Ploenpit Prommali (1998: 113-114) studied infectious waste management in Siriraj Hospital. The study covered volumes and components of infectious waste; procedure, methods and problems in infectious waste management in Siriraj Hospital by sorting wastes from infectious waste bags. The study conducted on 350 samples dumping infectious waste and 100 samples responsible for collection and transfer. The results showed that total waste from infectious waste bag stood at 833.70 kilogram a day. These represented a generation rate of waste from infectious waste bag of 0.50 kilogram/bed/day. When sorting out general waste, the infectious waste totaled 445.97 kilograms daily, or equal to the generation rate of infectious waste of 0.28 kilogram/bed/day. The in-patient building showed the highest rate of infectious waste generation. Knowledge about types of infectious waste collectors and carries. Some wastes, leading to contamination among infectious and normal waste, infectious waste dropping and risks of being pierced by needles or sharp objects.

Saranya Sutthiroajrak (1998: 80-81) studied practices on infectious waste collection of cleaning staffs of public hospitals in Bangkok. Information was compiled of cleaning staffs of public hospitals in Bangkok. Information was compiled from 337 cleaning staffs in 25 hospitals in Bangkok. The research disclosed that practices of cleaning staffs in most hospitals, or 2.9 percent of the samples, on infectious waste collection could be rated at medium level. Hospital cleaning staffs differed in operating period and knowledge of dangers of infectious waste to health. Practices on infectious waste collection did not differ with statistical significant. However, hospital differences in practices on infectious waste collection with statistical significance of 0.05. cleaning staffs holding different educational levels had different practices on infectious waste collection with statistical significance of 0.01

Thus, the researcher made a hypothesis that practices on infectious waste management of general medical staff and infectious waste disposal staff management

CHAPTER III

RESEARCH METHODOLOGY

The study an appropriate management on infectious waste by using infectious waste incinerator is the surrey research, using questionnaire and indepth-interview as information collecting instrument. Details can be categorized as the following;

3.1 Population and samples
3.2 Instrument and construction
3.3 Data collection
3.4 Data analysis

3.1 Population and samples

The population of this study, totaling 191 persons, are Hospital directors, general medical staff and infectious waste disposal staff at Pranangklao Hospital and Bamras-naradoon Hospital divided in 3 groups;

1. Hospital Director 2 persons (1 person / 1 hospital)
2. General medical staff 185 persons
3. Infectious waste disposal staff 4 persons

Calculation of population size General medical staff is based on a formula initiated by Taro Yamane (1973 : 727) Sampling deviation is set at 0.05, and the formula is, as follows ;

$$n = \frac{N}{1 + Ne^2}$$

When

n = Sample size
N = Number of population
e = Sample variance, here set at 0.05

Substitute in the equation, then ;

$$n = \frac{615}{1 + 615\ (0.05)^2}$$

$$= 185$$

Table 3 Numbers of Samples, Population and Size, Classified by Hospital

Hospital	No.of population (person)	Sample size (person)
1. Pranangklao	392	117
2. Bamras-naradoon	223	68
Total	**615**	**185**

Source : General Affair Section, The Ministry of Public Health, March 2001

Table 4 Numbers of Samples, Population and Size, Classified by Department at Pranangklao Hospital and Bamras-naradoon Hospital

Department	No.of population (person)	Sample size (person)
1. Operation	176	53
2. Medicine	146	44
3. Surgery	154	46
4. Obstetrics and Gynae	81	25
5. Pediatrics	58	17
Total	**615**	**185**

* With 2 Hospital director, 4 Infectious waste disposal staff

3.2 Instrument of the Research

1. The researcher used an indepth-interview for Hospital Director comprises policy an appropriate management, pursuit, assessment, guidelines in development, problems, impediments recommendations and budgeting on infectious waste management by using infectious waste incinerator in hospital

2. The researcher used a questionnaire for general medical staff comprises precise, practice, knowledge and practices on infectious waste management by using infectious waste incinerator in hospital

3. The researcher used 1 question paper for infectious waste disposal staff consist of indepth-interview comprises precise policy, practice base on policy on infectious waste management by using infectious waste incinerator in hospital and questionnaire comprises knowledge and practices on infectious waste management by using infectious waste incinerator in hospital

3.2.1 Steps and Details in Constructing the Indepth-Interview and Questionnaire

1. Study method in creating the questionnaire ; and measuring knowledge and practices on infectious waste management by using infectious waste incinerator. Texts, books, thesis and other documents were studied as guidelines in creating the Indepth-Interview and questionnaire

2. Determine information and content for creating the indepth-interview and questionnaire.

3. Create the indepth-interview and questionnaire in accordance with the set content and framework.

4. Present the completed indepth-interview and questionnaire to 5 specialists, acting as the thesis monitoring committee, the doctor and the engineer to consider, correct, examine the clarity and accuracy of language and content. The questionnaire would be revised prior to try-out.

5. Try-out the revised questionnaire with population, similar to the actual samples, totaling 30 persons. The answers would be graded and analyzed in order to indicate proper efficiency of the research tool.

3.2.2 Efficiency Determination of the Research

Efficiency determination of knowledge test

To analyze content validity, the questionnaire is presented to experts on infectious waste management to consider whether content of the questionnaire is complete and consistent with the research objectives Knowledge test would be analyzed question by question. A right answer gets 1 point and 0 point for wrong answer. The score would be calculated for difficulty level and discrimination power by using 25 percent technique in selecting the appropriate questions for the research. Difficulty level ranges from 0.20 to 0.80 and discrimination power is above 0.2

Formula in analyzing difficulty value (refer to Puangrat Taweerat 1996 : 136-137) as follow ;

$$P = \frac{R}{N}$$

When

P = Difficulty value in each question
R = Number of respondents with right answer in each question
N = Total number of respondents totaled 30 persons

Then reliability of the knowledge test is determined by Kuder-Richardson 20 formula (refer to Puangrat Taweerat 1998 : 120 – 123) ;

$$r_{tt} = \frac{n}{n-1}\left\{1 - \frac{\Sigma pq}{St^2}\right\}$$

When

r_{tt} = Reliability value
n = Number of questions
p = Ratio of right answer in each question
q = Ratio of wrong answer in each question = 1-p
St^2 = Variance of total score

Discrimination Power, using formula

$$r = \frac{Ru - Re}{N/2}$$

When r = Discrimination Power
N = Total number of respondents totaled 30 persons
Ru = Number of respondents with right answer in the high quartile, in each question
Re = Number of respondents with right answer in the low quartile, in each question

According to the selection criteria, messages with r value higher than the table or over 2.0 are regarded as quality and applicable messages.

The messages with discrimination power would be analyzed for confidence, using the Cronbach's Alpha Coefficient formula, as follows; (Boontham Kijpredaborisuth, 1994 : 251)

$$r_{tt} = \frac{n}{n-1}\left\{1 - \frac{\Sigma Si^2}{Sx^2}\right\}$$

When
r_{tt} = Reliability value
n = Number of questions
ΣSi^2 = Summation of variances in each question
Sx^2 = Variance of total scores

Efficiency determination of Practice Test

To create the precise practice test on infectious waste management by using infectious waste incinerator, the study was conducted on relevant documents, text and researches. The questionnaire was formulated in line with the research's scope. The practice test was then proposed to the thesis monitoring committee to examine precision, and clarity of language in keeping with the content. The revised test would be used as an instrument in collection information from the samples.

3.3 Data Collection

The researcher collect data, as follow;

3.3.1 The researcher requested official letters from the Dean of the Faculty of Social Sciences and Humanities, Mahidol University, for seeking cooperation from Pranangklao Hospital and Bamras-naradoon Hospital in collecting information.

3.3.2 The researcher Interview hospital directors and infectious waste disposal staff

3.3.3 The researcher presented the questionnaires to head nurses of each department to forward to general medical staff, explained objectives of the research and made appointment to pick up to completed questionnaires.

3.4 Data Analysis

The completed questionnaire were scored, grouped to the follow steps;

1. The test on knowledge on infectious waste management by using infectious waste incinerator is a multiple choice with 40 questions. The right answer gets 1 score and 0 score for the wrong one.

Total scores are graded as follows ;

	Positive message	Negative message
Yes	1 score	0 score
No	0 score	1 score

Scoring criteria consist of 3 levels ;

0 – 20 scores	low knowledge on an appropriate management by using infectious waste incinerator
21 – 30 scores	medium knowledge on an appropriate management by using infectious waste incinerator
31 – 40 scores	high knowledge on an appropriate management by using infectious waste incinerator

2. The test of practice on an appropriate management by using infectious waste incinerator comprises 20 questions. Total scores are graded as follow ;

	Positive message	Negative message
Practice regularly	3	1
Practice occasionally	2	2
Practice irregularly	1	3
Never practice	0	0
	(scores)	(scores)

Scoring criteria consist of 4 levels ;

0 scores	mean	Never practice
1 – 7 scores	mean	Practice irregularly
8 – 14 scores	mean	Practice occasionally
15 – 20 scores	mean	Practice regularly

3. The indepth-interview for hospital director, researcher create questions for policy, and impediments recommendations and budgeting on an appropriate management by using infectious waste incinerator in hospital

4. The other indepth-interview (part 4) for infectious waste disposal staff researcher create questions for precise, practice, knowledge in protect themselves from accident on an appropriate management include problems and impediments recommendations on an appropriate management by using infectious waste incinerator in hospital

After scoring, the researcher coded the questionnaires and statistical analysis, using record and analyze by Statistic Package for the Social Science = SPSS/FW

1. Personal data analyze by percentage.
2. Knowledge on infectious waste management by using infectious waste incinerator analyze by Percentage and Mean.
3. Practice on infectious waste management by using infectious waste incinerator analyze by Percentage, Mean and Mode.

4. Analyze relationship between independence variables and dependence variables ; relationship between knowledge and practice, through the Chi-square test.

5. Elaborate information from in-depth-interview will description of information

CHAPTER IV

RESEARCH RESULTS

The summary of findings was to study an appropriate management on infectious waste by using infectious waste incinerator of medical personnel in two comprehend the wider range of analysis, 3 sample groups of hospital staff were studied; 2 hospital directors, 185 general medical staff and 4 infectious waste of hospital's disposal staff. The questionnaire serves as the research instrument and the SPSS/FM social-science statistical analysis software tool is employed in the data analysis. Research outcome can be summarized as follows;

4.1 Personal data of general medical staff

4.2 Knowledge on an appropriate management by using infectious waste incinerator in the hospital

4.3 Behavior on an appropriate management by using infectious waste incinerator in the hospital

4.4 Analysis of relationship between behavior and independent variables on an appropriate management by using infectious waste incinerator in the hospital

4.6 Analysis of relationship between behavior and knowledge on an appropriate management by using infectious waste incinerator in the hospital

4.7 Policy on an appropriate management by using infectious waste incinerator in the hospital of hospital directors

4.8 An appropriate management by using infectious waste incinerator policy informed in the hospital of infectious waste of hospital's disposal staff

4.1 Personal Data of General Medical Staff

Table 5 Number and Percentage of General Medical Staff

Personal data	General medical Staff	
	Number	Percentage
1. Sex		
Male	15	8.1
Female	170	91.9
2. Age		
20-30 years	32	17.3
31.40 years	88	47.6
41.50 years	48	25.9
Over 51 years	17	9.2
3. Highest qualification		
Lower than certificate of nurse	0	0.0
Certificate of nurse	96	51.9
Bachelor degree	85	23.1
Higher than Bachelor degree	4	25.0
4. Job Title		
Chief of wards	13	6.5
Chief of laboratory	10	5.4
Nurse	82	44.3
Nurse assistant	82	44.3
Medical technologist	13	20.0
Scientist	13	7.0
Scientist	13	4.3
Clerk of science	23	12.5
5. Working department		
Operation	29	15.7
Medicine	66	35.7
Surgery	54	29.2
Obstetrics and Genie	21	11.4

Table 5 Number and Percentage of General Medical Staff (cont.)

Personal data	General medical staff	
	Number	Percentage
Pediatrics	15	8.0
6. Work duration		
1-10 years	68	36.8
11-20 years	75	40.5
21-30 years	31	16.8
Over 31 years	11	5.9
7. Infectious waste management training		
Yes	126.0	68.1
No	59.0	31.9

Table 5 General medical staff are male 8.1% and female 91.9%, age 31 to 40 years are 47.6%, 41 to 50 years old are 25.9%, 20-30 years old are 17.3% and over 51 years are 9.2%. Highest qualification lower than certificate of nurse are 51.9%. Higher than Bachelor Degree are 25.0% and Bachelor degree are 23.1%. Job title : nurses are 44.3%, nurse assistants are 20.0%, clerks of science are 12.5%, medical technologists are 7.0%, chivies o ward are 6.5%, chivies of laboratory are 5.4% and are 15.7%, Obstetrics and Genie are 11.4% and Pediatrics are 8.0%. Work duration 11-20 years are 40.5%, 1 to 10 years are 36.8% 21 to 30 years are 16.8% and over 31 years are 5.9%. having infectious waste management training are 68.1% and 31.9% have no infectious waste management training.

4.2 Knowledge on An Appropriate management by using Infectious Waste Incinerator in the Hospital

4.2.1 Knowledge on An Appropriate management by using Infectious Waste Incinerator in the Hospital

Table 6 Number and Percentage of General Medical Staff Samples with Right-Wrong Answers, Classified by Questions.

Knowledge on an appropriate management	Right answer		Wrong answer	
	Number	Percentage	Number	Percentage
1. Knowledge on Infectious Waste				
1.1 All wastes from hospital activities are infectious wastes.	149	80.5	36	19.5
1.2 Examples of Infectious wastes are cotton, gauze, needle, blazes, blood bag, saline bag, rubber gloves, water tube, saline tube, part of body, placenta, wastes from tested animal, slides.	123	66.5	62	33.5
1.3 Wastes with disease contamination such as used gauze, banners, cotton may cause infection.	140	75.7	45	24.3
1.4 Infectious wastes from hospital lead to the disease contamination in naturopathy, respiratory system, tuberculosis or enter hepatitis.	144	77.8	41	22.2
1.5 Some wastes from hospital activities can by recycled.	85	45.9	100	54.1
2. Knowledge of Infectious Waste Disposal				
2.1 Do you know the red plastic bag only use for leftover infectious wastes?	150	81.0	35	19.0
2.2 It's necessary to separate the carts for transferred normal wastes and infectious wastes	142	76.8	43	23.2

Table 6 Number and Percentage of General Medical Staff Samples with Right-Wrong Answers, Classified by Questions. (cont.)

Knowledge on an appropriate management	Right answer		Wrong answer	
	Number	Percentage	Number	Percentage
2.3 Infectious wastes such as cotton, gauze, syringe, needle should be disposed in the black plastic bag.	118	63.8	67	36.2
2.4 Infectious wastes such as blood bag, saline bag, rubble gloves, part of body, wastes from tested animals, slides should be disposed in the red plastic bag.	63	34.0	122	66.0
2.5 Crumble food leftover from non-patients should be disposed in the red plastic bag.	86	46.5	99	53.5
2.6 Infectious waste should be germ-killed by antiseptics only.	111	60.0	74	40.0
2.7 All waste bags should be gathered to a single spot before sorting for final disposal.	130	70.3	55	29.7
2.8 Wastes should be transferred by cart only.	92	49.7	93	50.3
2.10 Infectious wastes disposal should be germ-killed before being buried.	123	66.5	62	33.5
2.11 Infectious wastes should be disposed by burning in the infectious waste incinerator only.	130	70.3	55	29.7

Table 6 Number and Percentage of General Medical Staff Samples with Right-Wrong Answers, Classified by Questions. (cont.)

Knowledge on an appropriate management	Right answer		Wrong answer	
	Number	Percentage	Number	Percentage
2.12 The most appropriate disposal method for all hospital wastes is burning in the infectious waste incinerator.	61	33.0	124	67.0
2.13 Sorting of wastes before dumping and disposing should be done by the cleaning staff only.	74	40.0	111	60.0
2.14 Antiseptics must be used to clean up the floor where the infectious wastes leak from the bags during transportation.	117	63.2	68	36.8
2.15 Infectious wastes contaminated by blood or blood products should be germ-killed	73	39.4	112	60.6
2.16 All infectious wastes should be steamed before being fed into the infectious waste incinerator	72	38.9	113	61.1
2.17 Materials used to contain or wrap the medical instruments should be disposed in the black plastic bag.	117	63.2	68	36.8
2.18 All wastes from the microbiological laboratory should be autoclaved before being disposed in the bag.	130	70.3	55	29.7

Table 6 Number and Percentage of General Medical Staff Samples with Right-Wrong Answers, Classified by Questions. (cont.)

Knowledge on an appropriate management	Right answer		Wrong answer	
	Number	Percentage	Number	Percentage
2.19 At the central waste storage room of the hospital, infectious wastes should be separated from the normal wastes.	147	79.5	38	20.5
2.20 Infectious waste bags should be carried at the top or held with care, on dragging is allowed to avoid the leakage.	98	53.0	87	47.0
3. Knowledge on Infectious Waste Incinerator				
3.1 Burning the infectious waste in the infectious waste incinerator can eliminate all germs in the wastes.	136	73.5	49	26.5
3.2 Burning process of the infectious wastes incinerator will not create pollution.	68	36.8	117	63.2
3.3 The temperature in the waste and the smoke burning chamber should be between 600-100 degree Celsius.	69	37.3	116	62.7
3.4 Before the infectious waste burning, the burning chamber should be set up to not less than 400 degree Celsius.	156	84.3	29	15.7
3.5 The most suitable fuel for the infectious waste incinerator is natural gas	48	25.9	137	74.1

Table 6 Number and Percentage of General Medical Staff Samples with Right-Wrong Answers, Classified by Questions. (cont.)

Knowledge on an appropriate management	Right answer		Wrong answer	
	Number	Percentage	Number	Percentage
3.6 Normally, infectious waste burning in the infectious waste incinerator tends to create odor and smoke as well as soot during operation.	132	71.4	53	28.6
3.7 The infectious waste incinerator of any system should be operated continuously and automatically.	86	46.5	99	53.5
3.8 The temperature of smoke from the infectious waste incinerator should be lowered to around 200-400 degree Celsius before reaching the external atmosphere.	128	69.2	57	30.8
3.9 Water spraying to the smoke emitting shaft of the infectious waste incinerator is the most appropriate way to lower the temperature of such shaft.	46	24.9	139	75.1
3.10 The poison elimination at the shaft should be wet process by spraying lime or an alkali into the smoke emitting shaft, known as "Wet Scrubber"	116	62.7	69	37.3
3.11 Waste water from the infectious waste incinerator disposed by chemical treatment only.	148	80.0	37	20.0

Table 6 Number and Percentage of General Medical Staff Samples with Right-Wrong Answers, Classified by Questions. (cont.)

Knowledge on an appropriate management	Right answer		Wrong answer	
	Number	Percentage	Number	Percentage
3.12 All infectious waste incinerator used in the hospital should be facilitated with polluted air or dust control devices.	112	60.5	73	39.5
3.13 Infectious waste incinerator used in the hospital should be "Excess Air" type.	129	69.7	56	30.0
3.14 Gas residual from perfect combustion is Carbon-dioxide and steam.	63	34.1	122	65.9
3.15 Gas residual from imperfect combustion is Carbon-monoxide.	44	23.8	141	76.3

Table 6 is the summary of the research data. As the questionnaire is divided in 3 parts, the data analysis is hence carried out and interpreted for each part individually before the overall suggestion is discussed.

For "Knowledge on Infectious Waste", the table suggests that samples are well educated with average of right answers from all questions at 69.2%. The highest well educated with average of right answers from all questions at 69.2%. The highest 80.5% in question 1.1 points out the fact that not all wastes from the hospital are infectious in generally known by most general medical staff. The lowest 54.1% in question 1.5 shows that samples have the least knowledge on whether some wastes from hospital can be recycled.

For "Knowledge on Infectious Waste Disposal", the table suggests that samples have the second highest average of 58.8% among the three parts. The sample have shown their best training on infectious disposal from the hospital with the highest percentage of 81.0% This is followed by the suggested practice of separated infectious waste from normal waste (question 2.19), with the percentage of 79.5%. The samples have the least knowledge on whether all wastes in the hospital should be burned in the infectious waste incinerator (question 2.12), with the percentage of 33.0%. This is followed by infectious waste such as blood bag, saline bag, rubber gloves, part of body, wastes from tasted animals, slides should be disposed in the orange plastic bag (question 2.4), with the percentage of 34.0%.

For "Knowledge on Infectious Waste Incinerator", the table suggests that samples of the general medical staff average of right answers from all questions at 53.3%. The highest 84.3% at question 3.4. The lowest 23.8% at question 3.15.

Table 7 Number, Percentage and Mean of General Medical Staff Samples, Classified by Knowledge on An Appropriate Management by using Infectious Waste Incinerator in the Hospital

Levels of knowledge		Number	Percentage
Low	(0-20 scores)	23	12.4
Medium	(21-30 scores)	88	47.6
High	(31-40 scores)	74	40.0
Total		**185**	**100.0**

$\bar{X}$ = 26.1

According to table 7, classified by level of knowledge 47.6% have medium knowledge on an appropriate management by using infectious waste incinerator, followed by high and low knowledge at 40.0% and 12.4%. The average scores stood at 26.1.

4.3 Practice on An Appropriate Management by using Infectious Waste Incinerator in the Hospital

Table 8 Number, Percentage, Mean and Mode of General Medical Staff Samples, Classified by Questions of Behavior on An Appropriate management by using Infectious Waste incinerator in the Hospital

Content	Levels of behavior								Mode
	Practice Regularly		Practice Occasionally		Practice Irregularly		Never Practice		
	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	
1. While you working, you wear a veil, apron, gloves and boots	96	51.9	48	25.9	41	22.2	0	0.00	Practice regularly
2. After worked, you separate infectious wastes from normal wastes	89	48.1	82	44.3	14	7.6	0	0.0	Practice Regularly
3. Samples of infectious wastes are cotton, gauze, blazes and rubber gloves upon dispose in the red plastic bag	0	0.0	35	18.9	40	21.6	110	59.5	Never Practice
4. Examples of infectious waste are cotton, gauze, blazes and rubber gloves you dispose in the black plastic bag	110	59.5	40	21.6	35	18.9	0	0.0	Practice Regularly
5. Part of body, wastes from tested animal and slides you dispose in the black plastic bag	0	0.0	0	0.0	24	13.0	161	87.0	Never Practice
6. Part of body, wastes from tested animal and slides you dispose in the red plastic bag	161	87.0	24	13.0	0	0.0	0	0.0	Practice Regularly

Table 8 Number, Percentage, Mean and Mode of General Medical Staff Samples, Classified by Questions of Behavior on An Appropriate management by using Infectious Waste incinerator in the Hospital (cont.)

Content	Levels of behavior								Mode
	Practice Regularly		Practice Occasionally		Practice Irregularly		Never Practice		
	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	
7. Water tube, saline tube you reuse again	106	57.3	35	18.9	12	6.5	32	17.3	Practice Regularly
8. You reuse some of wastes from hospital activities	32	18.9	122	65.9	38	15.2	0	0.0	Practice Occasionally
9. Before dispose wastes, you will germ-killed by antiseptics	6	3.2	19	10.3	24	13.0	136	73.5	Never Practice
10.You leftover crumble food of infectious patient in red plastic bag	159	85.9	15	8.1	1	6.0	0	0.0	Practice Regularly
11.You move infectious waste bags to the dispose area	24	13.0	7	3.8	21	11.3	133	71.9	Never Practice
12.You dispose infectious waste in the black plastic bag	0	0.0	0	0.0	3	1.63	182	98.4	Never Practice
13.You dispose infectious waste in the black plastic bag	80	43.2	69	37.3	34	18.4	2	1.1	Practice Regularly
14.When your hospital had been trained on infectious waste incinerator. Have you been trained?	15	8.1	10	5.4	16	8.7	144	77.8	Never Practice
15.When your hospital had been trained on infectious waste management. Have you been trained?	36	19.5	98	53.0	12	6.5	39	21.0	Practice Occasionally
16.Have you hospital had been trained on infectious waste management. Have you been trained?	113	61.1	50	27.0	22	11.9	0	0.0	Practice Regularly
17.Do you go to infectious waste incinerator?	0	0.0	0	0.0	18	9.7	167	90.3	Never Practice
18.If you have a free time you leave infectious wastes in the red plastic bag.	20	10.8	98	53.0	59	31.9	8	4.3	Practice Occasionally
19.In case of emergency, you leave infectious wastes in the red plastic bag.	113	61.1	32	17.3	40	21.6	0	0.0	Practice Regularly
20.You leave infectious wastes in the right bag, though located further away.	111	60.0	69	37.3	5	0.7	0	0.0	Practice Regularly

Table 8 suggested that the most samples' practice were in practice with the texts. About 87.0% of samples' leave parts of body, wastes from tested animal and slides in the red plastic bag (question 6) followed by 85.9% samples' leftover crumble food of infectious patient in red plastic bag (question 10) and reuse some wastes from hospital activities 65.9% 9question 8)

Most of the samples' , or 98.4% had never disposed infectious wastes in the black plastic bag (question 12) followed by 90.3% of samples never go to infectious waste incinerator (question 17) and 87.0% of samples' never dispose part of body, wastes from tested animal and slides in the red plastic bag (question 5)

Table 9 Number, Percent and Mean of General Medical Staff Samples, Classified by Levels of Practice an Infectious Waste Management by using Infectious Waste Incinerator in the Hospital

Levels of Practice		Number	Percentage
Practice Regularly	(15-20 Scores)	40	21.6
Practice Occasionally	(8-14 Scores)	84	45.4
Practice Irregularly	(1-7 Scores)	51	27.6
Never Practice	(0 Score)	10	5.4
Total		**185**	**100.0**

$\bar{X}$ = 9.9

According to table 9, classified by levels of behavior 45.4% practice Occasionally practice on infectious waste management by using infectious waste incinerator in hospitals, followed by practice irregularly at 27.6% and practice regularly at 21.6%. At least never practice at 5.4%. In summary, the samples had occasionally managed infectious wastes. The average scores stood at 9.9.

4.4 Analysis of Relationship between Knowledge and Independent Variables on an Appropriate Management by using Infectious Waste Incinerator in Hospital

The relationship analysis between independent variables studied such as work duration, infectious waste management training and knowledge on an appropriate management by using infectious waste incinerator in the hospital using the Chi-Square statistics can be summarized, as follows;

4.4.1 Analysis of Relationship between Knowledge and Work Duration on an Appropriate Management by using Infectious Waste Incinerator in Hospital of General Medical Staff.

Table 10 Analysis of Knowledge on an Appropriate Management and Work Duration of general Medical Staff

Work Duration	Knowledge on an appropriate Management						Total	
	Low		Medium		High			
	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage
1-10 years	7	30.4	22	25.0	30	40.6	59	31.9
11-20 years	8	34.8	45	51.2	25	33.6	78	42.1
21-30 years	7	30.4	14	15.9	16	21.7	37	20.0
Over 31 years	1	4.4	7	7.9	3	4.1	11	6.0
Total	**23**	**100.0**	**88**	**100.0**	**74**	**10.0**	**185**	**100.0**

Chi-Square = 9.498 df = 6 Significance = 0.010

Table 10 Those general medical staff at all levels of work duration, had medium Knowledge on infectious waste management.

According to the analysis of relationship between knowledge on an appropriate management by using infectious waste incinerator and work duration knowledge did not rest on work duration with statistical significance of 0.05. The result was not in accordance with the research hypothesis 1.4.1, claiming that "Knowledge on an appropriate management of general medical staff depend on work duration",

4.4.2 Analysis of Relationship between Knowledge and Infectious Waste Management Training on and appropriate management by using Infectious waste Incinerator of General medical staff

Table 11 Analysis of Knowledge on Infectious Waste Management and Infectious Waste Management Training of General Medical Staff

Infectious Waste Management Training	Knowledge on an appropriate Management						Total	
	Low		Medium		High			
	Number	Percent-age	Number	Percent-age	Number	Percent-age	Number	Percent-age
Yes	15	65.2	69	78.4	42	56.8	126	68.1
No	8	34.8	19	21.6	32	43.2	59	31.9
Total	**23**	**100.0**	**88**	**100.0**	**74**	**10.0**	**185**	**100.0**

Chi-Square = 8.774 df = 2 Significance = 0.012

According to table 11 the analysis of relationship between Knowledge on management and infectious waste management training, knowledge on an appropriate management depend on infectious waste management training with statistical significance of 0.05. The result is in keeping with the research hypothesis 1.4.2, claiming that "Knowledge on an appropriate management of general medical staff depend on infectious waste management training"

4.5 Analysis of Relationship between behavior And Independent Variables An Appropriate Management by using Infectious Waste Incinerator in Hospital of General Medical Staff

using the Chi-Square statistics can be summarized, as follows,

4.5.1 Analysis of Relationship Between Behavior and Independent Variables An Appropriate Management by using Infectious Waste Incinerator in Hospital of General Medial Staff

Table 12 Analysis of Behavior on an Appropriate and Work Duration of General Medical Staff

Work duration	Behavior on an appropriate management								Total	
	Never practice		Practice irregularly		Practice Occasionally		Practice regularly			
	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage
1-10 years	3	30.0	20	39.2	27	32.1	9	22.5	59	31.9
11-20 years	2	20.0	14	27.5	40	47.6	22	55.0	78	42.1
21.30 years	4	40.0	15	29.4	13	15.5	5	12.5	37	20.0
Over 32 years	1	10.0	2	3.9	4	4.8	4	10.0	11	6.0
Total	**10**	**100.0**	**51**	**100.0**	**84**	**100.0**	**40**	**100.0**	**185**	**100.0**

Chi-Square = 17.437 df = 9 Significance = 0.007

According to table 12 the analysis of relationship between behavior on an appropriate management and work duration, behavior on an appropriate management depend on work duration with statistical significance of 0.05. The result is in keeping with the research hypothesis 1.4.3, claiming that "Behavior on an appropriate management of general medical staff depend on work duration"

4.5.2 Analysis of Relationship Between Behavior and Infectious Waste Management Training by using Infectious Waste Incinerator in the Hospital of general Medical Staff

Table 13 Analysis of Behavior on An Appropriate Management and Infections Waste Management Training of General Medical Staff

Work duration	Behavior on an appropriate management								Total	
	Never practice		Practice irregularly		Practice Occasionally		Practice regularly			
	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage
Yes	8	80.0	24	47.1	65	77.4	29	72.5	126	68.1
No	2	20.0	27	52.9	19	22.6	11	27.5	59	31.9
Total	**10**	**100.0**	**51**	**100.0**	**84**	**100.0**	**40**	**100.0**	**185**	**100.0**

Chi-Square = 14.734 df = 3 Significance = 0.034

According to the analysis of relationship between behavior on an appropriate management and infectious waste management training, behavior on an appropriate management depend on infectious waste management training with statistical significance of 0.05. The result is in keeping with the research hypothesis 1.4.4, claiming that "Behavior on an appropriate management training".

4.6 Analysis of Relationship between Behavior and Knowledge on An Appropriate Management by using Infectious Waste Incinerator in the Hospital of General Medical Staff

using the Chi-Square Statistics can be summarized, as follows;

4.6.1 Analysis of Relationship between Behavior and Knowledge on An Appropriate Management by using Infectious waste Incinerator in the Hospital of General Medical Staff

Table 14 Analysis of Behavior on An Appropriate Management and Knowledge of General Medical Staff.

Work duration	Behavior on an appropriate management								Total	
	Never practice		Practice irregularly		Practice Occasionally		Practice regularly			
	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage
Low	2	20.0	8	15.7	6	7.1	7	17.5	23	12.4
Medium	7	70.0	19	37.3	47	56.0	15	37.5	88	47.6
High	1	10.0	24	47.0	31	36.9	18	27.5	74	40.0
Total	**10**	**100.0**	**51**	**100.0**	**84**	**100.0**	**40**	**100.0**	**185**	**100.0**

Chi-Square = 11.238 df = 6 Significance = 0.021

The analysis of relationship between behavior on an appropriate management and knowledge, behavior on an appropriate management did not depend on an appropriate management with statistical significance of 0.05 The result was not in accordance with the research hypothesis 1.4.5, claiming that "Behavior on an appropriate management of general medical staff depend on knowledge on an appropriate management"

Table 15 Hypothesis conclusions

Hypothesis	Accepted	Rejected
1. Knowledge on an appropriate management of general medical staff depend on work duration		√
2. Knowledge on an appropriate management of general medical staff depend on infectious waste management training	√	
3. Behavior on an appropriate management of general medical staff depend on work duration	√	
4. Behavior on an appropriate management of general medical staff depend on infectious waste management training	√	
5. Behavior on an appropriate management of general medical staff depend on knowledge on an appropriate management		√

4.7 An Appropriate of Infectious Waste Management by using Infectious Waste Incinerator in Hospital of Hospital directors

Table 16 An Appropriate of Infectious Waste Management by using Infectious Waste Incinerator in the Hospital of Hospital Directors

Policy	Bamras-naradoon Hospital	Pranangklao hospital
1. Infectious waste management by using infectious waste incinerator in hospital of The Public Heath Ministry Policy	1. Accepted but have own policy of infectious waste management by using infectious waste incinerator	1. Main policy of the hospital
2. Infectious waste management by using infectious in your working hospital	2. Infectious wastes must collected in red bags and bring to the cart for transferring as 2 fictionist as 8.00-9.0 a.m. and 1:00-2:00 p.m. by infectious waste of hospital's disposal staff to the infectious waste incinerator - Wastes form operation room such as plate, blood tube, saline beg had be autoclaved before disposed in the bag - Needle, blaze disposed in red bag before transfer to the infectious waste incinerator - Part of body, dead embryo keeping cold storage before disposed by burning at the temple - Placenta disposed in waste water treatment system	2. set up IC team to look for separate wastes, plan of infectious waste management by using infectious waste incinerator training and control quantity of wastes such as humidity, types.
3. Budget for infectious waste management by using infectious waste incinerator	3. - Fuel cast of infectious waste incinerator about 30,000 baht/month (2,000 liters/month) - Worker's salary 3 persons; 4,100 baht/person/month	3. - Fuel cost of infectious waste incinerator 5,000 litres/1.5 month - Maintenance cost of infectious waste Incinerator 1,000,000 baht/year - Buying this infectious waste incinerator 8,500,000 baht

Table 16 An Appropriate of Infectious Waste Management by using Infectious Waste Incinerator in the Hospital of Hospital Directors (cont.)

Policy	Bamras-naradoon Hospital	Pranangklao hospital
4. Assign sub-ordinate to practice follow by policy	4. - Wastes from each of building collected by worker of medical department - Arrange training for medical personnel how to separate infectious wastes from normal wastes - Particle department control infectious waste disposal staff and infectious waste incinerator - In case of infectious waste disposal staff had injured, will be report to the medical service center of the hospital	4. - Environment and safety committee have 22 persons; secretary to main plan committee 1 person, secretary to external building environment committee 3 persons, secretary to infectious Sissies committee 4 persons, sub-committee of municipality 5 persons and sub-committed of safety 7 persons
5. Pursuit and assessment	5. - Infectious waste disposal staff weigh infectious wastes decrease, or not After separate infectious wastes from normal waster training - Fuel assumption decrease, or no not - During burning combustion have smoke and bad smell, or not	5. Authorized by sub-committee of municipality look after result of burning combustion
6. Problems and impediments	6. No. Because before training got problems; infectious wastes 200 kg/day, black smoke and bad smell. After training infectious waster 120-150 kg Idea, fuel consumption is deceased to 2,000 liters/ month, no black smoke and bad smell	6. If Methane is incased in volume it show low quality of infectious waste incinerator

Table 16 An Appropriate of Infectious Waste Management by using Infectious Waste Incinerator in the Hospital of Hospital Directors (cont.)

Policy	Bamras-naradoon Hospital	Pranangklao hospital
7. Guidelines to improve	7. - Improved by officer of The Department of Health - The maintenance infectious waste incinerator will be done when any equipment are out of order	7. To decrease of infectious wastes generation rates will be training of personnel again

4.8 An Appropriate Management by using Infectious Waste Incinerator in the Hospital Policy Informed by Infectious Waste of Hospital's Disposal Staff

Table 17 An Appropriate Management by using Infectious Waste Incinerator in the Hospital Policy Informed by Infectious Waste of Hospital's Disposal Staff

Policy	Bamras-naradoon Hospital	Pranangklao hospital
1. Describe of infectious waste policy	1. - Foreman has been trained of infectious wastes every 3 months. - All of infectious wastes have to burn - Not to black smoke and bad smell during burning combustion of infectious waste incinerator.	1. -Clean up infectious waste incinerator 1 time/week - Clean up waste storage area for good view
2. Describe of an appropriate management by using infectious waste incinerator policy in your working hospital	2. - Check of fuel before burning operation - Clean up infectious waste incinerator - Infectious wastes have been burned at 700-1,000 degree Celsius, so it have no bad smell	2. If infectious waste incinerator is out of order, will transfer infectious wastes to company (9 bht/kg)
3. Who you informed policy? Describe these policy.	3. - Hospital Directors - Daily service of infectious waste incinerator before burning operation - Prevent an accident which be happened to worker	3. -Medical Department - separate infectious wastes from normal wastes - Defected pollutant during burning operation

Table 17 An Appropriate Management by using Infectious Waste Incinerator in the Hospital Policy Informed by Infectious Waste of Hospital's Disposal Staff (cont.)

Policy	Bamras-naradoon Hospital	Pranangklao hospital
4. Do you practice follow by policy duty?	4. Yes, We do And match with practice duty.	4. - Yes. But difficult, because of human habit don't separate dispose of infectious wastes and normal wastes - Fix time to open infectious storage room at 6 a.m., 2 p.m. and 8:00 p.m. but can't do that because they dispose when they want to.
5. Protect yourself during work hour.	5. Wear a veil, apron, gloves and boots during work hour every time	5. Wear a mask, gloves sometimes because gloves are thin can't protect from heat

The most samples' behavior was in practice the texts. All of them have to control operating system of infectious waste incinerator (question 3) and they have to warm the infectious waste incinerator before burning process (question 20). Followed by 3 persons while working, wear a veil, apron, gloves and boots (question 1), after daily duties they take off a veil, apron, gloves and boots keep in detergent (question 6) they clean up the floor where the infectious wastes fallen (question 12) their duty have to burn both of infectious wastes and normal wastes (question 12) their duty have to burn both of infectious wastes and normal wastes (question 14) they have to eliminate ash after infectious wastes burning process (question 18) and they compile infectious wastes bags and separate normal wastes from infectious waste before burning (question 19).

Most of them never burn infectious wastes with normal wastes if there are no more (question 4) followed by 2 persons go to see the doctor if they got ill cause of burning infectious wastes such as cough, sneeze or rasp (question 5), normally infectious waste germ-killed by antiseptics before burning (question 8) and infectious wastes mix burned with radioactive wastes (question 10)

Levels of behavior on an appropriate management by using infectious waste incinerator in hospitals 3 persons practice regularly, followed by practice irregularly and 1 person never practice and practice occasionally. The average scores stood at 9.8.

The relationship between knowledge on an appropriate management by using infectious waste incinerator and infectious waste management training, knowledge did not rest on infectious waste management training with statistical significance 0.05.

CHAPTER V

RESEARCH DISCUSSION

This results are discuss as follows ;

5.1 Policy on an Appropriate Management by using Infectious Waste Incinerator of Hospital Director

Both of hospitals have no formality for infectious waste management, meanwhile have guidelines to operate in Bamras-naradoon Hospital just only 5 instructions by infectious waste disposal staff collect the red bags to the infectious incinerator; wastes from operation room have be autoclaved before disposed in the bag; needles, blazes dispose in the red bag; part of body, dead embryo keep in cold storage before burning at the temple and placenta dispose in waste water treatment system. In Pranangklao Hospital have IC team to inform the plan of infectious waste management by using infectious waste incinerator same as the study of Veerachai Chokwinyu (1996 : 89) found that hospitals have no formality for infectious waste management and the management personnel had less attention on the object thus could endanger to general medical staff and infectious waste disposal staff

5.2 Relationship between Knowledge, Practices and Independent Variables on Management by using Infectious Waste Incinerator in Hospital

- **General medical staff**

According to the result of this study found, Knowledge on infectious waste management by using infectious waste incinerator of general medical staff did not rest on work duration with statistical significance of 0.05 that differ from Concept of Jintana U-nipan (1984 : 31) pointed out that work duration is the basic factor enhancing an individual knowledge to think about and solve problems as well as initiate new thing.

May be cause of new gradated of general medical staff gained more acknowledge from education.

For practices on infectious waste management by using infectious waste incinerator of general medical staff depend on work duration with statistical significance of 0.05 that to be agreement with Panit Manogarn (1996 : 91-93) consisted with the less work duration staff has more correct practices in infections waste management than more work duration staff.

The result of this study found that knowledge on infectious waste management by using infectious waste incinerator of general medical staff depend on infectious wasted management training with statistical significance of 0.05 , the same

viewed of Noi Sirichot (1997 : 67) pointed out, training is the process of behave more knowledge in order to learn or adapt practice followed by the purpose of training after infectious waste management training, general medical staff get more knowledge in infectious waste management.

For practices on infectious waste management by using infectious waste incinerator of general medical staff depend upon in fictions waste management training with statistical significance of 0.05, this is consistent with the concept of Patcharee Pakcharoen (1997 : 150) found of studied most practices were regular practices and depended on training in infectious waste management in hospital.

To show that after infectious waste management training the general medical staff practices to be corrected practice in daily duty course of unknown information or fail to remember.

- **Infectious waste disposal staff**

According to the result of this study, knowledge on infectious waste management by using infectious waste incinerator and work duration of infectious waste disposal staff with statistical significance of 0.05 in contrast with the hypothesis of Saranya Sutthiroajrak (1998 : 80-81) claimed that infectious waste disposal staff differed in work period and knowledge of infectious waste management and knowledge of dangers of infectious waste to health.

This study found no relationship between practices on infectious waste management by using infectious waste incinerator not hennaed on work duration of infectious waste disposal staff with statistical significance of 0.05 in daily duty more period of work duration it is not important to be good practices of infectious waste management, it is not in the same line of Naowarat Satienpakinanakorn (1998 : 76-81) stated that practices on infectious waste management of the samples did not differ with work duration, age, types of hospitals, exposure of information on infectious waste management.

According to the study knowledge on infectious waste management by using infectious waste incinerator of infectious waste disposal staff did not rest on infectious waste management training with statistical significance of 0.05 not in the line with the set hypothesis. In contrast with Saranya Sutthiroajrak (1998 : 80) studied found that infectious waste disposal staff with infectious waste management training on accurate knowledge of infectious waste collection would collect infectious waste more accurately than those without training.

The study found that the practices on infectious waste management by using infectious waste incinerator of infectious waste disposal staff did not depend on infectious waste management training with statistical significance of 0.05, so this case disagreement with Saranya Sutthiroajrak (1998 : 80 – 81) pointed out that the practices on infectious waste management of infectious waste disposal staff varied in training on accurate practices on infectious waste management.

The analysis of relationship between practice on an appropriate management and knowledge, practice on an appropriate management did not depend on an appropriate management with statistical significance of 0.05

5.3 Relationship between Practices and Knowledge on an Appropriate Management by using Infectious Waste Incinerator in Hospital

- General medical staff

According of the studied, practices on infectious waste management did not hinged on infectious waste management by using infectious waste incinerator with statistical significance of 0.05 that contrast of Phada Limpasaichon (1998 : 105) stated of knowledge was a key in prediction practice on prevention and knowledge had effected of practice on acting, on beliefs.

- Infectious waste disposal staff

The studied found no relationship between practices on infectious waste management of infectious waste disposal staff and knowledge on infectious waste management by using infectious waste incinerator in hospital with statistical significance of 0.05 that agree with Ploenpit Prommali (1998 : 113-114) studied of knowledge about infectious waste disposal staff settled at 64.90 percent but had incorrectly managed infectious wastes it may risks of being pierced by needles or sharp objects.

CHAPTER VI

CONCLUSIONS AND RECOMMENDATIONS

The research's objectives An Appropriate Management by Infectious waste Incinerator of Medical Personnel: A case study of Hospital under Ministry of Public Health in Nonthaburi, variables and relationship between work duration, an appropriate management training and knowledge, practices of general medical staff, infectious waste disposal staff in hospitals and study the policy, process, budget, problem, Impediments, recommendations and guide lines to improve an appropriate management by using infectious waste incinerator of Hospital Directors

This research is survey research, the samples are 2 Hospital Directors (Bamras-naradoon Hospital and Pranangklao Hospital) 185 general medical staff and 4 infectious waste disposal staff (Bamras-naradoon 3 persons, Pranangklao 1 person) Research use indepth-interview for Hospital Director and part 4 for infectious waste disposal staff ; questionnaire for general medical staff.

Information analyze by statistic; percentage, mean, mode and Chi-Square test. Information of indepth-interview using description

6.1 Conclusions

6.1.1 Knowledge of personnel on An Appropriate Management by using Infectious Waste Incinerator in Hospitals

Knowledge on an appropriate management by using infectious waste incinerator of general medical staff in hospitals.

Most of the samples scored medium level of Knowledge on an appropriate management by using infectious waste incinerator. Total 185 respondents; medium knowledge had 88 persons (47.6 percent), high knowledge had 74 persons (40.0 percent),and low knowledge had 23 persons (12.4 percent) Knowledge on an appropriate management by using infectious waste incinerator of infectious waste disposal staff in hospital

6.1.2 Practice of personnel on An Appropriate Management by using Infectious Waste Incinerator in Hospital

Practice on an appropriate management by using infectious waste incinerator in hospital general medical staff in hospital

Most of the samples scored practice occasional 4 level of practice on an appropriate management by using infectious waste incinerator. Total 185 respondents; practice occasionally 84 persons (45.4 percent), practice irregularly 51 persons (27.6 percent) practice regularly 40 persons (21.6 percent) and never practice 10 persons (5.4 percent)

6.1.3 Results of the Hypothesis Testing

Knowledge on an appropriate management of general medical staff depend on work duration

According to the analysis of relationship between knowledge on an appropriate management by using infectious waste incinerator and work duration knowledge did not rest on work duration with statistical significance of 0.05. The result was not in accordance with the research hypothesis.

Therefore, the hypothesis I was rejected.

Knowledge on an appropriate management of general medical staff depend on an appropriate management training

According to the analysis of relationship between knowledge on an infectious waste management and an appropriate management training, knowledge on an infectious waste management hinged on an appropriate management training with statistical significance of 0.05. The result is in keeping with the research hypothesis.

Therefore, the hypothesis II was accepted.

Practice on an appropriate management of general medical staff depend on work duration

According to the analysis of relationship between practices on an appropriate management and work duration, practices on an appropriate management hinged on work duration with statistical significance of 0.05. The result is in keeping with the research hypothesis.

Therefore, the hypothesis III was accepted.

Practice on an appropriate management of general medical staff depend on an appropriate management training

According to the analysis of relationship between practices on an infectious waste management and an appropriate management training, practices on an appropriate management hinged on an infectious waste management training with statistical significance of 0.05. The result is in keeping with the research hypothesis.

Therefore, the hypothesis IV was accepted.

Practice on an appropriate management of general medical staff hinge on knowledge on an appropriate management.

The analysis of relationship between practice on an appropriate management and knowledge, practice on an appropriate management did not hinge on an appropriate management with statistical significance of 0.05. The result was not in accordance with the research hypothesis.

Therefore, the hypothesis V was rejected.

6.1.4 An Appropriate of An appropriate management by using infectious waste incinerator in Hospital of Hospital Director

1. An appropriate management by using infectious waste incinerator in hospital of Ministry of Public Health Policy

Bamras-naradoon hospital acknowledged the policy of the ministry but the hospital had it own policy. Pranangklao Hospital said the ministry's policy is the main policy of the hospital. However both of them didn't explain about what is the

policy of the ministry because they didn't pay attention, so they didn't know the detail of the policy. That is the reason why they could not explain.

2. An appropriate management by using infectious waste incinerator in your working hospital.

Both of hospitals didn't have the realistic policy but only 5 regulations as follow

1. placenta must be disposed into the water treatment plant
2. Infectious waste must be separated from normal wastes
3. Safety Committee has uncharged about environmental care and safety in the hospital buy the scope of work has still not cleared.

3. Budget for an appropriate management by using infectious waste incinerator

Bamras-naradoon Hospital is concerned about fuel cost and worker salary which is different from Pranangklao Hospital, only the maintenance cost of incinerator per year is around 1,000,000 bht. inculcating the efficiency of incinerator is high because the hospital is realized about infectious waste problem which effected to general people and set the high budget for incinerator. In the future Pranangklao Hospital will issue the main policy for infectious waste and incinerator

4. Assign sub-ordinate to practice follow by policy

Bamras -naradoon has assigned the Particle department to take care of incinerator worker and set the training corers to separate infectious waste, Pranangklao has set the environmental and safety committee in order to improve the environment and safety in the hospital.

5. Pursuit and assessment

Both of hospital just only check infectious wastes generation rates, fuel assumption and have to check smoke and smell during burning combustion but have no correspondent plan

6. Problems and impediments

Bamras- naradoon mentioned that the problem has been salved after the training because the volume of infectious waste is decreased, low fuel cost, no black smoke and bad smell. Pranangklao Hospital mentioned that if the incinerator has a problem they con check the volume of Methane

7. Guidelines to improve

Bamras-naradoon Hospital Director suggested this issue improved by officer of the Department of Health and infectious wastes incinerator will be maintenance it out of order and Pranangklao Hospital Director mentioned if infectious wastes increase of generation rates will be set up training again. Both of hospitals have no record found for this issue.

6.1.5 An appropriate management by using infectious waste incinerator in hospital policy informed by infectious waste disposal staff

Information found infectious waste disposal staff did not know about an appropriate management and an appropriate management by using infectious waste incinerator policy just to know all of infectious wastes have to be burned check up smoke and smell and have to clean up storage area and infectious waste to company. And about policy informed by infectious waste disposal staff of 2 hospitals found infectious waste disposal staff of Bamras-naradoon Hospital told that they informed policy from Hospital Director to daily service infectious waste incinerator before burning operation, Pranangklao infectious wastes disposal staff informed policy from Medical Department to separate infectious wastes from normal wastes and defect pollutant during burning operation infectious wastes disposal staff of Bamras-naradoon told that they practice based on policy and that policy match their practice duty buy infectious waste disposal staff of Pranangklao Hospital told that the policy rarely match his practice duty cause of low quality of a veil apron gloves and boots and separation of infectious wastes and normal wastes it is difficult because they practice incorrect way for along time

6.2 Recommendation of the Research

Health care waste management policy is only effective if it is used daily, consistently and occurately. Training employees in implementing the policy is critical to a successful health care waste management program. Training will provide orientation for new employees and for existing employees with new responsibilities, and should be modified if methods and requirements change.

Training should focus on all principles of health care waste management as discussed throughout this guide. It also should highlight employees' responsibilities and where they fit into the entire management program.

The health care risk waste collection portion of the management policy should include:

1. A list of persons responsible for collection
2. Collection schedule
3. Internal transport routes
4. Use of personal protective equipment
5. Decontamination and cleaning procedures for waste collection carts and storage areas
6. Use, maintenance and security of the storage area.

Effectiveness for Health Care Waste Management

Identify present technical aspects, functions and personnel involved in the production, handling, and management of health care waste

1. Assess the costs associated with present waste management
2. Define management policies for waste management to be used in the future
3. Train employees in policy, health and safety procedures
4. Analyze technical procedures. Costs and policies annually to identify if additional, better practices can be adopted.

Each of Department Should to Keep Records About

1. Amounts of waste generated in each department
2. Amounts of waste generated for entire facility

3. Direct costs for supplies and materials used for collection, transport, storage, treatment, disposal, decontamination, and cleaning
4. Costs for labor and materials for training
5. Costs for labor and materials for occupational health activities such as immunizations, needle sticks and other injuries, and post-exposure treatments
6. Costs for repairs and maintenance of incinerator or other treatment technology
7. Costs for contractor services

An appropriate management by Using Infectious Waste Incinerator Should to

1. Reduction of waste volume, weight
2. Waste unrecognizable after treatment
3. Acceptable for all waste types
4. Heat recovery potential

However under the present economic climate, there are second thoughts about this alternative. On the other hand, locally built incinerators, often constructed with "folk wisdom", tend to be rejected by the neighborhoods due to problems with odor and smoke. The main differences between locally built hospital waste incinerators and imported ones are that the latter are invariably of higher price sometimes 3-4 times higher and that their quality and performance in terms of waste destruction effectiveness and emission control efficiency are superior. Examples of countries of origin of these imported products include such developed nations as Germany, the United States, France, and Japan. As to the locally built incinerators, their quality is still unreliable and emissions resulting from the combustion process are problematic. Although Thai regulatory standards on the control of pollutant emissions from the incineration of hospital wastes are not yet in place, it is envisaged that the Ministry of Public Health would soon issue an ministerial announcement to this effect.

6.3 Recommendation for the Further Research

The problems in an appropriate management of infectious wastes from the hospitals have difference in many conditions such as the difference in size of hospitals will have difference in resources and facilities are personnel' quality and budget, so manufactured problems.

The recommendations for the Further Research were as below ;

1. The comparison the correct and incorrect of assessment regarding infectious waste management.
2. The management of infectious wastes in the hospitals.
3. The research about the standard in infectious wastes management in Thailand.
4. The research for development in tools of infectious wastes management in Thailand.
5. The research and development of communication system about higher efficiency in the infectious wastes management.
6. The research of handbook improved for conveniently of infectious wastes management.

7. The research of policy and scheme of the infectious wastes management by using infectious wastes incinerator in hospitals.
8. The research of standard infectious wastes management to find the problems and impediments.
9. The research of infectious wastes incinerator types to recover excellent efficiency incinerator to desire for each hospital.
10. The research comparison of personal protective of the infectious wastes of hospital's disposal staff in hospital.
11. The research of budget for infectious wastes management by using infectious wastes incinerator in hospitals.
12. The research abuse and frame of ashes storage by burning operation infectious wastes incinerator.

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APPENDIX A

Indepth-Interview and Questionnaires for Research on An Appropriate Management by Using Infectious Waste Incinerator : A Case Study of Hospital Under The Ministry of Public Health in Nonthaburi.

Faculty of Social Sciences and Humanities
Mahidol University, Salaya Amphur
Buddhamonthol Nakornphatom 73170

June 14, 2001

Subject: Request for cooperation in interview and answering questionnaire
To: Hospital Director

Mrs.Tarinee Navanuja the student of Education (Environmental Education) Faculty of Social Sciences and Humanities Mahidol University have to collect the data for thesis concerns with "An Appropriate Management by using Infectious waste Incinerator: A Case Study of Hospital under The Ministry of Public Health in Nonthaburi" Assistant Professor Subphachai Sukarawan, M.S. is Major - Advisor. In case study , student request collect data by interview and questionnaire with you, medical personnel in Operation Department - Medicine Department - Surgery Department - Obstetrics and Gynae Department - Pediatrics Department - Pediatrics Department and Infectious Waste Disposal Staff during June to July 2001.

Faculty of Social Sciences and Humanities request for your kind.

Sincerely yours,

(Asst. Jiraporn Jukpaiwong)
Asst. Dean, Faculty of Graduate Studies

ที่ ทม 0812/3993

คณะสังคมศาสตร์และมนุษยศาสตร์
มหาวิทยาลัยมหิดล ศาลายา
อ. พุทธมณฑล จ. นครปฐม 73170

14 มิถุนายน 2544

เรื่อง ขอความอนุเคราะห์เก็บข้อมูล

เรียน ผู้อำนวยการโรงพยาบาลโรคทรวงอก

ด้วย นางวิชชุภรณ์ นวานุช นักศึกษาปริญญาศึกษาศาสตรมหาบัณฑิต สาขาวิชาสิ่งแวดล้อมศึกษา คณะสังคมศาสตร์และมนุษยศาสตร์ มหาวิทยาลัยมหิดล กำลังทำวิทยานิพนธ์เรื่อง ความรู้และพฤติกรรม การจัดการมูลฝอยติดเชื้อ โดยใช้เตาเผามูลฝอยติดเชื้อ ของบุคลากรทางการแพทย์ : ศึกษาเฉพาะกรณีโรงพยาบาลในสังกัดกระทรวงสาธารณสุขในเขตจังหวัดนนทบุรี โดยมี ผู้ช่วยศาสตราจารย์ ศุภชัย ศุกรวรรณ เป็นอาจารย์ผู้ควบคุมวิทยานิพนธ์ ในการนี้ นักศึกษามีความประสงค์ใคร่ขอความอนุเคราะห์ขอเข้าทำการเก็บรวบรวมข้อมูลโดยการสัมภาษณ์ และใช้แบบสอบถาม กับท่าน และพยาบาลตึกผู้ป่วยนอก , ตึกผู้ป่วยในแผนกอายุรกรรม , ตึกผู้ป่วยในแผนกศัลยกรรม , ตึกผู้ป่วยในแผนกนรีเวชศาสตร์ , ตึกผู้ป่วยในแผนกกุมารเวช และผู้กำจัดมูลฝอยติดเชื้อ ระหว่างเดือนมิถุนายน – กรกฎาคม 2544 เพื่อนักศึกษาจักได้นำข้อมูลที่จะได้ไปประกอบในการทำวิทยานิพนธ์ ต่อไป

คณะสังคมศาสตร์และมนุษยศาสตร์ จึงเรียนมาเพื่อโปรดพิจารณาให้ความอนุเคราะห์แก่นักศึกษาเพื่อการดังกล่าวด้วย จักเป็นพระคุณยิ่ง

ผู้อำนวยการโรงพยาบาลฯ (ผ่านรองผู้อำนวยการฝ่ายบริหาร)

ขอแสดงความนับถือ

20 กค 44

(รองศาสตราจารย์จิราพร จักรไพวงศ์)
รองคณบดี
ปฏิบัติราชการแทนคณบดีคณะสังคมศาสตร์และมนุษยศาสตร์

สำนักงานคณบดี
โทร. 4410220-3
โทรสาร 4419738

Indepth-Interview Title (Hospital Director)

Title

An appropriate Management by Using Infectious Waste Incinerator: A Case study of Hospital under The Ministry of Public Health in Nonthaburi

Part 1: Personal Data of Replier

Please answer the following questions by mark " ✓" into ( ) and fill in the blank.

1. Sex
   ( ) Male ( ) Female
2. Age.....years.
3. Work duration.....years.
4. Working hospital
   ( ) Pranangklao ( ) Bamras-naradoon
5. Job title.....
6. Highest qualification.....

Part 2: Policy of Infectious Waste Management by Using Infectious Waste Incinerator in the Hospital

1. Have you informed policy of infectious waste management by using infectious waste incinerator in hospital of Public Health Ministry or not? And how?
   .....
   .....
   .....
   .....
   .....

2. How policy of infectious waste management by using infectious waste incinerator in your working hospital?

.....

.....

.....

.....

3. Do you obtain budget for infectious waste management by using infectious waste incinerator, or not? And how?

.....

.....

.....

.....

4. Do you assign an infectious waste management by using infectious waste incinerator to sub-ordinate to practice or not ? And how?

.....

.....

.....

.....

5. If your answer in question 4 is "yes". How your pursuit and assessment?

.....

.....

.....

.....

After pursuit and assessment. Do you have any problems and impediments, or not? And How?

.....

.....

.....

.....

6. How your guidelines to improve an appropriate management by using infections waste incinerator in your working hospital?

.....

.....

.....

.....

Questionnaire (General Medical Staff)

Title

An appropriate Management by Using Infectious Waste Incinerator: A Case Study of Under The Ministry of Public Health in Nonthaburi

Part 1: Personal Data of Replier

Please answer the following questions by mark " ✓" into ( ) and fill in the blank.

1. Sex
   ( ) Male ( ) Female
2. Age.....years.
3. Work duration .....years.
4. Working hospital
   ( ) Pranangklao ( ) Bamras-naradoon
5. Job title
   ( ) Chief of ward ( ) Scientist
   ( ) Chief of laboratory ( ) Clerk of Science
   ( ) Nurse ( ) Medical Technologist
   ( ) Assistant of nurse ( ) i.e.(please specific).....
6. Highest qualification
   ( ) Certificate of nurse ( ) Bachelor degree
   ( ) Higher than Bachelor degree ( ) i.e. (please specific)
7. Working department
   ( ) Operation ( ) Obstetrics and Gynae
   ( ) Medicine ( ) Pediatrics
   ( ) Surgery
8. Have you been trained on an appropriate management by using infectious waste incinerator?
   ( ) Yes ( ) No

Part 2: Knowledge on an appropriate Management by using Infectious Waste Incinerator in the Hospital.

Please mark " ✓"at your answer

Texts	Yes	No
1. Knowledge on an appropriate 1.1 All wastes from hospital activities are infectious wastes. 1.2 Examples of Infectious wastes are cotton, gauze, needle, blazes, blood bag, saline bag, rubber gloves, waster tube, saline tube, part of body,placenta, wasters from tested animal and slides. 1.3 Wastes with disease contamination such as used gauze, banners, cotton may cause infection. 1.4 Infectious wastes from hospital lead to the disease contamination in naturopathy, respiratory system, tuberculosis or enter hepatitis. 1.5 Some wastes from hospital activities can be recycled. **2. Knowledge of Infectious Waste Disposal** 2.1 Have you ever been trained on infectious waste disposal from your own organization ? 2.2 Have you conveyed the infectious waste disposal policy to your sub-ordinates for real world practicing? 2.3 Infectious wastes such as cotton, gauzes, syringe, needle should be disposed in the black plastic bag. 2.4 Infectious wastes such as blood bag , saline bag, rubber gloves, part of body, wastes from tested animals, slides should be disposed in the red plastic bag. 2.5 Food leftover from non-patients should be crumble disposed in the red plastic bag. 2.6 Infectious waste should be germ-killed by Antiseptics only. 2.7 All waste bags should be gathered to a single spot before sorting for final disposal.		

Part 2: Knowledge on an appropriate Management by using Infectious Waste Incinerator in the Hospital. (cont.)

Texts	Yes	No
2.8 Wastes should be transferred by cart only. 2.9 Infectious wastes should be transferred for disposal in separation from the normal wastes. 2.10 Infectious wastes disposal should be germ-killed before being buried. 2.11 Infectious wastes should be disposed by burning in the infectious waste incinerator only. 2.12 The most appropriate disposal method for all hospital wastes is burning in the infectious wastes incinerator. 2.13 Sorting of wastes before dumping and disposing should be done by the cleaning staff only. 2.14 Antiseptics must be used to clean up the floor where the infectious wastes leak from the bags during transportation. 2.15 Infectious waste contaminated by blood or blood products should be germ-killed by antiseptics before being fed into the infectious waste incinerator. 2.16 All infectious wastes should be steamed before being fed into the infectious waste incinerator. 2.17 Materials used to contain or wrap the medical instruments should be disposed in the black plastic bag. 2.18 All wastes from the microbiological Laboratory should be autoclaved before being disposed in the bag. 2.19 At the central waste storage room of the hospital infectious wastes should be separated from the normal wastes. 2.20 Infectious waste bags should be carried at the top or held with care, no dragging is allowed to avoid the leakage. **3. Knowledge on an appropriate incinerator infectious waste.**		

Part 2: Knowledge on an appropriate Management by using Infectious Waste Incinerator in the Hospital. (cont.)

Texts	Yes	No
3.1 Burning the infectious waste in the incinerator can eliminate all germs in the wastes.		
3.2 Burning process of the infectious waste incinerator will not create pollutant .		
3.3 The temperature in the waste and the smoke burning chamber should be between 600-100 degree celsius.		
3.4 Before the infectious waste burning, the burning chamber should be set up to not less than 400 degree celsius.		
3.5 The most suitable fuel for the infectious waste incinerator is natural gas.		
3.6 Normally, infections waste burning in the infectious waste incinerator tends to create odor and smoke as well as soot during operation.		
3.7 The infectious waste incinerator of any system should be operated continuously and automatically.		
3.8 The temperature of smoke from the infectious waste incinerator should be lowered to around 200-400 degree celsius before reaching the external Atmosphere.		
3.9 Water spraying to the smoke emitting shaft of the infectious waste incinerator. Is the most appropriate way to lower the Temperature of such shaft.		
3.10The poison elimination at the shaft should Be wet process by spraying lime or an Alkali into the smoke emitting shaft, known As " Wet Scrubber"		
3.11Waste water from the infectious waste incinerator Disposed by chemical treatment only.		
3.12All infectious waste incinerator Used in the hospital should be facilitated With polluted air or dust control devices.		

Part 2: Knowledge on an appropriate Management by using Infectious Waste Incinerator in the Hospital. (cont.)

Texts	Yes	No
3.13 All infectious waste incinerator Used in the hospital should be facilitated With polluted air or dust control devices.		
3.14 Infectious waste incinerator used in The hospital should be "Excess Air" Type.		
3.15 Gas residual from perfect combustion is Carbon – dioxide and steam. Gas residual from perfect combustion is Carbon – monoxide		

Part 3: Practice on an appropriate Management by Using Infectious Waste Incinerator in the Hospital

Please mark " ✓" at your practice.

Texts	Practice Regularly	Practice Occasionally	Practice Irregularly	Never Practice
1. While you working, you wear a veil, apron and gloves.				
2. After worked, you separate infectious wastes form normal wastes.				
3. Examples of infectious wastes are cotton, gauze, blazes and gloves you Dispose in the red plastic bag.				
4. Examples of infectious wastes are cotton, gauze, blazes and glove you dispose in the black plastic bag.				

Part 3: Practice on an appropriate Management by Using Infectious Waste Incinerator in the Hospital (cont.)

Texts	Practice Regularly	Practice Occasionally	Practice Irregularly	Never Practice
5. Part of body, wastes form tested animal and slides you dispose in the black plastic bag.				
6. Part of body, wastes form tested animal and slides you dispose in the red plastic bag.				
7. Water tube, saline tube you reuse it again.				
8. You reuse, saline tube you reuse it again				
9. Before dispose wastes, you will germ-killed by antiseptics.				
10. You left lover crumble food of infectious patient in red plastic bag.				
11. You move infectious wastes bags to the disposed area.				
12. You dispose infectious wastes in the black plastic bag.				
13. You clean up the floor where the infectious wastes leak from the bag.				
14. When your hospital had been trained on an appropriate management.				

Part 3: Practice on an appropriate Management by Using Infectious Waste Incinerator in the Hospital (cont.)

Texts	Practice Regularly	Practice Occasionally	Practice Irregularly	Never Practice
15. Have you protect your self during working hour?				
16. You go to infectious waste incinerator?				
17. If you have a free time, you will read on an appropriates handbook.				
18. In case of emergency, you leave infectious wastes in the red plastic bag.				
19. You leave infectious wastes in the right bag, though located further away.				

Indepth-Interview (Infectious Waste Disposal Staff)

Title

An Appropriate Management by using Infectious Waste Incinerator :
A Case Study of Hospital under The Ministry of Public Health in Nonthaburi

Part 1 : Personal Data of Replier

Please answer the following question by mark "✓" into ( ) and fill in the blank

1. Sex
   ( ) Male ( ) Female
2. Age.....years.
3. Work duration .....years.
4. Working hospital
   ( ) Pranangklao ( ) Bamras – naradoon
5. Job title.....
6. Highest qualification.....
7. Have you been trained on an appropriate management by using infectious waste incinerator?
   ( ) Yes ( ) No

Part 2 : Knowledge on an appropriate Management by Using Infectious Waste Incinerator in the Hospital.

Please mark " ✓" at your answer

Texts	Yes	No
1. Knowledge on an appropriate		
1.1 All wastes from hospital activities are Infectious wastes.		
1.2 Examples of Infectious wastes are cotton, Gauze, needle, blazes, blood bag, saline, Bag, rubber gloves, water tube, saline tube, Part of body, placenta waters from tested Animal, slides.		
1.3 Wastes with disease contamination such as Used gauze, banners, cotton may cause Infection.		
1.4 Infectious wastes from hospital lead to the Disease contamination in gastropsthy, Respiratory system, tuberculosis or Enter hepatitis.		
1.5 Some wastes from hospital activities can Be recycled.		
2. Knowledge of infectious Waste Disposal		
2.1 Have you ever been trained on an appropriate disposal from your own Organization?		
2.2 Have you conveyed the infectious waste Disposal policy to your sub-ordinates for Real world practicing?		
2.3 Infectious wastes such as cotton, gauze, Syringe, needle should be disposed in the Black plastic bag.		
2.4 Infectious wastes such as blood bag, saline bag, rubber gloves, part of body, wastes from tested animals, slides should be Disposed in the red plastic bag.		
2.5 Crumble Food leftover from non-patients should be Disposed in the red plastic bag.		
2.6 Infectious waste should be germ-killed by antiseptics only.		
2.7 All waste bags before sorting for final Disposal.		

Part 2 : Knowledge on an appropriate Management by Using Infectious Waste Incinerator in the Hospital. (cont.)

Texts	Yes	No
2.8 Wastes should be transferred by cart only.		
2.9 Infectious wastes should be transferred for disposal in separation from the normal wastes.		
2.10 Infectious wastes disposal should be germ- killed before being buried.		
2.11 Infectious wastes should be disposed by burning in the infectious waste incinerator only.		
2.12 The most appropriate disposal method for all hospital wastes is burning in the infectious waste incinerator.		
2.13 Sorting of wastes before dumping staff only.		
2.14 Antiseptics must be used to clean up the floor where the infectious wastes leak from the bags transportation.		
2.15 Infectious wastes contaminated by blood or blood products should be germ- killed by antiseptics before being fed into the infectious waste incinerator.		
2.16 All infectious waste should be steamed before being fed into the infectious waste incinerator.		
2.17 Materials used to contain or wrap the medical instruments should be disposed in the black plastic bag.		
2.18 All wastes from the microbiological laboratory should be autoclaved before being disposed in the bag.		
2.19 At the central waste storage room of the hospital, infectious wastes should be separated from the normal wastes.		
2.20 Infectious waste bags should be carried at the top or held with care, no dragging is allowed to avoid the leakage.		
3. Knowledge on an appropriate Incinerator		

Part 2 : Knowledge on an appropriate Management by Using Infectious Waste Incinerator in the Hospital. (cont.)

Texts	Yes	No
3.1 Burning the infectious waste in the infectious waste incinerator can eliminate all germs in the wastes.		
3.2 Burning process of the infectious waste incinerator will not create pollution.		
3.3 The temperature in the waste and the smoke burning chamber should be between 600-100 degree celsius.		
3.4 Before the infectious waste burning, the burning chamber should be set to not less than 400 degree celsius.		
3.5 The most suitable fuel for the infectious waste incinerator is natural gas.		
3.6 Normally, infectious waste burning in the infectious waste incinerator tends to create odor and smoke as well as soot during operation.		
3.7 The infectious waste incinerator of any system should be operated continuously and automatically.		
3.8 The temperature of smoke from the infectious waste incinerator should be lowered to around 200-400 degree celsius before reaching the external atmosphere.		
3.9 Water spraying to the smoke emitting shaft of the infectious waste incinerator is the most appropriate way to lower The temperature of such shaft.		
3.10 The poison elimination at the shaft should be wet process by spraying lime or an alkali into the smoke emitting shaft, Known as "Wet Scrubber"		
3.11 Waste water from the infectious waste incinerator should only.		
3.12 All infectious waste incinerator used in the hospital should be facilitated with polluted air or dust control devices.		

Part 2 : Knowledge on an appropriate Management by Using Infectious Waste Incinerator in the Hospital. (cont.)

Texts	Yes	No
3.13 Infectious waste incinerator used in the hospital should be "Excess Air" type rather than "Standard Air" type.		
3.14 Gas residual from perfect combustion is carbon-dioxide and steam.		
3.15 Gas residual from imperfect combustion is carbon-monoxide.		

Part 3 : Practice on an appropriate Management by Using Infectious Waste Incinerator in the Hospital

Please mark "✓" at your practice

Texts	Practice Regularly	Practice Occasionally	Practice Irregularly	Never Practice
1. While you working, you wear a veil, apron, gloves and boots.				
2. You had injured from carried infectious wastes bags.				
3. You have to control operating system of infectious waste incinerator.				
4. Infectious wastes burned with normal Wastes if there are no more.				
5. You go to see the doctor if you' re Got ill cause of burning infectious Wastes, such as cough, sneeze or Rasp.				
6. After daily duty, you take off the gloves, Apron , a veil and				

Part 3 : Practice on an appropriate Management by Using Infectious Waste Incinerator in the Hospital (cont.)

Texts	Practice Regularly	Practice Occasionally	Practice Irregularly	Never Practice
boots keep in detergent.				
7. You found infectious wastes mix normal wastes in one bag.				
8. Normally, Infectious wastes germ killed by antiseptics before burning.				
9. You divide infectious wastes and chemical wastes before burning.				
10. Infectious wastes mix burned with burned with radioactive wastes.				
11. Infectious wastes have burned once a day.				
12. You clean up the floor where the Infectious wastes fallen.				
13. You clean up the floor and infectious waste incinerator after burning.				
14. Your duty have to burn both of infectious wastes and normal wastes.				
15. Burning infectious waste process about 2-3 hours/time.				
16. You cheek up accessories waste incinerator after burning.				

Part 3 : Practice on an appropriate Management by Using Infectious Waste Incinerator in the Hospital (cont.)

Texts	Practice Regularly	Practice Occasionally	Practice Irregularly	Never Practice
17. You're not sure which is infectious waste or not				
18. You have to eliminate ash after infectious wastes burning process.				
19. You compile infectious wastes bags and separate normal waste from infectious wastes before burning.				
20. The infectious waste incinerator should before burning process.				

Part 4 : Policy on an Appropriate Management by Using Infectious Waste Incinerator in the Hospital.

1. How policy of infectious waste management in your working hospital ?
   .....
   .....
   .....
   .....

2. How policy of infectious waste management by using infectious waste incinerator in your working hospital ?
   .....
   .....
   .....
   .....

3. Who you infectious policy of infectious waste management by using infectious waste incinerator in your working hospital? Please describe these policy.
   .....
   .....
   .....
   .....

4. Do you practice follow policy? Do the policy match your practice duty, or not? and how?
   .....
   .....
   .....
   .....

5. Do you protect yourself during working hour, or not? and how?
   .....
   .....
   .....
   .....

Answer to Test of Knowledge on an Appropriate Management by using Infectious Waste Incinerator

1.1 No	2.16 Yes
1.2 No	2.17 Yes
1.3 Yes	2.18 Yes
1.4 Yes	2.19 Yes
1.5 Yes	2.20 No
2.1 Yes	3.1 No
2.2 Yes	3.2 Yes
2.3 No	3.3 No
2.4 No	3.4 No
2.5 No	3.5 No
2.6 Yes	3.6 No
2.7 No	3.7 Yes
2.8 Yes	3.8 Yes
2.9 Yes	3.9 Yes
2.10 No	3.10 Yes
2.11 Yes	3.11 No
2.12 No	3.12 Yes
2.13 No	3.13 Yes
2.14 Yes	3.14 No
2.15 Yes	3.15 Yes

Government section: Pranangklao Hospital

1 September 1999

Title: Regrets to separate in right method for saving infectious wastes burning cost.
To: Head of Department / Head of section

In connection with the Mistune of Public Health's policy to transfer the duty of wastes incineration to a local authority and the hospital's defective wastes incinerator as well as its inefficiency in incineration, Pranangklao hospital has the provincial Administration Body to handle the incineration of red-bag wastes since 6 September 1999. The incineration costs 9 bath / kilo.

The hospital would hereby like to ask all personnel's kind cooperation to sort out the wastes especially the red wastes bags which should contain only infectious wastes. Please items

(IC pouches or glass bottles) must be separated from the infectious wastes according to the hospital's IC committee's advice to help save the hospital's wastes incinerate on budget.

Please be in formed accordingly. Thank you.

Mr. Utai Suparb

Incharged of Pranangklao
Hospital Director

บันทึกข้อความ

ส่วนราชการ.....โรงพยาบาลพระนั่งเกล้า.....

ที่.....วันที่.....1.....เดือน.....กันยายน.....พ.ศ. 2542.....

เรื่อง.....ขอให้ช่วยแยกแยะขยะให้ถูกวิธีเพื่อประหยัดเงินค่าเผาขยะติเชื้อ.....

เรียน หัวหน้าฝ่าย/หัวหน้ากลุ่มงาน และหัวหน้างานทุกท่าน

ด้วยโรงพยาบาลพระนั่งเกล้าได้ดำเนินการจัดจ้าง องค์การบริหารส่วนจังหวัดให้ดำเนินการเผาขยะติดเชื้อถุงแดง ตั้งแต่วันที่ 6 กันยายน 2542 เนื่องจากเตาเผาขยะติดเชื้อของโรงพยาบาลชำรุด และไม่มีประสิทธิภาพในการเผาแล้ว ประกอบกับกระทรวงสาธารณสุขมีนโยบายถายโอนภารกิจในการกำจัดขยะติดเชื้อให้กับองค์กรบริหารส่งนท้องถิ่น รับไปดำเนินการแทน ซึ่งอัตราค่าใช้จ่ายในการให้องคีการบริหารส่วนจังหวัดเผาทำลายอยู่ที่กิลโกรัมละ 9 บาท

โรงพยาบาลจึงใคร่ขอความร่วมมือจากเจ้าหน้าที่ทุกคนช่วยคัดแยกขยะโดยเฉพาะขยะติดเชื้อถุงแดง ขอให้ทิ้งเฉพาะขยะติดเชื้อเท่านั้น ส่วนที่เป็นพลาสติก (ถุงน้ำเกลือ หรือขวดแก้ว) ให้แยกออกจากขยะติดเชื้อ ตามที่คณะกรรมการ IC โรงพยาบาลได้แนะนำไว้ เพื่อช่วยโรงพยาบาลประหยัดค่าใช้จ่ายในการเผาขยะต่อไป

จึงเรียนที่เพื่อโปรดช่วยกันดำเนินการต่อไป

นายแพทย์ 9 (ด้านเวชกรรม สาขาศัลยกรรม)
รักษาการแทนในตำแหน่ง ผู้อำนวยการ

In – house Waste Management of Pranangklao Hospital

All personnel in the hospital compound where wastes can be produced are responsible to sort out the wastes according to the categories prescribed by the Hospital's Infectious Control and Prevention Board. For patient' relatives or otherwise, the department in charge must propagate proper waste management so that they can properly sort out the waster. Liquid waste must be flushed in the toilet or drained in a sink first.

Instructions

1. Choose the color of the wastes bag according to the type of wastes produced by such department.
2. Choose the size of the wastes bag proportionate to the wastes pail and the amount of wastes produced or littered daily. The longer than the wastes bag should be a quarter of the pail's height longer than the pail.
3. Collect the wastes daily or when it's full by tying the part of the bag extending from the pail with a plastic rope tightly with the least amount of air trapped in the bag to prevent breakage when removed.
4. Make sure there's no breakage and that the bag's tied properly. Then, collect all the wastes bags into a wastes truck with care, taking them by the upper part from the tie. DO NDT TPROW OR DRAG. Categorize the wastes for convenient handling at the wastes dump or large sort-out pails by the time scheduled.
5. Infectious waste disposal staff must wear proper personal protection aids; namely, rubber apron, thick rebel gloves, mouth and nose masks, boots and a hat.
6. Clean the infectious wastes cart arteries and do not use the infectious wastes cart with other activities
7. Care concerning the use of the rubber gloves must be taken when removing the infectious wastes bags. Take off the gloves before touching the door or other clean materials.
8. Take the wastes to the wastes dump immediately. No stopping on the
9. If any part of the in fact wastes drops on the floor when removed or on the way, pick it up into a red bag with thick rubber gloves or metal gripping tool. Clean the floor with cleaning solution (0.5% Hypo chloride or 2% Lysol). Leave for 30 minutes before washing off.
10. Take off protection aids. Clean and sterilize them according to prescribed standard.
11. Wash hands and body immediately.

Protection and Disease Control in Hospital
September, 1999

การจัดการมูลฝอยภายในหน่วยงาน โรงพยาบาลพระนั่งเกล้า

บุคลากรในแหล่งกำเนิดมูลฝอยภายในโรงพยาบาลทุกแห่ง จัดการคัดแยกประเภทของมูลฝอยตามที่คณะกรรมการป้องกันและควบคุมการติดเชื้อในโรงพยาบาลกำหนด ในส่วนที่มีญาติผู้ป่วยหรือผู้ใช้บริการอื่น ๆ หน่วยงานนั้น ๆ ต้องประชาสัมพันธ์เกี่ยวกับการจัดการมูลฝอย ให้สามารถแยกมูลฝอยทิ้งได้ถูกต้อง มูลฝอยส่วนที่เป็นน้ำให้แยกทิ้งในชักโครก หรืออ่างซักล้างก่อน **โดยมีขั้นตอนดังนี้**

1. เลือกสีถุงมูลฝอยตามประเภทมูลฝอยของหน่วยงาน
2. เลือกขนาดของถุงมูลฝอยให้เหมาะกับภาชนะที่รองรับ และปริมาณการเกิดมูลฝอยในแต่ละวัน โดยให้ความยาวของถุงเลยจากถัง 1/4 ของความสูงของถัง
3. เก็บมูลฝอยในแต่ละวัน หรือเมื่อมูลฝอยเต็มถัง โดนผูกส่วนที่เลยออกจากตัวถังด้วยเชือกพลาสติกให้แน่น ไม่ให้มีอากาศค้างในถุง เพราะอาจทำให้ถุงแตกขณะเคลื่อนย้ายได้
4. ตรวจสอบถุงมูลฝอยว่าไม่มีการรั่ว คอถุงผูกเชือกเรียบร้อย เก็บรวบรวมถุงมูลฝอยในรถมูลฝอย ยกวางอย่างนุ่มนวล โดยจับที่คอถุง ห้ามโยนหรือลาก โดยแยกตามประเภทของมูลฝอยเพื่อสะดวกต่อการนำไปที่เรือนพักมูลฝอยหรือถังบรรจุมูลฝอยขนาดใหญ่แต่ละประเภท ตามเวลาที่กำหนด
5. ผู้ทำหน้าที่ในการเก็บรวบรวมมูลฝอยติดเชื้อต้องใส่อุปกรณ์ป้องกันส่วนบุคคลที่เหมาะสม คือ ผ้ายางกันเปื้อน, ถุงมือยางหนา, ผ้าปิดปากและจมูก, รองเท้าบูท, หมวก
6. ทำความสะอาดรถเข็นมูลฝอยติดเชื้อก่อนนำกลับ และไม่ใช้รถมูลฝอยติดเชื้อกับกิจ-กรรมอื่น ๆ
7. ระมัดระวังการใช้ถุงมือขณะขนส่งมูลฝอยติดเชื้อ ให้ถอดถุงมือออกก่อนสัมผัสประตู , ปุ่มลิฟต์, หรือการหยิบจับของสะอาดอื่น ๆ
8. ขนมูลฝอยตรงไปยังเรือนพักมูลฝอยทันที ไม่แวะทำธุระที่อื่น ๆ
9. ถ้ามีมูลฝอยติเชื้อตกหล่น ขณะเคลื่อนย้ายหรือระหว่างทาง ให้เก็บใส่ถุงแดงด้วยถุงมือยางหนาหรือใช้ปากคีบหยิบ ทำความสะอาดพื้นที่เปื้อนด้วยน้ำยาฆ่าเชื้อ (0.5% Hypo chlorite, หรือ 2% Lysol) ทิ้งไว้ 30 นาที ก่อนล้างตามปกติ
10. ถอดอุปกรณ์ป้องกันทำความสะอาดและฆ่าเชื้อตามมาตรฐานที่กำหนด
11. ล้างมือ และทำความสะอาดร่างกายทันที

งานป้องกันและควบคุมการติดเชื้อในโรงพยาบาล

กันยายน พ.ศ. 2542

APPENDIX B

Reliability, Difficulty Power and Discrimination Power of Knowledge Test

Calculation of Accuracy of the Questionnaire

Table 18 Distribution of Try-Out Scores of Knowledge Test

Respondent No.	*Question Number*												
	1.1	*1.2*	*1.3*	*1.4*	*1.5*	*2.1*	*2.2*	*2.3*	*2.4*	*2.5*	*2.6*	*2.7*	*2.8*
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*
1	1	1	1	1	1	1	1	1	1	1	0	1	1
2	1	1	1	1	0	1	1	1	1	1	1	1	0
3	1	1	1	1	1	1	1	1	1	0	1	1	0
4	1	1	1	1	1	1	1	1	1	1	0	1	0
5	1	1	1	1	1	1	1	1	1	1	1	1	1
6	1	1	1	1	0	1	1	1	0	0	0	1	1
7	1	1	1	1	1	1	1	1	1	1	1	1	1
8	1	1	1	1	1	1	1	1	1	1	1	1	1
9	1	0	0	1	1	0	1	0	1	1	1	0	1
10	1	1	1	1	1	1	1	1	1	1	1	0	1
11	1	1	0	1	1	1	1	1	1	1	0	1	1
12	1	0	1	1	1	1	0	1	0	1	1	1	1
13	1	1	1	0	0	1	1	1	1	0	0	1	1
14	1	1	1	1	0	0	1	0	1	1	1	0	1
15	1	1	1	0	1	1	1	1	1	0	1	1	1
16	1	0	0	1	1	1	1	1	1	1	1	0	1
17	0	0	1	1	1	1	1	0	1	0	0	1	0
18	0	1	1	1	0	1	1	0	1	0	0	1	0
19	0	0	1	1	0	1	0	1	0	0	1	1	0
20	1	1	0	1	0	0	1	0	0	0	0	0	1
21	1	1	1	0	1	1	1	0	1	0	0	1	0
22	1	1	1	1	0	1	1	1	0	0	0	1	0
23	0	1	1	0	0	1	0	1	1	0	0	1	1
24	1	1	1	1	0	0	1	0	0	0	0	1	0
25	0	0	0	0	0	1	0	1	1	0	0	1	0
26	1	1	0	1	0	1	1	0	1	0	0	0	0
27	0	0	1	1	0	0	0	0	0	0	0	0	0
28	1	0	1	0	0	0	1	0	0	0	0	0	0
29	1	0	1	1	0	1	0	0	0	0	0	1	0
30	1	0	0	0	0	1	0	0	0	0	0	0	0
Total	*24*	*20*	*23*	*23*	*14*	*24*	*23*	*18*	*20*	*14*	*12*	*21*	*15*

Question Number														
2.9	***2.10***	***2.11***	***2.12***	***2.13***	***2.14***	***2.15***	***2.16***	***2.17***	***2.18***	***2.19***	***2.20***	***3.1***	***3.2***	***3.3***
14	***15***	***16***	***17***	***18***	***19***	***20***	***21***	***22***	***23***	***24***	***25***	***26***	***27***	***28***
1	1	1	1	0	0	1	1	1	1	1	1	1	1	1
1	0	1	1	1	1	0	1	1	1	1	1	0	1	1
1	1	1	1	0	0	1	0	1	0	1	1	0	0	1
1	0	1	1	0	1	0	1	1	1	1	1	1	1	0
1	1	0	0	0	1	1	0	1	0	1	1	1	1	1
1	1	1	1	1	1	1	0	1	1	1	1	0	1	0
1	1	1	1	1	1	0	1	0	1	1	0	0	1	1
1	1	1	1	1	1	0	0	1	0	1	0	0	0	0
1	1	1	1	1	1	1	1	1	0	1	1	0	1	1
1	1	1	1	1	1	0	1	0	0	0	1	0	1	1
1	1	0	1	1	1	0	0	0	0	1	0	1	1	1
1	1	1	1	0	0	0	1	0	1	1	0	1	0	1
1	1	1	1	0	1	1	0	1	0	1	1	0	1	0
1	0	1	0	1	1	1	1	0	0	1	1	0	1	0
0	0	0	1	1	1	0	1	0	0	1	0	0	1	0
1	0	1	1	0	1	1	0	0	1	0	0	1	0	1
0	1	0	0	0	0	0	1	0	1	1	1	1	1	0
1	1	1	0	0	1	0	1	1	0	1	1	0	1	0
0	0	1	1	1	0	1	1	0	0	1	0	1	1	0
1	1	1	0	0	1	1	0	1	1	1	1	0	0	1
0	1	1	0	1	1	1	0	0	0	0	1	0	1	0
1	1	1	1	0	1	1	0	0	0	1	0	0	0	0
1	0	1	0	1	0	0	0	0	0	1	1	0	1	0
1	0	1	0	0	0	0	0	0	0	1	0	0	0	0
1	1	0	0	0	0	0	0	0	0	1	1	0	1	0
1	0	0	1	0	0	0	0	0	0	1	0	0	0	0
0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
0	0	1	1	0	0	0	0	0	0	0	0	0	0	0
1	1	0	0	0	1	0	0	0	0	1	0	0	0	0
23	***19***	***21***	***19***	***12***	***18***	***12***	***12***	***11***	***9***	***24***	***16***	***8***	***18***	***11***

Question Number												*X*	X^2
3.4	*3.5*	*3.6*	*3.7*	*3.8*	*3.9*	*3.10*	*3.11*	*3.12*	*3.13*	*3.14*	*3.15*		
29	*30*	*31*	*32*	*33*	*34*	*35*	*36*	*37*	*38*	*39*	*40*		
1	0	0	1	1	1	1	1	1	1	1	1	35	1,225
1	1	1	0	1	1	1	0	1	1	1	1	33	1,089
1	0	1	1	1	1	1	1	0	1	1	1	30	900
1	1	1	0	0	0	0	1	1	1	1	1	30	900
0	1	0	0	1	1	1	0	1	0	0	1	29	841
0	1	0	1	0	1	1	1	1	1	0	1	29	841
0	0	1	0	1	0	0	1	0	0	0	1	28	784
0	0	1	1	0	1	0	0	1	1	0	1	27	729
1	0	0	0	0	1	1	0	1	0	0	0	25	625
0	0	1	1	0	1	0	0	0	0	0	0	25	625
1	0	0	0	0	0	0	0	1	0	1	0	23	529
1	0	0	1	0	1	1	0	0	0	0	0	23	529
0	0	0	1	1	0	0	0	0	0	1	1	23	529
1	0	0	1	0	0	1	0	1	0	0	0	22	484
0	1	1	0	1	0	1	1	0	0	0	0	22	484
0	1	1	0	0	1	0	1	0	0	0	0	22	484
1	1	1	0	1	1	0	1	0	0	1	0	21	441
0	0	0	1	0	1	0	1	1	1	0	0	21	441
1	0	1	1	0	0	0	1	1	0	1	1	21	441
0	0	1	0	0	1	0	0	1	0	0	1	20	400
0	0	1	0	0	0	0	0	0	0	0	1	18	324
0	0	0	0	0	0	0	0	0	0	1	0	16	256
0	0	0	0	0	0	0	0	0	0	0	0	13	169
0	0	0	0	0	1	0	0	0	0	1	1	12	144
0	0	1	0	0	0	0	0	0	0	0	1	11	121
0	0	0	0	0	0	0	1	1	0	0	0	11	121
0	0	0	0	1	1	1	0	1	1	0	1	9	81
0	1	0	1	0	0	1	0	0	1	0	0	8	64
0	0	0	0	0	0	0	0	0	0	0	0	7	49
0	0	0	0	0	0	0	0	0	0	0	0	6	36
10	*8*	*13*	*11*	*9*	*15*	*11*	*11*	*14*	*9*	*10*	*15*	620	14,686

Variance of total scores, using formula; $S_x^2 = \frac{n\Sigma x^2 - (\Sigma x)^2}{n(n-1)}$

$= 64.57$

Table 19 Analysis of Difficulty Power and Discrimination Power of Knowledge Test

Question No.	*R*	*Ru*	*Re*	*Ru-Re*	*P=R/N*	*R=(Ru-Re) (N/2)*
1	*24*	*8*	*5*	*3*	*0.80*	*0.200*
2	*20*	*8*	*3*	*5*	*0.67*	*0.333*
3	*23*	*8*	*5*	*3*	*0.77*	*0.200*
4	*23*	*8*	*4*	*4*	*0.77*	*0.267*
5	*14*	*6*	*0*	*6*	*0.47*	*0.400*
6	*24*	*8*	*5*	*3*	*0.80*	*0.200*
7	*23*	*8*	*3*	*5*	*0.77*	*0.333*
8	*18*	*8*	*2*	*6*	*0.60*	*0.400*
9	*20*	*7*	*3*	*4*	*0.67*	*0.267*
10	*14*	*6*	*0*	*6*	*0.47*	*0.400*
11	*12*	*5*	*0*	*5*	*0.40*	*0.333*
12	*21*	*8*	*4*	*4*	*0.70*	*0.267*
13	*15*	*5*	*1*	*4*	*0.50*	*0.267*
14	*23*	*8*	*5*	*3*	*0.77*	*0.200*
15	*19*	*6*	*3*	*3*	*0.63*	*0.200*
16	*21*	*7*	*3*	*4*	*0.70*	*0.267*
17	*19*	*7*	*3*	*4*	*0.63*	*0.267*
18	*12*	*4*	*1*	*3*	*0.40*	*0.200*
19	*18*	*6*	*1*	*5*	*0.60*	*0.333*
20	*12*	*4*	*0*	*4*	*0.40*	*0.267*
21	*12*	*4*	*0*	*4*	*0.40*	*0.267*
22	*11*	*7*	*0*	*7*	*0.37*	*0.467*
23	*9*	*5*	*0*	*5*	*0.30*	*0.333*
24	*24*	*8*	*5*	*3*	*0.80*	*0.200*
25	*16*	*6*	*2*	*4*	*0.53*	*0.267*
26	*8*	*3*	*0*	*3*	*0.27*	*0.200*
27	*18*	*6*	*2*	*4*	*0.60*	*0.267*
28	*11*	*5*	*0*	*5*	*0.37*	*0.333*
29	*10*	*4*	*0*	*4*	*0.33*	*0.267*
30	*8*	*4*	*1*	*3*	*0.27*	*0.200*
31	*13*	*5*	*1*	*4*	*0.43*	*0.267*
32	*11*	*4*	*1*	*3*	*0.37*	*0.200*
33	*9*	*5*	*1*	*4*	*0.30*	*0.267*
34	*15*	*6*	*2*	*4*	*0.50*	*0.267*
35	*11*	*5*	*2*	*3*	*0.37*	*0.200*
36	*11*	*5*	*1*	*4*	*0.37*	*0.267*
37	*14*	*6*	*2*	*4*	*0.47*	*0.267*
38	*9*	*6*	*2*	*4*	*0.30*	*0.267*
39	*10*	*4*	*1*	*3*	*0.33*	*0.200*
40	*15*	*8*	*3*	*5*	*0.50*	*0.333*

Difficulty Power, using formula; $P = R/N$

Discrimination Power, using formula; $r = \frac{R_u - R_e}{N/2}$

When R = Number of Respondents with right answer in each question

N = Total Number of Respondents totaled 30 persons

Ru = Number of Respondents with right answer in the high quartile, in each question

Re = Number of Respondents with right answer in the low quartile, in each question

Table 20 Reliability Analysis of knowledge test

Question No.	*p*	*q*		*pq*	Sx^2
1	0.80	0.20		0.1600	0.1655
2	0.67	0.33		0.2222	0.2299
3	0.77	0.23		0.1789	0.1851
4	0.77	0.23		0.1789	0.1851
5	0.47	0.53		0.2489	0.2575
6	0.80	0.20		0.1600	0.1655
7	0.77	0.23		0.1789	0.1851
8	0.60	0.40		0.2400	0.2483
9	0.67	0.33		0.2222	0.2299
10	0.47	0.53		0.2489	0.2575
11	0.40	0.60		0.2400	0.2483
12	0.70	0.30		0.2100	0.2172
13	0.50	0.50		0.2500	0.2586
14	0.77	0.23		0.1789	0.1851
15	0.63	0.37		0.2322	0.240
16	0.70	0.30		0.2100	02172
17	0.63	0.37		0.2322	0.2402
18	0.40	0.60		0.2400	0.2483
19	0.60	0.40		0.2400	0.2483
20	0.40	0.60		0.2400	0.2483
21	0.40	0.60		0.2400	0.2483
22	0.37	0.63		0.2322	0.2402
23	0.30	0.70		0.2100	0.2172
24	0.80	0.20		0.1600	0.1655
25	0.53	0.47		0.2489	0.2575
26	0.27	0.73		0.1956	0.2023
27	0.60	0.40		0.2400	0.2483
28	0.37	0.63		0.2300	0.2402
29	0.33	0.67		0.2222	0.2299
30	0.27	0.73		0.1956	0.2023
31	0.43	0.57		0.2456	0.2540
32	0.37	0.63		0.2322	0.2402
33	0.30	0.70		0.2100	0.2172
34	0.50	0.50		0.2500	0.2586
35	0.37	0.63		0.2300	0.2402
36	0.37	0.63		0.2322	0.2402
37	0.47	0.53		0.2489	0.2575
38	0.30	0.70		0.2100	0.2172
39	0.33	0.67		0.2222	0.2299
40	0.50	0.50		0.2500	0.2586
		Total		***8.8222***	***9.1264***

Reliability of the knowledge test is determined by Kuder Richardson Cronbach's 20 formula;

$$rtt = \frac{n}{n-1}\left\{1 - \frac{\Sigma pq}{S_t^2}\right\}$$

$$= 0.886$$

When rtt = Reliability Value

n = Number of ques

p = Ratio of right answers in

q = Ratio of wrong answer in each question(1-p)

S_t^2 = Variance of total scores

Reliability Value is also determined using Alpha Coefficient Formula;

$$rtt = \frac{n}{n-1}\left\{1 - \frac{\Sigma S_i^2}{S_x^2}\right\}$$

$$= 0.881$$

When rtt = Reliability Value

n = Number of questions

ΣS_i^2 = Summation of variances in each question

S_x^2 = Variance of total scores

APPENDIX C

Figure of An appropriate management by Using

Infectious Waste Incinerator in the Hospital :

A Case Study of Hospital under The Ministry of Public Health

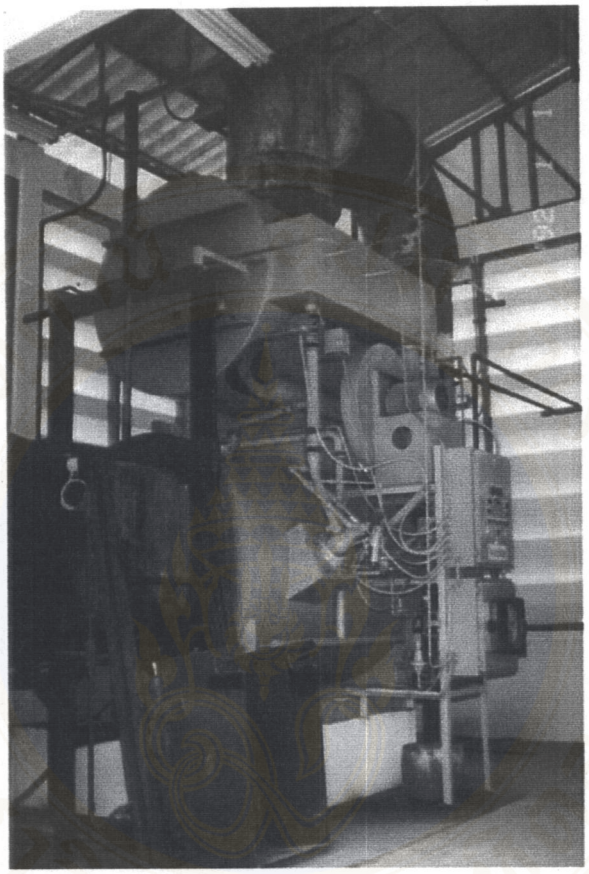

Figure 5 Infectious Waste Incinerator in Pranangklao Hospital

Figure 6 Normal Wastes Transferred by Municipality to elimination area in Pranangklao Hospital

Figure 7 Normal Waste Disposed in storage room in Pranangklao Hospital

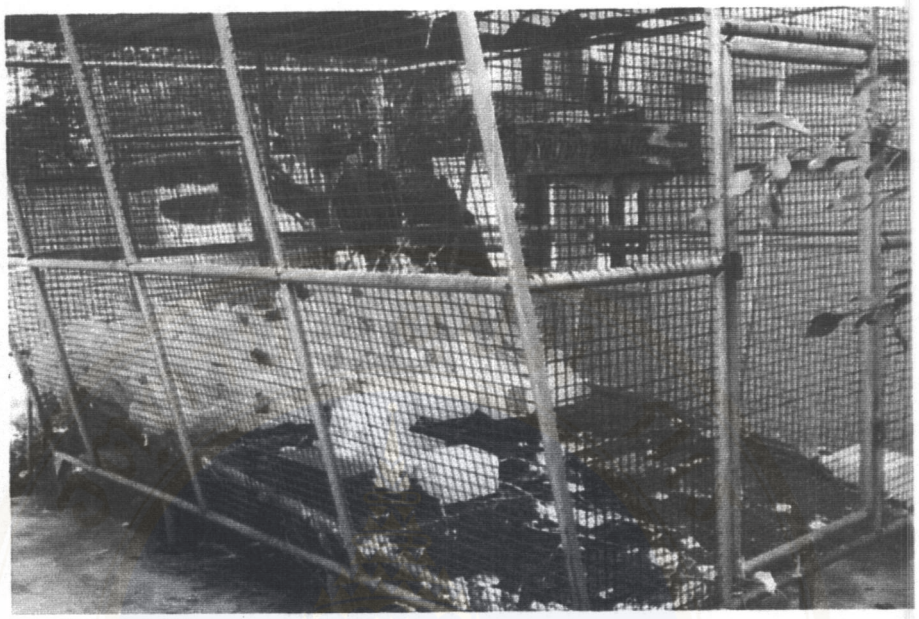

Figure 8 Sieve room for dispose recycle wastes in Pranangklao Hospital

Figure 9 Remaining ashes nearby infectious waste incinerator in Prananklao Hospital

Figure 10 Infectious waste disposal staff in Pranangklao Hospital wear of personal protective equipment

Figure 11 Infectious bins in cool storage room in Pranangklao Hospital

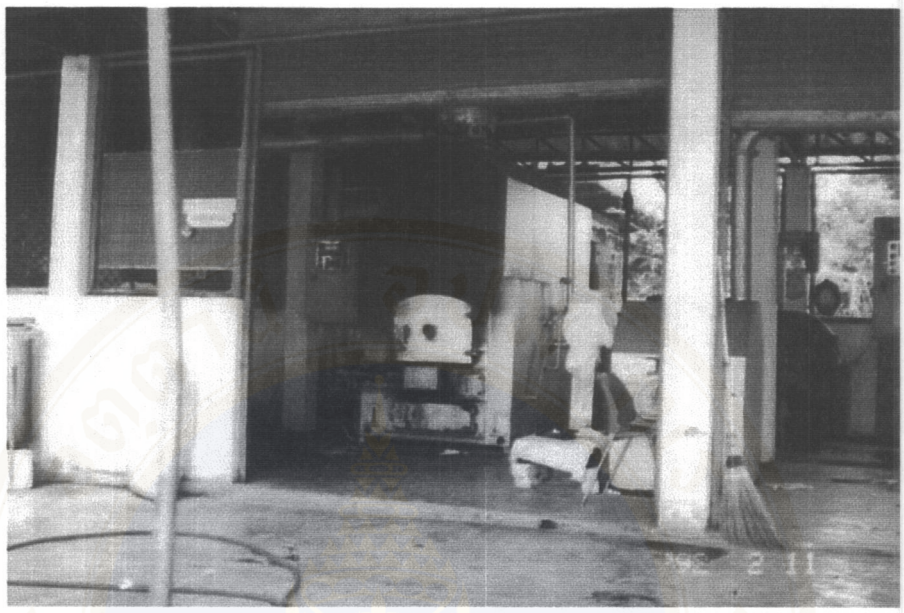

Figure 12 Infectious waste incinerator in Bamras-Naradoon Hospital

Figure 13 Normal wastes disposed in storage room in Bamras-Naradoon Hospital

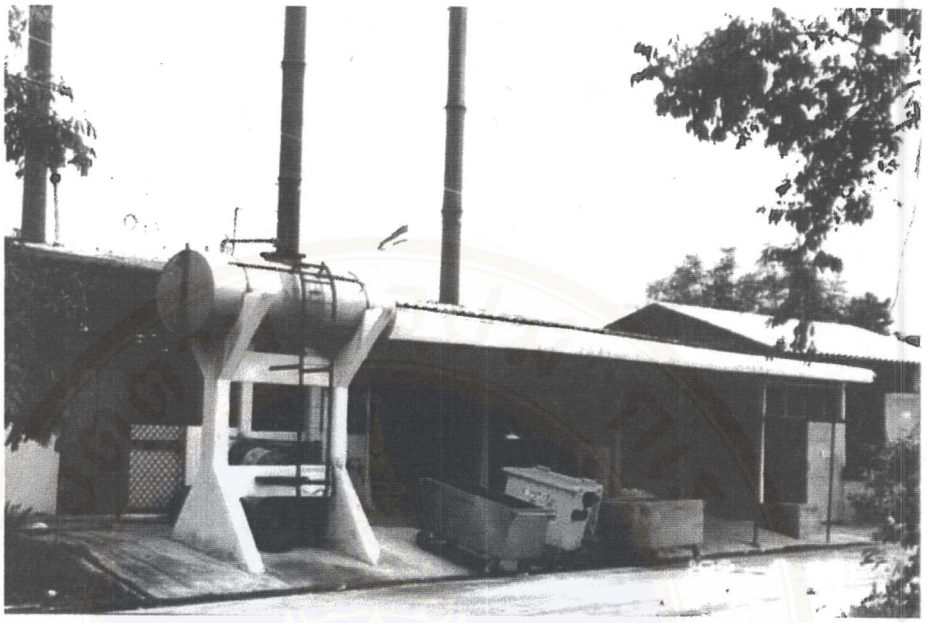

Figure 14 Infectious wastes storage building in Bamras-Naradoon Hospital

Figure 15 Carts for transferring normal wastes and the middle one for transferring infectious waste in Bamras-Naradoon

BIOGRAPHY

NAME	Tarinee Naranuja
DATE OF BIRTH	January 14, 1973
PLACE OF BIRTH	Bangkok, Thailand
INSTITUTIONS ATTENNDED	Prince of Songkla University, (1991-1994) Bachelor of Arts Mahidol University, (1999-2002) Master of Education
POSITION & OFFIOE	(2001-Present) Rainmaker Computer Graphics Production Co., Ltd. Position: Executive Client Service & Project Planner